CAVE CREEK
From CAP Canal to Loop 101 Highway
FLOODPLAIN DELINEATION STUDY

Maricopa County

Technical Data Notebook

Contract Number: FCD 2004C024
PCN 014.27.01

Prepared for:

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

Prepared by:

WEST Consultants, Inc.
960 West Elliot Road, Suite 201
Tempe, Arizona 85284-1137

January 2007

Federal Emergency Management Agency

Washington, D.C. 20472

DEC 11 2007

FILE
FCD2004C024

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Phil Gordon
Mayor, City of Phoenix
200 West Washington Street, 11th Floor
Phoenix, AZ 85003-1611

IN REPLY REFER TO:
Case No.: 06-09-B582P
Community Name: City of Phoenix, AZ
Community No.: 040051
Effective Date of This Revision: APR 03 2008

Dear Mayor Gordon:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Oakland, California, at (510) 627-7175, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

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

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

List of Enclosures:
- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (See attached list.)

FLOOD CONTROL DISTRICT
RECEIVED
DEC 18 '07

CH & GM	FINANCE
PIO	LANDS
ADMIN	P & [illegible]
REG	P & PM
ENG	FILE
CONTRACTS	
ROUTING	MWZ

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Tempe, Arizona 85284-1137

January 2007

Registered Professional Engineer (Civil)
CERTIFICATE NO.
41980
BRIAN THOMAS
WAHLIN
Date Signed 1/24/07
ARIZONA, U.S.A.

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BRIAN THOMAS
WAHLIN
Date Signed 1/24/08
ARIZONA, U.S.A.

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1. Introduction

The Flood Control District of Maricopa County (DISTRICT) contracted WEST Consultants, Inc. (WEST) to re-study the existing Zone-AE floodplain of Cave Creek from the CAP Canal to the Loop 101 Highway. The study included floodway delineation. The re-study reach is in the City of Phoenix and is shown in Figure 1-1. Southwest Mapping Technologies, Inc. provided the Digital Terrain Model (DTM) and the 2-foot vertical resolution contours based on the DTM. The ground control points for the aerial survey were set by Hersey Land Surveying, L.L.C. A Triangulated Irregular Network (TIN) was generated using the digital terrain model in ArcView GIS. The TIN was used to cut channel cross-sections using the HEC-GeoRAS extension of ArcView GIS. The hydrologic data for this project was obtained from the Kaminski-Hubbard (1993) hydrology report for the Cave Creek Watershed. Water surface elevations in the upstream and downstream model limits were tied-in to those in the HEC-2 model developed by Burges and Niple (1989), which is the basis for the existing Flood Insurance Study.

The purpose of the study was to delineate the 100-year floodplain and floodway of the Cave Creek, and prepare a Technical Data Notebook (TDN) submittal package. The work met the requirements of the DISTRICT's Consultant Guidelines (Flood Control District of Maricopa County, 2003).

2. ADWR/FEMA Forms

2.1 Study Documentation Abstracts for ADWR Submittals

Information related to Sections 2.1.1 through 2.1.10 of the State Standard Attachment SSA1-97, dated November 1997 is included following page 1.

2.2 FEMA Forms

Forms required by FEMA are included in the text of this TDN following the ADWR forms.

3. Surveying and Mapping Information

3.1 Field Survey Information

Field survey was conducted by Hersey Land Surveying on March 11, 2005 to collect point elevation data at the bridge locations, on the CAP Canal overshoot, and adjacent to other features such as utilities, and in-channel obstructions. Typical measurements included bridge low chord elevations, pier cap elevations and the distance from top of guard rail to the low chord. Survey field notes and copies of deliverables from Hersey Land Surveying are included in Appendix C.

3.2 Mapping

The primary source of the topography was the aerial survey data provided by Southwest Mapping Technologies. The data included Digital Terrain Model (DTM) and contours at 2-foot vertical intervals. The contour map of the study area is at a scale of 1" = 200'. All elevations were based on NGVD 1929.

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

Section 2.1: Study Documentation Abstract for FEMA Submittals

2.1.1	Date Study Accepted	
2.1.2	Study Contractor Contact(s) Address Phone Internal Reference Number	WEST Consultants, Inc. Dennis L. Richards, P.E. 960 W. Elliot Road, Suite 201 Tempe, Arizona 85284 (480) 345-2155 631A01
2.1.3	FEMA Technical Review Contractor Contact(s) Address Phone Internal Reference Number	
2.1.4	FEMA Regional Reviewer Phone	
2.1.5	State Technical Reviewer Phone	Arizona Department of Water Resources (602) 417-2400
2.1.6	Local Technical Reviewer Phone	Michael Duncan, PE, CFM, Flood Control District of Maricopa County (FCDMC) (602) 506-1501
2.1.7	Reach Description	Cave Creek – FIRM Panels 1210H, 1220J, 1215K
2.1.8	USGS Quad Sheet(s) with original photo date & latest photo revision date	
2.1.9	Unique Conditions and Problems	
2.1.10	Coordination of Q's Discharges (Agency, Date, Comments)	Hydrology was based on Kaminsi-Hubbard Engineering (1993) Hydrology Report. Source: FCDMC Library Flood Insurance Study by Burges & Niple (1989). HEC-2 Model Files Source: FCDMC Library

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 480287	City of Katy Harris County	TX TX	480301 48201C	0005D 0220G	02/08/83 09/28/90
040037	Maricopa County, Unincorporated Areas	AZ	04013C	1210H	07/19/01
040051	City of Phoenix --- panels 1215K, 1220J	AZ	04013C	1215K	07/19/01

2. Flooding Source: Cave Creek

3. Project Name/Identifier: Cave Creek Floodplain Delineation Study: From CAP Canal to Loop 101 Highway

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

5. Basis for Request and Type of Revision:

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

☐ Physical Change ☐ Improved Methodology/Data

☐ Regulatory Floodway Revision ☒ Other (Attach Description)

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

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

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

☐ Alluvial fan ☐ Lakes ☐ Other (Attach Description)

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

☐ Dam ☐ Fill ☐ Other, Attach Description

C. REVIEW FEE

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

☐ No, Attach Explanation

Please see the FEMA Web site at http://www.fema.gov/fhm/frm_fees.shtm for Fee Amounts and Exemptions.

D. SIGNATURE

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

Name: Michael Duncan, PE, CFM, Principal Flood	Company: Delineation Engr., Fld.Ctrl.Distr.,Maric	
Mailing Address: FLOOD CONTROL DISTRICTof MARICOPA COUNTY 2801 W DURANGO ST PHOENIX AZ 85009	Daytime Telephone No.: (602) 506-4732	Fax No.: (602) 506-4601
	E-Mail Address: mwd@mail.maricopa.gov	
Signature of Requester (required): Michael Duncan		Date: 12-5-05

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: Hasan Mushtaq, PhD, PE, CFM, Floodplain Manager		Telephone No.: 602-262-4062
Community Name: City of Phoenix	Community ~~Official's Signa~~ature (required): Hmushtaq	Date: 3/13/06

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

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

Certifier's Name: Dennis L. Richards	License No.: 21560	Expiration Date: 3/31/2007
Company Name: WEST Consultants, Inc.	Telephone No.: (480) 345-2155	Fax No.: (480) 345-2156
Signature: Dennis L. Richards		Date: 12/1/2005

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. 21560 DENNIS L. RICHARDS Date Signed 12/1/05 ARIZONA, U.S.A.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

PAPERWORK REDUCTION ACT

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

Flooding Source: Cave Creek
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)
25.528	4.11	4900	2880
24.504	4.97	5300	3300
23.040	5.90	5500	3660

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/fhm/en_modl.shtm.

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit	Downstream from Loop 101 Bridges	22.880	1420.05	1420.05
Upstream Limit	Just Upstream of CAP Canal Overshoot	25.561	1514.36	1513.88

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

Duplicate Effective Model*	Natural File Name:	Floodway File Name:
Corrected Effective Model*	Natural File Name:	Floodway File Name:
Existing or Pre-Project Conditions Model	Natural File Name: CAVESUB.IN	Floodway File Name: CAVEFW.IN
Revised or Post-Project Conditions Model	Natural File Name: Cave Creek.prj	Floodway File Name: Cave Creek.prj
Other - (attach description)	Natural File Name:	Floodway File Name:

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

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

C. MAPPING REQUIREMENTS

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

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

D. COMMON REGULATORY REQUIREMENTS

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

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

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

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

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

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

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

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

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 7 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: Cave Creek
Note: Fill out one form for each flooding source studied

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization..... complete Section B
Bridge/Culvert..... complete Section C
Dam..... complete Section D
Levee/Floodwall..... complete Section E
Sediment Transport ..... complete Section F (if required)

Description Of Structure

1. **Name of Structure: 7th Street Bridge (Structure Number BR-76198)**

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: 1 mile north of State Route Loop 101 Mainline Bridges

   Downstream Limit/Cross Section: 24.057

   Upstream Limit/Cross Section: 24.068

2. **Name of Structure: State Rt. Loop 101 Mainline Bridges (Structure No. EB 1490 & WB 1491): Modeled as 1 Bridge**

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: State Route Loop 101 at Mile Post 25.90

   Downstream Limit/Cross Section: 23.101

   Upstream Limit/Cross Section: 23.128

3. **Name of Structure: North Frontage Road Bridge (Structure Number WBFR 2466)**

   Type (check one) ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: North of State Route Loop 101 Mainline Bridges

   Downstream Limit/Cross Section: 23.142

   Upstream Limit/Cross Section: 23.150

NOTE: For more structures, attach additional pages as needed.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

   The channelization includes (check one):

   ☐ Levees [Attach Section E (Levee/Floodwall)]
   ☐ Superelevated sections
   ☐ Debris basin/detention basin
   ☐ Other (Describe):
   ☐ Drop structures
   ☐ Transitions in cross sectional geometry
   ☐ Energy dissipator

2. Drawing Checklist

   Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Hydraulic Considerations

   The channel was designed to carry (cfs) and/or the -year flood.

   The design elevation in the channel is based on (check one):

   ☐ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line

   If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

   ☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions
   ☐ Other locations (specify):

4. Sediment Transport Considerations

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

C. BRIDGE/CULVERT

Flooding Source: Cave Creek

Name of Structure: 7th Street Bridge, Loop 101 Mainline Bridges, North & South Frontage & On/Off Ramp Bridges

1. This revision reflects (check one):

   ☐ New bridge/culvert not modeled in the FIS
   ☐ Modified bridge/culvert previously modeled in the FIS
   ☒ New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): HEC-RAS
   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

   ☒ Dimensions (height, width, span, radius, length)
   ☐ Shape (culverts only)
   ☐ Material
   ☐ Beveling or Rounding
   ☒ Wing Wall Angle
   ☒ Skew Angle
   ☐ Distances Between Cross Sections
   ☐ Erosion Protection
   ☒ Low Chord Elevations – Upstream and Downstream
   ☐ Top of Road Elevations – Upstream and Downstream
   ☐ Structure Invert Elevations – Upstream and Downstream
   ☐ Stream Invert Elevations – Upstream and Downstream
   ☐ Cross-Section Locations

4. Sediment Transport Considerations

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

D. DAM

Flooding Source:

Name of Structure:

1. This request is for (check one): ☐ Existing dam ☐ New dam ☐ Modification of existing dam
2. The dam was designed by (check one): ☐ Federal agency ☐ State agency ☐ Local government agency

   ☐ Private organization Name of the agency or organization:
3. Does the project involve revised hydrology? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).
4. Does the submittal include debris/sediment yield analysis? ☐ Yes ☐ No

   If yes, then fill out Section F (Sediment Transport).
   If No, then attach your explanation for why debris/sediment analysis was not considered.
5. Does the Base Flood Elevation behind the dam or downstream of the dam change?

   ☐ Yes ☐ No If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)		
50-year (2%)		
100-year (1%)		
500-year (0.2%)		
Normal Pool Elevation		

6. Please attach a copy of the formal Operation and Maintenance Plan

E. LEVEE/FLOODWALL

1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

☐ upgrading of an existing levee/floodwall system
☐ a newly constructed levee/floodwall system
☐ reanalysis of an existing levee/floodwall system

b. Levee elements and locations are (check one):

☐ earthen embankment, dike, berm, etc.	Station	to
☐ structural floodwall	Station	to
☐ Other (describe):	Station	to

c. Structural Type (check one):

☐ monolithic cast-in place reinforced concrete
☐ reinforced concrete masonry block
☐ sheet piling
☐ Other (describe):

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

☐ Yes ☐ No

If Yes, by which agency?

e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

1. Plan of the levee embankment and floodwall structures. Sheet Numbers:
2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers:
3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers:
4. A layout detail for the embankment protection measures. Sheet Numbers:
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers:

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

3.0 feet or more at the downstream end and throughout	☐ Yes	☐ No
3.5 feet or more at the upstream end	☐ Yes	☐ No
4.0 feet within 100 feet upstream of all structures and/or constrictions	☐ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater).	☐ Yes	☐ No
2.0 feet above the 1%-annual-chance stillwater surge elevation	☐ Yes	☐ No

2. Freeboard (continued)

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☐ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. *Openings through the levee system (check one):* ☐ *exists* ☐ *does not exist*

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data

In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. The maximum levee slope landside is:

b. The maximum levee slope floodside is:

c. The range of velocities along the levee during the base flood is: (min.) to (max.)

d. Embankment material is protected by (describe what kind):

e. Riprap Design Parameters (check one): ☐ Velocity ☐ Tractive stress
Attach references

Reach		Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
						D_{100}	D_{50}	Thickness	
Sta	to								
Sta	to								
Sta	to								
Sta	to								
Sta	to								
Sta	to								

(Extend table on an added sheet as needed and reference each entry)

4. Embankment Protection (continued)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☐ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:

☐ Overall height: Sta. ; height ft.

☐ Limiting foundation soil strength:

Sta. , depth to

strength ϕ = degrees, c = psf

slope: SS = (h) to (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

c. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction		1.3
II	Sudden drawdown		1.0
III	Critical flood stage		1.4
IV	Steady seepage at flood stage		1.4
VI	Earthquake (Case I)		1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

d. Was a seepage analysis for the embankment performed? ☐ Yes ☐ No

If Yes, describe methodology used:

e. Was a seepage analysis for the foundation performed? ☐ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☐ Yes ☐ No

g. Were seepage exit gradients checked for piping potential? ☐ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is hours.

Attach engineering analysis to support construction plans.

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):

☐ UBC (1988) or ☐ Other (specify):

b. Stability analysis submitted provides for:

☐ Overturning ☐ Sliding If not, explain:

c. Loading included in the analyses were:

☐ Lateral earth @ P_A = psf; P_p = psf

☐ Surcharge-Slope @ , ☐ surface psf

☐ Wind @ P_w = psf

☐ Seepage (Uplift); ☐ Earthquake @ P_{eq} = %g

☐ 1%-annual-chance significant wave height: ft.

☐ 1%-annual-chance significant wave period: sec.

d. Summary of Stability Analysis Results: Factors of Safety.

Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)

(Note: Extend table on an added sheet as needed and reference)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection ☐ is, ☐ is not provided. If provided, attach explanation and supporting documentation:

Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin? ☐ Yes ☐ No

b. The computed range of settlement is ft. to ft.

c. Settlement of the levee crest is determined to be primarily from :

☐ Foundation consolidation
☐ Embankment compression
☐ Other (Describe):

d. Differential settlement of floodwalls ☐ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: acres
Draining to ponding area: acres

b. Relationships Established

Ponding elevation vs. storage	☐ Yes	☐ No
Ponding elevation vs. gravity flow	☐ Yes	☐ No
Differential head vs. gravity flow	☐ Yes	☐ No

c. The river flow duration curve is enclosed: ☐ Yes ☐ No

d. Specify the discharge capacity of the head pressure conduit: cfs

e. Which flooding conditions were analyzed?

• Gravity flow (Interior Watershed)	☐ Yes	☐ No
• Common storm (River Watershed)	☐ Yes	☐ No
• Historical ponding probability	☐ Yes	☐ No
• Coastal wave overtopping	☐ Yes	☐ No

If No for any of the above, attach explanation.

f. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☐ Yes ☐ No

If No, attach explanation.

g. The rate of seepage through the levee system for the base flood is cfs

h. The length of levee system used to drive this seepage rate in item g: ft.

8. Interior Drainage (continued)

i. Will pumping plants be used for interior drainage? ☐ Yes ☐ No

If Yes, include the number of pumping plants:
For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☐ is not a problem
Hydrocompaction ☐ is ☐ is not a problem
Heave differential movement due to soils of high shrink/swell ☐ is ☐ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Attach supporting documentation

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?
☐ Yes ☐ No

Attach supporting documentation

d. Sediment Transport Considerations:

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

E. LEVEE/FLOODWALL (CONTINUED)

10. Operational Plan And Criteria

    a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No

    b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations? ☐ Yes ☐ No

    c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations? ☐ Yes ☐ No

    If the answer is No to any of the above, please attach supporting documentation.

11. Maintenance Plan

    a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No
    If No, please attach supporting documentation.

12. Operations and Maintenance Plan

    Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

F. SEDIMENT TRANSPORT

Flooding Source:

Name of Structure:

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume acre-feet

Debris load associated with the base flood discharge: Volume acre-feet

Sediment transport rate (percent concentration by volume)

Method used to estimate sediment transport:

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition:

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport:
Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

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

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 7 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: Cave Creek
Note: Fill out one form for each flooding source studied

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization..... complete Section B
Bridge/Culvert..... complete Section C
Dam..... complete Section D
Levee/Floodwall..... complete Section E
Sediment Transport ..... complete Section F (if required)

Description Of Structure

1. **Name of Structure: South Frontage Road Bridge (Structure Number EBFR 2281)**

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: South of State Route Loop 101 Mainline Bridges

   Downstream Limit/Cross Section: 23.084

   Upstream Limit/Cross Section: 23.077

2. **Name of Structure: North On Ramp Bridge (Structure Number 1466)**

   Type (check one): ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: State Route Loop 101 at Mile Post 25.90

   Downstream Limit/Cross Section: 23.131

   Upstream Limit/Cross Section: 23.138

3. **Name of Structure: South Off Ramp Bridge (Structure Number 1486)**

   Type (check one) ☐ Channelization ☒ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

   Location of Structure: State Route Loop 101 at Mile Post 25.90

   Downstream Limit/Cross Section: 23.090

   Upstream Limit/Cross Section: 23.097

NOTE: For more structures, attach additional pages as needed.

B. CHANNELIZATION

Flooding Source:

Name of Structure:

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin
- ☐ Other (Describe):
- ☐ Drop structures
- ☐ Transitions in cross sectional geometry
- ☐ Energy dissipator

2. Drawing Checklist

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Hydraulic Considerations

The channel was designed to carry (cfs) and/or the -year flood.

The design elevation in the channel is based on (check one):

☐ Subcritical flow ☐ Critical flow ☐ Supercritical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions
☐ Other locations (specify):

4. Sediment Transport Considerations

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

C. BRIDGE/CULVERT

Flooding Source: *Cave Creek*

Name of Structure: 7th Street Bridge, Loop 101 Mainline Bridges, North & South Frontage & On/Off Ramp Bridges

1. This revision reflects (check one):

- ☐ New bridge/culvert not modeled in the FIS
- ☐ Modified bridge/culvert previously modeled in the FIS
- ☒ New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): HEC-RAS
If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

- ☒ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☒ Wing Wall Angle
- ☒ Skew Angle
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection
- ☒ Low Chord Elevations – Upstream and Downstream
- ☐ Top of Road Elevations – Upstream and Downstream
- ☐ Structure Invert Elevations – Upstream and Downstream
- ☐ Stream Invert Elevations – Upstream and Downstream
- ☐ Cross-Section Locations

4. Sediment Transport Considerations

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

D. DAM

Flooding Source:

Name of Structure:

1. This request is for (check one): ☐ Existing dam ☐ New dam ☐ Modification of existing dam
2. The dam was designed by (check one): ☐ Federal agency ☐ State agency ☐ Local government agency

   ☐ Private organization Name of the agency or organization:
3. Does the project involve revised hydrology? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2).
4. Does the submittal include debris/sediment yield analysis? ☐ Yes ☐ No

   If yes, then fill out Section F (Sediment Transport).
   If No, then attach your explanation for why debris/sediment analysis was not considered.
5. Does the Base Flood Elevation behind the dam or downstream of the dam change?

   ☐ Yes ☐ No If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)		
50-year (2%)		
100-year (1%)		
500-year (0.2%)		
Normal Pool Elevation		

6. Please attach a copy of the formal Operation and Maintenance Plan

E. LEVEE/FLOODWALL

1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

☐ upgrading of an existing levee/floodwall system
☐ a newly constructed levee/floodwall system
☐ reanalysis of an existing levee/floodwall system

b. Levee elements and locations are (check one):

☐ earthen embankment, dike, berm, etc.	Station	to
☐ structural floodwall	Station	to
☐ Other (describe):	Station	to

c. Structural Type (check one):

☐ monolithic cast-in place reinforced concrete
☐ reinforced concrete masonry block
☐ sheet piling
☐ Other (describe):

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

☐ Yes ☐ No

If Yes, by which agency?

e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

1. Plan of the levee embankment and floodwall structures. Sheet Numbers:
2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers:
3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers:
4. A layout detail for the embankment protection measures. Sheet Numbers:
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers:

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

3.0 feet or more at the downstream end and throughout	☐ Yes	☐ No
3.5 feet or more at the upstream end	☐ Yes	☐ No
4.0 feet within 100 feet upstream of all structures and/or constrictions	☐ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater).	☐ Yes	☐ No
2.0 feet above the 1%-annual-chance stillwater surge elevation	☐ Yes	☐ No

2. Freeboard (continued)

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing Paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☐ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Openings through the levee system (check one): ☐ exists ☐ does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data

In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers [USACE] EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. *The maximum levee slope landside is:*

b. The maximum levee slope floodside is:

c. The range of velocities along the levee during the base flood is: (min.) to (max.)

d. Embankment material is protected by (describe what kind):

e. Riprap Design Parameters (check one): ☐ Velocity ☐ Tractive stress
Attach references

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D_{100}	D_{50}	Thickness	
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								

(Extend table on an added sheet as needed and reference each entry)

4. Embankment Protection (continued)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☐ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:

☐ Overall height: Sta. ; height ft.

☐ Limiting foundation soil strength:

Sta. , depth to

strength ϕ = degrees, c = psf

slope: SS = (h) to (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

c. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction		1.3
II	Sudden drawdown		1.0
III	Critical flood stage		1.4
IV	Steady seepage at flood stage		1.4
VI	Earthquake (Case I)		1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

d. Was a seepage analysis for the embankment performed? ☐ Yes ☐ No

If Yes, describe methodology used:

e. Was a seepage analysis for the foundation performed? ☐ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☐ Yes ☐ No

g. Were seepage exit gradients checked for piping potential? ☐ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is hours.

Attach engineering analysis to support construction plans.

6. Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):

☐ UBC (1988) or ☐ Other (specify):

b. Stability analysis submitted provides for:

☐ Overturning ☐ Sliding If not, explain:

c. Loading included in the analyses were:

☐ Lateral earth @ P_A = psf; P_p = psf

☐ Surcharge-Slope @ , ☐ surface psf

☐ Wind @ P_w = psf

☐ Seepage (Uplift); ☐ Earthquake @ P_{eq} = %g

☐ 1%-annual-chance significant wave height: ft.

☐ 1%-annual-chance significant wave period: sec.

d. Summary of Stability Analysis Results: Factors of Safety.

Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)

(Note: Extend table on an added sheet as needed and reference)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection ☐ is, ☐ is not provided. If provided, attach explanation and supporting documentation:

Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specified construction elevations to maintain the established freeboard margin? ☐ Yes ☐ No

b. The computed range of settlement is ft. to ft.

c. Settlement of the levee crest is determined to be primarily from :

☐ Foundation consolidation
☐ Embankment compression
☐ Other (Describe):

d. Differential settlement of floodwalls ☐ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: acres
Draining to ponding area: acres

b. Relationships Established

Ponding elevation vs. storage	☐ Yes	☐ No
Ponding elevation vs. gravity flow	☐ Yes	☐ No
Differential head vs. gravity flow	☐ Yes	☐ No

c. The river flow duration curve is enclosed: ☐ Yes ☐ No

d. Specify the discharge capacity of the head pressure conduit: cfs

e. Which flooding conditions were analyzed?

• Gravity flow (Interior Watershed)	☐ Yes	☐ No
• Common storm (River Watershed)	☐ Yes	☐ No
• Historical ponding probability	☐ Yes	☐ No
• Coastal wave overtopping	☐ Yes	☐ No

If No for any of the above, attach explanation.

f. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☐ Yes ☐ No

If No, attach explanation.

g. The rate of seepage through the levee system for the base flood is cfs

h. The length of levee system used to drive this seepage rate in item g: ft.

8. Interior Drainage (continued)

i. Will pumping plants be used for interior drainage? ☐ Yes ☐ No

If Yes, include the number of pumping plants:
For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104, and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☐ is not a problem
Hydrocompaction ☐ is ☐ is not a problem
Heave differential movement due to soils of high shrink/swell ☐ is ☐ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Attach supporting documentation

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?
☐ Yes ☐ No

Attach supporting documentation

d. Sediment Transport Considerations:

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

E. LEVEE/FLOODWALL (CONTINUED)

10. Operational Plan And Criteria

    a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No

    b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations? ☐ Yes ☐ No

    c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations? ☐ Yes ☐ No

    If the answer is No to any of the above, please attach supporting documentation.

11. Maintenance Plan

    a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No
    If No, please attach supporting documentation.

12. Operations and Maintenance Plan

    Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

F. SEDIMENT TRANSPORT

Flooding Source:

Name of Structure:

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or based on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume acre-feet

Debris load associated with the base flood discharge: Volume acre-feet

Sediment transport rate (percent concentration by volume)

Method used to estimate sediment transport:

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition:

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport:
Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

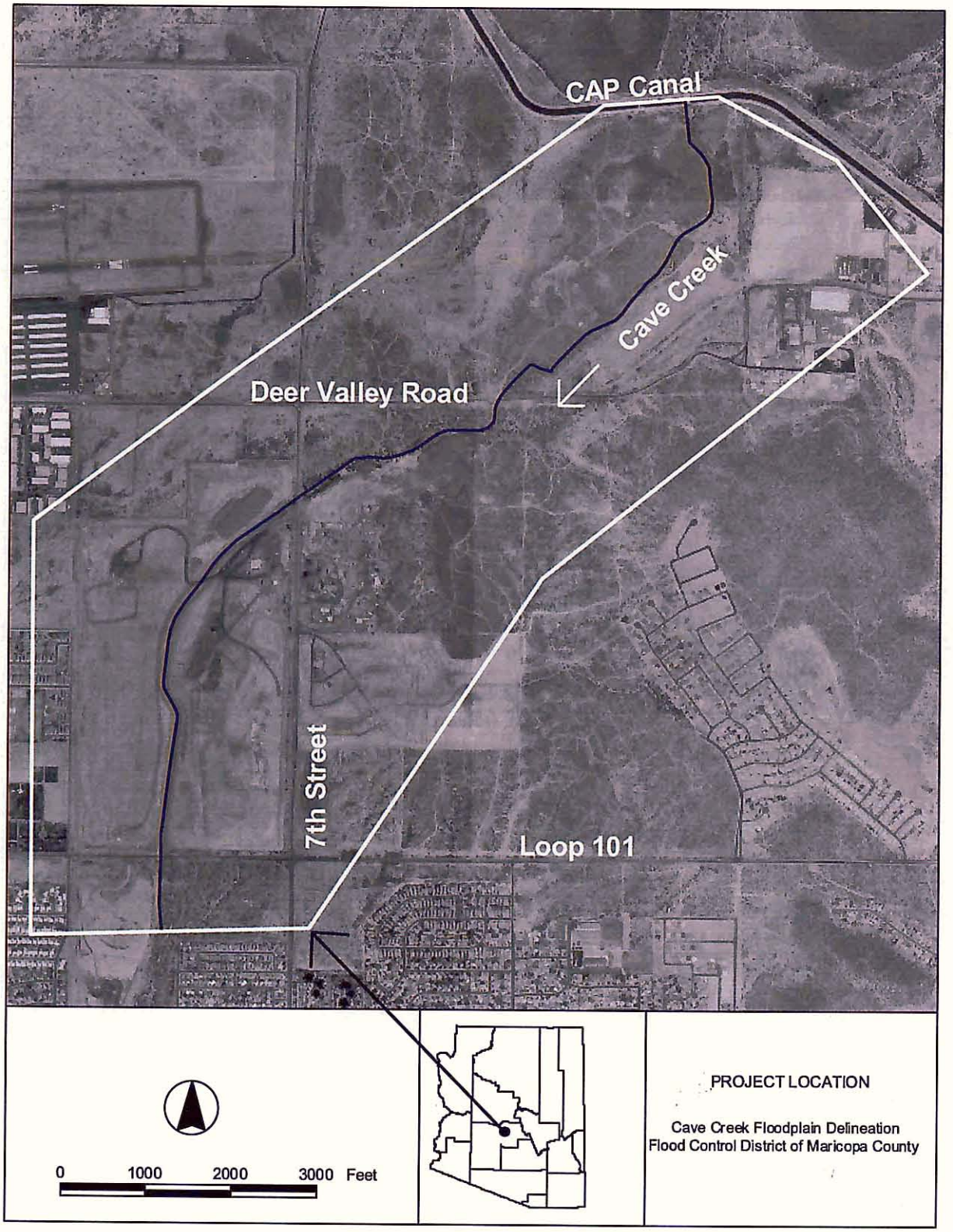


Figure 1-1 Approximate Project Limits

4. Hydrology

The peak discharges used in the hydraulic model were selected based on correspondence with the Project Manager at the Flood Control District of Maricopa County. The discharges were based on the hydrology work by Kaminski-Hubbard (1993), and the HEC-2 model developed by Burges & Niple (1989). Table 4-1 lists the discharges by flow change locations or HEC-RAS cross-section ID. The 2,880 cfs discharge at cross-section 25.528 is based on the Kaminski-Hubbard (1993) hydrology report. Upstream of cross-section 25.528, a discharge of 4,900 cfs reported in Burges & Niple HEC-2 model was used to tie-in to the upstream water surface elevation. The three upstream cross-sections were borrowed from the HEC-2 model for this purpose. Figure 4-1 shows the flow change locations.

Table 4-1 Discharges Used in the Main Channel of the Hydraulic Model

Flow Change Location (HEC-RAS Cross-Section ID Number)	Discharge (cfs)
25.561	4,900
25.528	2,880
24.673	3,090
24.504	3,300
23.040	3,660
22.880	5,500

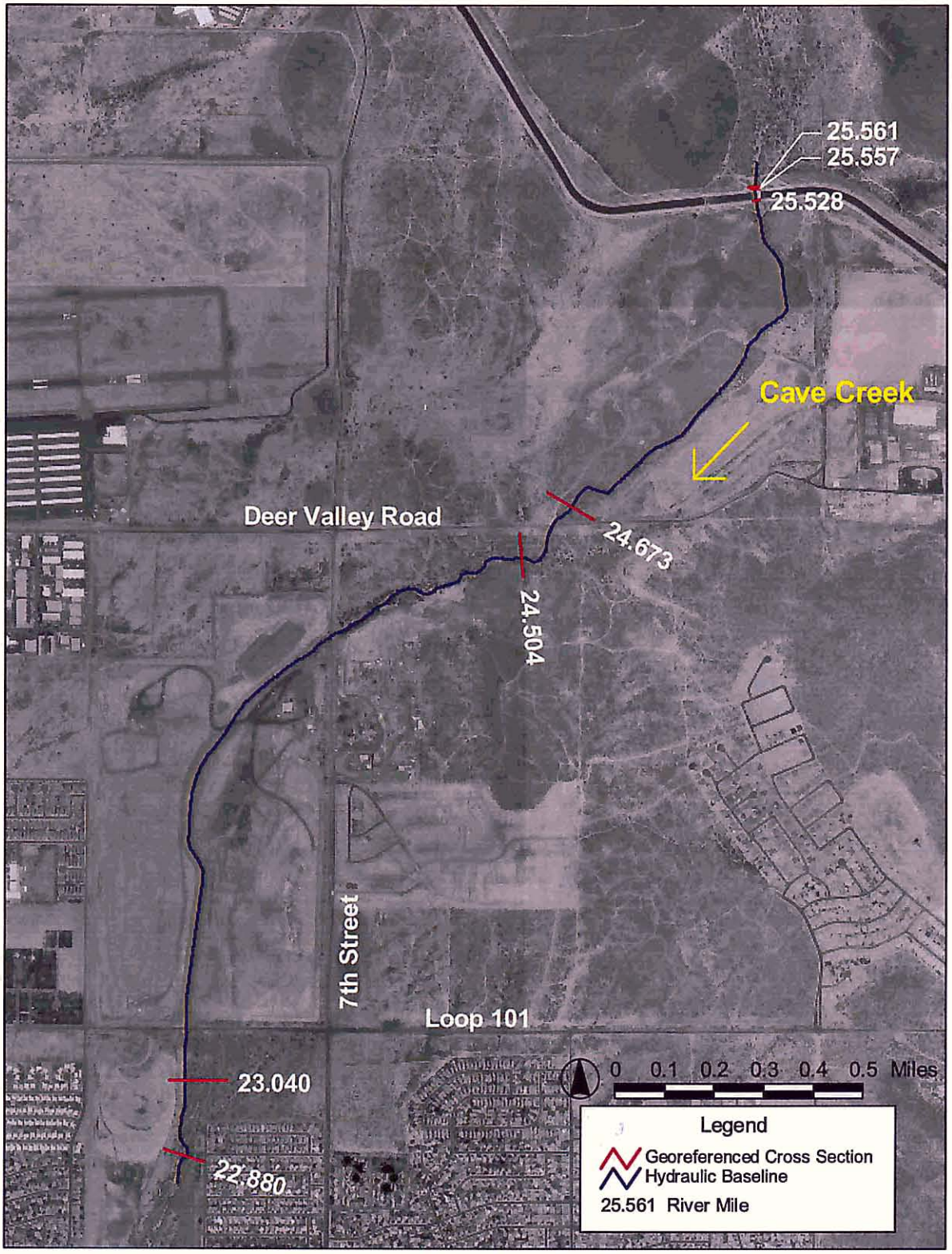


Figure 4-1 Flow Change Locations at River Miles

5. Hydraulics

5.1 Method Description

A geo-referenced hydraulic model of the study reach was developed using the U.S. Army Corps of Engineer's HEC-RAS, v. 3.1.2 and the HEC-GeoRAS extension of ArcViewGIS v. 3.2a by Environmental Systems Research Institute, Inc. A Triangulated Irregular Network was developed from a combination of the DTM mass points and 3-D break lines. NGVD 29 vertical datum was used. The study reach extends from the CAP Canal overshoot in the north to approximately 450 feet downstream of Loop 101 Highway. The study reach was divided into seven (7) sub-reaches based on Manning's *n* value distribution. The sub-reaches are identified in Table 5-1, and shown in Figure 5-1. Sub-reaches 3 and 4 were each further divided into 2 sub-reaches based on changes in the overbank Manning's *n* values. The full Manning's *n* report is included in Appendix E.1. A summary of Manning's *n* value is provided in section 5.3 of this Technical Data Notebook. Subcritical flow regime was used in HEC-RAS. Downstream boundary water surface elevation of 1420.05 feet was obtained from the Burges & Niple (1989) HEC-2 model. The last downstream cross-section in the HEC-RAS model was borrowed from the HEC-2 model to assign the boundary condition at location far enough from the study limit to assist in water surface profile computation and eliminate any numerical disturbances. As-Builts for the CAP Canal overshoot were provided by the Engineering Resources Supervisor Mr. Dennis Francom, P.E. of the Central Arizona Project. The As-Builts are included in Appendix E.4

Table 5-1 Hydraulic Model Sub-reach Description

Sub-reach Number	Location
1	CAP Canal overshoot
2	CAP Canal to Deer Valley Road
3	Deer Valley Road to RS 24.300
4	RS 24.300 to 300 feet downstream of the 7th Street Bridge
5	From 300 feet downstream of the 7th Street Bridge to the upstream limit of riprap
6	From the start of riprap to the North face of the Loop 101 Highway Bridge
7	North face of the Loop 101 Highway Bridge to end of the study reach

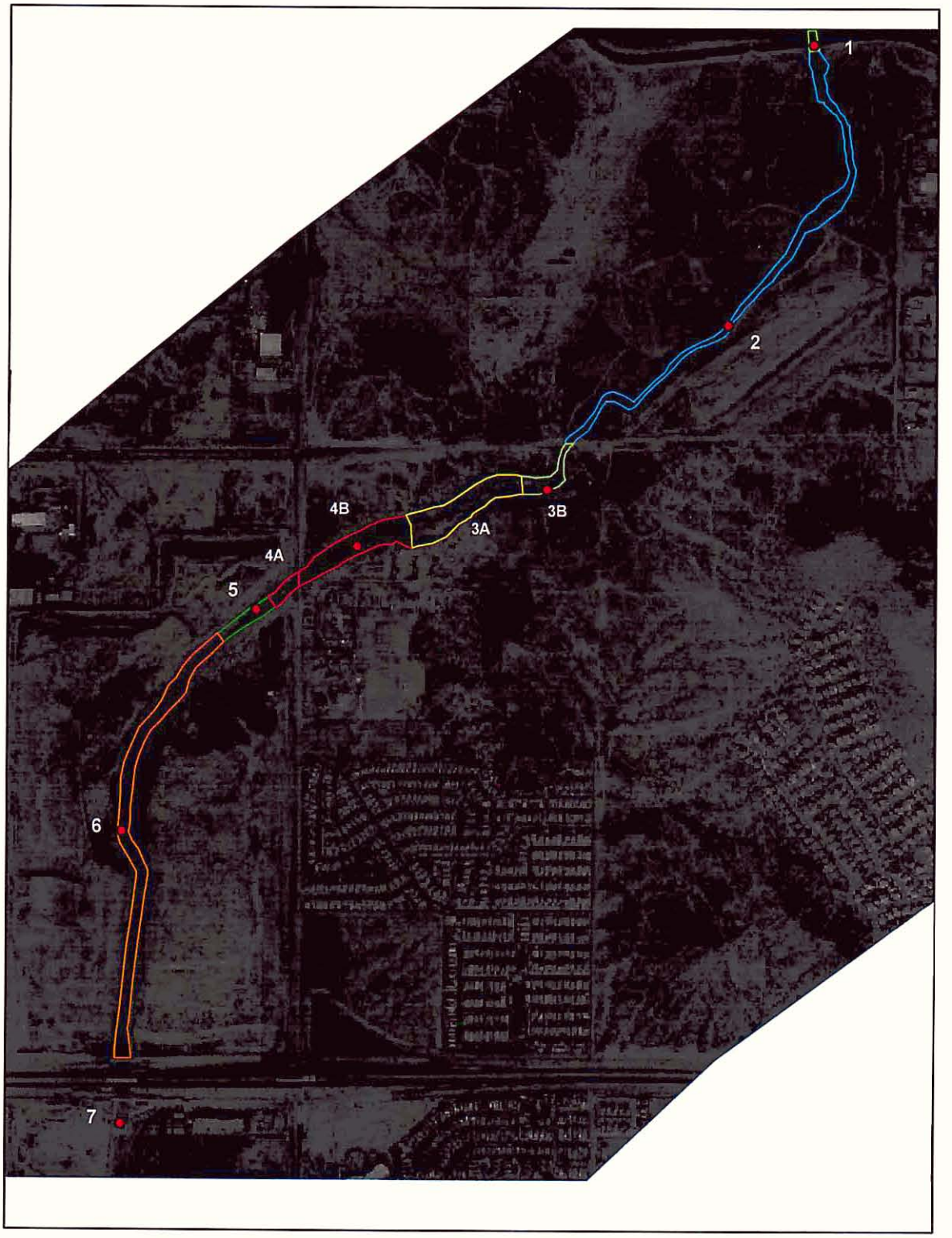


Figure 5-1 Hydraulic Model Sub-reaches Based on Manning's *n* Distribution

5.2 Work Study Maps

The study area was shown in three work study maps. The full size 24" by 36" plots, at 1" = 200' scale, are included in the Exhibit Maps section following the Appendices.

The revised 100-year floodplain boundary is shown on the work study maps as a heavy solid line. The floodway boundary is shown as heavy dashed line. The thalweg (hydraulic baseline) of the channel is shown as a thin center line. Each cross-section is geo-referenced and labeled with final computed floodplain and floodway water surface elevations, and discharges. Major streets, such as Loop 101 Highway, 7th Street, and Deer Valley Roads are shown on the map. The work maps also show the Zone AE floodplain, and Zone AH ponding areas. The 100-year FIRM panel floodplain limits are shown in the 8-1/2" by 11" annotated FIRM maps included in the Exhibit Maps section.

5.3 Parameter Estimation

5.3.1 Roughness Coefficients

The full Manning's *n* report is included in Appendix E.1. The Manning's *n* report includes a summary on calculating composite Manning's *n* values for the channel which used the equal conveyance method described by Chow (1959). A summary of the report is provided here. Color aerial photographs, provided by the Flood Control District of Maricopa County, the black and white orthophotos provided by Southwest Mapping Technologies, L.L.C., and photos taken during field reconnaissance were studied and used to assign Manning's *n* value in channel and overbank areas. The study area was divided into seven sub-reaches (Figure 5-1) to define the existing vegetation and bed and overbank conditions. Sub-reaches 3 and 4 were further divided into 2 reaches to capture the Manning's *n* distribution in the overbank areas.

The general procedure adopted for determining *n* values was to first select a base value of *n* for the bed material, followed by selection of *n*-value adjustments for channel irregularities and alignment, obstructions, vegetation, and other factors (Chow, 1959). Table 5-2 lists the composite Manning's *n* values by sub-reaches.

Table 5-2 Manning's *n* Value by Model Sub-reaches

Sub-reach	Left Overbank *n*	Channel *n*	Right Overbank *n*
1	0.015	0.015	0.015
2	0.045	0.034	0.052
3B	0.053	0.043	0.046
3A	0.033	0.043	0.046
4B	0.033	0.042	0.047
4A	0.058	0.042	0.067
5	0.058	0.038	0.067
6	0.037	0.044	0.037
7	0.046	0.031	0.033

The model was verified using the CHECKRAS program. CHECKRAS sets limits on channel and overbank Manning's *n* values. However, it does not restrict use of Manning's *n* based on field conditions.

5.3.2 Expansion and Contraction Coefficients

Contraction and expansion coefficients of 0.1 and 0.3, respectively, were used along the study reach except at the 7th Street Bridge where contraction and expansion coefficients of 0.3 and 0.5 were used, respectively. CHECKRAS issued warnings about contraction and expansion losses at the Loop 101 bridges. The contraction and expansion coefficients were left at 0.1 and 0.3 because no contraction or expansion took place in this reach.

5.4 Cross-Section Descriptions

The final HEC-RAS model for the Cave Creek had sixty one (61) new geo-referenced cross-sections plus the four (4) cross-sections borrowed from the Burges & Niple (1989) HEC-2 model (22.880, 25.551, 25.557, and 25.561). The final location of cross-sections was agreed upon by both the DISTRICT and WEST. All cross-sections were cut using HEC-GeoRAS extension of ArcView GIS exept for cross-section 25.528 at the CAP Canal overshoot which was based on the engineering drawings of the overshoot as well as a surveyed spot elevation at the top of the overshoot. Also, the upstream and downstream bounding cross-sections of the 7th Street Bridge (24.068, and 24.057) were modified slightly to represent the prismatic bridge opening. The last model cross-section (22.880) was located approximately 585 feet downstream of cross-section number 22.991 which is the most downstream section in the study limits. A CHECKRAS run was successfully completed.

5.5 Modeling Considerations

5.5.1 Hydraulic Jump and Drop Analysis

Although the hydraulic model did not capture hydraulic jumps, this could occur at several locations along the study reach. A sloping concrete drop structure was identified approximately 200 feet south (downstream) of the southernmost of the Loop 101 Bridges. Hydraulic cross-sections were cut at the top and downstream of the toe of the drop structure. Water surface elevation at the top of the drop structure went critical, indicating a potential supercritical flow over the structure and a hydraulic jump. Boulders that were identified in the main channel at cross-section 23.204 have the potential to cause a hydraulic jump just downstream. In the reach from Deer Valley Road to the CAP Canal, there were several cross-section locations where flow went critical and HEC-RAS indicated there was no subcritical solution. Although a subcritical flow regime was modeled, supercritical flow is possible in some areas along the reach since the channel bed is comprised mainly of gravel. This could lead to hydraulic jumps.

5.5.2 Bridges and Culverts

The seven bridges in the study reach were coded in HEC-RAS based on the As-Builts obtained from the respective owners of the structures. Table 5-3 summarizes the bridges. The Loop 101 Mainline Bridges (East and West bound) were modeled as single structure. HEC-RAS was prompted to accept the highest energy answer from the three available bridge modeling methods: Energy, Momentum and the Yarnell method. The 7th Street Bridge was skewed at 37.5 degrees to the Cave Creek flow. A contraction coefficient of 0.3 and an expansion coefficient of 0.5 were used at the 7th Street Bridge location. A contraction coefficient of 0.1 and an expansion coefficient of 0.3 were used at the North and South faces of the Loop 101 Highway since the main channel in this reach was straight with no visible contraction or expansion.

CHECKRAS issued numerous warnings about bridge cross-sections not having encroachments. Encroachments cannot be entered at bridge cross-sections, but only at the bounding cross-sections. Warnings were issued regarding the bounding bridge cross-sections being closer to the bridge than the bridge height, and that the bounding cross-section should be beyond the embankment. This is not relevant in this model. The roadway / deck was higher than the ground points at all the bridges, making the ground points outside of the bridge opening irrelevant. Furthermore, the flow was entirely under all bridges. Placing the bounding cross-section closer to the bridge face provides for more accurate modeling of each bridge.

Table 5-3 Bridge Data

Bridge ID	Mile Post	Structure No.	Bridge Type	Agency
7th Street @ Cave Creek	N/A	BR-76198	Reinforced Concrete	City of Phoenix
101 Mainline, Westbound	25.90	1491	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
101 Mainline, Eastbound	25.90	1490	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
North Ramp @ 101	25.90	1466	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
South Ramp @ 101	25.90	1486	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
Frontage Road @ 101, Westbound	N/A	2466	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
Frontage Road @ 101, Eastbound	N/A	2281	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT

5.5.3 Levees and Dikes

Berms were identified during field visit and from contour maps along the left and right banks of Cave Creek upstream of Deer Valley Road. The left bank berms in this reach extended from downstream of the CAP Canal overshoot to cross-section number 25.299. Downstream of cross-section 25.299, the left bank is defined as natural high ground except from 25.270 to 29.191, near the roadway crossing. The right berm extends from the CAP Canal overshoot to about cross-section 24.700, with the exception of the roadway crossing near 25.191. This right berm separates the channel from the deep gravel pit that exists to the right of the channel. The area to the right of this berm was considered to be flooded at the same elevation as the channel, but considered to be ineffective flow.

Although a breakout could occur into the gravel pit at the roadway crossing near cross-section 25.191, for the purposes of the model, it was assumed that the gravel pit was full of water and that this would prevent any flow from escaping from the channel.

Downstream of the 7th Street Bridge, the overbank was considerably higher than the channel due to the landfill. The channel banks have riprap protection from about 800 feet downstream of the 7th bridge until just upstream of the Loop 101 North Frontage Road.

Downstream of the Loop 101 bridges, there was a berm on the left side of the channel. The effective flow was assumed to be contained in front of this berm; however, a ponding area was also delineated behind the berm due to backwater from downstream.

5.5.4 Islands and Split Flows

Two major islands were identified in the study reach. The first, upstream of Deer Valley road on the right overbank area approximately extends from between cross-sections 25.191 and 25.155 to just downstream of cross-section 25.039. This island stood on what was identified as a large pit extending from downstream of the CAP Canal overshoot to cross-section 24.828. This island was completely within the ineffective flow area in the gravel pit. The second island was downstream of Deer Valley Road, between cross-sections 24.549 and 24.466, and caused a flow split. The distance of the flow split was fairly short, only about 300 feet along the channel. Because of the short distance of the split, no flow split was modeled in HEC-RAS, however, a cross-section was cut through the island (25.504). The thalweg (hydraulic baseline) was on the left side of the island with bank stations aligned to maintain main channel definition and consistency with upstream and downstream sections of the reach.

Ponding areas were identified at locations where water broke out of the main channel through an opening in the banks or due to backwater effect in low areas adjacent to the main channel. The first was located on the left overbank upstream of Deer Valley Road between cross-sections 24.793 and just downstream of cross-section 24.673. The ponding elevation was 1479 feet. This ponding elevation was based on the energy grade line at cross-section 24.700, the approximate location at which the ponded flow would return to the channel. The second ponding zone was in an area that was identified as the low flow channel from the old Cave Creek alignment between about cross-section 23.019 and 23.040. This area is behind a man-made berm which constitutes the left side of the main channel for most of the distance beween 23.019 and 23.040. Backwater flows into and ponds in this area at an elevation of 1423 feet, based on the water surface elevation at the downstream limit of the berm. The third ponding zone was in a tributary artifical channel downstream of the Loop 101 bridges, which conveys flow exiting from culverts that come from the east. The ponding elevation in this area was 1430 feet. The ponding areas were identified as Zone AH on the Work Study Maps. None of the ponding zones was the result of any overland flow but was simply the result of water break-out from the Cave Creek, or strictly riverine in nature. It was therefore not preferable to analyze these areas by using storage routing techniques provided in HEC-1 hydrologic software.

5.5.5 Ineffective Flow Areas

Right ineffective flow areas were assigned along the top of the right berm which extends from the CAP Canal overshoot to cross-section 24.700 which is upstream of Deer Valley Road. Thus the entire gravel pit area was flooded but assumed to be ineffective flow. Additional ineffective flow areas were assigned along the left side of the cross-sections from the CAP Canal to cross-section 25.299, where man-made berms and other obstructions in the overbank restrict the flow. From 25.271 to 25.151, the left ineffective flow areas were set on the basis of flow expansion and contraction which takes place in this large flattened area. The right ineffective flow limit at 25.191, the approximate location of a road crossing, was chosen to maintain continuity between the right berms which exist just upstream and downstream.

Ineffective areas were assigned for the first three cross-sections downstream of Deer Valley Road, to prevent the effective flow width from changing too abruptly. No ineffective areas were defined from 24.504 (downstream of Deer Valley Road) to the Loop 101 Bridges. Downstream of the Loop 101 bridges, left ineffective areas were set at 23.040, to prevent the ponded area on the left side of the section from conveying flow, at 23.019, to prevent flow in most of the area just downstream of the ponded area from being effective, and at 22.991, to prevent a low area on the left side of the cross-section, separated from the main reach, from becoming effective.

5.5.6 Supercritical Flow

None identified.

5.6 Floodway Modeling

Floodway analysis was conducted due to overtopping of banks in the study reach. The goal of conducting the floodplain encroachment analysis was to determine the limits of encroachment that would produce a rise in water surface elevation that is as near the one-foot maximum as possible. Equal conveyance method with encroachment methods 4 and 5 in HEC-RAS was used initially to get a first cut at the encroachment stations. However, only encroachment method 1 was used in the final floodway analysis per the DISTRICT's Consultant Guidelines. Encroachment method 1 allows the user to enter the right and left encroachment stations while method 4 lets the user specify a "target" water surface increase. Method 5 allows user to specify target water surface increase and maximum change in energy (in feet).

Initial floodway runs were made with several "target" values because typically the initial floodway computations provide changes in water surface elevations greater or less than the "target" increase. This task was accomplished using a combination of encroachment methods 4 and 5. Profile #3 (PF3) in the Cave Creek HEC-RAS model "encroachments" editor shows how the floodway was developed. Profile #2 (PF2) had the floodway imported into method 1 for final analysis with specific encroachment stations.

The majority of the encroachment to the Cave Creek model was introduced upstream of the 7th Street Bridge. Upstream of Deer Valley Road water overtops the right bank into the large pit. Overtopping of the left bank downstream of the CAP Canal overshoot was also observed. A target water surface elevation increase of 1 foot was applied at each of these cross-sections with encroachment method 4. Encroachment method 5 was applied from cross-sections 25.155 to 24.828 with a target water surface elevation increase between 0.8 and 1 foot and a maximum change in energy of 1 foot. Method 5 was used in order to achieve surcharges close to 1 foot and to avoid negative surcharge. Manual adjustments to the encroachment stations were made at 24.872 and 25.361 to avoid negative surcharges or surcharges in excess of 1 foot. Encroachment stations at 22.880 and 25.561 were set per the FIS model.

The major issue regarding floodway analysis was near the island at 24.504. Although it was theoretically possible to encroach so that the island was outside the floodway, this could only be achieved with an abrupt transition between the floodway limits at cross-section 24.466 (wide floodway) and the narrow floodway on the left side of the island. Since such transition would have been too abrupt to be realistic, encroachment method 1 was used during the initial floodway runs for cross-section 24.504 and few sections upstream to smooth the transition and insure that the part of the channel on the right side of the island remained in the floodway. Encroachment was also applied downstream of the set of bridges at Loop 101, from cross-sections 23.04 to 22.991 where backwater flows into the old low flow area of the old Cave Creek alignment. Encroachment method 1 was also applied at 22.991, the most downstream of the cross-section cut from the new topography, in order to smooth transition to the existing floodway.

Downstream boundary condition was adjusted to a water surface elevation of 1420.53 feet based on the floodway analysis in the Burges and Niple (1989) HEC-2 model.

CHECKRAS issued a warning about the floodway boundaries being within the channel banks at 25.561. This cross-section was copied from the HEC-2 FIS model, and the floodway boundaries were in-bank in that model. A warning was also provided about floodway encroachments at 25.557. This cross-section was copied from the HEC-2 FIS model, and there are no floodway encroachments there.

The floodway run, at cross-section 23.204, reported a negative surcharge of –0.03 feet. This was a computational anomaly and without any hydraulic basis. For numerous cross-sections downstream, the flow was entirely in bank and the floodplain and floodway elevations were identical. Similarly, the flow at 23.204 was also entirely in-bank and the encroachment (to the bank stations) should have no effect on water surface elevations. The surcharges at cross-section 23.204 and the next upstream section 22.223 (where the flow was also entirely in-bank) were reported as 0.00 in the floodway data table and the floodway profile. Removal of the encroachment limits at 23.204 resulted in zero surcharge at 23.204 and 23.223.

5.7 Problems Encountered During the Study

5.7.1 Special Problems and Solutions

None identified.

5.7.2 Modeling Warning and Error Messages

HEC-RAS generated several warning messages along the study reach. Divided flow was computed at all cross-sections from 25.482 and 24.343 except at cross-sections 24.587 and 24.549. These results were indicative of local high points created by the berms and natural high bank areas notable between the CAP Canal overshoot and Deer Valley Road. These were not true split flow phenomena.

Model tolerances were exceeded at several cross-section locations for the conveyance ratio, velocity head or energy losses. These warnings were not a source of concern, and additional cross-sections would have avoided them. The final location and frequency of cross-sections were agreed upon by both the DISTRICT and WEST.

Several cross-sections upstream of Deer Valley Road crossing indicated that the energy equation could not be balanced, and the program defaulted to critical depth. Most of these locations show grade breaks such as adverse bed slope (at or near cross-sections 24.828, 24.732, and 24.617), or step-up in bed (at cross-section 25.299) over a short reach length. Critical depth condition at cross-section 25.039 was believed to be due to steep slope which is not a great cause of concern for this type of channel. Water surface also defaulted to critical depth at cross-section 23.040 due to the sloping drop structure that extends downstream, and at cross-sections 23.204 and 23.192, due to the break in bed slope just upstream of the bridges. Attempts to add further cross-sections did not eliminate the critical depth problems due to the aforementioned factors. That the water surface would approach critical depth as it approached a break in bed slope is not unreasonable.

5.8 Calibration

Calibration of the hydraulic model was beyond the scope of this analysis.

5.9 Final Results

5.9.1 Hydraulic Analysis Results

A summary table of the existing condition (without floodway) hydraulic results is presented in Table 5-4. The table summarizes the following variables by cross-section: peak discharge, water surface elevation, critical water surface elevation, average channel velocity, top width, hydraulic depth, Froude number, and stations for left and right edges of water surface. For comparative purposes, the floodplain and floodway elevations of the effective models and those calculated for this analysis are presented in graphical form in Figure 7-1. At the upstream tie-in cross-section 25.561, the Flood Insurance Study floodplain and floodway water surface elevations were 1514.36 feet and 1514.32 feet, respectively, giving a negative surcharge of 0.04 feet. The revised model floodplain and floodway water surface elevations were 1513.88 feet and 1513.71 feet, respectively, giving a negative surcharge of 0.17 feet. The final discharges were agreed upon by the DISTRICT and WEST.

5.9.2 Verification of Results

The results generated by the hydraulic model are reasonable and within expected parameters.

Table 5-4 HEC-RAS Output

River	River Sta.	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Top Width	Hydr Depth	Froude # Chl	Sta W.S. Lft	Sta W.S. Rgt
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)
Cave Creek	25.561	4900	1513.88	1510.63	6.37	115.34	6.67	0.43	9950.54	10065.87
Cave Creek	25.557	4900	1511.43	1511.43	12.64	77.65	4.99	1	9961.17	10038.83
Cave Creek	25.551	4900	1510.77	1510.77	12.92	73.11	5.19	1	9963.45	10036.55
Cave Creek	25.528	2880	1509.45	1509.45	10.88	72	3.68	1	9964	10036
Cave Creek	25.515	2880	1504.78	1500.62	4.3	157.24	7.3	0.28	9928.03	10085.27
Cave Creek	25.482	2880	1503.3	1502.62	9.42	1207.55	4.33	0.8	9758.82	11063.55
Cave Creek	25.428	2880	1501.25	1500.44	9.9	1648.92	4.85	0.79	9778.11	11441.54
Cave Creek	25.367	2880	1500.05	1498.59	8.41	1978.56	5.28	0.61	9651.12	11701.4
Cave Creek	25.299	2880	1496.6	1496.6	11.93	2024.83	4.38	1.01	9709.46	11752.35
Cave Creek	25.271	2880	1495.13	1492.09	2.38	2127.97	4.4	0.22	9570.99	11703.83
Cave Creek	25.21	2880	1494.94	1492	3.1	2178.14	4.55	0.25	9321.01	11502.05
Cave Creek	25.191	2880	1494.61	1493.02	5.16	1835.26	3.06	0.39	9618.81	11454.07
Cave Creek	25.155	2880	1493.46	1492.72	8.65	1318.18	3.56	0.67	9848.98	11437.74
Cave Creek	25.096	2880	1492.57	1491.27	7.02	1331.11	3.52	0.55	9857.64	11332.01
Cave Creek	25.039	2880	1489.75	1489.75	11.71	1081.74	3.42	0.94	9924.39	11127.79
Cave Creek	24.953	2880	1487.08	1485.23	6.93	1214.47	4.64	0.5	9922.89	11150.27
Cave Creek	24.872	2880	1485.37	1483.82	8.99	1070.11	3.3	0.6	9870.79	10964.36
Cave Creek	24.828	2880	1482.89	1482.89	12.65	899.48	4.52	0.95	9964.88	10865.83
Cave Creek	24.793	2880	1481.2	1481.2	11.67	863.44	3.9	0.93	9920.56	10808.88
Cave Creek	24.732	2880	1479.1	1478.39	8.94	681.63	3.81	0.74	9737.23	10583.87
Cave Creek	24.7	2880	1477.25	1477.25	10.87	352.14	3.48	0.96	9884.37	10303.15
Cave Creek	24.673	3090	1477.44	1474.73	5.21	308.76	4.36	0.37	9870.65	10250.59
Cave Creek	24.632	3090	1474.39	1474.39	13.17	52.94	4.91	1.01	9974.83	10027.76

River	River Sta.	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Top Width	Hydr Depth	Froude # Chl	Sta W.S. Lft	Sta W.S. Rgt
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)
Cave Creek	24.617	3090	1471.71	1471.71	10.21	251.99	2.8	0.97	9696.47	10073
Cave Creek	24.587	3090	1469.03	1468.51	7.14	356.57	2.34	0.69	9666.15	10022.72
Cave Creek	24.549	3090	1468.44	1466.63	3.78	339.44	3.32	0.33	9829.33	10168.77
Cave Creek	24.504	3300	1466.24	1466.15	9.75	132.93	2.91	0.81	9956.42	10169.79
Cave Creek	24.466	3300	1465	1464.34	6.54	218.55	2.69	0.62	9955.43	10173.98
Cave Creek	24.427	3300	1464.37	1462.57	4.35	252.34	3.36	0.37	9935.92	10189.49
Cave Creek	24.343	3300	1463.53	1460.82	3.71	258.16	3.65	0.32	9890.61	10165.08
Cave Creek	24.3	3300	1463.5	1458.86	1.88	328.89	5.58	0.14	9865.43	10194.32
Cave Creek	24.264	3300	1463.42	1458.53	2.25	257.15	5.94	0.16	9865.36	10122.51
Cave Creek	24.232	3300	1462.72	1459.89	6.21	105.99	5.08	0.46	9946.8	10052.79
Cave Creek	24.21	3300	1462.95	1457.54	2.67	189.21	6.68	0.17	9888.79	10078
Cave Creek	24.169	3300	1462.85	1457.2	2.8	175.01	6.9	0.18	9944.32	10119.34
Cave Creek	24.112	3300	1462.77	1455.94	2.48	171.47	7.94	0.15	9965.16	10136.62
Cave Creek	24.068	3300	1461.85	1458.95	6.63	71.63	6.95	0.44	9964.19	10035.82
Cave Creek	24.062	7th Street Bridge								
Cave Creek	24.057	3300	1461.28	1458.83	7.09	71.63	6.5	0.49	9964.19	10035.82
Cave Creek	23.963	3300	1459.68	1456.64	6.68	79.65	6.2	0.47	9959.27	10038.92
Cave Creek	23.883	3300	1457.9	1455.14	7.87	64.21	6.53	0.54	9968	10032.21
Cave Creek	23.822	3300	1455.38	1453.88	9.53	60.33	5.74	0.7	9967.79	10028.12
Cave Creek	23.787	3300	1455.49	1451.75	4.8	112.17	6.13	0.34	9933.22	10045.39
Cave Creek	23.756	3300	1454.74	1451.45	6.52	81.66	6.2	0.46	9960.1	10041.75
Cave Creek	23.662	3300	1452.11	1449.74	8.37	62.52	6.31	0.59	9970.07	10032.58
Cave Creek	23.567	3300	1449.58	1446.82	7.72	66.72	6.41	0.54	9963.56	10030.28
Cave Creek	23.488	3300	1447.83	1444.7	7.32	67.87	6.64	0.5	9966.62	10034.48
Cave Creek	23.389	3300	1445.02	1442.61	8.39	61.66	6.38	0.59	9971.21	10032.87

River	River Sta.	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Top Width	Hydr Depth	Froude # Chl	Sta W.S. Lft	Sta W.S. Rgt
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)
Cave Creek	23.307	3300	1442.67	1440.21	8.16	63.61	6.36	0.57	9966.9	10030.51
Cave Creek	23.223	3300	1440.52	1437.67	7.79	63.21	6.7	0.53	9967.15	10030.35
Cave Creek	23.204	3300	1438.07	1438.07	12.49	54.06	4.89	1	9972.4	10026.46
Cave Creek	23.192	3300	1435.57	1435.57	12.24	58.04	4.64	1	9972.29	10030.33
Cave Creek	23.15	3300	1434.09	1432.57	6.74	111.89	4.37	0.57	9945.32	10057.21
Cave Creek	23.146	North Frontage Road Bridge								
Cave Creek	23.142	3300	1433.06	1431.86	7.28	109.12	4.15	0.63	9947.35	10056.47
Cave Creek	23.138	3300	1433.02	1431.63	7.06	106.91	4.37	0.6	9945.11	10052.01
Cave Creek	23.134	North On Ramp Bridge								
Cave Creek	23.131	3300	1432.35	1431.29	7.37	113.11	3.96	0.65	9943.39	10056.5
Cave Creek	23.128	3300	1432.33	1431.16	7.21	112.59	4.07	0.63	9942.96	10055.54
Cave Creek	23.114	Loop 101 Mainline Bridges								
Cave Creek	23.101	3300	1431.65	1430.37	7.01	111.42	4.22	0.6	9944.27	10055.68
Cave Creek	23.097	3300	1431.6	1430.27	6.86	112.85	4.26	0.59	9943.71	10056.55
Cave Creek	23.093	South Off Ramp Bridge								
Cave Creek	23.09	3300	1431.45	1430.12	6.76	116.96	4.17	0.58	9944.88	10061.84
Cave Creek	23.084	3300	1431.37	1430.01	6.7	117.75	4.18	0.58	9944.86	10062.61
Cave Creek	23.081	South Frontage Road Bridge								
Cave Creek	23.077	3300	1431.24	1429.7	6.47	117.05	4.36	0.55	9944.09	10061.14
Cave Creek	23.04	3660	1429.35	1429.35	9.93	469.21	3.1	0.99	9573.66	10065.45
Cave Creek	23.019	3660	1423.08	1422.4	7.34	289.02	3.22	0.69	9777.41	10066.43
Cave Creek	22.991	3660	1422.71	1421.85	6.24	262.81	2.77	0.61	9801.09	10063.9
Cave Creek	22.88	5500	1420.05	1418.49	6.1	211.79	4.26	0.52	9952.12	10163.91

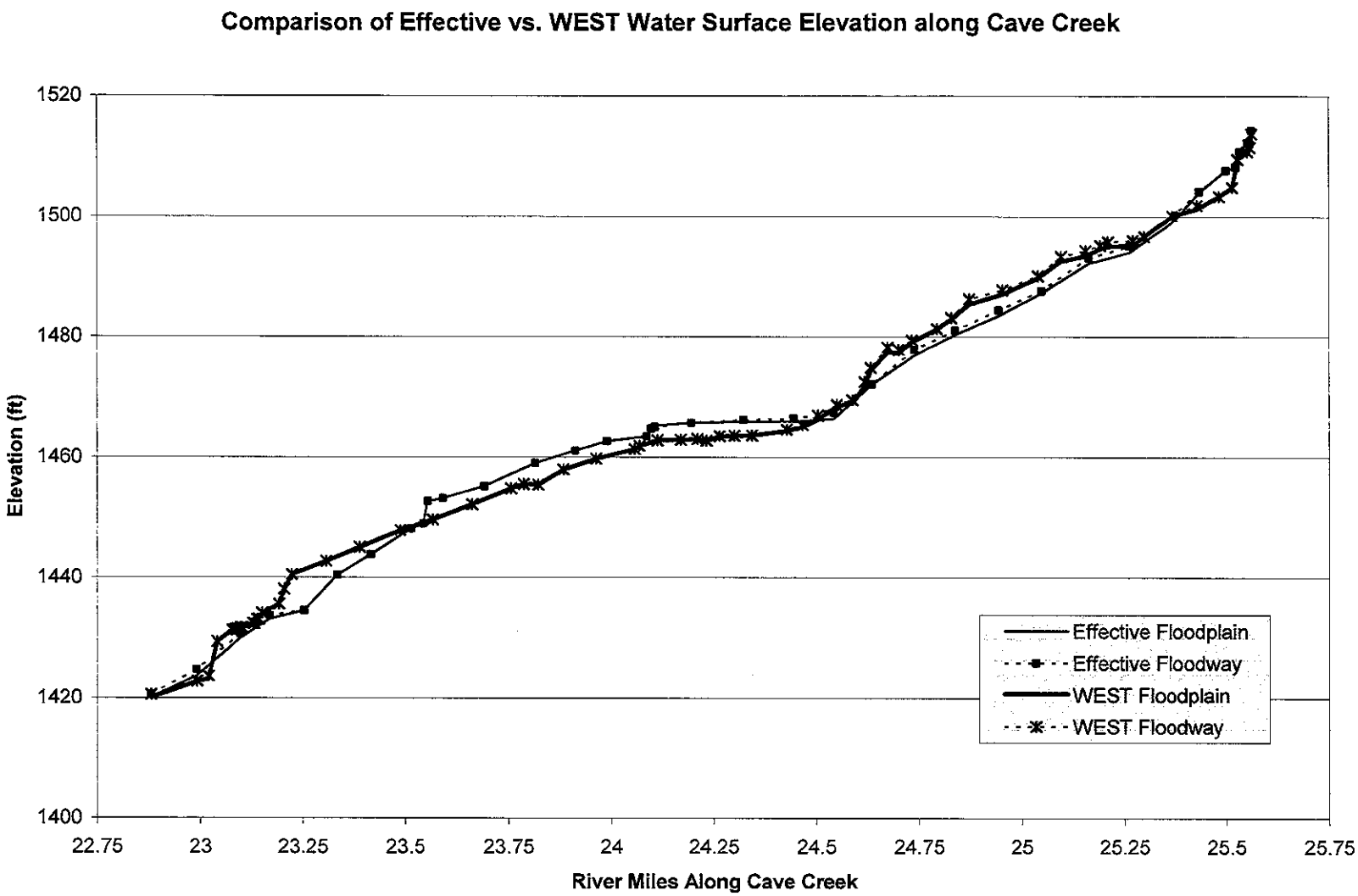


Figure 7-1 Water Surface Comparison along Cave Creek

6. Erosion and Sediment Transport

Erosion and sediment transport analysis was outside the scope of this study and was not addressed in this analysis.

7. Draft FIS Report Data

7.1 Summary of Discharges

Table 7-1 summarizes the discharges of the revised model.

Table 7-1 Summary of Discharges

Cross-Section	Discharge (cfs)
25.561	4,900
25.528	2,880
24.673	3,090
24.504	3,300
23.040	3,660
22.880	5,500

7.2 Floodway Data

The draft Floodway data is listed in Table 7-2. The table summarizes the following variables for the floodway by cross-section: width, section area, and mean velocity. The table also lists by cross-section the base flood water surface elevations for floodway and floodplain, and the corresponding water surface elevation increase.

Table 7-2 Floodway Data

Flooding Source	Floodway			Base Flood Water Surface Elevation[1]		
Cross-Section	Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Floodway (ft)	Floodplain (ft)	Increase (ft)
25.528	72	264.7	10.9	1509.45	1509.45	0.00
25.515	91	671.6	4.3	1504.81	1504.78	0.04
25.482	71	305.9	9.4	1503.30	1503.30	0.00
25.428	63	324.4	8.9	1501.79	1501.25	0.55
25.367	60	326.2	8.8	1500.08	1500.05	0.03
25.299	55	242.7	11.9	1496.62	1496.60	0.02
25.271	224	1149.3	2.5	1495.99	1495.13	0.85
25.210	195	1041.9	2.8	1495.77	1494.94	0.82
25.191	94	505.8	5.7	1495.17	1494.61	0.56
25.155	78	409.6	7.0	1494.27	1493.46	0.81
25.096	84	450.8	6.4	1493.35	1492.57	0.78
25.039	59	262.8	11.0	1490.10	1489.75	0.35
24.953	71	441.5	6.5	1487.73	1487.08	0.65
24.872	50	368.1	7.8	1486.22	1485.37	0.85
24.828	40	222.7	12.9	1483.11	1482.89	0.22
24.793	46	228.7	12.6	1481.27	1481.20	0.07
24.732	69	325.8	8.8	1479.37	1479.10	0.27
24.700	63	283	10.2	1477.80	1477.25	0.55
24.673	103	670.2	4.6	1478.23	1477.44	0.79
24.632	40	229.3	13.5	1474.86	1474.39	0.47
24.617	62	264.8	11.7	1472.51	1471.71	0.80
24.587	151	396.8	7.8	1469.48	1469.03	0.45
24.549	241	829.4	3.7	1468.65	1468.44	0.21
24.504	110	428.9	7.7	1466.86	1466.24	0.62
24.466	155	474.2	7.0	1465.29	1465.00	0.29
24.427	150	655.1	5.0	1464.57	1464.37	0.20
24.343	197	825	4.0	1463.57	1463.53	0.05
24.300	261	1587.5	2.1	1463.55	1463.50	0.04
24.264	215	1366.6	2.4	1463.45	1463.42	0.03
24.232	94	531.3	6.2	1462.74	1462.72	0.02
24.210	167	1219.6	2.7	1462.97	1462.95	0.02
24.169	152	1162.7	2.8	1462.86	1462.85	0.01
24.112	150	1310.8	2.5	1462.77	1462.77	0.00
24.068	72	497.9	6.6	1461.85	1461.85	0.00
24.062	7th Street Bridge					
24.057	72	465.7	7.1	1461.28	1461.28	0.00
23.963	80	494	6.7	1459.68	1459.68	0.00
23.883	64	419.6	7.9	1457.90	1457.90	0.00
23.822	60	346.4	9.5	1455.38	1455.38	0.00
23.787	112	687.8	4.8	1455.49	1455.49	0.00

[1]Vertical Datum: NGVD 29

Flooding Source	Floodway			Base Flood Water Surface Elevation[1]		
Cross-Section	Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Floodway (ft)	Floodplain (ft)	Increase (ft)
23.756	82	506.3	6.5	1454.74	1454.74	0.00
23.662	63	394.2	8.4	1452.11	1452.11	0.00
23.567	67	427.4	7.7	1449.58	1449.58	0.00
23.488	68	450.6	7.3	1447.83	1447.83	0.00
23.389	62	393.3	8.4	1445.02	1445.02	0.00
23.307	64	404.5	8.2	1442.67	1442.67	0.00
23.223	63	423.6	7.8	1440.52	1440.52	0.00
23.204	54	264.1	12.5	1438.07	1438.07	0.00
23.192	58	269.6	12.2	1435.57	1435.57	0.00
23.150	112	489.4	6.7	1434.09	1434.09	0.00
23.146	North Frontage Road Bridge					
23.142	109	453.1	7.3	1433.06	1433.06	0.00
23.138	107	467.3	7.1	1433.02	1433.02	0.00
23.134	North On Ramp Bridge					
23.131	113	447.9	7.4	1432.35	1432.35	0.00
23.128	113	457.8	7.2	1432.33	1432.33	0.00
23.114	Loop 101 Mainline Bridges					
23.101	111	470.5	7.0	1431.65	1431.65	0.00
23.097	113	480.6	6.9	1431.60	1431.60	0.00
23.093	South Off Ramp Bridge					
23.090	117	488	6.8	1431.45	1431.45	0.00
23.084	118	492.3	6.7	1431.37	1431.37	0.00
23.081	South Frontage Road Bridge					
23.077	117	509.8	6.5	1431.24	1431.24	0.00
23.040	119	368.7	9.9	1429.35	1429.35	0.00
23.019	134	530.5	6.9	1423.80	1423.08	0.72
22.991	174	505.9	7.2	1423.41	1422.71	0.70

[1]Vertical Datum: NGVD 29

7.3 Annotated Flood Insurance Rate Maps

Copies of draft annotated Flood Insurance Rate Maps are included in the Exhibit Maps section following the Appendices.

7.4 Flood Profiles

A draft Flood Profile is included in the Exhibit Maps section following the Appendices.

A.1 Data Collection Summary

Cave Creek
Floodplain Delineation

Maricopa County

Data Collection Report

Contract Number: FCD 2004 C024

Prepared for:

Flood Control District of Maricopa County
Phoenix, AZ

Prepared by:

WEST CONSULTANTS, INC.

WEST Consultants, Inc.
960 W Elliot Road, Suite 201
Tempe, AZ 85284-1137

December 23, 2004

Introduction

The Flood Control District of Maricopa County (FCDMC) has tasked WEST Consultants, Inc. (WEST) to perform a floodplain delineation study for Cave Creek reach between the Central Arizona Project (CAP) canal and the bridges at Loop 101, located in Phoenix, Arizona (Figure 1). This report summarizes the data collection efforts in support of the project. This project is officially referred to by FCDMC as contract number FCD 2004 C024. Mr. Michael Duncan, [mwd@mail.maricopa.gov] is the project manager.

Project Limits

The upstream project limit is the midspan of the CAP canal overchute for Cave Creek, and the downstream limit is approximately 900 feet south of the median centerline of the Loop 101 Freeway. Both 7th Street and Deer Valley Road cross Cave Creek within the study reach. The crossings at 7th Street and Deer Valley Road are defined by a bridge and a dip crossing, respectively.

Survey Data

Mapping data is scheduled to be ready at the end of January 2005. Field surveys of structures have also not been conducted yet. WEST will review the data to determine what is needed for field surveys.

Hydraulic Models: Existing Study

The hydraulic models developed by Burgess & Niple, Inc (1991b, and 1991c), which are the basis for the existing Flood Insurance Study, have been obtained from the FCDMC library.

Existing Flood Insurance Study Report

The Flood Insurance Study Report by Burgess & Niple, Inc (1991a) has been obtained from FCDMC library.

Hydrologic Data

The hydrology to be utilized in this study was performed by Kaminski-Hubbard Engineering, Inc. A copy of their report (Kaminsky-Hubbard, 1993) has been obtained from the FCDMC library. The discharges utilized in the existing Flood Insurance Study are contained in the Burgess & Niple hydraulic models and reports (Burgess & Niple, 1991a, 1991b, 1991c).

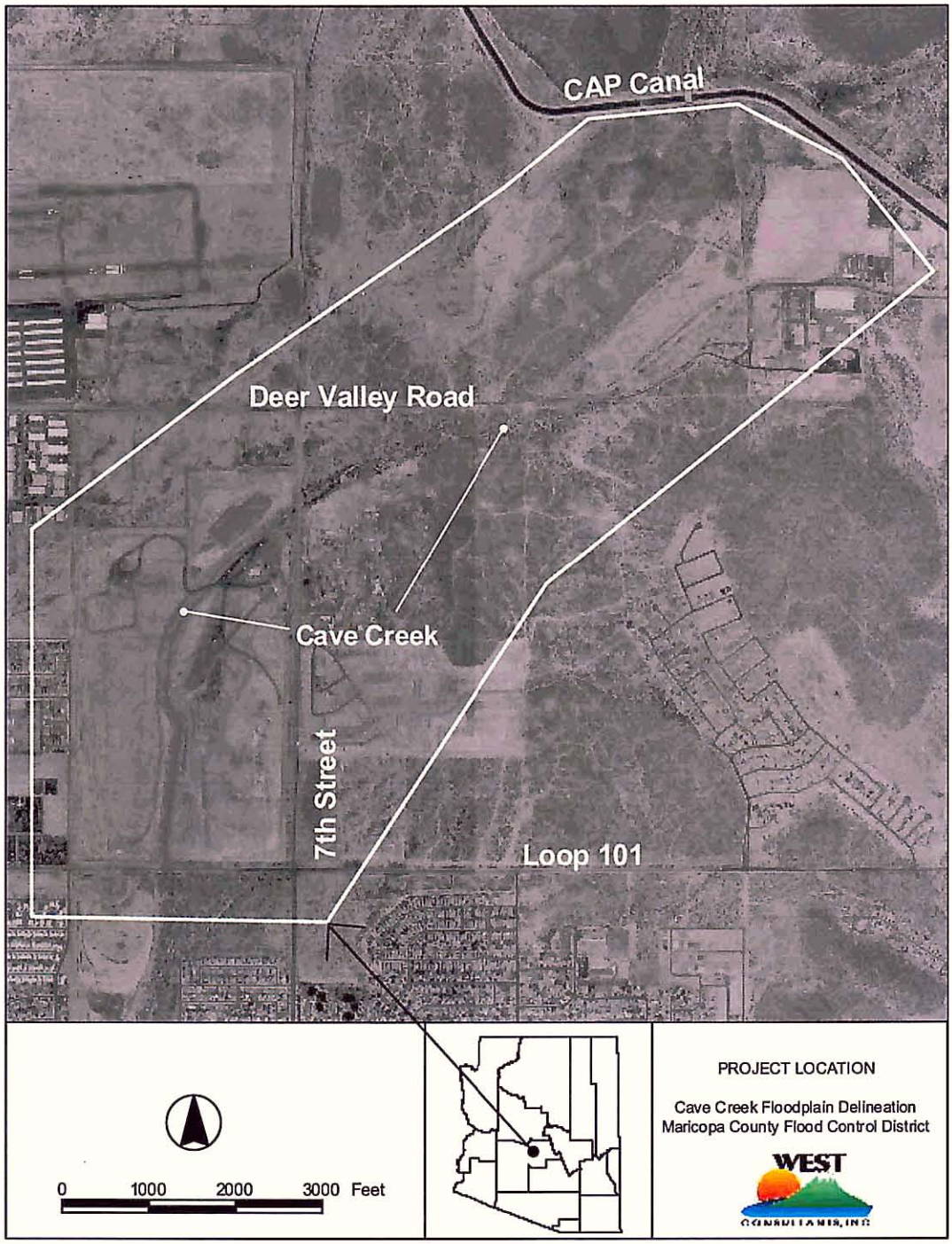


Figure 1. Approximate Project Extent

FIRM Panels FIS Study Reports

Electronic versions of the FIRM panels (Panel Numbers: 04013C1215J, 04013C1220H, and 04013C1210G) and PDF versions of FIS study reports (Volumes 1, 2 and 5, Revised July 19, 2001) for the study reach have been obtained. Summary of peak discharges is included in Volume 1 (pages 51-53), Volume 2 lists the floodway data in alphabetical order by wash names, and Volume 5 includes the water surface profiles (pages 60P-64P).

Existing Structures

A total of 7 existing bridge As-Builts were collected in support of the study. These are the City of Phoenix Bridge at the 7th Street crossing, and six other bridges: two on the Freeway 101 main line (East and Westbound), two on the north and south frontage roads (East and Westbound), and two on the south and north ramps. Table 1 summarizes the existing bridge data.

Table 1. Existing Bridge Data

Bridge ID	Mile Post	Structure No.	Type	Agency
7th Street @ Cave Creek	N/A	BR-76198	Reinforced Concrete	City of Phoenix
101 Mainline, Westbound	25.90	1491	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
101 Mainline, Eastbound	25.90	1490	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
North Ramp @ 101	25.90	1466	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
South Ramp @ 101	25.90	1486	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
Frontage Road @ 101, Westbound	N/A	2466	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT
Frontage Road @ 101, Eastbound	N/A	2281	AASHTO Type III Precast/Prestressed Concrete Girder	ADOT

Proposed Structures

Two bridges are proposed by the City of Phoenix within the study reach. One of these bridges will replace the existing reinforced concrete slab bridge at the 7th Street crossing and the other will be built on the Deer Valley Road dip crossing.

A December 14, 2004 correspondence with Mr. Ralph Goodall [Ralph.Goodall@phoenix.gov] of the City of Phoenix points out that the City has recently opened construction bids for improving 7th Street from Loop 101 to Deer Valley Road, including a new bridge over Cave Creek and associated channel improvements. Landmark Engineering (Mr. Craig Bolze) is the City's prime design consultant, and Landmark's bridge design sub-consultant is TranSystems (Mr. Jerry Cannon). This

bridge is designed as a 3-span reinforced concrete slab bridge with concrete floor, and is designed to pass a 100-year flow of 5,400 cfs. Construction is expected to begin in late February to early March 2005.

On the Deer Valley Road crossing over Cave Creek, the City is currently in the design process. Aztec Engineering (Mr. Chris Woolery) is the City's prime design consultant. This bridge will be designed to pass a similar 100-year flow, and will be a precast, prestressed AASHTO Girder bridge. This project is scheduled to open construction bids October 25, 2005 and begin construction in late January or early February 2006.

References

Burgess & Niple, Inc. (1991a). "Cave Creek and East Fork of Cave Creek Floodplain Delineation Study: Arizona Canal Diversion Channel to Cave Butte Dam." Final Hydraulics Report, Book 1 of 2 (Report).

Burgess & Niple, Inc. (1991b). "Cave Creek and East Fork of Cave Creek Floodplain Delineation Study: Arizona Canal Diversion Channel to Cave Butte Dam." Final Hydraulics Report, Book 2 of 2 (Hydraulic Models).

Burgess & Niple, Inc. (1991c). "Cave Creek Floodplain Delineation, Cave Buttes Dam to Arizona Canal Diversion Channel." Final Hydraulics Report (Addendum).

Kaminski-Hubbard Engineering, Inc. (1993). "Arizona Canal Diversion Channel Area Drainage Master Study, ACDC/ADMS Phase I." Hydrology Report, Book 1 of 3.

A.2 Referenced Documents

References

1. ArcView GIS, v. 3.2a (2000). Environmental Systems Research Institute, Inc.

2. Arizona Department of Water Resources (1997). Instructions for Organizing and Submitting Technical Documentation for Flood Studies. State Standard Attachment SSA 1-97.

3. Burges and Niple (1989). HEC-2 Model Files.

4. CHECK-RAS v.1.4 (2005). HEC-RAS Automated Review Program. Federal Emergency Management Agency.

5. Chow, V.T. (1959). *Open Channel Flow*. McGraw-Hill, New York, NY.

6. Flood Control District of Maricopa County (2003). Consultant Guideline. Flood Control District of Maricopa County. 3rd Edition, Revision 1.

7. Kaminski-Hubbard Engineering, Inc. (1993). Hydrology Report: Cave Creek Watershed. Arizona Canal Diversion Channel Area Drainage Master Study ACDC/ADMS Phase I. Prepared for Flood Control District of Maricopa County, Phoenix, AZ.

8. HEC-GeoRAS (2000). ArcView GIS Extension. Environmental Systems Research Institute, Inc.

9. HEC-RAS, v. 3.1.2 (2004). "River Analysis System." Hydrologic Engineering Center, Davis, CA.

10. HEC-RAS, River Analysis System (2001a). "User's Manual." Hydrologic Engineering Center, Davis, CA.

11. HEC-RAS, River Analysis System (2001b). "Hydraulic Reference Manual." Hydrologic Engineering Center, Davis, CA.

B.1 Special Problem Reports

Not Applicable / Not Included

B.2 Contact (telephone) Reports

Not Applicable / Not Included

B.3 Meeting Minutes or Reports

Subject: Cave Creek from CAP Canal to Loop 101 Freeway Floodplain Delineation Study

Contract: FDC 2004 C024

Location: Flood Control District Offices

Date: Thursday, December 2, 2004 from 10:00 a.m. to 11:10 a.m.

Participants: Mike Duncan, FCD
Steve Tucker, FCD
Hassan Mushtaq, City of Phoenix
Doug Hauth, FCD
Tim Murphy, FCD
Dennis Richards, WEST Consultants
Leo Kreymborg, WEST Consultants
Sam Hersey, Hersey Land Surveying
Ivan Morales, Southwest Mapping Technologies

Summary

Mike Duncan opened the Kickoff meeting at 10am with the attendees introducing themselves. Mike passed out the Kickoff meeting agenda to the meeting participants. The discussion closely followed Mike Duncan's agenda.

Discussion

Coordination / Schedule

Mike Duncan asked who project manager was to replace Gary. Dennis responded that he would be the project manager and Leo Kreymborg would be assistant project manager. Mike mentioned the notice to proceed date of 11/9/04, that FEMA submittal must be ready by 6/7/05 and that total project ends on 4/3/06.

Mike asked if ground control was reasonable by end of next week. Sam said yes. Ivan said they could fly the following Saturday, weather permitting. Sam said NAVD 88 would be used for control, the vertcon would be used to convert to NAVD 29.

Sam will provide both datums to FCD, and will provide only NGVD 29 to Ivan.

Sam said all the controls are 1988, and the conversion to 1929 is about 1.8 feet.

Coordination / Meetings

Mike Duncan recommended that a 2-3 week interval be used for meetings. Dennis suggested 3 weeks and Mike agreed. Mike recommended against setting any fixed day of the week for meetings.

Coordination / Billing Projections

Mike asked if there were any billing projections. Dennis said he could work some up.

Coordination / Monthly Progress Reports

Mike would like monthly progress reports before he gets the invoice. It would be ok to send another copy of the progress report to him at the same time the invoice is sent out. He mentioned the need to have MBE/WBE attached every month.

Coordination / Public Information

Mike will have newspaper ads printed and send a flyer to property owners. He will draft ads and flyer and get mailing list from GIS.

Sam said he did not forsee any problems with right of entry.

Data Collection

Mike mentioned that data collection report is due within 45 days of notice to proceed.

There are two new bridges going in:
Aztec is doing one – Deer Valley bridge
Landmark Design is doing the other one – 7th Street bridge.
Both structures are under Mike Goodall. Construction schedule is at least 2 years out.

Hassan said if it's called a bridge, need 3 ft. of freeboard for FEMA. But with a culvert don't need 3 ft. of freeboard. Hassan said FIS has 5,200 cfs.

Hassan indicated there is a breakout (just downstream of Deer Valley Road), but Mike Duncan said there is no breakout. Hassan asked if we can find the breakout. Hassan said that hydraulically there will be no change due to the new structures.

Mapping

Mike Duncan summarized:
Mapping 2 feet contours
1 inch=200 ft.
NGVD 1929
Each map will have conversion to NAVD 1988
Flight date is roughly 12/11.
Have scoped out 5 new monuments.

Hydrology

Steve Tucker said hydrology is straightforward. Need to interpret which discharge to use. The Qs are in the ACDC ADMP.

Tim Murphy asked why we are aren't using Qs from the FIS. Mike said the ACDC hydrology is quite a bit newer.

Mike said Burgess & Niple had 5,200 cfs all the way down. ACDC hydrology (Naminsky-Hubbard) 2,900 cfs at CAP Canal, 3,700 cfs at downstream limit (101)

Tim Murphy raised questions about lowering the Qs and whether this might introduce complexity because FEMA might not approve of the new Qs. A long discussion regarding the hydrology followed. Tim asked why the Qs were different. Steve responded that the basins were larger and used the curve number method. Mike said the Burgess & Niple hydrology was from 1988. Mike said the 2,900 cfs (newer) versus the older 4,600 cfs (older) (at the CAP Canal) was due to different methodology

Floodplain Delineation

Mike explained that sub-sections were required in HEC-RAS.

Mike explained that 2 new appendices needed to be added to TDN.

Digital Data

There will be a GIS class held. When Mike finds out a date, he will let WEST know. WEST is expected to send 1 engineer and 1 CAD person.

Tim mentioned that common problems were not following the layering scheme, computer displays that don't match printed output, and non-closed polygons.

Other

Mike explained that he preferred zigzag folding, both ways, for maps, and gave Dennis a sample folded paper. Mike explained that the TDN should be organized and easy to use with tabs.

Leo asked about review time, and Mike said that 2 weeks was OK for each of the district reviews, and to use 270 days for FEMA and 30 days for Final Submittal after FEMA review. Leo said he would modify schedule to reflect 45 days from NTD to Data Collection report.

Ivan mentioned the review of the blind panels and DTM, and cross-section review, should be inserted in the schedule.

Mike said he would get Leo information regarding review times for these mapping issues.

Subject: Progress Meeting, Cave Creek from CAP Canal to Loop 101 Freeway Floodplain Delineation Study

Contract: FDC 2004 C024

Location: WEST Consultants, Inc. office

Date: Monday, March 14, 2005, 10:30 am

Participants: Mike Duncan, FCD
Dennis Richards, WEST Consultants
Leo Kreymborg, WEST Consultants
Brian Wahlin, WEST Consultants

Minutes Prepared by: Leo Kreymborg

Summary

Leo Kreymborg passed out to the participants a list of items to discuss with Mike Duncan. A discussion of these points, as well as some additional concerns from Mike Duncan ensued.

Discussion

Draft Manning n-value report

Leo outlined to Mike how the n-value report was prepared and the level of detail contained in it. He explained the seven different reaches that were used to assign n-values. Mike inquired about Reach 4, which was broken into subreaches 4A and 4B. Leo explained that this was done because reach 4A used the overbank n-values from reach 3. Mike requested that the heading in the Reach 4 table clarify that the channel n-values apply to Reaches 4A and 4B.

Leo discussed how the bed and sloping banks of the channel were categorized separately for n-values, then composited. Mike said that usually just one channel n-value appeared in the n-value report, but he would look at the report. Mike inquired as to how the compositing was done. Leo explained that the estimated wetted perimeter of the bed and banks was used to calculate a composite n-value, using a representative cross-section from the reach. Leo explained that the compositing procedure was documented in the introduction. Mike asked if the compositing calculations were available. Leo explained that he had a spreadsheet with the calculations, but that the calculations themselves were not shown in the Draft Manning n-value report.

Leo said that he would like to be able to change the composited n-values slightly based on a more mature version of the hydraulic model, since the composite values depended

on water surface elevations. He estimated this would not change the compositied values by more than 0.001 or 0.002.

Mike requested that after the meeting, Leo provide to him the spreadsheet used to make the calculations. Also, it was agreed that the final compositing calculations would appear in an Appendix to the report.

Location of bank stations / bank lines

The preliminary models have the bank stations at the top of the slope, and that assumption was used for the n-value report as well. The issue of possibly locating the bank stations at the toe of the slope was raised by Leo. Mike said he wanted the bank stations at the top of the slope.

Tying into FIS (HEC-2) model on the downstream side

A discussion took place regarding how the new model would tie into the existing FIS model. Mike suggested adding two or three cross-sections from the FIS model on the downstream end of the new model.

The transition in discharges and water surface elevation between the new model's cross-sections and the FIS / HEC-2 sections was discussed. The alternatives of using normal depth at the downstream limit or using a backwater condition were discussed. Leo expressed a preference for using a backwater condition from the HEC-2 cross-sections. Mike and Leo agreed that the downstream HEC-2 cross-sections would be added, the most downstream cross-sections would have the higher FIS discharge, and that at some point, the transition to the new lower discharge would be made. For each HEC-RAS model, the last HEC-2 section would have a known water surface from the old HEC-2 model. There would be one water surface each for the floodplain model, and for the floodway model. The exact cross-section of the transition of discharge was not specified.

Tying into the FIS (HEC-2) model on the upstream side

Mike suggested that the new discharge be used in the cross-section about halfway through the overshoot. Then HEC-2 cross-section(s) would be added to the upstream end of the model, and these sections would have the higher discharge from the existing FIS. If necessary, it was agreed that intermediate transition cross-sections could be added if HEC-RAS had problems solving for the water surface between the HEC-2 section and the first new cross-section.

Mike said that the important thing was that the profile have a smooth transition from the upstream discharge to the lower downstream discharge.

Modeling of the overshoot at upstream end of model

Leo showed Mike engineering drawings provided by CAP, and recent field photos of the overshoot. The issue of modeling the energy dissipaters / baffles at the downstream end

of the overshoot was discussed. Mike suggested to try not putting the baffles in the HEC-RAS model, to see how the model would behave.

Modeling of Highway 101 bridges

Leo asked Mike if he thought the five bridges that comprise Highway 101, the ramps, and frontage roads, should be modeled as five separate bridges in HEC-RAS. Mike and Dennis inquired about the piers, and Leo and Brian responded that they were all round and all aligned with each other. Mike asked if the bridges were the same, and Leo pointed out that the bridges were all slightly different, but they all had round center piers.

Since the channel appears to be uniformly sloped and shaped across the bridges, Mike suggested we try modeling all the bridges as one bridge, as long as this did not cause suspect results in HEC-RAS. Leo said WEST would try this, checking among other things for sufficient freeboard to the water surface and to the energy grade line so that the results could be considered reliable.

Floodplain and floodway issues

Leo showed the participants some preliminary mapping of the floodplain based on a preliminary HEC-RAS model. The size and extent of the pit on the west side of the channel north of Deer Valley Road was pointed out, and that the floodplain in this region was going to be larger than before, due apparently to excavation. The issue of ineffective flow areas on the west and east side of the channel upstream of Deer Valley Road was discussed.

Leo mentioned that the floodwaters from 7th Street to the Highway 101 bridges would be completely contained with the channel banks. It was agreed that if this was the case, then there was no need to separately delineate a floodway in this reach, and that the floodway would equal the floodplain in this reach.

Boundary line for topography

Leo pointed out that the based on the preliminary floodplain, there was a small area to the northwest of the mapping limits where the current topography boundary line did not contain the floodplain. However, it appeared that there were enough breaklines available to the west to contain the expected floodplain. It was agreed that the boundary line would be moved slightly so that it would contain the expected floodplain.

Mike also asked about the generation of contours, and that Southwest Mapping would need to provide contours as well. These contours would need to extend to the boundary line.

Leo agreed to notify Southwest Mapping about moving the boundary line, and that the contours would need to extend to this line as well. Mike requested a plot of the affected area so that he could show John Stock what the issue was.

Length of cross-sections

Mike requested that cross-sections be trimmed so that they include the top banks and the floodplain and few hundred feet more, but that they not extend excessively. Leo sketched some lines on a plot showing where the cross-sections might be trimmed.

Cross-Section Spacing

Leo asked Mike about desired cross-section spacing. Mike mentioned the 500-foot recommended interval, and that additional cross-sections could be added for hydraulic reasons.

Boulders and spheres in the Channel

Leo mentioned that there were three approximately 3 foot boulders at the bottom of the channel shortly upstream of the 101 bridges, and that WEST was planning to cut some cross-sections near the boulders to model them. Mike asked if these boulders would cause the floodwaters to go out of bank, and Leo said they would not.

Another obstruction, a 3 foot diameter concrete sphere, was also mentioned as being in the channel farther upstream, but still in the riprapped reach. Leo said he was not planning on modeling that obstruction and Mike agreed.

Timeline for submission of cross-sections for review

Leo mentioned that Sam Hersey promised to deliver the field survey results today, March 14, and that given this, it should be possible to submit the cross-sections for review by the end of next week.

Projected billings

Mike inquired about the expenditure forecast, when we were going to revise it, and if the cumulative expenditure forecast for March was accurate. Leo said that the current forecast was probably too high because we were running 2 to 3 weeks late. Dennis and Mike agreed that the forecast would be updated for the next billing cycle, and it was agreed that the bill and the forecast would be sent by April 1.

Other

Mike requested that 4 cross-section per page plots of the current preliminary model be provided to him after the meeting.

Subject: Progress Meeting, Cave Creek from CAP Canal to Loop 101 Freeway Floodplain Delineation Study

Contract: FDC 2004 C024

Location: WEST Consultants, Inc. office

Date: Tuesday, May 10, 2005, 9:30 am

Participants: Mike Duncan, FCDMC
Dennis Richards, WEST Consultants, Inc.
Leo Kreymborg, WEST Consultants, Inc.

Minutes Prepared by: Leo Kreymborg

Summary

The March 29 draft submission of the hydraulic model and the plots of the draft floodplain, bank stations, and ineffective flow limits were discussed. Leo's comments that accompanied that submittal along with Mike Duncan's responses of May 5 were discussed.

Discussion

Upstream limit of HEC-RAS Model

Mike wanted the 2 most upstream cross-sections borrowed from the HEC-2 model removed from the HEC-RAS model. These cross-sections are 25.786 and 25.680

Gaps in floodplain just downstream of the CAP overshoot

Mike wanted the gaps in the floodplain downstream of the overshoot addressed. These gaps appear at the berm locations, where water has not broken out of the channel yet, but the overbank areas are shown as flooded to the same elevation as the channel. It was agreed that the assumption should be that the berms fail, therefore the overbank areas are flooded to the same elevation, and also that the area of these berms appears as floodplain.

Islands and Isolated Patches of Floodplain

A number of islands (dry areas) appear in the middle of the floodplain. All these islands will be eliminated except the two major ones which intersect 24.495 and 25.087. It was also agreed that a gap between an isolated patch of floodplain at the left side of 24.644 would be connected to a finger just upstream of it. It was agreed that an isolated patch of floodplain on the right side of the channel between 24.622 and 24.664 would be examined to see if it should be removed, or connected to the rest of the floodplain. The determination would depend on how much freeboard there was between the isolated

patch and the principal floodplain. All other isolated patches of floodplain present in the March 29 submittal are to be removed.

Flooding east of berm, downstream of 101

The backwater flooding that occurs east of the eastern berm, downstream of the 101, will be set at the elevation of the creek just downstream of the berm.

Low areas east of channel, upstream of Deer Valley Road

Some low spots just upstream of Deer Valley Road were examined to see if flow could breakout into these areas. Another low spot near the left limit of cross-section 24.722 was examined to see if flow could break out. It was determined that the channel had sufficient freeboard, typically about 5 feet, on the left side to prevent flow breaking out into these areas.

Downstream Limit of HEC-RAS model

It was determined that cross-section 22.794, borrowed from the HEC-2 model, would be removed and that the model would instead terminate with cross-section 22.880, also borrowed from the HEC-2 model. It was also determined that the finger of the old floodplain, which is on the east side of the channel at about river mile 22.982, will be left in the floodplain.

Extent of Study, Downstream Side

It was decided that the study should extend to approximately the end of the topography, about 100 feet or so downstream of cross-section 22.982

Boulders in Channel

The handling of the boulders which function as grade control structures at cross-section 23.195 was discussed. In the March 29 model, there are closely spaced cross-sections just upstream and downstream of 23.195. It was agreed to move the upstream and downstream cross-sections farther apart from 23.195, about 100 feet away.

River Stationing

The issue of the new hydraulic baseline being slightly shorter than the FIS baseline was discussed. This difference will create a slight discontinuity in stationing at the upstream end of the model, between the most upstream new cross-section and the adjacent section borrowed from the HEC-2 model. It was agreed that the discontinuity would be documented in the project description box of the HEC- RAS model

Vertical Datum

Mike instructed that the vertical datum of NGVD 1929 used for the project be documented in the HEC-RAS project description box.

Bank Stations

The bank stations upstream of Deer Valley Road were discussed. These bank stations do not always match the topographic breaks in slope, some were set on the basis of terrain roughness features. Mike instructed that we could leave the bank stations as per the March 29 submittal.

Modification to Cross-Sections

It was agreed that cross-section 23.479 would be trimmed on the left side to eliminate the bend in the cross-section.

7th Street Bridge

The issue of the obstruction which appears in the cut cross-section of left and right side of 7th Street bridge opening was discussed. Mike agreed that the cut cross-sections could be modified to match what was observed in the field, which is an unobstructed opening.

Hydraulic Baseline Transition

Mike pointed out that the hydraulic baseline would need to be smoothly transitioned on the downstream end between the new model and the FIS baseline. It was agreed that the transition could extend beyond the downstream limits of the study if necessary.

Revision of Model and Plots for Review

It was agreed that another set of draft cross-sections and floodplain plots, and a draft HEC-RAS model would be prepared. These would incorporate all the changes discussed in the meeting, including the baseline which would smoothly transition in the FIS baseline upstream and downstream. These plots and models are to be submitted to Mike Duncan for review.

Topography

Leo mentioned that he would like to remove the elevations that are attached to the boundary line in breakline file. The reason was to make the boundary line consistent with other breakline files used by FCD, as well as to remove some inconsistencies in the elevations that appear to be introduced by the boundary line with elevations attached. Mike agreed.

Other

Mike mentioned that the FEMA floodplain maps would be at 1000 scale, so small details cannot be seen in those maps.

B.4 General Correspondence

WEST CONSULTANTS, INC.

960 West Elliot Road, Suite 201
Tempe, Arizona 85284-1137
(480) 345-2155 phone (480) 345-2156 fax

LETTER OF TRANSMITTAL

JOB NO.:	DATE: 5/20/2005
ATTENTION: Michael Duncan	
Re.: Cave Creek CAP Canal to Loop 101	

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

GENTLEMEN:

WE ARE SENDING YOU

[x] Enclosed [ ] Under Separate Cover
[ ] Shop Drawings [ ] Prints [ ] Plans [ ] Change order
[ ] Copy of Letter [ ] Samples Other:

COPIES	DATE	NO.	DESCRIPTION
1	5/20/2005		Map of Cave Creek CAP Canal to Loop 101 (dated May 20)
1			CD-ROM
1			Memo

THESE ARE TRANSMITTED as checked below:

[ ] For approval
[ ] For your use
[x] As requested
[ ] For review & comment
[ ]

[ ] Approved as submitted
[ ] Approved as noted
[ ] Please return

[ ] Resubmit __ copies for approval
[ ] Submit __ copies for distribution
[ ] Return __ corrected prints

Remarks:

COPY TO:

SIGNED:
Leo Kreymberg

WEST CONSULTANTS, INC.

960 West Elliot Road, Suite 201
Tempe, Arizona 85284-1137
(480) 345-2155 phone (480) 345-2156 fax

LETTER OF TRANSMITTAL

JOB NO.:	DATE: 3/29/2005
ATTENTION: Michael Duncan	
Re.: Cave Creek Loop 101 to CAP Canal	

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

GENTLEMEN:

WE ARE SENDING YOU

- [x] Enclosed
- [ ] Under Separate Cover
- [ ] Shop Drawings
- [ ] Prints
- [ ] Plans
- [ ] Change order
- [ ] Copy of Letter
- [ ] Samples

Other: _____

COPIES	DATE	NO.	DESCRIPTION
1	3/29/2005		CD - Cave Creek
1	3/29/2005		Set HEC-RAS Cross-section Elevations
1	3/29/2005		Draft Manning n-value Report
1	3/29/2005		Preliminary Floodplain Plot
2	3/29/2005		Contour Map Plots - 1"=200'
1	3/29/2005		Memo

THESE ARE TRANSMITTED as checked below:

- [ ] For approval
- [ ] For your use
- [x] As requested
- [ ] For review & comment
- [ ]
- [ ] Approved as submitted
- [ ] Approved as noted
- [ ] Please return
- [ ] Resubmit ___ copies for approval
- [ ] Submit ___ copies for distribution
- [ ] Return ___ corrected prints

Remarks: _____

COPY TO: _____

SIGNED: Leo Kreymborg

6311

WEST CONSULTANTS, INC.

960 West Elliot Road, Suite 201
Tempe, Arizona 85284-1137
(480) 345-2155 phone (480) 345-2156 fax

LETTER OF TRANSMITTAL

JOB NO.:	DATE: 2/10/2005
ATTENTION: Sam Hersey	
Re.: Bridge Drawings	

Hersey Land Surveying
5025 S. Ash Ave., Suite B/3
Tempe, AZ 85281

GENTLEMEN:

WE ARE SENDING YOU

- [x] Enclosed
- [ ] Under Separate Cover
- [ ] Shop Drawings
- [ ] Prints
- [ ] Plans
- [ ] Change order
- [ ] Copy of Letter
- [ ] Samples

Other:

COPIES	DATE	NO.	DESCRIPTION
1	2/10/2005		Bridge #1 - 2-11x17; 9-8½x11
1	2/10/2005		Bridge #2 - 2-11x17; 12-8½x11
1	2/10/2005		Bridge #3 - 2-11x17; 15-8½x11
1	2/10/2005		Bridge #4 - 2-11x17; 11-8½x11
1	2/10/2005		Bridge #5 - 9-8½x11

THESE ARE TRANSMITTED as checked below:

- [ ] For approval
- [x] For your use
- [ ] As requested
- [ ] For review & comment
- [ ]
- [ ] Approved as submitted
- [ ] Approved as noted
- [x] Please return
- [ ] Resubmit ___ copies for approval
- [ ] Submit ___ copies for distribution
- [ ] Return ___ corrected prints

Remarks: For your use for the bridge survey for the Cave Creek Floodplain Delineation. Please return them when finished.

COPY TO:

SIGNED: Leo Kreymborg

B.5 Contract Documents

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

The **Flood Control District of Maricopa County**, Arizona, hereinafter called "District", is desirous of having certain professional services performed in connection with **Contract FCD 2004C024, Cave Creek from CAP Canal to Loop 101 Hwy Floodplain Delineation Study,** hereinafter called the "Project" and as more fully described in Exhibit A, Scope of Work, and in accordance with Exhibit B, Fee Proposal, attached; and **WEST Consultants, Inc.**, hereinafter called "Consultant", with its principal offices located at 960 West Elliot Road, #201, Tempe, Arizona 85284-1137, is desirous of performing said services;

THEREFORE, the parties hereto mutually agree as follows:

SECTION I—SERVICES OF THE CONSULTANT

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

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

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

SECTION II—PERIOD OF SERVICE

The Consultant shall complete all work per the schedule provided in Exhibit A, Scope of Work, **within 510 calendar days** after receipt of the Notice to Proceed. Should extension of this contract period be necessary, and any such extension(s) continue the date of contract performance for a time period of more than one (1) year from the original date of contract expiration, adjustment(s) of the Consultant's fee(s) may, upon agreement by both the District and the Consultant, be made in accordance with the Consumer Price Index for Urban Consumers, Western Division, published by the U.S. Department of Labor, Bureau of Labor Statistics, using the published edition coinciding with the initial contract expiration date. Any such fee adjustment shall only apply to the extended contract time period.

SECTION III—PAYMENTS TO THE CONSULTANT

The Consultant shall be paid for work under this contract in accordance with the Scope of Work a **lump sum fee of ninety-one thousand nine hundred eleven dollars and seventy-eight cents ($91,911.78)**

plus any adjustments that have been approved in writing in accordance with the Maricopa County Procurement Code.

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

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

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

Any retention shall be paid or substitute security returned or released to the Consultant, as applicable, within forty-five (45) calendar days after:

A. final completion of all work per Exhibit A and the detailed Scope of Work,

B. acceptance of the work by the District,

C. the District's receipt of the "Certificate of Performance" form furnished by the Agent,

D. the District's receipt of an invoice for any retained monies, and if applicable,

E. the District's receipt of a final MWBE Participation Report for the assignment, stating the total payments received by the prime, as well as total payments the prime has made to MWBE subconsultants, vendors, and suppliers.

SECTION IV—THE DISTRICT'S RESPONSIBILITIES

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

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

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

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

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

SECTION V—AMENDMENTS

This contract may be amended by mutual agreement of the District and the Consultant.

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

SECTION VI—RECORDS

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

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

SECTION VII—PROJECT COMPLETION

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

SECTION VIII—TERMINATION

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

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

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

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

SECTION IX—OWNERSHIP OF DOCUMENTS

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

B. If the Consultant retains reproducible copies of all such documents delivered to the District, the Consultant may not use those documents in regard to current or future claims or litigation against the District brought by another party or parties unless the documents are independently produced in accordance with a court order or procedural rules and notice of such production is given to the District immediately and prior to their production.

C. Copies retained by the Consultant, sub-consultant(s), or any related entities are governed by Arizona Law regarding the use of public records and may not be used for commercial purpose without additional written permission from the District and the payment of all applicable fees.

D. The District reserves the right to reuse the documents as it sees fit.

SECTION X—COMPLIANCE WITH LAWS

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

SECTION XI—GENERAL CONSIDERATIONS

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

   The Consultant in replacing a MWBE subcontractor shall attempt to contract with another MWBE subcontractor.

B. The Consultant shall perform, with its own firm, work amounting to fifty percent (50%) or more of the total amount of the contract value. Any deviation may be approved, in writing, at the discretion of the Agent.

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

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

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

F. It is mutually understood and agreed that this contract shall be governed by the laws of the State of Arizona, both as to interpretation and performance. Any action at law, suit in equity, or judicial proceeding for the enforcement of this contract, or any provision thereof, shall be instituted only in the courts of the State of Arizona.

G. When this contract requires the Consultant to study specific geographic areas of Maricopa County (including but not limited to floodplain delineations, watercourse master plans, area drainage master studies, or any other site specific assignment) the Consultant agrees during the term of this contract and any extensions thereof that Consultant will not perform similar services for any clients other than the District within that specific geographic area without the written authorization and approval of the Chief Engineer and General Manager of the District.

H. The Consultant agrees that it, its principals, employees, sub-consultants, agents and assigns, shall not accept employment as consultants, expert witnesses or otherwise in any pending or contemplated litigation against the District during the term of this contract and any extensions thereof without the written authorization and approval of the Chief Engineer and General Manager of the District.

I. The Consultant agrees that it, its principals, employees, sub-consultants, agents and assigns, shall not accept employment as consultants, expert witnesses or otherwise in any future litigation against the District in regard to the subject matter of this contract without the written authorization and approval of the Chief Engineer and General Manager of the District.

J. It is understood that the District shall have the right to seek and obtain in any court of competent jurisdiction an injunction to restrain a violation or alleged violation by the Consultant, its principals, employees, sub-consultants, agents or assigns, of the provisions of G., H., and I. of this section or of the provisions of B. of Section IX, and the right of action for full damages at law, in addition to any other remedies provided by this contract. In no case shall a waiver by the District of the right to seek relief under this provision constitute a waiver of any other or further violation.

SECTION XII—SUCCESSORS AND ASSIGNS

This contract shall not be assigned by either party without prior written approval of the other except that the Consultant may use in the performance of this contract without prior approval of the District, personnel or services of its related entities and affiliated companies as if they were an integral part of the Consultant; and it shall extend to and be binding upon the heirs, executors, administrators, successors and assigns of the parties hereto.

SECTION XIII—NO KICK-BACK CERTIFICATION

The Consultant warrants that no person has been employed or retained to solicit or secure this contract upon any agreement or understanding for a commission, percentage, brokerage, or contingent fee; and that no member of the Board of Directors or any employee of the District has any interest, financially or otherwise, in the Consultant's firm.

For breach or violation of this warranty, the District shall have the right to annul this contract without liability, or at its discretion to deduct from the contract price or consideration, the full amount of such commission, percentage, brokerage, or contingent fee.

SECTION XIV—ANTI-DISCRIMINATION PROVISION

The District will endeavor to ensure in every way possible that minority and women-owned business enterprises shall have every opportunity to participate in providing professional services, purchased goods, and contractual services to the District without being discriminated against on the grounds of race, religion, gender, age, disability, or national origin.

The Consultant agrees not to discriminate against any employee or applicant for employment because of race, religion, gender, age, disability, or national origin, and further agrees not to engage in any unlawful employment practices. The Consultant further agrees to insert the foregoing provisions in all subcontracts hereunder.

SECTION XV—INDEMNIFICATIONN

Indemnification for Professional Liability:
To the fullest extent permitted by law, the Consultant shall indemnify and hold harmless the District and Maricopa County, their agents, representatives, officers, directors, officials, and employees from and against all claims, damages, losses and expenses, including but not limited to attorney fees, court costs, expert witness fees, and the cost of appellate proceedings, relating to, arising out of, or alleged to have resulted from the Consultant's negligent acts, errors, omissions or mistakes relating to professional services in the performance of this contract. Consultant's duty to indemnify and hold harmless the District, Maricopa County, and their agents, representatives, officers, directors, officials, and employees shall arise in connection with any claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, or injury to, impairment, or destruction of property, including loss of use resulting therefrom, caused by any negligent acts, errors, omissions or mistakes, related to professional services in the performance of this contract including any person for whose negligent acts, errors, omissions or mistakes, the Consultant may be legally liable.

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

For all other hazards, liabilities, and exposures:
To the fullest extent permitted by law, the Consultant shall defend, indemnify and hold harmless the District and Maricopa County, their agents, representatives, officers, directors, officials, and employees from and against all claims, damages, losses and expenses (including but not limited to attorney fees, court costs, expert witness fees, and the cost of appellate proceedings), relating to, arising out of or resulting from the Consultant's work or services. Consultant's duty to defend, indemnify and hold harmless the District, Maricopa County, and their agents, representatives, officers, directors, officials, and employees shall arise in connection with any claim, damage, loss or expense that is attributable to bodily injury, sickness, disease, death, injury to, impairment or destruction of property including loss of use resulting therefrom, caused in whole or in part by any act or omission of the Consultant, anyone Consultant directly or indirectly employs or anyone for whose acts Consultant may be liable.

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

Abrogation of Arizona Revised Statutes § 34-226:
In the event that A.R.S. § 34-226 shall be repealed or held unconstitutional or otherwise invalid by a court of competent jurisdiction, then this duty of indemnification shall extend to all claims, damages, losses and expenses, including but not limited to attorney fees, court costs, expert witness fees, and the cost of appellate proceedings, relating to, arising out of, or alleged to have resulted therefrom, caused in whole or in part by any negligent acts, errors, or omissions relating to professional work or services in the performance of this contract by the Consultant, or anyone directly employed by the Consultant or anyone for whose acts Consultant may be liable regardless of whether it is caused by any party indemnified hereunder, including the District and Maricopa County.

The amount and type of insurance coverage requirements set forth herein will in no way be construed as limiting the scope of the indemnity in this paragraph.

The scope of this indemnification does not extend to the sole negligence of the District.

SECTION XVI—INSURANCE REQUIREMENTS

Consultant, at Consultant's own expense, shall purchase and maintain the herein stipulated minimum insurance with companies duly licensed, possessing a current A.M. Best Company, Inc. Rating of at least B++ or a Financial Performance Rating (FPR) of at least 6, or approved unlicensed companies in the State of Arizona with policies and forms satisfactory to the District.

All insurance required herein shall be maintained in full force and effect until all work or service required to be performed under the terms of the contract is satisfactorily completed and formally accepted. Failure to do so may, at the sole discretion of the District, constitute a material breach of this contract.

The Consultant's insurance shall be primary insurance as respects the District and any insurance or self-insurance maintained by the District shall not contribute to it.

The policies required hereunder, except Workers' Compensation and Professional Liability, shall contain a waiver of transfer of rights of recovery (subrogation) against the District, its agents, representatives, officers, directors, officials, and employees for any claims arising out of the Consultant's work or service.

Any failure to comply with the claim reporting provisions of the insurance policies or any breach of an insurance policy warranty shall not affect coverage afforded under the insurance policies to protect the District.

The insurance policies may provide coverage which contains deductibles or self-insured retentions. Such deductible and/or self-insured retentions shall not be applicable with respect to the coverage provided to the District under such policies. The Consultant shall be solely responsible for the deductible and/or self-insured retention and the District, at its option, may require the Consultant to secure payment of such deductibles or self-insured retentions by a surety bond or an irrevocable and unconditional letter of credit.

The District reserves the right to request and to receive, within ten (10) working days, certified copies of any or all of the herein required insurance policies and/or endorsements. The District shall not be obligated, however, to review such policies and/or endorsements or to advise Consultant of any deficiencies in such policies and endorsements, and such receipt shall not relieve Consultant from, or be deemed a waiver of, the District's right to insist on strict fulfillment of Consultant's obligations under this contract.

The insurance policies required by this contract, except Workers' Compensation and Professional Liability, shall name the District, its agents, representatives, officers, directors, officials, and employees as Additional Insureds.

Commercial General Liability:
Consultant shall maintain Commercial General Liability insurance with a limit of not less than $1,000,000 for each occurrence with a $2,000,000 Products/Completed Operations Aggregate and a $2,000,000 General Aggregate Limit. The policy shall include coverage for bodily injury, broad form property damage, personal injury, products and completed operations and blanket contractual coverage including, but not limited to, the liability assumed under the indemnification provisions of this contract which coverage will be at least as broad as Insurance Service Office, Inc. Policy Form CG 00 01 10 93 or any replacements thereof.

The policy shall contain a severability of interest provision, and shall not contain a sunset provision or commutation clause, or any provision which would serve to limit third party action over claims.

The Commercial General Liability additional insured endorsement shall be at least as broad as the Insurance Service Office, Inc.'s Additional Insured, CG 20 10 11 85, and shall include coverage for Consultant's operations and products and completed operations.

Automobile Liability:
Consultant shall maintain Automobile Liability insurance with an individual single limit for bodily injury and property damage of no less than $1,000,000, each occurrence, with respect to Consultant's vehicles (whether owned, hired, non-owned), assigned to or used in the performance of this contract. Coverage will be at least as broad as coverage code 1, "any auto" (Insurance Services Office, Inc. Policy Form CA 00 01 12 93, or any replacements thereof). Such insurance shall include coverage for loading and off-loading and off-loading hazards. If hazardous substances, materials, or wastes are to be transported, MCS 90 endorsement shall be included and $5,000,000 per accident limits for bodily injury and property damage shall apply.

Workers' Compensation:
The Consultant shall carry Workers' Compensation insurance to cover obligations imposed by federal and state statutes having jurisdiction of Consultant's employees engaged in the performance of the work or services, as well as Employer's Liability insurance of not less than $1,000,000 for each accident, $1,000,000 disease for each employee, and $1,000,000 disease policy limit.

In case any work is subcontracted, the Consultant will require the Subconsultant to provide Worker's Compensation and Employers' Liability insurance to at least the same extent as required of the Consultant.

Professional Liability:
The Consultant retained by the District to provide the work or service required by this contract shall maintain Professional Liability insurance covering negligent acts, errors, or omissions arising out of the work or services performed by the Consultant, or any person employed by the Consultant, with a limit of not less than $1,000,000 each claim.

Certificates of Insurance:
Prior to commencing work or services under this contract, Consultant shall furnish the District with Certificates of Insurance (Attachment 3), or formal endorsements as required by the contract, issued by Consultant's insurer(s), as evidence that policies providing the required coverage's, conditions, and limits required by this contract are in full force and effect. Such certificates shall identify this contract number and title.

In the event any insurance policy(ies) required by this contract is (are) written on a "claims made" basis, coverage shall extend for two (2) years past completion and acceptance of the Consultant's work or services and as evidenced by annual Certificates of Insurance.

If a policy does expire during the life of the contract, a renewal certificate must be sent to the District fifteen (15) days prior to the expiration date.

Cancellation and Expiration Notice:
Insurance required herein shall not expire, be cancelled, or materially changed without thirty (30) days prior written notice to the District.

.....

IN WITNESS WHEREOF, the parties herein have executed this contract.

WEST Consultants, Inc.

Dennis L. Richards
Principal (Signature)

DENNIS L. RICHARDS
Printed Name

VICE PRESIDENT
Title

OCTOBER 5, 2004
Date

33-0303017
Federal Tax Identification Number

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY:

10/18/04
Timothy S. Phillips, P.E. Date
Acting Chief Engineer and General Manager

ACCEPTED AND APPROVED:

11/3/04
Chairman, Board of Directors Date

ATTEST:

11/3/04
Clerk of the Board Date

LEGAL REVIEW

Approved as to form and within the powers and authority granted under the laws of the State of Arizona to the Flood Control District of Maricopa County.

Julie M. Lemmon 10/16/04
General Counsel, District Date

EXHIBIT A

SCOPE OF WORK

CONTRACT FCD 2004C024

Cave Creek from CAP Canal to Loop 101 Hwy
Floodplain Delineation Study

EXHIBIT A

SCOPE OF WORK

CONTRACT FCD 2004C024

Cave Creek from CAP Canal to Loop 101 Hwy
Floodplain Delineation Study

GENERAL

This floodplain delineation will re-study the existing Zone AE floodplain of Cave Creek from the CAP Canal, downstream to the Loop 101 Highway. This re-study reach is in the City of Phoenix and is shown on Attachment 1.

This Flood Control District of Maricopa County (DISTRICT) project consists of new topographic mapping, refinement (if necessary) of the available 100-year Hydrology for the 6- and 24-hour rainfall events, and the delineation of the 100-year floodplain. The delineation length is approximately two (2) linear miles.

For this study the CONSULTANT will develop all the necessary topographic data to delineate the floodplain. In order to do the watershed modeling required for this study, the CONSULTANT may have to develop additional topographic data outside the area being delineated. The CONSULTANT will develop the hydrology for the contributing watershed using the U.S. Army Corps of Engineer's HEC -1 computer model, and the floodplain delineations using their HEC-RAS computer model. The CONSULTANT must use sound engineering judgment in the development of the hydrologic and hydraulic models. The CONSULTANT must analyze the results of the models carefully and make refinements to the input parameters in order to obtain the most realistic results.

All work must meet the requirements of the DISTRICT's Consultant Guidelines, Third Edition - December 1, 2003 - Revision 1. All work must also meet Arizona Department of Water Resources (ADWR) and Federal Emergency Management Agency (FEMA) requirements for 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 must be completed within five hundred ten (510) days from the Notice to Proceed (NTP). The FEMA submittal package must be completed within two hundred ten (210) days (which includes at least sixty (60) days for DISTRICT reviews). The remaining three hundred (300) days is allotted for obtaining FEMA approval, and the completion of those tasks called for after FEMA approval is obtained.

TASK 1 - COORDINATION

1.1 Within fourteen (14) days of the 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 (SOW). The CONSULTANT will update this project schedule when appropriate.

1.2 The CONSULTANT will participate in regular coordination meetings (at least every four [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. Coordination and milestone meetings should be combined whenever possible.

1.3 The CONSULTANT will submit an estimate of the monthly billing within fourteen (14) days of the NTP. Thereafter, this estimate will be updated and submitted to the DISTRICT's Project Manager at least ten (10) days before the end of each quarter.

1.4 The CONSULTANT will submit monthly progress reports at least five (5) days before submittal of monthly invoices. The report shall be brief and should be no longer than two (2) 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.

1.5 The DISTRICT will be responsible for placing the legal advertising at the beginning of the study. The advertisement will be run in a widely circulated newspaper twice, with approximately one (1) week between runs. The advertisement will be run twice in a local newspaper that serves the area being studied.

1.6 The DISTRICT will also notify property-owners in the vicinity of the existing floodplain of the study using a mailer. The CONSULTANT will obtain Right-of-Entry for survey, from necessary landowners, on an as-needed basis during the study.

1.7 The DISTRICT will mail fliers to affected property owners announcing the results of the study. If comments are received from the owners, the CONSULTANT will respond to the public's comments and make revisions to the study if necessary.

1.8 CONSULTANT/DISTRICT Performance Evaluations will be performed. An informal evaluation will be performed at the completion of the hydrologic analysis. A formal evaluation will be performed at the completion of the project upon receipt of all deliverables.

TASK 2 - DATA COLLECTION

2.1 The CONSULTANT will collect and review pertinent data from the DISTRICT and other outside sources. Data to be collected will include previous flood hazard reports and hydrology for the study area, existing topographic mapping, historical flooding information, as-built plans for existing structures, relevant storm drain infrastructure information, drainage design reports for the adjacent freeways, FEMA Flood Hazard Boundary Maps, FEMA Letters of Map Amendment/Revision, and other pertinent information.

2.2 The CONSULTANT will consult with officials from the DISTRICT, the cities, the county, and state transportation departments, in order to identify local flooding problems and obtain information on current and planned public works projects, channel modifications, storm-drainage systems, development, and corporate limits.

2.3 A data collection summary will be submitted to the DISTRICT for information purposes. A preliminary draft is due within forty-five (45) days of the NTP. The final will be included in Appendix A of the Technical Data Notebook.

TASK 3 - TOPOGRAPHIC MAPPING

3.1 An aerial survey subcontractor shall be retained by the CONSULTANT as part of this contract. The CONSULTANT will coordinate all the aerial surveying work with the aerial surveying subcontractor to ensure that the specifications of the aerial surveying work are met. The CONSULTANT is responsible for ensuring that the topographic mapping completely covers the area of delineation. The accuracy of the mapping and quality control on surveys will be per FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, April 2003.

3.2 Digital contour and planimetric data for this study will be developed and delivered according to the DISTRICT's C.A.D.D. Data Delivery Specifications Rev. 1.0 January 2000.

3.3 As required for delineation of the floodplain, the CONSULTANT shall use a Digital Terrain Model to develop topographic mapping. The elevation contour interval will be 2-foot and the horizontal scale will be 1 inch = 200 feet.

3.4 Ground Control:

a. Survey control will be on the Arizona Coordinate System Central Zone 1983 North American Datum (NAD), horizontally; and the National Geodetic Vertical Datum of 1929 (NGVD 29), vertically.
b. The CONSULTANT shall systematically set panel points and establish horizontal and vertical control throughout the areas to be mapped for use in compilation by the aerial survey contractor. Field control will be sufficient to readily allow for compilation of maps by the aerial survey contractor at the desired map scale and contour interval, and will be based on the National Geodetic Vertical Datum of 1929 (NGVD 29). The CONSULTANT will provide conversion factors to the North American Vertical Datum of 1988 (NAVD 88), including documentation of how it was derived, to allow comparison of NGVD 29 elevations to NAVD 88 elevations. The documentation on the conversion factors will be included in the Technical Data Notebook.
c. The horizontal and vertical control points shall be located and marked by the CONSULTANT. The controls for the aerial mapping will be in sufficient numbers and will be in locations that will be compatible with the accuracy of the mapping requirements.
d. Additional road profile and cross-section work as specified by the DISTRICT will be conducted by GPS RTK methods and will meet or exceed the technical requirements of the aerial mapping.
e. Control points from surrounding studies will be incorporated into the ground control for the existing study.
f. The CONSULTANT shall set blind aerial targets that meet the requirements of Section 3.2.3 Blind Aerial Targets, of the DISTRICT's Consultant Guidelines, Third Edition - December 1, 2003 - Revision 1.

3.5 The work-study drawings, produced by the CONSULTANT, will be 24" X 36" in size. A cover sheet will be part of the work study drawings and shall have on it the project title, date of

topographic mapping, and a location map showing geographic range covered by each specific mapping sheet. Each drawing will include the floodplain and floodway delineations and a minimum of a north arrow, scale, section corners and quarter corners, current and proposed streets and highway names, State Plane Coordinate System, major drainage features, corporate boundaries, cross section lines, channel station center line, index map, the floodplain and floodway computed water surface elevations, rate of flow, base flood elevations (BFE), and a description and elevation of each elevation reference mark (ERMs). Notes explaining the proper means to convert the NGVD 29 elevations to NAVD 88 elevations shall be included in "NOTES" in the map border. See Section 5.0 of the Hydrologic Information System Data Delivery specifications for how the drawings are to be laid out. The mapping will have an accuracy such that ninety percent (90%) of all contours will be within one-half (½) contour of the true elevations and the remaining ten percent (10%) of the contours will not be in error by more than one (1) contour interval.

TASK 4 - FIELD SURVEY

4.1 For all floodplain delineation areas, the CONSULTANT's topographic mapping will include spot elevations on all section-line and mid-section-line roads.

4.2 Ground Control for Floodplain Delineations:

4.2.1 All topographic mapping and survey work will meet or exceed current FEMA minimum criteria as defined in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, April 2003. This includes, but is not limited to: the establishment of "permanent" elevation reference marks (ERMs); field control; and verification of profiles by the ground survey profile procedure. The ground control survey requirements of Section 3.4 of this scope will also be met or exceeded.

4.2.2 Horizontal and Vertical Control: Systematically set panel points and establish horizontal and vertical control throughout the area to be mapped for use in compilation by the aerial survey contractor. Field control shall be sufficient, at least one (1) "permanent" point per mile, such point(s) being used as Elevation Reference Marks (ERMs). Surveys will be based on the National Geodetic Vertical Datum of 1929 (NGVD 29), per FEMA guidelines. The CONSULTANT will provide a conversion factor, including documentation of how it was derived, to allow conversion of NGVD 29 elevations to NAVD 88 elevations. The documentation on the conversion factors will be included in the Technical Data Notebook. "Permanent" survey points will consist of existing monuments, such as brass caps or similar survey monuments.

4.2.3 Five new survey monuments shall be constructed, conforming to Maricopa Association of Governments (MAG) Uniform Standard Detail for Public Works Construction, detail 120-1, Type C, shall be placed 2" +/- above grade, and topped with a brass cap. The brass caps will be provided by the DISTRICT.

4.2.4 Elevation Reference Marks will be labeled on available maps and described so that they can be easily located in the field.

4.2.5 All temporary aerial target materials are to be removed following completion of the topographic mapping. The actual markers will be set flush and be of a permanent nature.

4.3 The CONSULTANT shall verify the accuracy of the mapping by the procedures called for in FEMA's Guidelines and Specifications for Flood Hazard Mapping Partners, April 2003, or other

methods approved by FEMA. This shall include the verification of cross sections used in the floodplain delineation.

4.4 Field surveys of bridges, culverts, catch basins, storm drains, over-chutes, other hydraulic structures, and significant storm-water storage basins are to be obtained by the CONSULTANT when as-built plans are not available or when changes significant to the modeling, such as sedimentation, have occurred since the date of the as-built plan. Field surveys of roadways and canal banks are to be obtained, as required for the development of hydrology and hydraulics. This information should be reduced and compiled into an 11"x 17" (maximum size) drawing for inclusion in the final report. Field surveys of bridges, culverts, hydraulic structures, and routing reaches must also be obtained where necessary for proper hydrologic modeling. It may be necessary to field survey some structures since the as-built plans may not be on the same datum as the study.

4.5 Copies of the survey field books and office calculations must be included in the Technical Data Notebooks. If DISTRICT approval is obtained, this information can be submitted separately.

TASK 5 - HYDROLOGY

5.1 Based on data collected under Task 2, peak discharges will be selected for use the hydraulic modeling. DISTRICT concurrence will be obtained for the peak discharges.

TASK 6 - FLOODPLAIN DELINEATION

6.1 Floodplain delineations must be obtained using the U.S. Army Corps of Engineers latest release of HEC-RAS and methodology acceptable to FEMA. The CONSULTANT will prepare the study using the guidelines established in FEMA's Guidelines and Specifications for Flood Mapping Partners, April 2003, and FIA Document 12, Appeals, Revisions, and Amendments to Flood Insurance Maps, December 1993.

6.2 The delineation work shall meet requirements for floodplain delineations as prescribed by FEMA and the Arizona Department of Water Resources, including SSA 9-02, State Standard for Hydraulic Modeling.

6.3 The CONSULTANT will conduct a field reconnaissance of the full study area. This will include observation of watershed and floodplain conditions for estimating Manning's "n" values; photographic documentation of floodplain characteristics; observation of land use, retention/detention areas, and street intersections; determination of channel bank stations; observation of possible overflow areas; inspection of levees or other flood control structures; and measurement of bridge dimensions. 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. A draft report on the field reconnaissance will be submitted to the DISTRICT for review and approval prior to beginning the hydrologic modeling. The report will present the determination of channel and overbank "n" values using captioned color photographs or color photocopies. 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.

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

a. Field reconnaissance report and estimation of Manning's "n" values.
b. Proposed locations and alignment of the cross sections and channel centerline.
c. Floodplain (natural) delineation.
d. Floodway delineation.
e. Final Hydraulics Report.

6.5 The Floodway Delineation shall be accomplished by using Encroachment Method 4 (Equal Conveyance) of HEC-RAS, and then refined by using Method 1 (Manual) of HEC-RAS.

6.6 The location and alignment of cross sections and channel centerline will be submitted for the DISTRICT's review and approval before digitizing the cross section data. Cross section stationing will be from left to right looking downstream with the thalweg as station 10,000. Cross sections will be spaced approximately every five hundred (500) feet, unless geographic or structural constraints dictate otherwise, and will extend the full width of the area inundated by 100-year floodwaters. Identification of cross sections will be in river miles, increasing upstream. The stationing will tie into the specified river mile of the existing FEMA studies. The cross section may need to be reoriented or altered after running the HEC-RAS model to ensure that they are perpendicular to flow per FEMA criteria. Cross sections developed by the HEC-RAS interpolation feature are not to be used.

6.7 For the cross-sections of this study that are near roads, the existing locations of the Flood Insurance Study cross-sections should be matched, unless there is good reason not to. The HEC-RAS output of the Technical Data Notebook, in addition to tables and a full output report, should include cross-section plots with water surfaces.

6.8 Bridges and culverts must be modeled according to HEC-RAS modeling requirements for the selected routine. Where multiple bridges occur, each bridge will be modeled separately. The HEC-RAS modeling results for bridges, culverts, and other hydraulic structures must be checked by using an independent method approved by the DISTRICT to analyze these structures.

6.9 Flood zones must be determined according to FEMA criteria and clearly labeled on the final drawings.

6.10 The findings of the floodplain delineation study will be presented in the Technical Data Notebook, according to ADWR State Standards Attachment 1-97 (SSA 1-97). The report will be organized as specified by the DISTRICT standards, following SSA 1-97 format.

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

TASK 7 – DIGITAL DATA

Digital data shall be delivered in a CADD standard binary DXF format from either AutoCAD or MicroStation outlined in the DISTRICT's "CADD Data Delivery Specifications Rev 1.0 January 2000" and will be prepared in conformance with the above standards. The following themes are

generally used for the data developed for Floodplain Delineation Studies. 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 is 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. NDXPRJ (FCD Project Map Index)
b. PRJ (Project Boundaries)
c. CARTO (Cartographic Features) (separate submittals for Mapping and Flood Delineation)
d. CORNERS (if any)CTRL (Miscellaneous Control Survey Points)
e. LNDUSECUR and LNDUSEFUT (Current and future Land Use, if not provided by the DISTRICT)
g. STRCT (Structure)
h. DQ (Data Quality)
i. PRJDAT (Project Identification xls table, no theme)
j. FPCTLFCD (FCD Reference Marks) (any new monuments should go here)
k. FPSRFFCD (Floodplain FCD Water Surface Elevation)
l. FPXFCD (Floodplain FCD Cross Section)
m. FPZNFCD (Floodplain FCD Zone)
n. FPBLN (Floodplain Baseline Route System)
o. CNL (Canal System, if any)
p. RR (Railroad System, if any)
q. STRTDTL (Street Detail)
r. ELV (Elevation (Land))
s. SOIL (Soil Type Area, if not provided by FCD)
t. DRNBSN (Drainage Sub-basin Area)
u. CULVERTS (if any)
v. PRJDAT (project identification)
w. DRNPTH (Drainage Path)
x. LAKE (if any)
y. RIVER (if any)

TASK 8 - DELIVERABLES

8.1 Prior to FEMA Submittal: The CONSULTANT will deliver the following items to the DISTRICT before delivering the FEMA submittal package:

8.1.1 One (1) complete set of 9" X 9" contact prints of the aerial stereo photographs sequentially numbered and catalogued. **An exhibit showing the flight path shall also be included.**

8.1.2 All topographic and related data for the DISTRICT's Hydrologic Information System that is not subject to change during FEMA's review should be submitted at this time. The Digital Terrain Model and related data should also be submitted at this time.

8.1.3 If bound separately from the Technical Data Notebook, three (3) copies of the field survey notes and office calculations.

8.2 Submittal to Local Jurisdictions: When the preliminary Technical Data Notebook has been sufficiently reviewed and revised, the DISTRICT will provide a copy to the local jurisdictions. The CONSULTANT shall address the comments from the local jurisdictions through the DISTRICT.

8.3 FEMA Submittal: 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:

8.3.1 Three (3) complete sets of blackline paper 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.

8.3.2 Three (3) complete copies of the Technical Data Notebook, including completed FEMA forms, annotated Flood Insurance Rate Maps showing the proposed delineation, HEC-1, and HEC-RAS input/output files on diskettes. The Technical Data Notebook will be prepared in accordance with ADWR State Standards Attachment 1-90 (SSA 1-90). The notebook will be organized as specified by the DISTRICT, following SSA 1-90 format.

8.4 Final Submittal: The following products are considered deliverables for the final submittal to the DISTRICT after FEMA approval is issued:

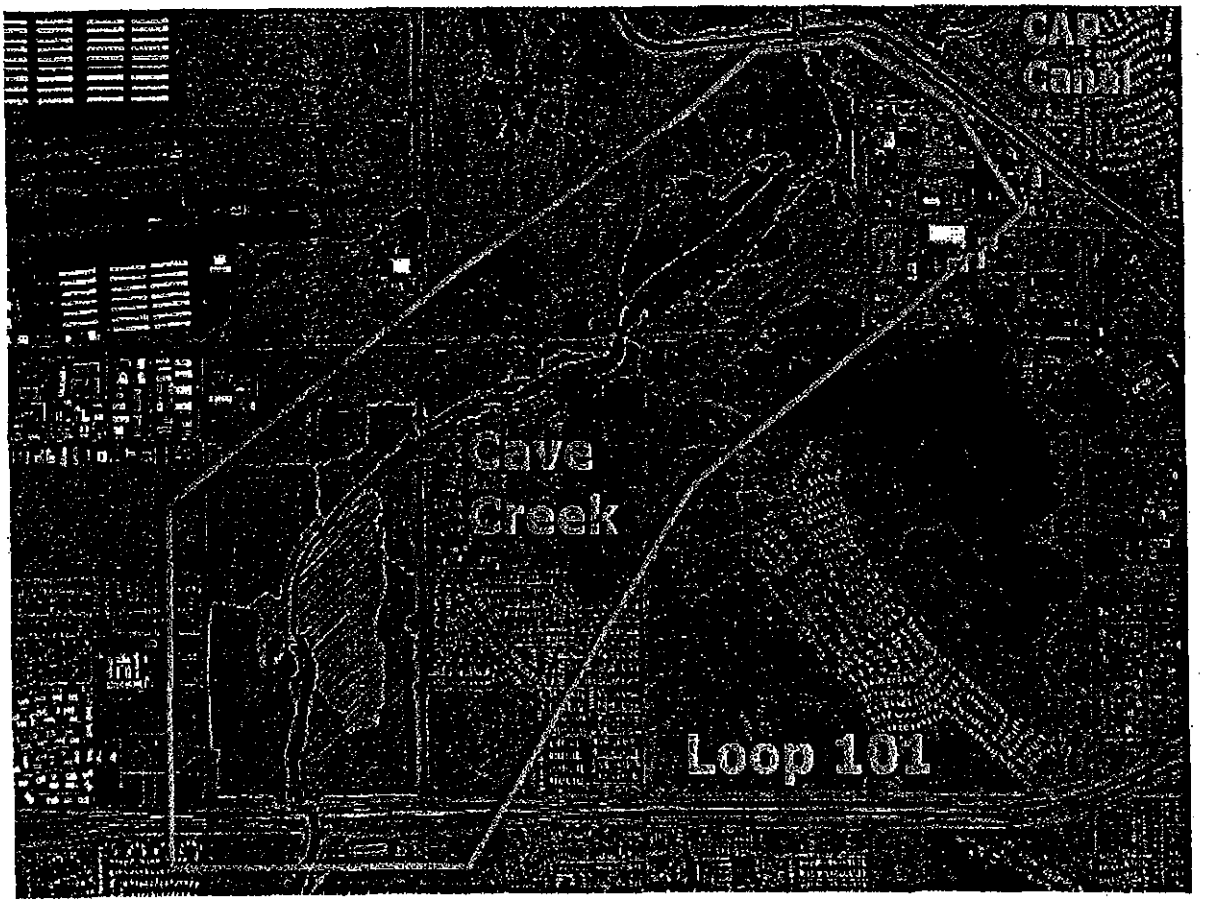
8.4.1 One (1) complete set of Mylars and three (3) complete sets of sealed blackline paper topographic maps with the floodplain/floodway delineations shown. All drawings will be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

8.4.2 All remaining hydrologic and floodplain/floodway delineation data in conformance with the DISTRICT's HIS Specifications.

8.4.3 Three (3) complete copies of the Technical Data Notebook including HEC-1 and HEC-RAS input/output files on diskettes. 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. Revisions may include, but are not limited to, addressing FEMA's comments, modifications to the delineation maps, the HEC-1 model, the HEC-RAS model, and/or the Final Report.

8.4.4 Three (3) electronic copies of the TDN report on CD's as pdf files.

ATTACHMENT 1 -- FLOODPLAIN DELINEATION AREA



B.6 Public Information

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

Flood Control District
of Maricopa County

www.fcd.maricopa.gov
2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

January 24, 2005

<Name>
<Address>
<City, State Zip>

Announcing: CAVE CREEK from CAP CANAL to LOOP 101 HWY.
Floodplain/Floodway Delineation Study

Dear: <Name>

The Flood Control District of Maricopa County (District) is conducting a Floodplain/Floodway Delineation re-study of Cave Creek from the Central Arizona Project (CAP) Canal, at the upstream end, to 900 feet south of the Loop 101 Hwy., at the downstream end. The Floodplain (blue) and the Floodway (green) of the study area are shown here:

STUDY INFO

This study was requested by the City of Phoenix, to update the floodplain and floodway elevations and widths, to reflect the construction of the Loop 101 Highway and other changed conditions. The District has contracted with WEST Consultants, Inc., to perform the study. The study will use hydrologic and hydraulic computer modeling to identify storm runoff quantities and the associated floodplain and floodway. You received this letter because some portion of your property is located within this study area.

ABOUT FLOODPLAIN/FLOODWAY DELINEATION

The District conducts Floodplain/Floodway Delineation Studies throughout the County, to define 100-year floodplains (1 percent chance of occurring each year) and floodways (the no-build portions of the floodplains). The studies also allow for sound floodplain management so that future development will not impede, divert, or retard the movement of floodwaters, nor experience flooding.

PROJECT SCHEDULE

The study began in November 2004, and is scheduled to be completed by June 2005. When the study is completed, the results will be sent to the Federal Emergency Management Agency (FEMA) for review, approval, and production of the revised Flood Insurance Rate Maps (FIRMs), which take approximately nine months. During this nine-month-period, the City of Phoenix will begin using the study results as the "best available information," in their floodplain management.

CONTACT US

If you know of any flooding-problem-areas within the study area, or have any other relevant facts, or have any questions, please contact:

Mike Duncan, P.E., Project Manager
Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, AZ 85009
Phone: (602) 506-4732
Fax: (602) 506-4601
Email: mwd@mail.maricopa.gov

APN	TAX_OWNER	TAX_ADD1	TAX_CITY	TAX_STATE	ZIPA	ZIPB
20911360	ORSETT / PIMA LLC	372 WASHINGTON ST	WELLESLEY	MA	02481	6202
20911001A	SOL / HELEN YUAN TRUST / ET AL	115 W WOOD DR	PHOENIX	AZ	85029	1850
21305002B	AMERITRUST CO TR	127 PUBLIC SQ	CLEVELAND	OH	44114	1221
21305001C	GEUPEL FAMILY LIMITED PARTNERSHIP	2760 EDINGTON RD	COLUMBUS	OH	43221	2503

AFFIDAVIT OF PUBLICATION
CAVE CREEK FLOODPLAIN

01

Arizona Business Gazette
The business resource

PO BOX 194
Phoenix, Arizona 85001-0194
(602) 444-7315 FAX (602) 444-7364

ANNOUNCEMENT OF INTENT TO IDENTIF NEW AND UPDATE EXISTING FLOODPLAIN/FLOODWAY AREAS IN PHOENIX, ARIZONA

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 (PL93-234) is funding a detailed restudy of the CAVE CREEK floodplain and floodway from the Central Arizona Project (CAP) canal at the upstream end to 1900 feet south of the Loop 101 freeway, at its downstream end, for a flooding source. FCDMC has contracted with WEST Consultants, Inc. to perform the study. The study will use hydrologic and hydraulic computer modeling to identify storm runoff quantities and the associated floodplain areas. This study will re-examine and re-evaluate the extent of flood-prone areas and will reflect the changed conditions since the original study. The results will be used by local jurisdictions to regulate development within the floodplain and will be submitted to the Federal Emergency Management Agency (FEMA) in order to update the existing Flood Insurance Rate Maps (FIRM), which are used to determine Federal flood insurance rates.

This announcement is intended to inform all interested persons and communities of the commencement of this study to provide concerned citizens with an opportunity to bring any relevant technical information to the attention of the FCDMC/FEMA. This information will be considered during the course of the study, which commenced in November 2004, and is scheduled to end by October 2006. Your comments should be addressed to Mr. Mike Duncan, Project Manager at the Flood Control District of Maricopa County, 2801 West Durango Street, Phoenix, AZ 85009, (602) 506-1733, email: mwdemail.maricopa.gov

Published: July 7, 14, 2005

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

Tom Bianco, being first duly sworn, upon oath deposes and says: That he is the advertising manager of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, State of Arizona, published weekly at Phoenix, Arizona, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates indicated.

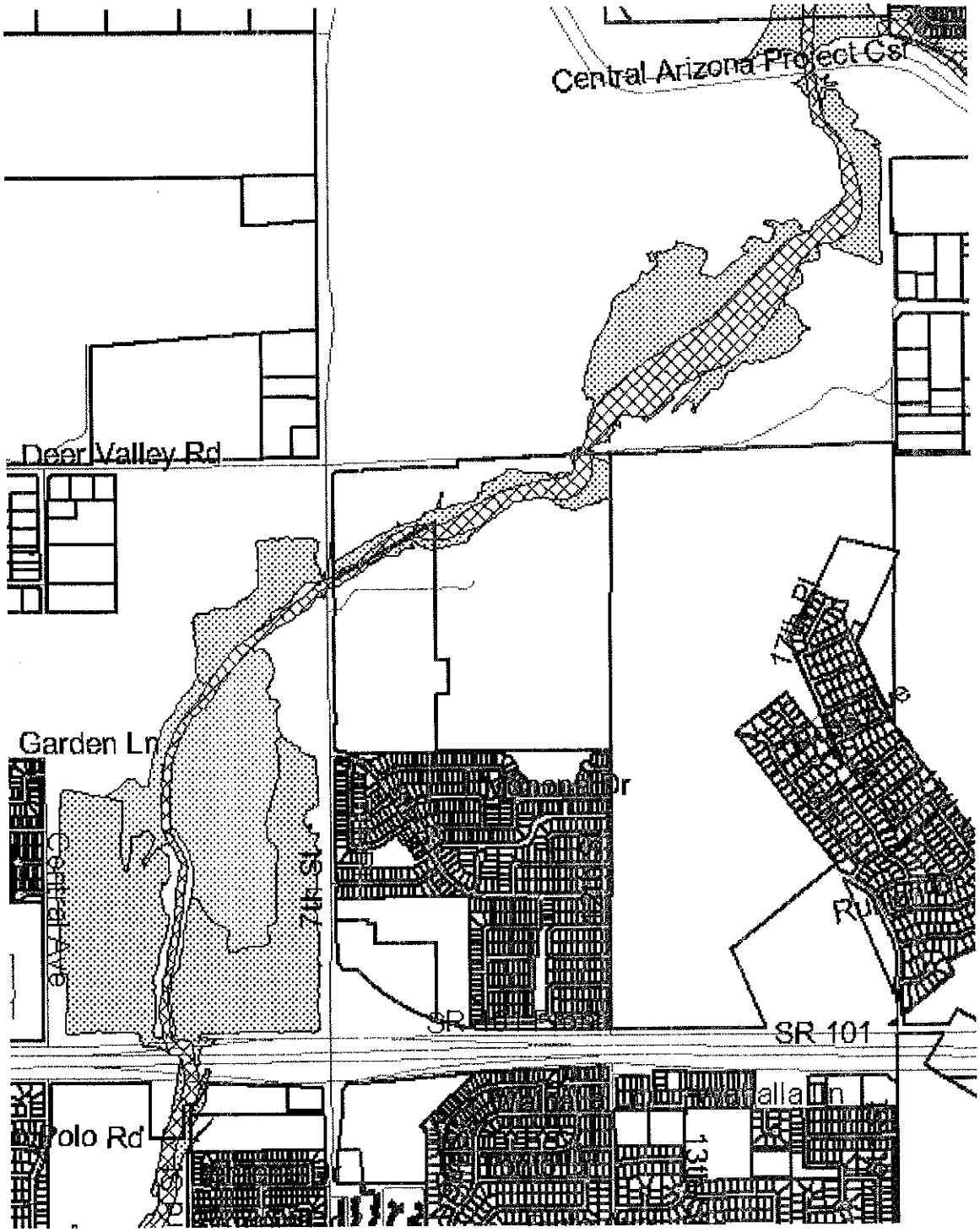
7/7/2005
7/14/2005

Sworn to before me this
14TH day of
JULY 2005

OFFICIAL SEAL
MARILYN GREENWOOD
NOTARY PUBLIC-ARIZONA
MARICOPA COUNTY
My Comm. Expires May 23, 2007

Notary Public

PARCEL BOUNDARIES in green



For March 3, 2006 mailing
6 parcels affected by floodplain re-study, 4 owners total

APN	OWNER_NAME	OWN_ADDR1	OWN_CITY	OWN_STATE	OWN_ZIP
21305002C	DEER VALLEY VENTURE LLC	100 BAYVIEW CIR STE 310	NEWPORT BEACH	CA	92660
21305849	PHOENIX CITY OF	251 W WASHINGTON ST 8TH FL	PHOENIX	AZ	850032245
20911001A	YUAN SOL C TR/HELEN F TR/ETAL	115 W WOOD DR	PHOENIX	AZ	85029
20911005	PHOENIX CITY OF	251 W WASHINGTON ST 8TH FL	PHOENIX	AZ	85003
21305001D	DEER VALLEY VENTURE LLC	100 BAYVIEW CIR STE 310	NEWPORT BEACH	CA	92660
20911360	ORSETT/PIMA LLC	20 WILLIAM ST STE G-50	WELLESLEY	MA	02481

Flood Control District
of Maricopa County

www.fcd.maricopa.gov
2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

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

March 3, 2006

City of Phoenix
251 W Washington St, 8th Floor
Phoenix AZ 85003-2245

RE: Results of the Floodplain Re-study of Cave Creek by the
Cave Creek from CAP Canal to Loop 101 Hwy. Floodplain Delineation Study

PARCEL NUMBERS: 209-11-005 and 213-05-849

Dear Property Owner:

We have completed a comprehensive re-study of this portion of Cave Creek. The study has produced new boundaries and elevations for the Floodplain and the Floodway. The Floodplain is the area that would be inundated by a 100-year flood (which has a 1 % chance of occurring in any one year). The Floodway is that portion of the Floodplain that is reserved for the conveyance of flood flows, and is basically a no-build zone.

The enclosed three 8 1/2 in. by 11 in. sheets show the new floodplain and floodway boundaries in red with the existing Flood Insurance Rate Maps as background. The three enclosed large maps (24 in. by 36 in.) show the details of the study results.

If you have any comments or questions, please contact me at 602-506-4732.

Yours truly,

Mike Duncan

Mike Duncan, PE, CFM
Project Manager

Enclosures

Flood Control District
of Maricopa County

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

www.fcd.maricopa.gov
2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

March 3, 2006

Deer Valley Venture LLC
100 Bayview Circle STE 310
Newport Beach CA 92660

RE: Results of the Floodplain Re-study of Cave Creek by the
Cave Creek from CAP Canal to Loop 101 Hwy. Floodplain Delineation Study

PARCEL NUMBERS: 213-05-001D and 213-05-002C

Dear Property Owner:

We have completed a comprehensive re-study of this portion of Cave Creek. The study has produced new boundaries and elevations for the Floodplain and the Floodway. The Floodplain is the area that would be inundated by a 100-year flood (which has a 1 % chance of occurring in any one year). The Floodway is that portion of the Floodplain that is reserved for the conveyance of flood flows, and is basically a no-build zone.

The enclosed three 8 1/2 in. by 11 in. sheets show the new floodplain and floodway boundaries in red with the existing Flood Insurance Rate Maps as background. The three enclosed large maps (24 in. by 36 in.) show the details of the study results.

If you have any comments or questions, please contact me at 602-506-4732.

Yours truly,

Mike Duncan

Mike Duncan, PE, CFM
Project Manager

Enclosures

Flood Control District
of Maricopa County

www.fcd.maricopa.gov
2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

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

March 3, 2006

YUAN SOL C TR/HELEN F TR/ETAL
115 W Wood Drive
Phoenix AZ 85029

RE: Results of the Floodplain Re-study of Cave Creek by the
Cave Creek from CAP Canal to Loop 101 Hwy. Floodplain Delineation Study

PARCEL NUMBERS: 209-11-001A

Dear Property Owner:

We have completed a comprehensive re-study of this portion of Cave Creek. The study has produced new boundaries and elevations for the Floodplain and the Floodway. The Floodplain is the area that would be inundated by a 100-year flood (which has a 1 % chance of occurring in any one year). The Floodway is that portion of the Floodplain that is reserved for the conveyance of flood flows, and is basically a no-build zone.

The enclosed three 8 1/2 in. by 11 in. sheets show the new floodplain and floodway boundaries in red with the existing Flood Insurance Rate Maps as background. The three enclosed large maps (24 in. by 36 in.) show the details of the study results.

If you have any comments or questions, please contact me at 602-506-4732.

Yours truly,

Mike Duncan

Mike Duncan, PE, CFM
Project Manager

Enclosures

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapley, District 2
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Max Wilson, District 4
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www.fcd.maricopa.gov
2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

March 3, 2006

Orsett / Pima LLC
20 William Street STE G-50
Wellesley MA 02481

RE: Results of the Floodplain Re-study of Cave Creek by the
Cave Creek from CAP Canal to Loop 101 Hwy. Floodplain Delineation Study

PARCEL NUMBERS: 209-11-360

Dear Property Owner:

We have completed a comprehensive re-study of this portion of Cave Creek. The study has produced new boundaries and elevations for the Floodplain and the Floodway. The Floodplain is the area that would be inundated by a 100-year flood (which has a 1 % chance of occurring in any one year). The Floodway is that portion of the Floodplain that is reserved for the conveyance of flood flows, and is basically a no-build zone.

The enclosed three 8 1/2 in. by 11 in. sheets show the new floodplain and floodway boundaries in red with the existing Flood Insurance Rate Maps as background. The three enclosed large maps (24 in. by 36 in.) show the details of the study results.

If you have any comments or questions, please contact me at 602-506-4732.

Yours truly,

Mike Duncan

Mike Duncan, PE, CFM
Project Manager

Enclosures

B.7 Correspondence with FEMA

Flood Control District
of Maricopa County

www.fcd.maricopa.gov
2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

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

March 17, 2006

Craig Kennedy, Arizona Revisions Coordinator
Michael Baker Jr. Inc.
3601 Eisenhower Avenue
Alexandria, Virginia 22304-6425

Subject: Submission of LOMR package for Re-study of Cave Creek from CAP Canal to Loop 101 Highway

Flooding Source:	Cave Creek
Flood Insurance Rate Map Panel IDs:	04013C -1210, -1215 , and -1220
Vertical Datum of LOMR package:	NGVD29

Dear Craig:

We have completed a re-study of approximately 3 miles of Cave Creek. This re-study was initiated by the City of Phoenix, and lies fully within the City of Phoenix.

AutoCAD dxf files are included on the CD at the back of the notebook. If you have any questions, please contact me at 602-506-4732 or mwd@mail.maricopa.gov.

Sincerely,

Mike Duncan

Mike Duncan, P.E., CFM
Project Manager

Enclosure: 1 notebook

Copies to:

Michael Godesky, Project Manager
Hazards Study Branch, Mitigation Directorate
Federal Emergency Management Agency
500 C STREET SW
WASHINGTON DC 20472-0001

Ray Lenaburg
Floodplain Mapping Coordinator
FEMA Region IX
1111 BROADWAY STE 1200
OAKLAND CA 94607

Hasan Mustaq, Ph.D., P.E., CFM
Floodplain Manager
City of Phoenix
200 W WASHINGTON ST 5TH FLOOR
PHOENIX AZ 85003-1611

Dennis Richards, P.E.
Project Manager
WEST Consultants, Inc.
960 W ELLIOT RD STE 201
TEMPE AZ 85284-1137

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

March 24, 2006

Mr. Dennis L. Richards, P.E.
WEST Consultants, Inc.
960 West Elliot Road, Suite 201
Tempe, AZ 85284-1137

IN REPLY REFER TO:
Case No.: 06-09-B582P
Community: City of Phoenix, AZ
Community No.: 040051

316-AD

Dear Mr. Richards:

This responds to your request dated March 17, 2006, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Cave Creek Floodplain Delineation Study
Flooding Source:	Cave Creek
FIRM Panel(s) Affected:	04013C1210 H, 1215 K, 1220 J

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

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the flat review and processing fee for requests of this type established by the current fee schedule.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. In addition, as a result of the aftermath of recent hurricanes, many FEMA employees have been deployed to assist in disaster relief efforts. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data/fee **must** be submitted within 90 days of the date of the letter. Any fees already paid will be forfeited for any request for which the requested data are not received within 90 days.

We will continue to work expeditiously to review all submittals in accordance with National Flood Insurance Program (NFIP) regulations, and will aim to meet the regulatory timeframe for the review of all requests. However, requesters should be aware that delays may occur in the review process because of the current emergency situation. We appreciate the patience and cooperation of all requesters as FEMA assists in hurricane relief efforts.

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

Sincerely,

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

Enclosures

cc: Hasan Mushtaq, Ph. D., P.E., CFM
Floodplain Manager
City of Phoenix

Mr. Michael Duncan, P.E., CFM
Project Manager
Flood Control District of Maricopa County

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

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

Summary of Additional Data Required to Support a
Letter of Map Revision

Case No.: 06-09-B582P

Requester: Dennis L. Richards, P.E.

Community: City of Phoenix, AZ

Community No.: 040051

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

1. Our preliminary review of the discharge values for Cave Creek revealed differences between the effective Flood Insurance Study discharges and the existing conditions model. Please submit the digital input and output for the hydrologic analysis and all applicable backup information to support the discharges used in the submitted hydraulic analyses for Cave Creek.

2. Please submit an annotated Flood Insurance Rate Map (FIRM), at the scale of the effective FIRM, that shows the revised conditions boundary delineations of the floodplain and floodway of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood), as shown on the submitted work map, and how they tie into the base floodplain and floodway boundary delineations shown on the effective FIRM at the downstream and upstream ends of the revised reach.

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

Effective October 30, 2005, the Federal Emergency Management Agency (FEMA) revised the fee schedule for reviewing and processing requests for conditional and final modifications to published flood information and maps. A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register*, is enclosed for your information. In accordance with this schedule, the fee for your request is $4,400 and must be submitted before we can continue processing your request. Payment of this fee must be made in the form of a check or money order, payable in U.S. funds to the National Flood Insurance Program, or a credit card payment. For identification purposes, the case number referenced above must be included on the check or money order. We will not perform a detailed technical review of your request until we receive this payment.

Payment must be forwarded to one of the addresses listed below.

Using U.S. Postal Service:
Federal Emergency Management Agency
Fee-Charge System Administrator
P.O. Box 22787
Alexandria, VA 22304

Using overnight service:
FEMA Fee-Charge System Administrator
c/o Michael Baker Jr., Inc.
3601 Eisenhower Avenue
Alexandria, VA 22304

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

May 25, 2006

Mr. Dennis L. Richards, P.E.
WEST Consultants, Inc.
960 West Elliot Road, Suite 201
Tempe, AZ 85284

IN REPLY REFER TO:
Case No.: 06-09-B582P
Community: City of Phoenix, AZ
Community No.: 040051

316-ACK

Dear Mr. Richards:

This responds to your request dated March 17, 2006, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Cave Creek Floodplain Delineation Study
Flooding Source:	Cave Creek
FIRM Panel(s) Affected:	04013C0120 H, 1215 K, 1220 J

We have completed an inventory of the items you submitted. Our review of the submitted data indicates we have the minimum data required to perform a detailed technical review of your request. If additional data are required or if delays are encountered, we will inform you within 60 days of the date of this letter.

As you may know, FEMA has implemented a procedure to recover costs associated with reviewing and processing requests for modifications to published flood information and maps. However, because your request is based on flood hazard information meant to improve upon that shown on the flood map or within the flood study and does not partially or wholly incorporate manmade modifications within the Special Flood Hazard Area, no fees will be assessed for our review.

Please direct questions concerning your request to us at the address shown at the bottom of this page. For identification purposes, please include the case number referenced above on all correspondence.

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

Sincerely,

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

cc: Mr. Hasan Mushtaq, Ph. D., P.E., CFM
Floodplain Manager
City of Phoenix

Mr. Michael Duncan, P.E., CFM
Project Manager
Maricopa County

Mr. Brian Cosson, CFM
NFIP Coordinator
Arizona Department of Water Resources

Brian Wahlin

From: Edie Vinson-Wright [Edie.Vinson-Wright@mapmodteam.com]

Sent: Thursday, July 06, 2006 6:58 AM

To: Michael Duncan - FCDX

Cc: Brian Wahlin

Subject: RE: Cave Creek from CAP Canal to Loop 101, FEMA case no. 06-09-B582P

Hi Michael, thanks for the information on the pipes. Could you forward the 1993 image of the area where the culverts were to show that they no longer exist there? I have additional comments as well.

1) The removal of the culvert and the addition of the Loop 101 structures impact all the profiles (10-, 50- and 100-year). The hydraulic analyses submitted only covers the 100-year storm (and floodway), however we need the analyses for all the recurrence intervals previously studied to accurately show the changes along this restudied reach of Cave Creek.
2) The discharge in the effective model at cross section 25.561, the natural section upstream of the CAP Canal overshoot, is 2,900 cfs, not 4,900 cfs (see attachment). Also, the negative surcharge of 0.17 in the revised HEC-RAS model at this cross section is outside of FEMA's tolerance for surcharge, (surcharge = 0.00). The hydraulic model should be revised to have the discharge at 25.561 at 2,900 cfs. (Note: this will reduce the negative surcharge occurring at this cross section).
3) FEMA defines ponding as the result of runoff or flows collecting in a depression that may have no outlet, subterranean outlets, rim outlets, or manmade outlets such as culverts or pumping stations. Impoundments behind manmade obstructions (e.g., levees, road fills, railroad grades, canal banks or similar structures) are included in this type of shallow flooding as long as they are not **backwater** from a defined channel or do not exceed 3.0 feet in depth. The Zone AH areas described in your submittal do not meet FEMA's requirements to be classified as Zone AH ponding. Please review the Guidelines and Specification for Flood Hazard Mapping Partners, Appendix E. These areas will be shown as backwater off of Cave Creek unless an appropriate analysis is provided defining these areas as areas of ponding as per FEMA specifications.
4) The hydraulic model shows high ground at cross section 24.343 that is not mapped. The map shows backwater at cross section 22.991 that is not reflected in the model and a floodway top width at cross section 22.880 (modeled approximately coincident with 1% flood boundary) that is not consistent with the model. The data on the maps must correspond with the model output. Please adjust the model or map (annotated FIRM and corresponding digital file) as appropriate so that the information on the map is consistent with the model.
5) Cross sections CA through BV are shown mapped in the floodplain (right overbank) on the annotated FIRM. Please correct. Also, the top width at cross section CA for the floodplain in the digital file exceeds the top width generated by the model. Please correct.
6) The distance along the profile baseline on the annotated FIRM between cross section CA (25.482) and BZ (25.428) exceeds the distance in the model and the digital file. Please correct.
7) The are discrepancies between the distance measured along the profile baseline on the annotated map between lettered cross sections and the presumed modeled cross sections in the digital file. For all cross sections, please indicate the corresponding lettered and numbered cross sections shown on the annotated FIRM and in the digital file; please review and correct as needed the distance between the following lettered cross sections: BY-BX, BX-BW, BV-BU, BU-BT, BS-BR, BR-BQ, BQ-BP, BM-BL, BE-BD, BC-BB and BB-BA.
8) At cross section 23.040, the top width in the digital file (approximately 217 feet for the floodplain) is less than the modeled top width of 469.21 feet. Please correct.
9) At cross section 24.504, the top width in the digital file (approximately 213 feet for the floodplain, 184 feet for the floodway) is greater than the modeled top width of 132.93 feet for the floodplain, and 109.80 for the floodway. Also, the high ground modeled is not shown in the digital file. Please correct.
10) At cross section 24.617, the top width in the digital file (approximately 154 feet for the floodplain) is less than the modeled top width of 251.99 feet. Please correct.
11) The orientation of the cross sections in the digital file is not consistent with the cross sections shown on the annotated FIRM. For example, cross section 24.549 is shown as a dog-legged cross section in the digital file, however the lettered cross section presumed to represent this cross section of the annotated firm is straight. Please correct the annotated FIRM or digital file as appropriate.

12) Please provide as-built data for the channelization project between 7th Street and Pima Freeway/Route 101. The effective mapping indicates flow escapes the channel, creating backwater areas. Additionally, there are shallow flooding areas shown that appear to be removed with this analysis.

Please give me a call at your convenience to discuss these comments. I can be reached at (703) 960-8800 x 3191.

Edie Vinson-Wright, CFM
MAPMODTEAM
Michael Baker Jr, Inc.
3601 Eisenhower Avenue
Alexandria, VA 23434

From: Michael Duncan - FCDX [mailto:mwd@mail.maricopa.gov]
Sent: Tuesday, June 27, 2006 3:20 PM
To: Edie Vinson-Wright
Cc: Brian Wahlin
Subject: Cave Creek from CAP Canal to Loop 101 -- FEMA case no. 06-09-B582P -- when was culvert removed

Hi Edie,

Concerning: the culvert (2 at 36 inch corrugated metal pipes) that appears in the HEC-2 and Profile plots of the Burgess and Niple study (with PE stamp of 3-26-91), at approximately 1,950 ft. north of the Beardsley Rd./Loop 101 centerline.

You had asked when it was removed. I looked at our aerial photos. The oldest that we have in this area were flown in 1993, and this culvert does not appear in this 1993 image.

If and when you have any more questions, please contact me.

Mike Duncan, PE, CFM
Flood Delineation Branch
Flood Control District of Maricopa County

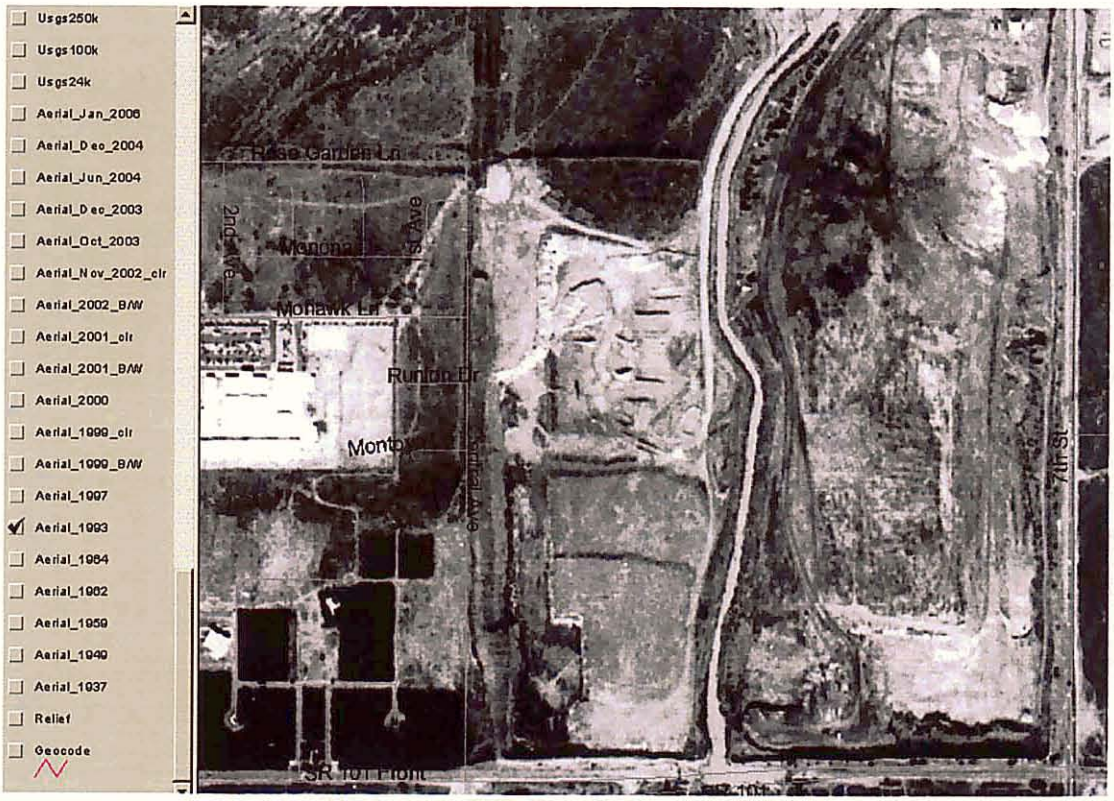
phone 602-506-4732

RESPONSES TO FEMA
Cave Creek from CAP Canal to Loop 101 Highway
Case No. 06-09-B582P
Review Comments of Edie Vinson-Wright email of 7-6-06

9-14-06
Mike Duncan, FCD
Brian Wahlin, WEST

Comment # 0: Please submit the 1993 aerial image that shows that the previous culverts have been removed.

Response by Flood Control District of Maricopa County:
Here is a clipped image from our GIS database:



Comment # 1: The removal of the culvert and the addition of the Loop 101 structures impact all the profiles (10-, 50- and 100-year). The hydraulic analyses submitted only covers the 100-year storm (and floodway), however we need the analyses for all the recurrence intervals previously studied to accurately show the changes along this restudied reach of Cave Creek.

Response by Flood Control District of Maricopa County:
We do not have 10-year or 50-year analyses in our studies. The Flood Control District of Maricopa County stopped scoping 10-year, 50-year, and 500-year discharges in its Floodplain Delineation Studies in 1989. Since that time, the District has sponsored 120 Floodplain Delineation Studies that have produced only the 100-year discharges. These Studies have all been reviewed and processed by FEMA and its Map Contractors.

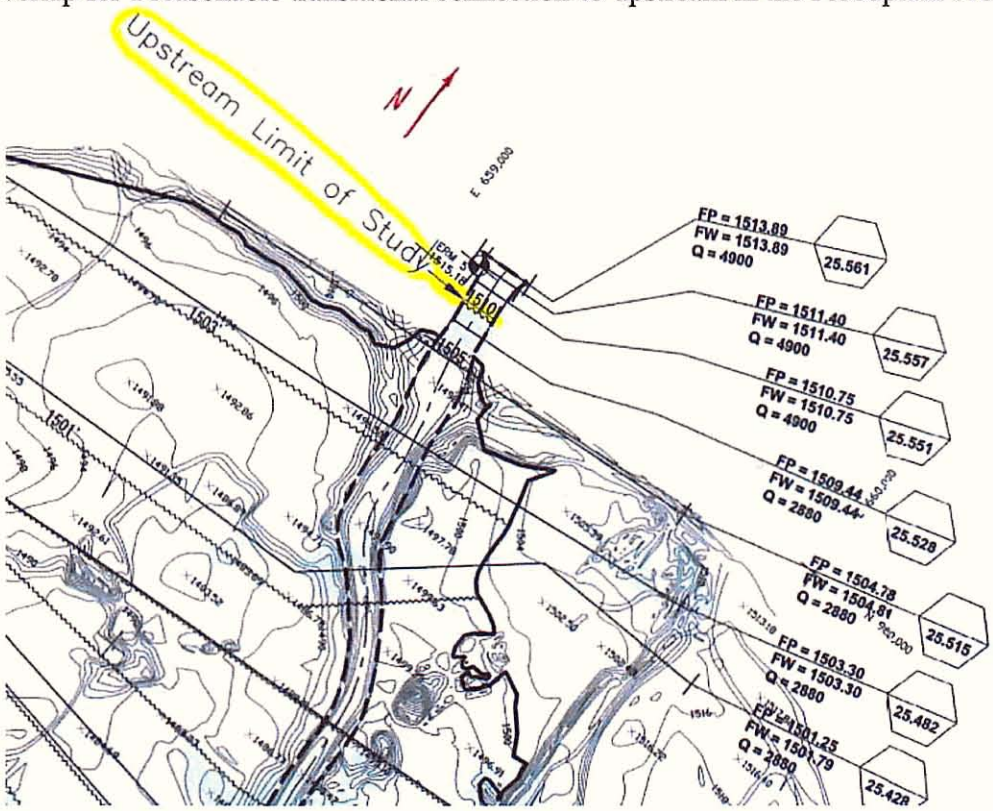
Even if we had 10-year and 50-year profiles, the bridges would not cause any rises in the profiles, since the bridges of Loop 101 do not constrict the floodplain. The width of the floodplain is

approximately the same upstream of the bridges, at the bridges, and downstream of the bridges; and the span of the bridges is 35 feet longer than the floodplain width.

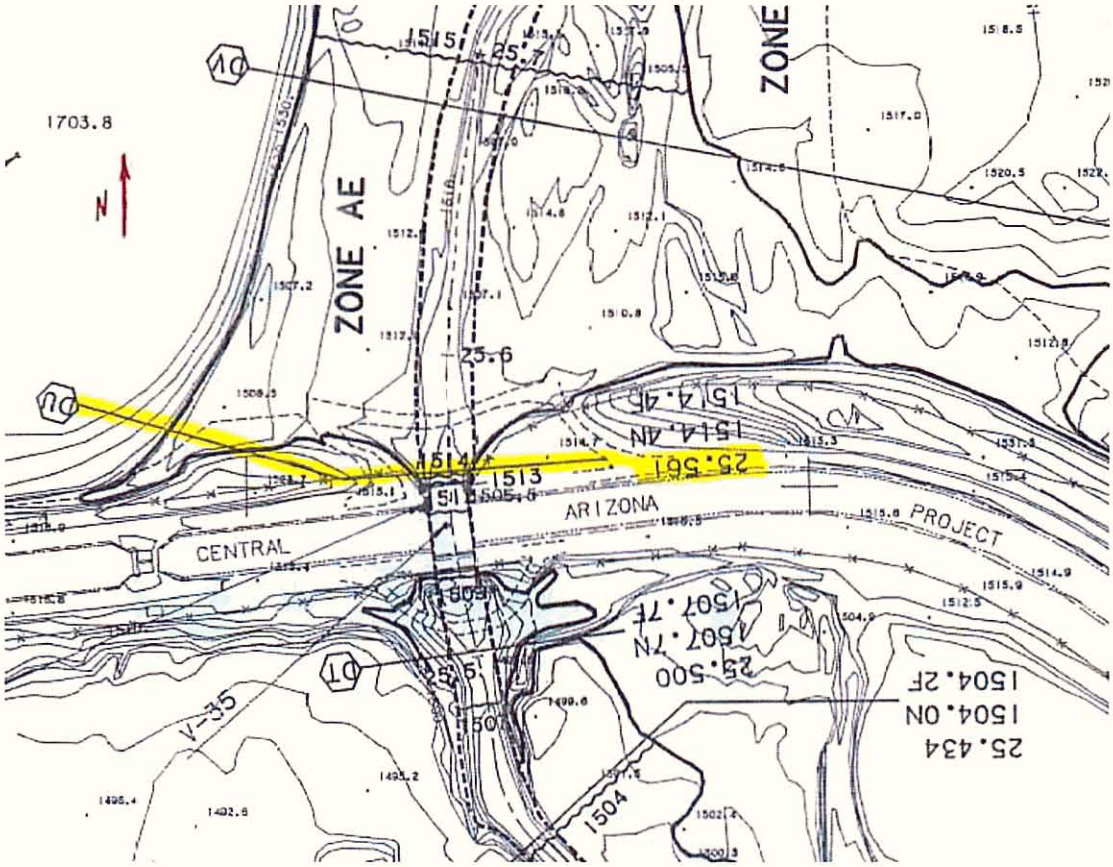
Regarding the National Flood Insurance Program, the 10-year profile was used in computing the Flood Hazard Factor that was used to determine the old A1 through A30 flood zone designations, which have not been used since 1985, when the FEMA 37 Guidelines and Specifications for Study Contractors was revised in September 1985. My understanding of the use of 50-year discharges is that it was included in studies as a possible convenience for transportation-drainage designers. Additionally, the key simple fact is that the 10-year and 50-year profiles have no uses or implications in the regulation of development in floodplains.

Comment # 2: The discharge in the effective model at cross section 25.561, the natural section upstream of the CAP Canal overshoot, is 2,900 cfs, not 4,900 cfs (see attachment). Also, the negative surcharge of 0.17 in the revised HEC-RAS model at this cross section is outside of FEMA's tolerance for surcharge, (surcharge = 0.00). The hydraulic model should be revised to have the discharge at 25.561 at 2,900 cfs. (Note: this will reduce the negative surcharge occurring at this cross section).

Response by Flood Control District of Maricopa County:
The upstream limit of the new re-study is the mid-point of the canal overchute, as shown in the below map portion from sheet 1 of 3 of the new re-study. Downstream of this point, the 2,880 cfs of the updated-hydrology is used; while upstream, the 4,900 cfs of the old hydrology is used in the HEC-RAS. Cross-sections 25.551, 25.557, and 25.561 were included in the HEC-RAS model to provide overlap for a reasonable transitional connection-to-upstream in the Floodplain Profile.



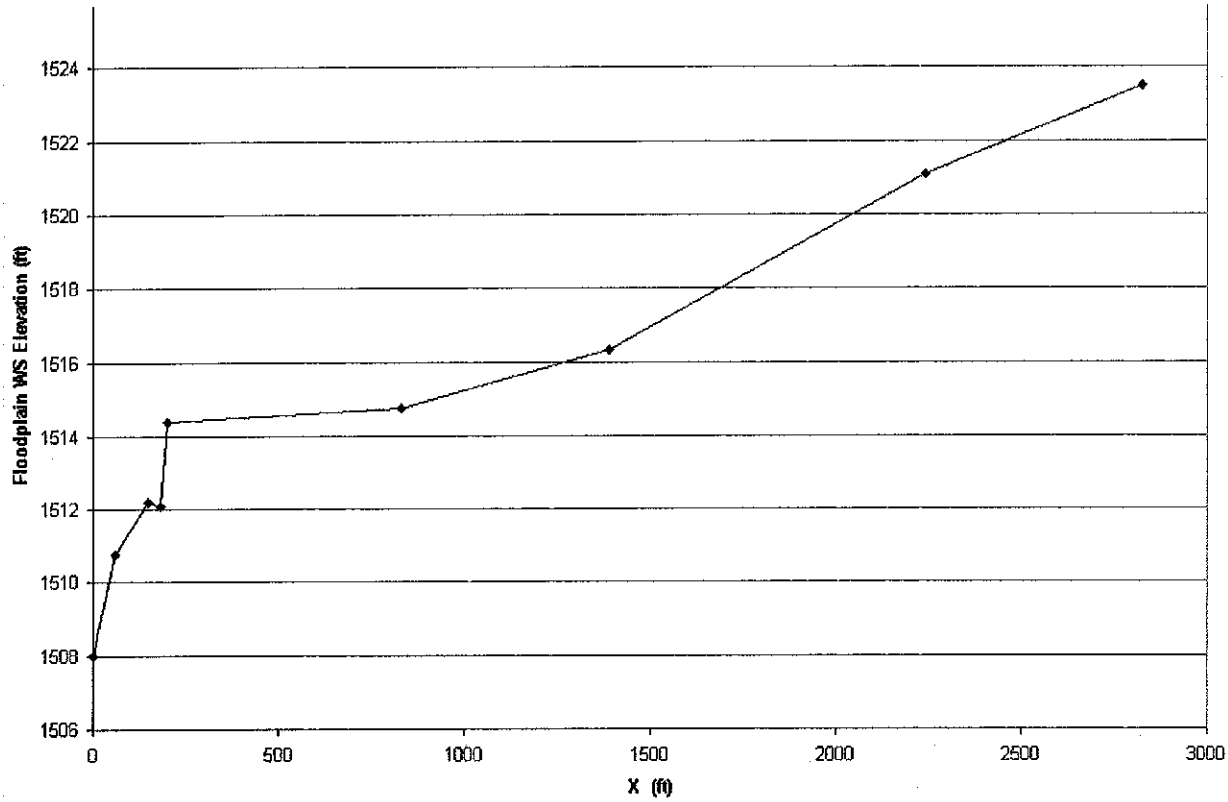
As shown below, cross section 25.561 is just upstream of the overchute, and the floodplain is confined here (just 115 ft. wide). We determined that the 2,900 cfs of the HEC-2 was in error, and we chose not to repeat this error. Based on conservation of mass, it is impossible for the discharge to increase from 2,900 cfs to 4,900 cfs in traveling just 21 feet in this confined area (between xsecs. 25.557 and 25.561 of the HEC-2).



In the HEC-2, the erroneous discharge of 2,900 cfs causes a steep change in the water surface and a bump in the water surface immediately downstream. This is due to the velocity of 11.16 fps (which gives a velocity head of 1.94 ft) at cross section 25.557, and a velocity of 3.51 fps (which gives a velocity head of 0.19 ft) at cross-section 25.561. The 1.75 ft. difference in velocity heads is the major reason for the abrupt 2.28 ft. difference in water surfaces, as shown below.

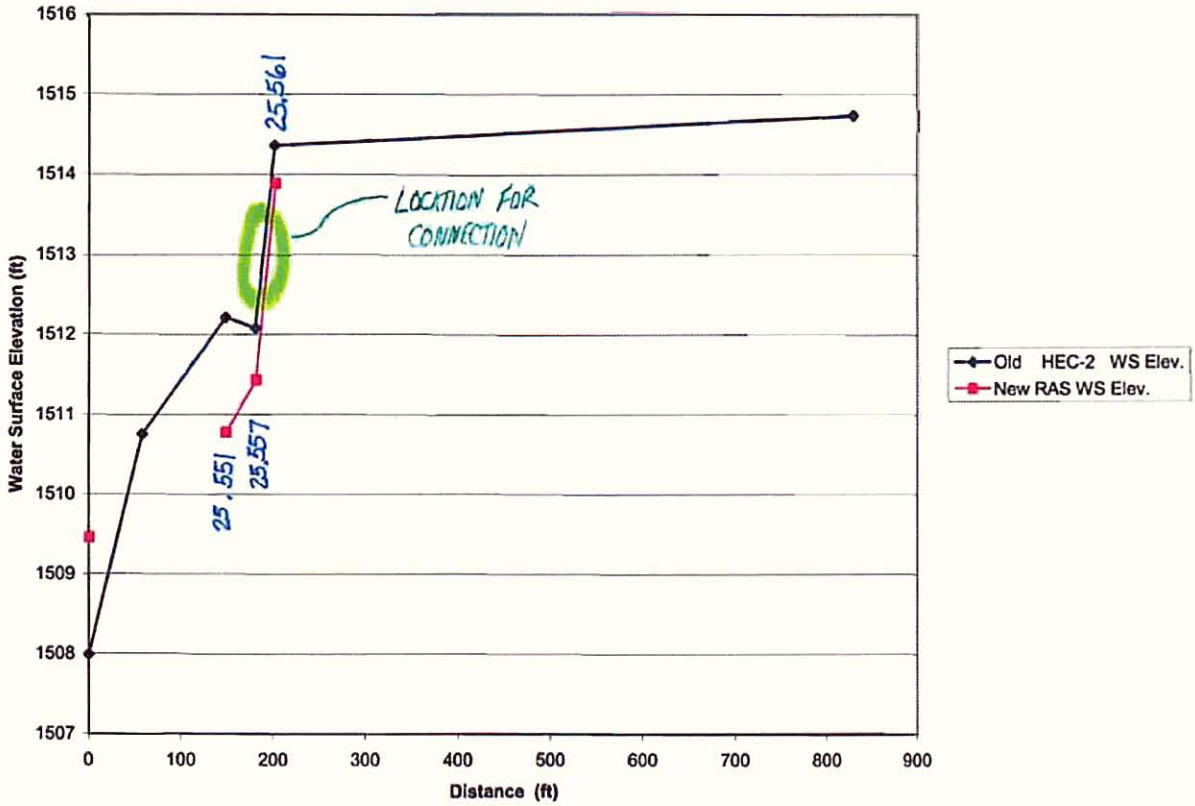
Cave Creek CAP to Loop101 EFFECTIVE HEC-2

Riv. Mi.	Q (cfs)	xsec to xsec dist	X (ft)	Y (ft)	CHAN. VEL. (fps)
25.523	4900		0	1507.99	3.95
25.534	4900	58	58	1510.75	12.96
25.551	4900	90	148	1512.21	10.1
25.557	4900	32	180	1512.08	11.16
25.561	2900	21	201	1514.36	3.51
25.68	2700	628	829	1514.74	1.74
25.786	2500	560	1389	1516.32	7.24
25.947	2300	850	2239	1521.07	6.24
26.058	2200	586	2825	1523.49	6.27



The negative surcharge at cross-section 25.561 is not a problem, since this is beyond the upstream limit of the new study.

A good location for the transitional-connection of the Floodplain Profile between the old and the new study (between cross sections 25.557 and 25.561) is shown here:



Comment # 3: FEMA defines ponding as the result of runoff or flows collecting in a depression that may have no outlet, subterranean outlets, rim outlets, or manmade outlets such as culverts or pumping stations. Impoundments behind manmade obstructions (e.g., levees, road fills, railroad grades, canal banks or similar structures) are included in this type of shallow flooding as long as they are not backwater from a defined channel or do not exceed 3.0 feet in depth. The Zone AH areas described in your submittal do not meet FEMA's requirements to be classified as Zone AH ponding. Please review the Guidelines and Specification for Flood Hazard Mapping Partners, Appendix E. These areas will be shown as backwater off of Cave Creek unless an appropriate analysis is provided defining these areas as areas of ponding as per FEMA specifications.

Response by WEST Consultants:
All of the areas labeled Zone AH have been reclassified as Zone AE on both the work maps and the annotated FIRM panels.

Comment #4: The hydraulic model shows high ground at cross section 24.343 that is not mapped. The map shows backwater at cross section 22.991 that is not reflected in the model and a floodway top width at cross section 22.880 (modeled approximately coincident with 1% flood boundary) that is not consistent with the model. The data on the maps must correspond with the model output. Please adjust the model or map (annotated FIRM and corresponding digital file) as appropriate so that the information on the map is consistent with the model.

Response by WEST Consultants:
The high point in cross-section 24.343 is a small area of local high ground that constitutes only about 5% of the total width of the cross-section. This area occurs in the middle of the channel and does not occur in overbanks. This high area also does not extend to either the adjacent upstream or downstream cross-sections. Because of the small size of this high ground, it is not physically reasonable to reclassify it as Zone X. Merging this small high ground with the floodplain is also a more conservative approach to mapping the floodplain.

The floodplain on the work maps and annotated FIRM panels has been corrected at cross-section 22.991 so that it is consistent with the hydraulic model.

The floodway top width at cross-section 22.880 has been corrected on the work maps and the annotated FIRM panels so that it is consistent with the hydraulic model. This correction resulted in slight changes in the floodway elevations at cross-sections 22.991 and 23.019. An updated floodway data table (Table 7.2 from the TDN) is included.

Comment #5: Cross sections CA through BV are shown mapped in the floodplain (right overbank) on the annotated FIRM. Please correct. Also, the top width at cross section CA for the floodplain in the digital file exceeds the top width generated by the model. Please correct.

Response by WEST Consultants:
The cross-sections shown on the annotated FIRM panels were the cross-sections from the original FIS. Our restudy changed the location and length of many of the cross-sections based on the new hydraulic conditions of Cave Creek. The new cross-sections have been plotted on the annotated FIRM panels in green. The new cross-sections CA through BV are now shown to extend beyond the floodplain extents in the annotated FIRM panels.

Cross-section CA (25.482) has small areas of high ground near the left and right bank stations. These two small areas of high ground were included in the floodplain on the work maps and annotated FIRM panels for the same reasons discussed in Comment #4 for cross-section 24.343. When RAS reports top widths, it does not include these areas of high ground. However, the floodplain top width obtained in the hydraulic model from subtracting the left station of the floodplain from the right station of the floodplain is the same as the floodplain width shown in the work maps and annotated FIRM panels.

Comment # 6: The distance along the profile baseline on the annotated FIRM between cross section CA (25.482) and BZ (25.428) exceeds the distance in the model and the digital file. Please correct.

Response by WEST Consultants:
The cross-sections shown on the annotated FIRM panels were the cross-sections from the original FIS. Our restudy changed the location and length of many of the cross-sections based on the new hydraulic conditions of Cave Creek. The new cross-sections have been plotted on the annotated FIRM panels in green. The distance between the new cross-sections CA and BZ on the annotated FIRM panel now agree with the hydraulic model.

Comment # 7: There are discrepancies between the distances measured along the profile baseline on the annotated map between lettered cross sections and the presumed modeled cross sections in

the digital file. For all cross sections, please indicate the corresponding lettered and numbered cross sections shown on the annotated FIRM and in the digital file; please review and correct as needed the distance between the following lettered cross sections: BY-BX, BX-BW, BV-BU, BU-BT, BS-BR, BR-BQ, BQ-BP, BM-BL, BE-BD, BC-BB and BB-BA.

Response by WEST Consultants:
The cross-sections shown on the annotated FIRM panels were the cross-sections from the original FIS. Our restudy changed the location and length of many of the cross-sections based on the new hydraulic conditions of Cave Creek. The new cross-sections have been plotted on the annotated FIRM panels in green. Using the new cross-sections, the discrepancies in the measured distances have been eliminated.

Comment # 8: At cross section 23.040, the top width in the digital file (approximately 217 feet for the floodplain) is less than the modeled top width of 469.21 feet. Please correct.

Response by WEST Consultants:
The floodplain in the area of cross-section 23.040 was corrected. The measured floodplain width at cross-section 23.040 is now approximately 470 feet, which agrees with the value of 469.21 feet reported by the hydraulic model.

Comment # 9: At cross section 24.504, the top width in the digital file (approximately 213 feet for the floodplain, 184 feet for the floodway) is greater than the modeled top width of 132.93 feet for the floodplain, and 109.80 for the floodway. Also, the high ground modeled is not shown in the digital file. Please correct.

Response by WEST Consultants:
At cross-section 24.504, there is a large section of high ground that is classified as Zone X. The top widths measured on the work maps and the annotated FIRM panels should not include this area of high ground. The floodplain and floodway widths measured on the work maps are 135 feet and 105 feet, respectively. These values agree with the values reported by the hydraulic model.

Comment # 10: At cross section 24.617, the top width in the digital file (approximately 154 feet for the floodplain) is less than the modeled top width of 251.99 feet. Please correct.

Response by WEST Consultants:
Cross-section 24.617 is a dog-legged cross-section that includes a portion of high ground that is not to be included in the floodplain or floodway. The measured floodplain width from the work maps is 247 feet, which agrees with the 251.99 feet top width reported by the hydraulic model.

Comment # 11: The orientation of the cross sections in the digital file is not consistent with the cross sections shown on the annotated FIRM. For example, cross section 24.549 is shown as a dog-legged cross section in the digital file; however, the lettered cross section presumed to represent this cross section of the annotated firm is straight. Please correct the annotated FIRM or digital file as appropriate.

Response by WEST Consultants:
The cross-sections shown on the annotated FIRM panels were the cross-sections from the original FIS. Our restudy changed the location and length of many of the cross-sections based on the new

hydraulic conditions of Cave Creek. The new cross-sections have been plotted on the annotated FIRM panels in green.

Comment # 12: Please provide as-built data for the channelization project between 7th Street and Pima Freeway/Route 101. The effective mapping indicates flow escapes the channel, creating backwater areas. Additionally, there are area shallow flooding areas shown that appear to be removed with this analysis.

Response by Flood Control District of Maricopa County:
We have been unable to find any as-built plans. The re-study is based on new 2-foot contour topographic mapping. The flow of Cave Creek no longer escapes, to cause any shallow flooding.

Table 7-2 Floodway Data

Flooding Source	Floodway			Base Flood Water Surface Elevation[1]		
Cross-Section	Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Floodway (ft)	Floodplain (ft)	Increase (ft)
25.528	72	264.7	10.9	1509.45	1509.45	0.00
25.515	91	671.6	4.3	1504.81	1504.78	0.04
25.482	71	305.9	9.4	1503.30	1503.30	0.00
25.428	63	324.4	8.9	1501.79	1501.25	0.55
25.367	60	326.2	8.8	1500.08	1500.05	0.03
25.299	55	242.7	11.9	1496.62	1496.60	0.02
25.271	224	1149.3	2.5	1495.99	1495.13	0.85
25.210	195	1041.9	2.8	1495.77	1494.94	0.82
25.191	94	505.8	5.7	1495.17	1494.61	0.56
25.155	78	409.6	7.0	1494.27	1493.46	0.81
25.096	84	450.8	6.4	1493.35	1492.57	0.78
25.039	59	262.8	11.0	1490.10	1489.75	0.35
24.953	71	441.5	6.5	1487.73	1487.08	0.65
24.872	50	368.1	7.8	1486.22	1485.37	0.85
24.828	40	222.7	12.9	1483.11	1482.89	0.22
24.793	46	228.7	12.6	1481.27	1481.20	0.07
24.732	69	325.8	8.8	1479.37	1479.10	0.27
24.700	63	283	10.2	1477.80	1477.25	0.55
24.673	103	670.2	4.6	1478.23	1477.44	0.79
24.632	40	229.3	13.5	1474.86	1474.39	0.47
24.617	62	264.8	11.7	1472.51	1471.71	0.80
24.587	151	396.8	7.8	1469.48	1469.03	0.45
24.549	241	829.4	3.7	1468.65	1468.44	0.21
24.504	110	428.9	7.7	1466.86	1466.24	0.62
24.466	155	474.2	7.0	1465.29	1465.00	0.29
24.427	150	655.1	5.0	1464.57	1464.37	0.20
24.343	197	825	4.0	1463.57	1463.53	0.05
24.300	261	1587.5	2.1	1463.55	1463.50	0.04
24.264	215	1366.6	2.4	1463.45	1463.42	0.03
24.232	94	531.3	6.2	1462.74	1462.72	0.02
24.210	167	1219.6	2.7	1462.97	1462.95	0.02
24.169	152	1162.7	2.8	1462.86	1462.85	0.01
24.112	150	1310.8	2.5	1462.77	1462.77	0.00
24.068	72	497.9	6.6	1461.85	1461.85	0.00
24.062	7th Street Bridge					
24.057	72	465.7	7.1	1461.28	1461.28	0.00
23.963	80	494	6.7	1459.68	1459.68	0.00
23.883	64	419.6	7.9	1457.90	1457.90	0.00
23.822	60	346.4	9.5	1455.38	1455.38	0.00
23.787	112	687.8	4.8	1455.49	1455.49	0.00

[1]Vertical Datum: NGVD 29

Flooding Source	Floodway			Base Flood Water Surface Elevation[1]		
Cross-Section	Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Floodway (ft)	Floodplain (ft)	Increase (ft)
23.756	82	506.3	6.5	1454.74	1454.74	0.00
23.662	63	394.2	8.4	1452.11	1452.11	0.00
23.567	67	427.4	7.7	1449.58	1449.58	0.00
23.488	68	450.6	7.3	1447.83	1447.83	0.00
23.389	62	393.3	8.4	1445.02	1445.02	0.00
23.307	64	404.5	8.2	1442.67	1442.67	0.00
23.223	63	423.6	7.8	1440.52	1440.52	0.00
23.204	54	264.1	12.5	1438.07	1438.07	0.00
23.192	58	269.6	12.2	1435.57	1435.57	0.00
23.150	112	489.4	6.7	1434.09	1434.09	0.00
23.146	North Frontage Road Bridge					
23.142	109	453.1	7.3	1433.06	1433.06	0.00
23.138	107	467.3	7.1	1433.02	1433.02	0.00
23.134	North On Ramp Bridge					
23.131	113	447.9	7.4	1432.35	1432.35	0.00
23.128	113	457.8	7.2	1432.33	1432.33	0.00
23.114	Loop 101 Mainline Bridges					
23.101	111	470.5	7.0	1431.65	1431.65	0.00
23.097	113	480.6	6.9	1431.60	1431.60	0.00
23.093	South Off Ramp Bridge					
23.090	117	488	6.8	1431.45	1431.45	0.00
23.084	118	492.3	6.7	1431.37	1431.37	0.00
23.081	South Frontage Road Bridge					
23.077	117	509.8	6.5	1431.24	1431.24	0.00
23.040	119	368.7	9.9	1429.35	1429.35	0.00
23.019	134	530.5	6.9	1423.80	1423.08	0.72
22.991	174	505.9	7.2	1423.41	1422.71	0.70

[1]Vertical Datum: NGVD 29

7.3 Annotated Flood Insurance Rate Maps

Copies of draft annotated Flood Insurance Rate Maps are included in the Exhibit Maps section following the Appendices.

7.4 Flood Profiles

A draft Flood Profile is included in the Exhibit Maps section following the Appendices.

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

September 22, 2006

Mr. Dennis L. Richards, P.E.
WEST Consultants, Inc.
960 West Elliot Road, Suite 201
Tempe, AZ 85284

IN REPLY REFER TO:
Case No.: 06-09-B582P
Community: City of Phoenix, AZ
Community No.: 040051

316-ACK

Dear Mr. Richards:

This responds to your request dated March 17, 2006, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Cave Creek Floodplain Delineation Study
Flooding Source:	Cave Creek
FIRM Panel(s) Affected:	04013C0120 H, 1215 K, 1220 J

We have completed an inventory of the items you submitted. Our review of the submitted data indicates we have the minimum data required to perform a detailed technical review of your request. If additional data are required or if delays are encountered, we will inform you within 60 days of the date of this letter.

As you may know, FEMA has implemented a procedure to recover costs associated with reviewing and processing requests for modifications to published flood information and maps. However, because your request is based on flood hazard information meant to improve upon that shown on the flood map or within the flood study and does not partially or wholly incorporate manmade modifications within the Special Flood Hazard Area, no fees will be assessed for our review.

Please direct questions concerning your request to us at the address shown at the bottom of this page. For identification purposes, please include the case number referenced above on all correspondence.

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Assistance Center, toll-free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please call the Revisions Coordinator for your State, Mr. Mounir Boudjemaa, MS, who may be reached at (703) 960-8800, ext. 3012.

Sincerely,

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

cc: Hasan Mushtaq, Ph. D., P.E., CFM
Floodplain Manager
City of Phoenix

Mr. Michael Duncan, P.E., CFM
Project Manager
Flood Control District of Maricopa County

Mr. Brian Cosson, CFM
NFIP Coordinator
Arizona Department of Water Resources

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

December 4, 2006

Mr. Dennis L. Richards, P.E.
WEST Consultants, Inc.
960 West Elliot Road, Suite 201
Tempe, AZ 85284

IN REPLY REFER TO:
Case No.: 06-09-B582P
Community: City of Phoenix, AZ
Community No.: 040051

316-AD

Dear Mr. Richards:

This is in regard to your request dated March 17, 2006, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the Flood Insurance Rate Map (FIRM) for Maricopa County, Arizona and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Cave Creek Floodplain Delineation Study
Flooding Source:	Cave Creek
FIRM Panel(s) Affected:	04013C1210 H, 1215 K, 1220 J

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

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

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

If you have general questions about your request, FEMA policy, or the National Flood Insurance Program (NFIP), please call the FEMA Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627).

3601 Eisenhower Avenue, Alexandria, VA 22304-6425 PH:1-877-FEMA MAP FX: 703.960.9125

If you have specific questions concerning your request, please call the Revisions Coordinator for your State, Mounir Boudjemaa, M.S., who may be reached at (703) 960-8800, ext. 3012.

Sincerely,

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

Enclosures

cc: Hasan Mushtaq, Ph. D., P.E., CFM
Floodplain Manager
City of Phoenix

Mr. Michael Duncan, P.E., CFM
Project Manager
Flood Control District of Maricopa County

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

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

Summary of Additional Data Required to Support a
Letter of Map Revision

Case No.: 06-09-B582P

Requester: Mr. Dennis L. Richards, P.E.

Community: City of Phoenix, AZ

Community No.: 040051

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

1. Our detailed review revealed that the submitted revised conditions hydraulic analysis only contains models for the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) and a floodway model. FEMA requires that all hydraulic analyses shall be performed for all flood frequencies and the floodway published in the effective Flood Insurance Study (FIS) report. The effective study along Cave Creek includes an analysis for the floods having a 10-percent and a 2-percent chance of being equaled or exceeded in any given year, in addition to the base flood and floodway. Please submit a diskette containing the digital input and output files for the floods having a 1-, 2-, and 10-percent chance of being equaled or exceeded in any given year.

2. Our detailed review revealed that we have not received certified "as-built" plans for the channel located between Seventh Street and Pima Freeway/Route 101. Please provide certified "as-built" plans for this manmade structure.

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

3601 Eisenhower Avenue, Alexandria, VA 22304-6425 PH:1-877-FEMA MAP FX: 703.960.9125

The Mapping on Demand Team, under contract with the Federal Emergency Management Agency, is the National Service Provider for the National Flood Insurance Program

Dear Peter Reinhardt, 12-18-06

In response to your letter (below), I am sending this note.

Summary of Additional Data Required to Support a Letter of Map Revision

Case No.: 06-09-B582P **Requester: Mr. Dennis L. Richards, P.E.**

Community: City of Phoenix, AZ **Community No.: 040051**

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

1. **Our detailed review revealed that the submitted revised conditions hydraulic analysis only contains models for the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) and a floodway model. FEMA requires that all hydraulic analyses shall be performed for all flood frequencies and the floodway published in the effective Flood Insurance Study (FIS) report. The effective study along Cave Creek includes an analysis for the floods having a 10-percent and a 2-percent chance of being equaled or exceeded in any given year, in addition to the base flood and floodway. Please submit a diskette containing the digital input and output files for the floods having a 1-, 2-, and 10-percent chance of being equaled or exceeded in any given year.**

2. **Our detailed review revealed that we have not received certified "as-built" plans for the channel located between Seventh Street and Pima Freeway/Route 101. Please provide certified "as-built" plans for this manmade structure.**

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

And here again is our response from our responses of 9-19-06 for issue No. 1 (above):

Response by Flood Control District of Maricopa County:
We do not have 10-year or 50-year analyses in our studies. The Flood Control District of Maricopa County stopped scoping 10-year, 50-year, and 500-year discharges in its Floodplain Delineation Studies in 1989. Since that time, the District has sponsored 120 Floodplain Delineation Studies that have produced only the 100-year discharges. These Studies have all been reviewed and processed by FEMA and its Map Contractors.

Even if we had 10-year and 50-year profiles, the bridges would not cause any rises in the profiles, since the bridges of Loop 101 do not constrict the floodplain. The width of the floodplain is approximately the same upstream of the bridges, at the bridges, and downstream of the bridges; and the span of the bridges is 35 feet longer than the floodplain width.

Regarding the National Flood Insurance Program, the 10-year profile was used in computing the Flood Hazard Factor that was used to determine the old A1 through A30 flood zone designations, which have not been used since 1985, when the FEMA 37 Guidelines and Specifications for Study Contractors was revised in September 1985. My understanding of the use of 50-year discharges is that it was included in studies as a possible convenience for transportation-drainage designers. Additionally, the key simple fact is that the 10-year and 50-year profiles have no uses or implications in the regulation of development in floodplains.

IN ADDITION, NOTE THAT:

Cave Creek does not have 10-year and 50-year profiles in the Flood Insurance Study (FIS) at these locations:

0.0 to 9.6 miles	(Reference FIS Vol. 5, plates 44P to 67P)
20.84 to 22.09	
29.5 to 43.3	(Reference FIS Vol. 15, plates 1012P to 1023P)

also

New River does not have 10-year and 50-year profiles in the FIS at these locations:
0.0 to 1.4 miles (Reference FIS Vol. 7, plates 238P to 260P)
20.1 to 38.8

also

Skunk Creek does not have 10-year and 50-year profiles in the FIS at these locations:
Mile 0 to 31,800 ft. from confluence (Reference FIS Vol. 7, plates 305P to 326P)
45,500 to 48,000
64,000 to 68,000

These 3 major watercourses have a total of 52 river-miles without any 10-year or 50-year profiles.

The hydrology for this Cave Creek LOMR is from our 1990 Arizona-Canal-Diversion-Canal Area Drainage Master Study, which cost hundreds and hundreds of thousands of dollars back then, and included new hydrology using up-to-date methods, for about 100 square miles of watershed. The few discharges extracted from the study for this Cave Creek LOMR are miniscule compared to the entire study and its watershed. We **wisely did not scope** the ACDC ADMS to obtain flood frequencies that are not for anything in the National Flood Insurance Program.

I repeat; we have not done 10-year or 50-year in our 120-some floodplain studies that we have done since 1989. Your may speak to Craig Kennedy or Pernille Buch-Pedersen about the floodplain study and LOMR history of Maricopa.

THE BOTTOM LINE IS THAT WE DO NOT HAVE THE 10-YR AND 50-YR DISCHARGES FOR THIS SEGMENT OF CAVE CREEK, AND WE DO NOT HAVE THE MONEY BUGETED TO OBTAIN THE DISCHARGES (WHICH WOULD NOT USED BY ANY F.I.R.M. AND F.I.S. USER).

Mike Duncan, PE, CFM
Flood Delineation Group
Flood Control District of Maricopa County
phone 602-506-4732
mwd@mail.maricopa.gov

Federal Emergency Management Agency

Washington, D.C. 20472

DEC 11 2007

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Phil Gordon
Mayor, City of Phoenix
200 West Washington Street, 11th Floor
Phoenix, AZ 85003-1611

IN REPLY REFER TO:

Case No.:	06-09-B582P
Community Name:	City of Phoenix, AZ
Community No.:	040051
Effective Date of This Revision:	APR 03 2008

Dear Mayor Gordon:

The Flood Insurance Study report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Oakland, California, at (510) 627-7175, or the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

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

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

List of Enclosures:
- Letter of Map Revision Determination Document
- Annotated Flood Insurance Rate Map
- Annotated Flood Insurance Study Report

cc: (See attached list.)

FLOOD CONTROL DISTRICT
RECEIVED
DEC 18 '07
GH & GM | FINANCE
PIO | LANDS
ADMIN | E & T
REG | IF & PM
ENG | FILE
CONTRACTS
ROUTING
MWZS

Courtesy Copies List – City of Phoenix

Hasan Mushtaq, Ph.D., P.E., CFM
Floodplain Manager
City of Phoenix

Mr. Michael Duncan, P.E., CFM
Project Manager
Flood Control District of Maricopa County

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

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

Mr. Kevin LaVallee
GIS Analyst
Flood Control District of Maricopa County

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

Mr. Dennis L. Richards, P.E.
WEST Consultants, Inc.

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	City of Phoenix Maricopa County Arizona	NO PROJECT	FLOODWAY HYDRAULIC ANALYSIS HYDROLOGIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 040051		
IDENTIFIER	Cave Creek Floodplain Delineation Study	APPROXIMATE LATITUDE & LONGITUDE: 33.674, -112.070 SOURCE: Precision Mapping Streets DATUM: NAD 83	

ANNOTATED MAPPING ENCLOSURES			ANNOTATED STUDY ENCLOSURES
TYPE: FIRM*	NO.: 04013C1210 H	DATE: September 30, 2005	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 30, 2005
TYPE: FIRM	NO.: 04013C1215 K	DATE: September 30, 2005	PROFILE(S): 60P THROUGH 64P
TYPE: FIRM	NO.: 04013C1220 J	DATE: September 30, 2005	FLOODWAY DATA TABLE: 5
			SUMMARY OF DISCHARGES TABLE: 3

osures reflect changes to flooding sources affected by this revision.
RM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Cave Creek – from approximately 1,050 feet downstream of the South Frontage Road of Loop 101 to approximately 40 feet upstream of Hayden-Rhodes Aqueduct

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
Cave Creek	Zone AE	Zone AE	YES	YES
	Floodway	Floodway	YES	YES
	Zone AO	Zone AE	NONE	YES
	BFEs*	BFEs	YES	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

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

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance discharges computed in the submitted hydrologic model. Future development of projects upstream could cause increased discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on discharges and could, therefore, indicate that greater flood hazards exist in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

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

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Sally M. Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7175

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel(s) and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

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

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD 29)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
Cave Creek	Approximately 450 feet downstream of South Frontage Road of Loop 101	1,424	1,423	04013C1215 K
	Approximately 120 feet downstream of Hayden-Rhodes Aqueduct	1,508	1,507	04013C1210 H

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the *Federal Register*. A short notice also will be published in your local newspaper on or about the dates listed below. Please refer to FEMA's website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp for a more detailed description of proposed BFE changes, which will be posted within a week of the date of this letter.

LOCAL NEWSPAPER Name: *Arizona Business Gazette*
Dates: 12/27/2007 01/03/2008

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

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

Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

MAP SCALE 1" = 1000'

500 0 1000 FEET

300 0 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1210H

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1210 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1210	H
PHOENIX, CITY OF	040051	1210	H

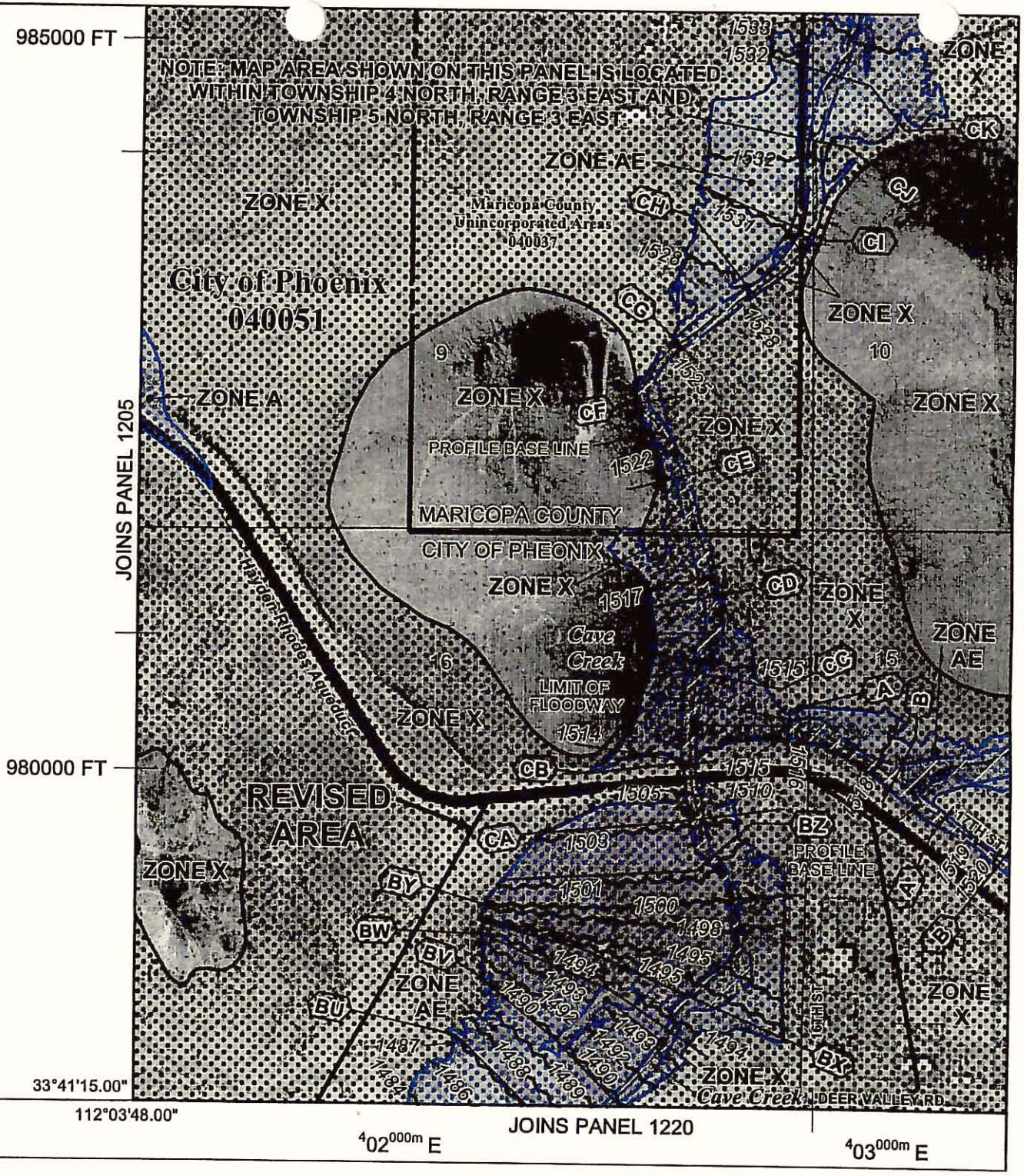
REVISED TO REFLECT LOMR EFFECTIVE APR 03 2008

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1210H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency



Legend

1% annual chance (100-Year) Floodplain

1% annual chance (100-Year) Floodway

0.2% annual chance (500-Year) Floodplain

MAP SCALE 1" = 1000'

500 0 1000 FEET

300 0 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1215K

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1215 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1215	K
PHOENIX, CITY OF	040051	1215	K

RESTYLO
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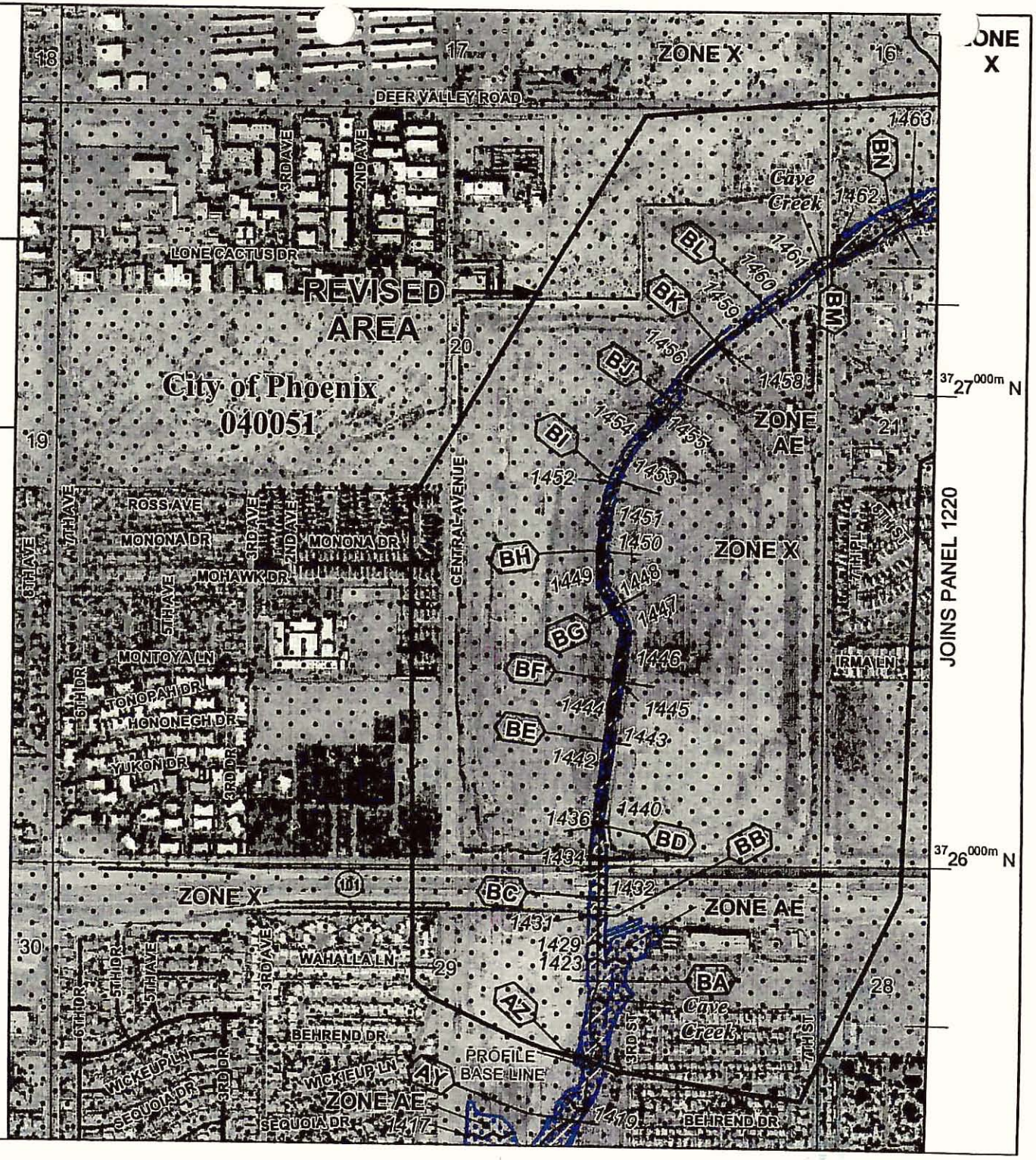
EFFECTIVE APR 03 2008

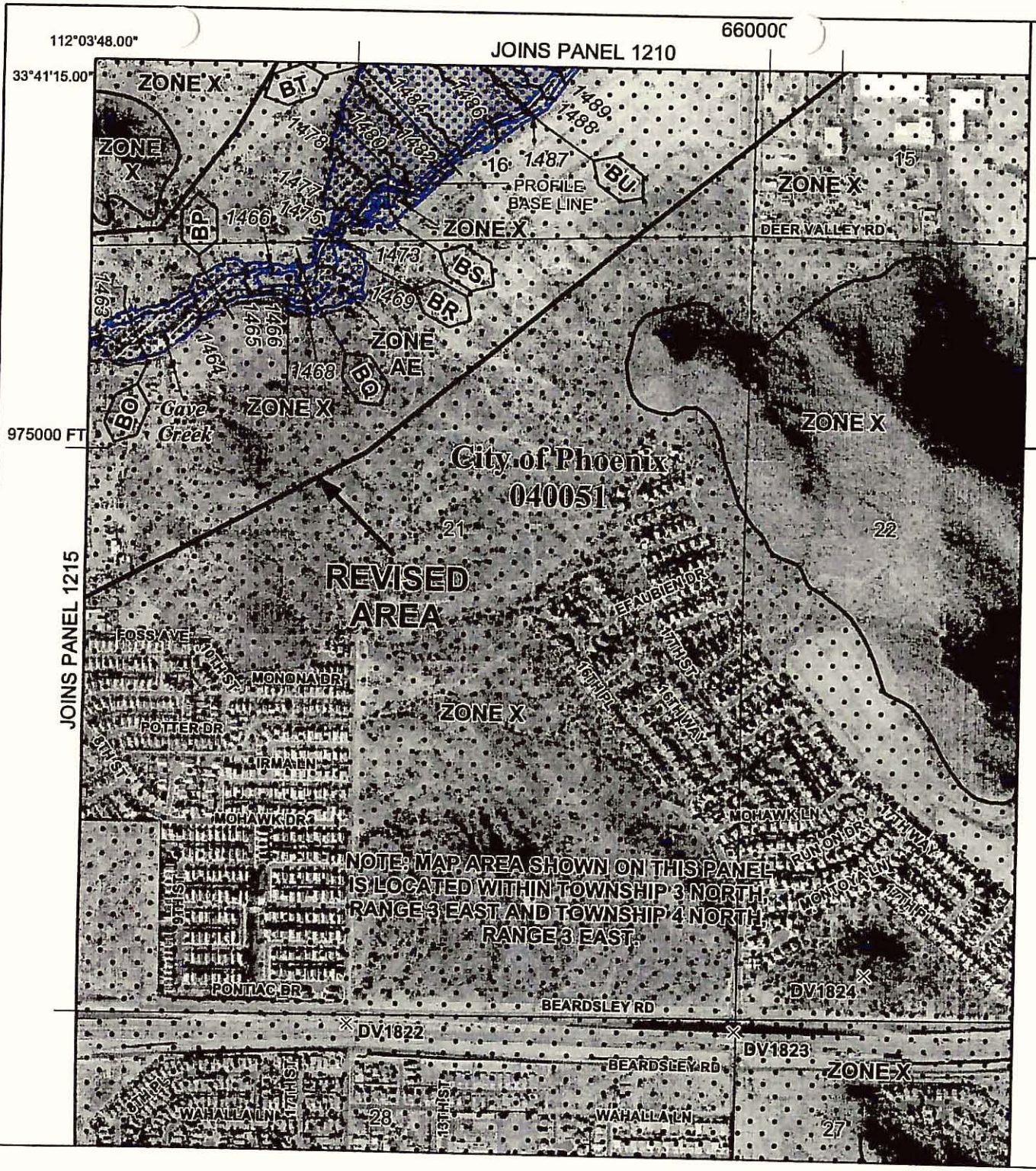
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1215K

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency





Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

MAP SCALE 1" = 1000'

500 0 1000 FEET

300 0 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1220J

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

PANEL 1220 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1220	J
PHOENIX, CITY OF	040051	1220	J

REVISED TO REFLECT LOMR EFFECTIVE APR 03 2008

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1220J

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

DEPARTMENT OF HOMELAND SECURITY

FEDERAL EMERGENCY MANAGEMENT AGENCY

Proposed Base Flood Elevation Determination for the City of Phoenix, Maricopa County, Arizona and case 06-09-0582P. The Department of Homeland Security's Federal Emergency Management Agency solicits technical information or comments on the proposed Base (1-percent-annual-chance) Flood Elevations (BFEs) shown in the Flood Insurance Study (FIS) and/or on the Flood Insurance Rate Map (FIRM) for your community. These proposed BFEs are the basis for the floodplain management measures that your community is required to either adopt or show evidence of having in effect in order to qualify or remain qualified for participation in the National Flood Insurance Program (NFIP). For a detailed listing of the proposed BFEs and information on the statutory period provided for appeals, please visit FEMA's website at https://www.floodmaps.fema.gov/fhm/Scripts/bfe_main.asp, or call the FEMA Map Assistance Center toll free at 1-877-FEMA MAP.

FEMA.gov
Federal Emergency Management Agency

[redacted]

Download RTF Table

DEPARTMENT OF HOMELAND SECURITY

Federal Emergency Management Agency

Changes to Base Flood Elevations Determinations

AGENCY: Federal Emergency Management Agency (FEMA), Emergency Preparedness and Response Directorate, Department of Homeland Security.

SUMMARY: On September 30, 2005 the Department of Homeland Security's Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the CITY OF PHOENIX, MARICOPA COUNTY, ARIZONA, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Division has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate.

DATES: Upon the second publication of notice of these changes in a newspaper of local circulation in your community, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Division reconsider the determination. Any request for reconsideration must be based on knowledge of changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Division's determination to modify the BFEs may itself be changed.

ADDRESSES: Any person having knowledge or wishing to comment on these changes should immediately notify:

City of Phoenix
The Honorable Phil Gordon
Mayor, City of Phoenix
200 West Washington Street 11th Floor
Phoenix, AZ 85003-1611

FOR FURTHER INFORMATION CONTACT: William R. Blanton, Jr., CFM, Chief, Engineering Management Branch, Mitigation Directorate, Federal Emergency Management Agency, 500 C Street SW, Washington, DC 20472, (202) 646-2903.

SUPPLEMENTARY INFORMATION: A hydraulic analysis was performed to incorporate channelization and updated topographic information along Cave Creek and has resulted in a revised delineation of the regulatory floodway, an increase in SFHA width, a decrease in SFHA width, increased BFEs and decreased BFEs for Cave Creek. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

* Elevation in feet (NGVD)[1]
\+ Elevation in feet (NAVD)[2]
\# Depth in feet above ground

Source of Flooding	Location	Lat/Long Coordinates	Existing BFE	Modified BFE	Affected Communities
Cave Creek					City of Phoenix
	Approximately 450 feet downstream of South Frontage Road of Loop 101	33° 39' 57.81" / -112° 4' 14.74"	* 1424	* 1423	
	Approximately 140 feet downstream of Hayden-Rhodes Aqueduct	33° 41' 35.41" / -112° 3' 2.94"	* 1508	* 1507	

[1]National Geodetic Vertical Datum, rounded to nearest whole foot
[2]North American Vertical Datum, rounded to nearest whole foot

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Division must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Back to Top

Last Updated: Thursday, December 13, 2007

FEMA 500 C Street, SW Washington, D.C. 20472 Phone: (202) 566-1600

Table 3. Summary of Discharges (Continued)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet Per Second) 10-Year	50-Year	100-Year	500-Year
Cave Creek (Continued)					
Below confluence with East Fork of Cave Creek (contributing drainage area below Cave Buttes Dam only and discharges are regulated)	22.5	3,100	8,700	11,000	25,000
Below Loop 101 (contributing drainage area below Cave Buttes Dam only and discharges are regulated)	5.0	--[1]	--[1]	5,500	--[1]
Above Loop 101 (contributing drainage area below Cave Buttes Dam only and discharges are regulated)	4.97	--[1]	--[1]	3,300	--[1]
Above Dear Valley Road (contributing drainage area below Cave Buttes Dam only and discharges are regulated)	4.5	--[1]	--[1]	3,090	--[1]
Below CAP Canal (contributing drainage area below Cave Buttes Dam only and discharges are regulated)	4.11	--[1]	--[1]	2,880	--[1]
Above CAP Canal (contributing drainage area below Cave Buttes Dam only and discharges are regulated)	--[1]	--[1]	--[1]	4,900	--[1]
Above Cave Buttes Dam Ponding Area	142.5	--[1]	--[1]	38,200	
Above confluence with Minor Tributary	137.9	--[1]	--[1]	36,800	
At Carefree Highway	124.4	--[1]	--[1]	33,800	
Below New River Road	118.1	--[1]	--[1]	31,400	--[1]
Near Andora Hills Wash Drive	115.0	--[1]	--[1]	31,200	--[1]
Below confluence with Andora Hills Wash	112.2	--[1]	--[1]	30,900	--[1]
Below confluence with Galloway Wash	91.4	--[1]	--[1]	24,700	--[1]
Below confluence with Willow Springs Wash	86.0	--[1]	--[1]	24,700	--[1]

Revised Data

REVISED TO REFLECT LOMR EFFECTIVE APR 03 2008

Above confluence with Willow Springs Wash	80.1	--[1]	--[1]	23,400	--[1]
Below Cahava Ranch Road	77.5	--[1]	--[1]	23,200	--[1]
At northeast corner of Section 4 above Cottonwood	61.64	--[1]	--[1]	20,680	--[1]

--[1] Not Computed

REVISED TO
REFLECT LOMR
EFFECTIVE APR 03 2008

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NGVD)			
Cave Creek (Cont'd)								
AA	20.335	73	640	8.9	1,347.4	1,347.4	1,347.5	0.1
AB	20.423	114	796	7.2	1,349.6	1,349.6	1,349.7	0.1
AC	20.529	139	841	6.8	1,352.3	1,352.3	1,352.3	0.0
AD	20.628	130	1,059	5.4	1,353.3	1,353.3	1,353.3	0.0
AE	20.725	64	398	14.3	1,356.0	1,356.0	1,356.0	0.0
AF	20.860	162	1,041	5.5	1,367.0	1,367.0	1,367.5	0.5
AG	20.943	220	1,271	4.5	1,367.9	1,367.9	1,368.2	0.3
AH	21.117	151	1,041	5.5	1,369.1	1,369.1	1,369.3	0.2
AI	21.287	229	1,190	4.8	1,375.4	1,375.4	1,375.5	0.1
AJ	21.438	231	1,199	4.8	1,376.4	1,376.4	1,376.4	0.0
AK	21.571	211	919	6.2	1,378.3	1,378.3	1,378.3	0.0
AL	21.639	198	593	9.6	1,383.2	1,383.2	1,383.2	0.0
AM	21.711	198	550	10.0	1,386.9	1,386.9	1,386.9	0.0
AN	21.771	235	1,311	4.2	1,388.6	1,388.6	1,388.6	0.0
AO	21.884	222	1,321	4.2	1,391.7	1,391.7	1,391.7	0.0
AP	21.931	198	1,226	4.5	1,392.0	1,392.0	1,392.0	0.0
AQ	21.989	85	540	10.2	1,392.4	1,392.4	1,392.4	0.0
AR	22.103	406	717	7.7	1,401.7	1,401.7	1,402.0	0.3
AS	22.165	303	663	8.3	1,405.1	1,405.1	1,405.1	0.0
AT	22.273	241	880	6.2	1,408.3	1,408.3	1,408.3	0.0
AU	22.410	180	560	9.8	1,414.2	1,414.2	1,414.2	0.0
AV	22.483	160	1,293	4.3	1,416.5	1,416.5	1,416.8	0.3
AW	22.578	96	772	7.1	1,416.3	1,416.3	1,417.0	0.7
AX	22.675	198	1,406	3.9	1,418.0	1,418.0	1,418.7	0.7
AY	22.794	183	1,174	4.7	1,418.6	1,418.6	1,419.5	0.9
AZ	22.880	169	774	7.1	1,420.1	1,420.1	1,420.5	0.4

REVISED DATA

[1] Miles Above Confluence With Salt River

REVISED TO REFLECT LOMR EFFECTIVE APR 03 2008

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

CAVE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NGVD)			
Cave Creek (Cont'd)								
BA	22.991	175	624	5.9	1,422.7	1,422.7	1,423.4	0.7
BB	23.077	117	510	6.5	1,431.2	1,431.2	1,431.2	0.0
BC	23.101	111	471	7.0	1,431.7	1,431.7	1,431.7	0.0
BD	23.192	58	270	12.2	1,435.6	1,435.6	1,435.6	0.0
BE	23.307	64	405	8.2	1,442.7	1,442.7	1,442.7	0.0
BF	23.389	62	393	8.4	1,445.0	1,445.0	1,445.0	0.0
BG	23.488	68	451	7.3	1,447.8	1,447.8	1,447.8	0.0
BH	23.567	67	427	7.7	1,449.6	1,449.6	1,449.6	0.0
BI	23.662	63	394	8.4	1,452.1	1,452.1	1,452.1	0.0
BJ	23.787	112	688	4.8	1,455.5	1,455.5	1,455.5	0.0
BK	23.883	64	420	7.9	1,457.9	1,457.9	1,457.9	0.0
BL	23.963	80	494	6.7	1,459.7	1,459.7	1,459.7	0.0
BM	24.068	72	498	6.6	1,461.9	1,461.9	1,461.9	0.0
BN	24.169	152	1,163	2.8	1,462.9	1,462.9	1,462.9	0.0
BO	24.300	261	1,587	2.1	1,463.5	1,463.5	1,463.6	0.1
BP	24.427	150	655	5.0	1,464.4	1,464.4	1,464.6	0.2
BQ	24.549	241	829	3.7	1,468.4	1,468.4	1,468.7	0.3
BR	24.617	62	265	11.7	1,471.7	1,471.7	1,472.5	0.8
BS	24.732	69	326	8.8	1,479.1	1,479.1	1,479.4	0.3
BT	24.828	40	223	12.9	1,482.9	1,482.9	1,483.1	0.2
BU	24.953	71	441	6.5	1,487.1	1,487.1	1,487.7	0.6
BV	25.039	59	410	11.0	1,489.8	1,489.8	1,490.1	0.3
BW	25.155	78	1,042	7.0	1,493.5	1,493.5	1,494.3	0.8
BX	25.210	195	326	2.8	1,494.9	1,494.9	1,495.8	0.9
BY	25.367	60	324	8.8	1,500.1	1,500.1	1,500.1	0.0
BZ	25.428	63	324	8.9	1,501.3	1,501.3	1,501.8	0.5

REVISED DATA

[1] Miles Above Confluence With Salt River

REVISED TO REFLECT LOMR EFFECTIVE APR 03 2008

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

CAVE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					FEET (NGVD)			
Cave Creek (Cont'd)								
CA	25.482	71	306	9.4	1,503.3	1,503.3	1,503.3	0.0
CB	25.561	101	759	3.8	1,514.4	1,514.4	1,514.4	0.0
CC	25.680	100	497	5.4	1,514.7	1,514.7	1,514.8	0.1
CD	25.786	100	276	9.1	1,516.3	1,516.3	1,516.4	0.1
CE	25.947	100	388	5.9	1,521.1	1,521.1	1,521.9	0.8
CF	26.058	73	307	7.2	1,523.5	1,523.5	1,523.8	0.3
CG	26.152	70	353	5.7	1,525.0	1,525.0	1,525.7	0.7
CH	26.265	87	220	8.7	1,528.2	1,528.2	1,528.2	0.0
CI	26.372	97	372	4.6	1,531.4	1,531.4	1,531.5	0.1
CJ	26.492	90	511	3.1	1,532.2	1,532.2	1,532.3	0.1
CK	26.582	80	544	2.4	1,532.2	1,532.2	1,532.4	0.2
CL	26.673	60	146	8.9	1,534.0	1,534.0	1,534.9	0.9
CM	26.784	50	123	8.9	1,546.2	1,546.2	1,546.3	0.1
CN	26.883	50	391	2.6	1,547.3	1,547.3	1,547.9	0.6
CO	26.984	50	273	3.3	1,547.3	1,547.3	1,548.1	0.8
CP	27.060	29	90	10.0	1,559.5	1,559.5	1,559.5	0.0
CQ	27.166	39	182	3.3	1,562.2	1,562.2	1,562.2	0.0
CR	27.294	50	233	1.7	1,562.5	1,562.5	1,562.5	0.0

REVISED DATA

1 Miles Above Confluence With Salt River

REVISED TO REFLECT LOMR EFFECTIVE APR 03 2008

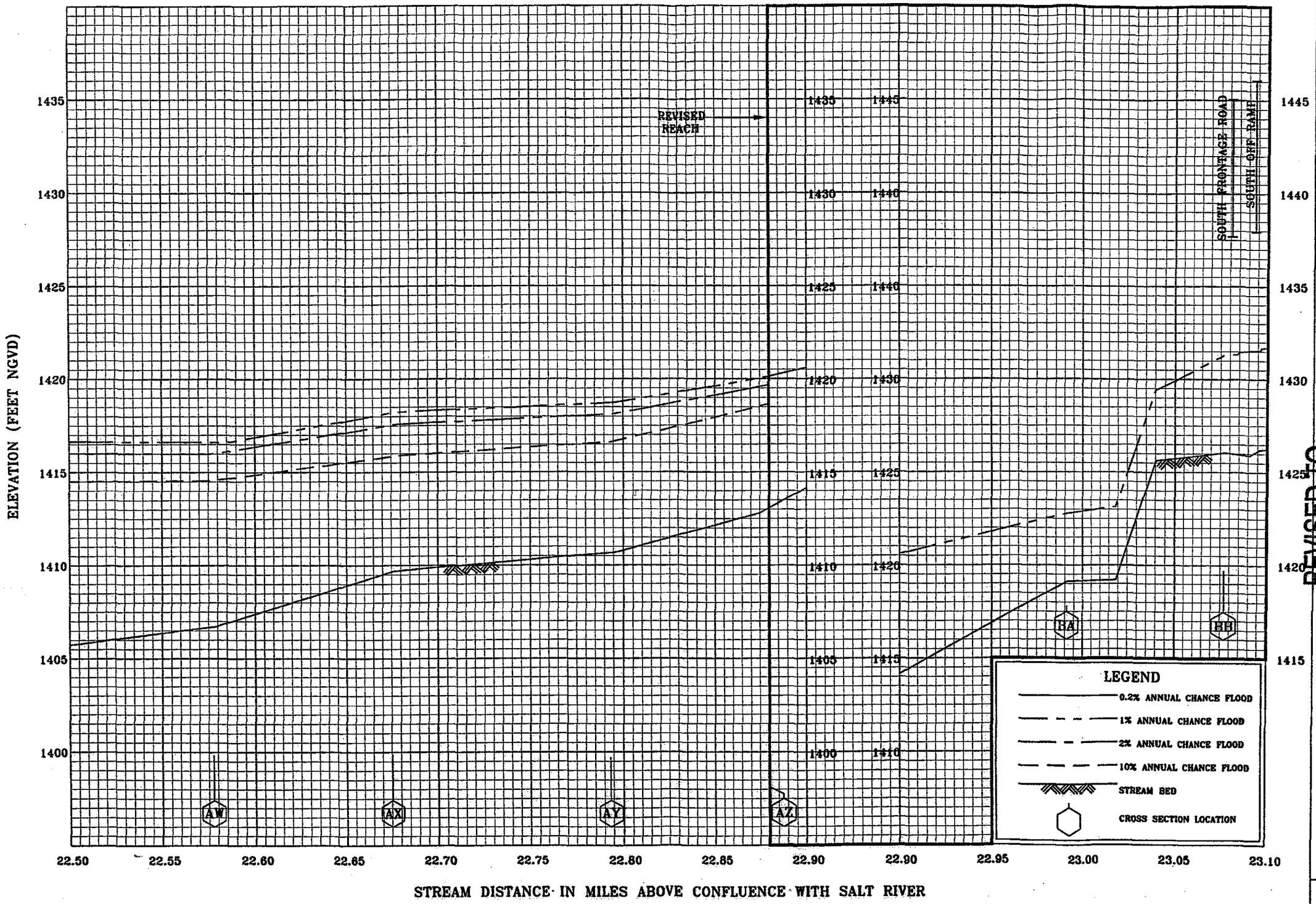
TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

CAVE CREEK



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MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

FLOOD PROFILES

CAVE CREEK

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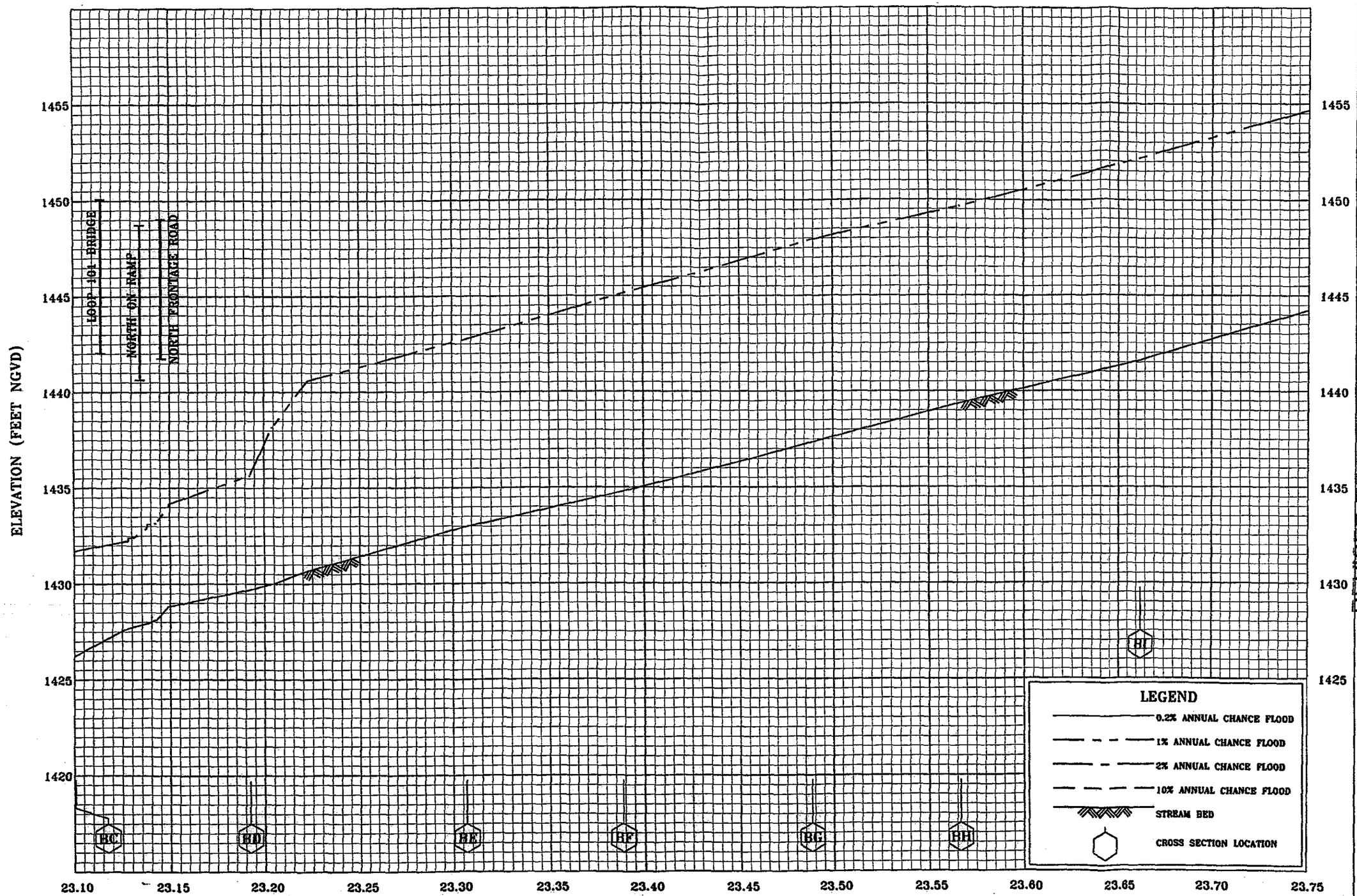
60P



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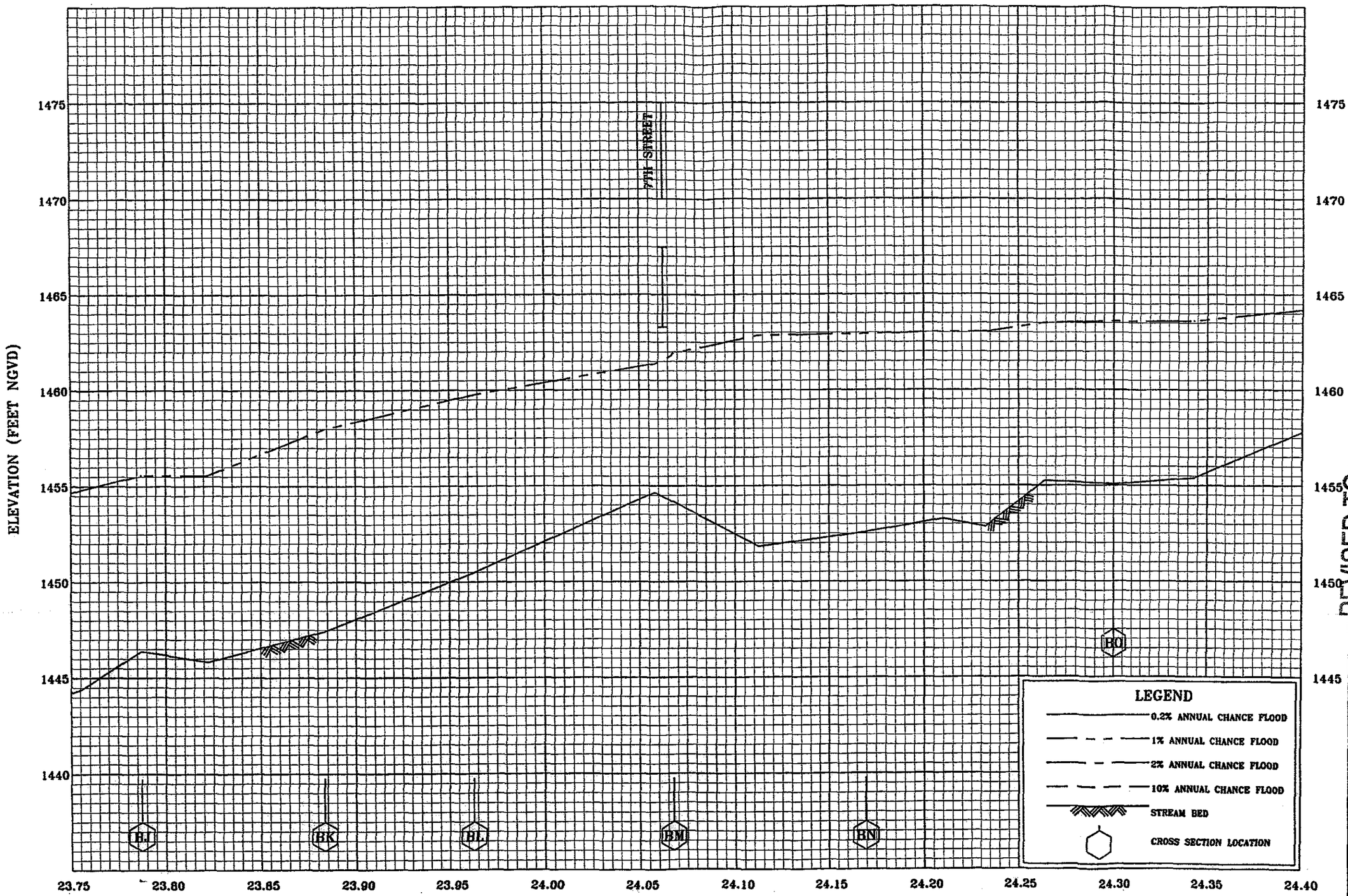
MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

FLOOD PROFILES

CAVE CREEK

REVISED TO REFLECT LOMR EFFECTIVE APR 03 2008

61P



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MARICOPA COUNTY, ARIZONA
AND INCORPORATED AREAS

FLOOD PROFILES

CAVE CREEK

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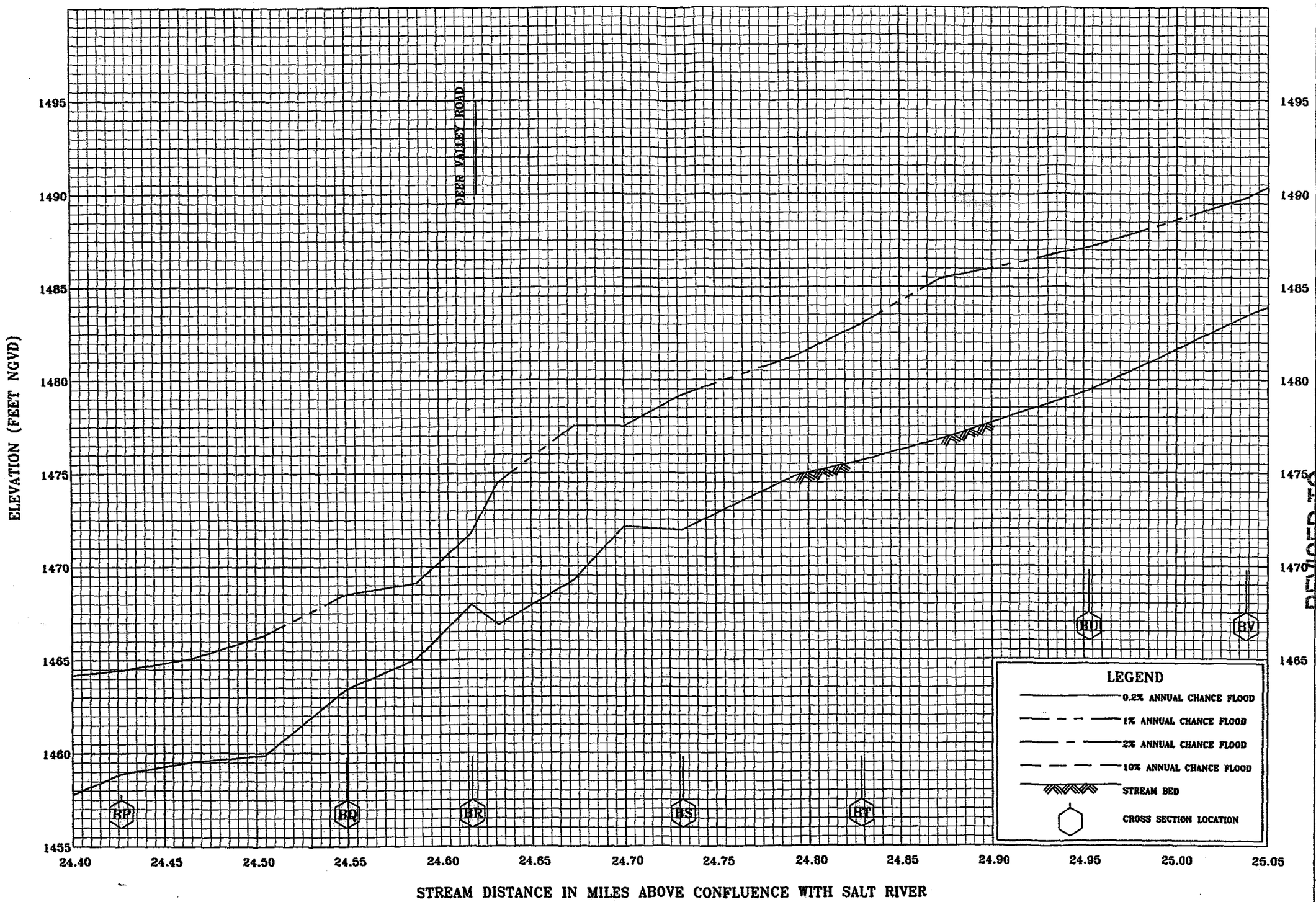
62P



FEDERAL EMERGENCY MANAGEMENT AGENCY

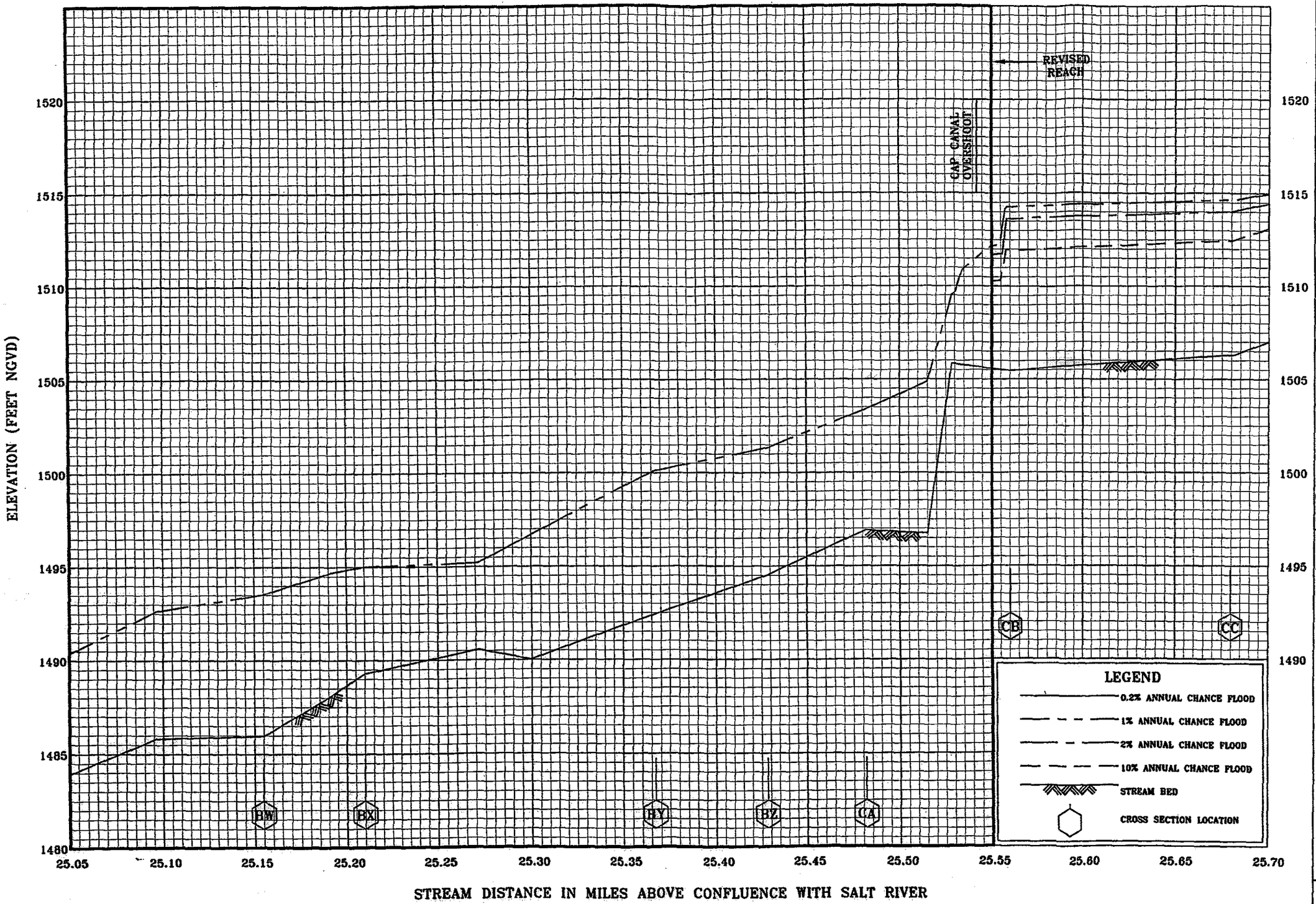
MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

FLOOD PROFILES

CAVE CREEK

REVISED TO REFLECT LOMR EFFECTIVE APR 03 2008

63P



FLOOD PROFILES

CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY
AND INCORPORATED AREAS

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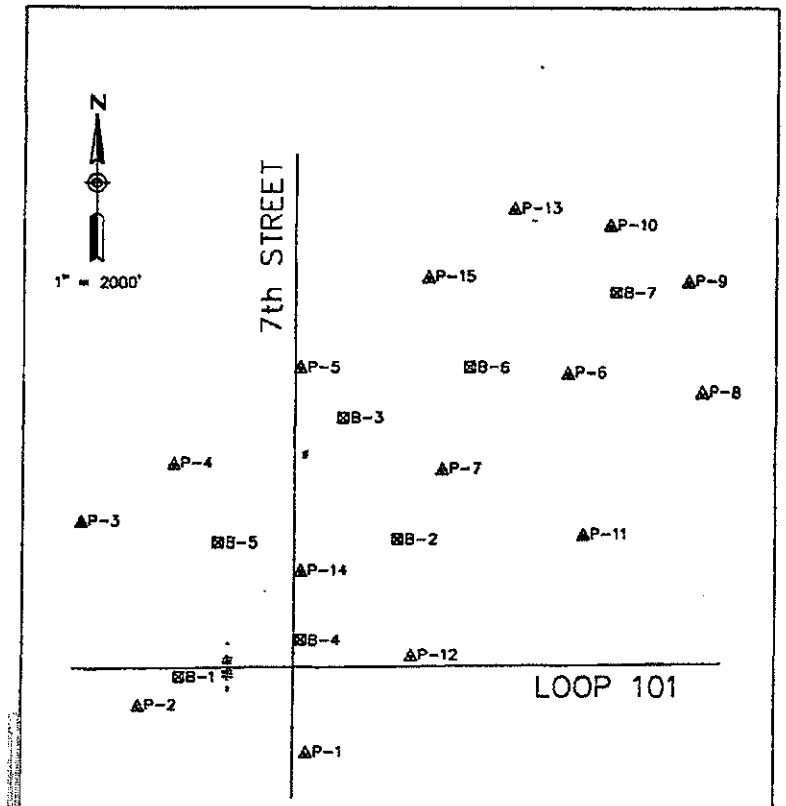
C.1 Survey Field Notes for Aerial Mapping Control



	BY	DATE
DESIGNED		
DRAWN	SSH	12/15/04

HLS HERSEY LAND SURVEYING, L.L.C. LAND SURVEYORS

AERIAL DIAGRAM
FCD 2004 C024

JOB NUMBER	4201
SHEET 1	OF 2

Electronic copy of final document. Original sealed document with Samuel S. Hersey Jr. LS 11750

```
;SOFTWARE:  Corpscon for Windows 5.11.08
;COMPANY:  Hersey Land Surveying
;PROJECT:  2004 C024
;Horizontal Datum:  State Plane, NAD83
;Horizontal Zone:   Arizona Central - 0202
;Horizontal Units:  International Feet
;Vertical Datum:    NGVD29
;Vertical Units:    U.S. Survey Feet
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C.2 Survey Field Notes for Hydrologic Modeling

Not Applicable / Not Included

C.3 Survey Field Notes for Hydraulic Modeling

4.89

Hersey Land Surveying
304 West Jeanine Drive
Tempe, AZ. 85284
Phone (480) 897-0018
Fax (480) 897-0018

JOB FCD 2004 C024 (4201)
SHEET NO. 1 OF 1
CALCULATED BY RWL DATE 3-11-05
CHECKED BY DATE
SCALE NTS

I-101 Bridges @ Cave Creek Wash

Location #	Bridge Low Cord	Pier Cap Low Cord	Shelf Measurement	Top Guard Rail To Low Cord
11	#646	—	4.70'	—
12	#645	#644	—	—
13	#647	—	5.20'	7.28'
21	#641	—	3.00'	—
22	#642	#643	—	—
23	#640	—	4.00'	8.10
31	#636	—	3.00'	—
32	#638	#639	—	—
33	#637	—	4.40'	8.05
34	#633	—	4.40'	—
35	#634	#635	—	—
36	#632	—	6.00	—
41	#628	—	4.00'	—
42	#629	#630	—	—
43	#631	—	5.40'	8.10
51	#624	—	6.00'	—
52	#625	#626	—	—
53	#627	—	5.60'	7.35

Pt #	Desc.
618	Random Control Pt.
619	" " "
620	" " "
621	Item 5 Modif. 3' Dia Rock
622	Item 2 Modif. North T/Slab
623	Item 2 modif. South T/Slab
648	Top Beam Seat - Abut. #1 @ Girder #10 (S-5.11) El=439.170 Meters
	Note: Elastomeric Bearing Pad thickness 0'-3" Typ. on Main Bridge

Hersey Land Surveying
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Tempe, AZ 85284
Phone (480) 897-0018
Fax (480) 897-0018

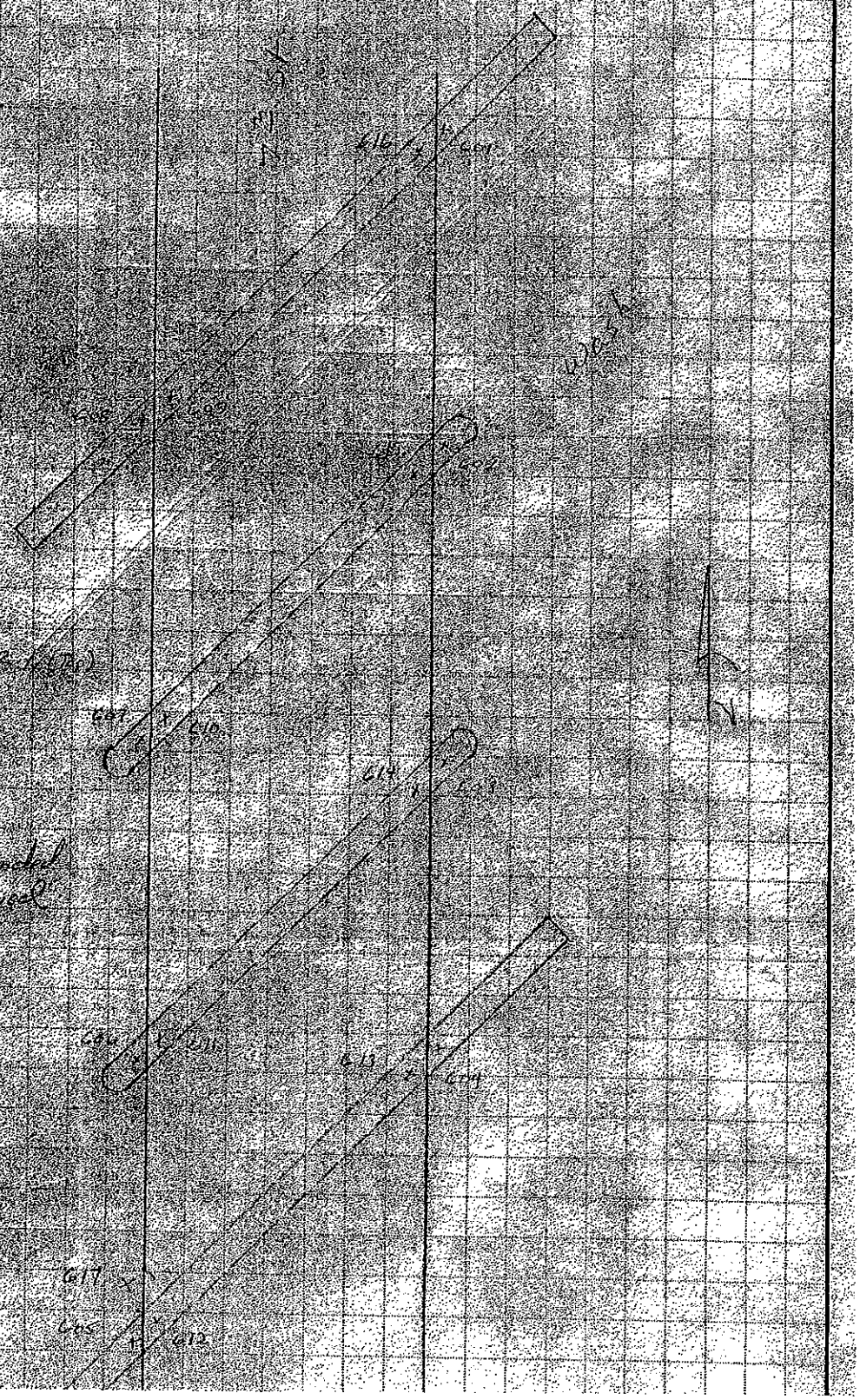
JOB: FCD 2004 C024 (42a1)
SHEET NO. 1 OF 1
CALCULATED BY: RWL DATE: 3-8-05
CHECKED BY: DATE:
SCALE: NTS

7 7½ 54 Bridge
4h
Cave Creek Wash

N

Item #	Pt #s
1 & 2	601-608
3	609-616
4	2 4" Galv pipe (617)
5	1-1" Galv pipe
4 modif	617

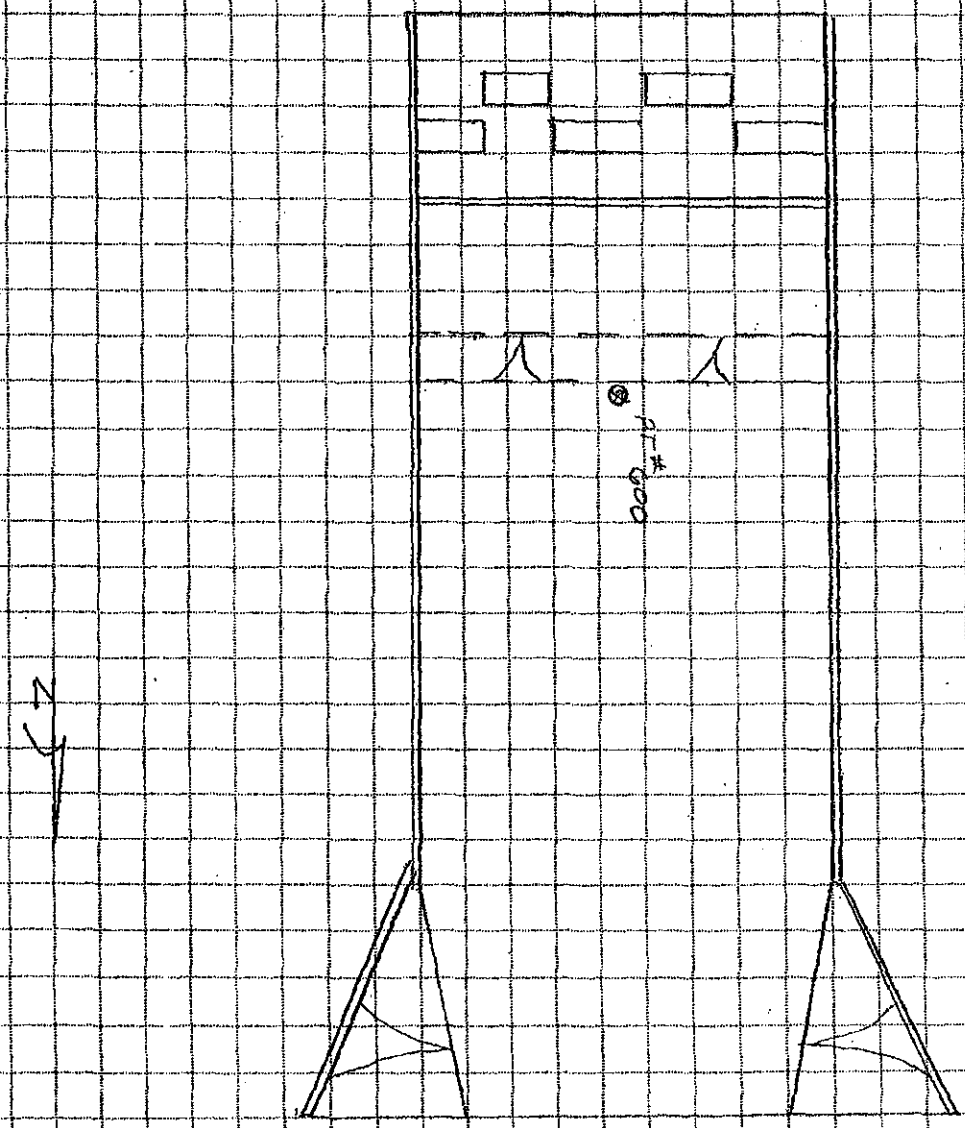
Note: Item 3 modif supports
Pipe has been Removed



Hersey Land Surveying
304 West Jeanine Drive
Tempe, AZ. 85284
Phone (480) 897-0018
Fax (480) 897-0018

JOB FCD 2004 C024 (4201)
SHEET NO. 1 OF 1
CALCULATED BY RWL DATE 3-8-05
CHECKED BY _____ DATE _____
SCALE NTS

Cave Creek Wash Overshoot
@
C.A.P. Canal



D.1 Precipitation Data

Not Applicable / Not Included

D.2 Physical Parameter Calculations

Not Applicable / Not Included

D.3 Hydrograph Routing Data

Not Applicable / Not Included

D.4 Reservoir Routing Data

Not Applicable / Not Included

D.5 Flow Splits and Diversion Data

Not Applicable / Not Included

D.6 Hydrologic Calculations

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CAVE CREEK WATERSHED

Volume 1.7

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Area Drainage Master Study
ACDC/ADMS Phase I

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HYDROLOGY REPORT

May, 1993

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO.
25957
DARRYL L.
BRADLEY
Date Signed 5-26-93
ARIZONA, U.S.A.

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO.
18153
JAMES O.
HUBBARD
Date Signed 5/26/93
ARIZONA, U.S.A.

Prepared For:

Flood Control District Of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009
(60) 506-1501

Prepared By:

Kaminski-Hubbard Engineering, Inc.
4550 North Black Canyon Highway, Suite C
Phoenix, Arizona 85017
(602) 242-5588

CAVE CREEK WATERSHED
HYDROLOGY REPORT

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REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 25957
DARRYL L. BRADLEY
Date Signed 5-26-93
ARIZONA, U.S.A.

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 18153
JAMES O. HUBBARD
Date Signed 5/26/93
ARIZONA, U.S.A.

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SECTION II	Green-Ampt & Land Use Parameters
SECTION III	Hydrologic Sub-Basin Characteristics
SECTION IV	Hydrograph Routing Parameters
SECTION V	Divert & Onsite Retention Parameters
SECTION VI	HEC-1 Hydrology Results, 100-Year 24-Hour Storm (Existing Conditions)
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SECTION VIII	Plates 1-24
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TABLE 3
EXISTING PEAK DISCHARGES
IN CAVE CREEK (CFS)

Location	HEC-I.D.	2-Year		10-Year		100-Year		100-Year 24-Hour Time To Peak (Hrs.)
		6 Hr.	24 Hr.	6 Hr.	24 Hr.	6 Hr.	24 Hr.	
Above the Central Arizona Project Canal	HC250	55	67	550	878	2,071	2,879	12.67
Below Beardsley Road	HC253	79	89	618	1,052	2,590	3,659	13.00
Above Confluence with East Fork Cave Creek	HC258U	156	184	823	1,297	3,238	4,450	13.40
Below Confluence with East Fork Cave Creek	HC258D	1,340	1,545	3,626	4,231	8,562	10,123	12.93
Above Confluence with Moon Valley Wash	HC263U	1,730	1,981	4,327	4,956	9,908	11,646	13.27
Below Confluence with Moon Valley Wash	HC263D	1,932	2,224	5,009	5,750	12,164	14,239	13.07
Confluence of ACDC	HC266	1,945	2,201	4,990	5,714	12,197	14,032	13.27

TABLE 4
EXISTING PEAK DISCHARGES
IN EAST FORK CAVE CREEK (CFS)

Location	HEC-I.D.	2-Year		10-Year		100-Year		100-Year 24-Hour Time To Peak (Hrs.)
		6 Hr.	24 Hr.	6 Hr.	24 Hr.	6 Hr.	24 Hr.	
Above Confluence with Cave Creek	HC245	1,192	1,404	2,910	3,400	6,702	8,136	12.80

TABLE 5
EXISTING PEAK DISCHARGES
IN MOON VALLEY WASH (CFS)

Location	HEC-I.D.	2-Year		10-Year		100-Year		100-Year 24-Hour Time To Peak (Hrs.)
		6 Hr.	24 Hr.	6 Hr.	24 Hr.	6 Hr.	24 Hr.	
Above Confluence with Cave Creek	HC215	374	547	1,266	1,629	3,321	4,065	12.67

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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID       ACDC AREA DRAINAGE MASTER STUDY
  2           ID       FILENAME:  CCW324.DAT        KHE JOB NO. 0146
  3           ID       CAVE CREEK WATERSHED
  4           ID       100-YEAR 24-HOUR DURATION STORM
  5           ID       SCS TYPE-II DISTRIBUTION WAS USED
              *                                                          *
              *              HEC-1 RUN FOR CAVE CREEK WATERSHED          *
              *                  Submitted August 26, 1992               *
              *                  Revised October 2, 1992                 *
              *                  REVISED NOVEMBER 30, 1992               *
              *                    - Revised Kn Values                   *
              *                                                          *
              *DIAGRAM
  6           IT       4 10OCT92    1200     800
  7           IO       5
              *   *   *   *   *   *   *   *
              *                           *
              *       MOON VALLEY WASH    *
              *     SUB-BASINS 200 - 215  *
              *                           *
              *   *   *   *   *   *   *   *

  8           KK    200S
  9           KM    RUNOFF GENERATED ON SUB-BASIN 200
 10           KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
 11           KM    L=  1.12 mi.  Lca= 0.58 mi.  S= 148 ft/mi.  Kn= .070  LAG= 33.11 min.
 12           KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
 13           BA    .580
 14           IN      30
 15           KM    RAINFALL DEPTH OF 4.10 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 16           KM    AN AREAL REDUCTION COEFFICIENT OF .89  WAS USED
 17           PB    3.65
 18           KM    THE FOLLOWING PC RECORD USED A 24-HR SCS TYPE II RAINFALL
 19           PC    .000    .005    .011    .016    .022    .028    .035    .041    .048    .056
 20           PC    .063    .071    .080    .089    .098    .109    .120    .133    .147    .163
 21           PC    .181    .204    .235    .283    .663    .735    .772    .799    .820    .838
 22           PC    .854    .868    .880    .891    .902    .912    .921    .929    .937    .945
 23           PC    .952    .959    .965    .972    .978    .984    .989    .995   1.000
 24           LG    .148    .361   5.360    .228   9.330
 25           UI     59.     72.    211.    288.    341.    409.    507.    717.    658.    524.
 26           UI    441.    362.    294.    219.    128.    100.     82.     59.     39.     18.
 27           UI     18.     18.     18.     18.      0.      0.      0.      0.      0.      0.
 28           UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

 29           KK  RM200A
 30           KM    MUSKINGUM-CUNGE ROUTE IN CHANNEL FROM SUB-BASIN 200 THROUGH 202
 31           KM            1) Natural Channel
 32           KM            2) Reach Length = 2320 ft.
 33           RD
 34           RC    .045    .035    .045    2320   .0084
 35           RX      42      44     144     150     165     171     271     273
 36           RY       6       5       3       0       0       3       5       6
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1243        KK    R211
1244        KM    RETRIEVE HYDROGRAPH OF DIVERTED FLOW THROUGH 84" PIPE FROM SUB-BASIN 211
1245        DR    245D

1246        KK  RM211B
1247        KM    MUSKINGUM-CUNGE ROUTE DIVERTED FLOW THROUGH SUB-BASIN 245
1248        KM            1) Reach Length = 3720 ft.
1249        RD
1250        RC    .045    .035    .045    3720    .0060
1251        RX       0       1       5      25       85     105     109     110
1252        RY      21      20      20      10       10      20      20      21

1253        KK    245S
1254        KM    RUNOFF GENERATED ON SUB-BASIN 245
1255        KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1256        KM    L= 1.46 mi.  Lca= 0.65 mi.  S= 29 ft/mi.  Kn= .076  LAG= 56.58 min.
1257        KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1258        BA    .506
1259        LG    .201    .286    3.82    .382    35.24
1260        UI     30.     30.     30.     81.     111.    138.    155.    171.    188.    211.
1261        UI    234.    277.    345.    393.    335.    290.    259.    237.    210.    187.
1262        UI    167.    148.    129.     99.     72.     53.     51.     49.     37.     30.
1263        UI     30.     22.      9.      9.      9.      9.      9.      9.      9.      9.
1264        UI      9.      9.      0.      0.      0.      0.      0.      0.      0.      0.
1265        UI      0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1266        KK   DT245
1267        KM    THROW AWAY 10-YR 2-HR RETENTION VOLUME:  1) 0.7 AC-FT FROM SUB-BASIN 245
1268        KM                                               (Hydrograph identified as OR245)
1269        KM                                             2) Balance of runoff continues on.
1270        KM                                               (Hydrograph identified as DT245)
1271        DT   OR245     0.7
1272        DI       0   10000
1273        DQ       0   10000

1274        KK   HC245
1275        KM    COMBINE HYDROGRAPH FROM SUB-BASIN 245 WITH ROUTED FLOWS FROM 211 & 244.
1276        KM    ALSO, TOTAL FLOW INTO CAVE CREEK FROM EAST FORK OF CAVE CREEK
1277        HC       3
1278        ZW    A=EAST FORK CAVE CREEK  B=HC245  C=FLOW  F=CAVE CREEK
            *     *     *     *     *     *     *     *     *
            *                                                *
            *        BREAK SEQUENCE - JUMP TO SUB-BASIN 250  *
            *                                                *
            *                   CAVE CREEK                   *
            *              SUB-BASINS 250 - 266              *
            *                                                *
            *     *     *     *     *     *     *     *     *
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1279          KK   250S
1280          KM   RUNOFF GENERATED ON SUB-BASIN 250
1281          KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1282          KM   L= 3.58 mi.  Lca= 1.44 mi.  S= 43 ft/mi.  Kn= .040  LAG= 52.57 min.
1283          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1284          BA  2.396
1285          BF    420
1286          LG   .347    .349    3.61    .315    6.49
1287          UI   153.    153.    153.    501.    620.    733.    838.    919.   1029.   1169.
1288          UI  1355.   1707.   2001.   1702.   1459.   1301.   1173.   1028.    915.    797.
1289          UI   717.    554.    410.    271.    262.    252.    189.    153.    153.     88.
1290          UI    47.     47.     47.     47.     47.     47.     47.     47.     47.      0.
1291          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1292          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1293          KK   251S
1294          KM   RUNOFF GENERATED ON SUB-BASIN 251
1295          KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1296          KM   L= 3.89 mi.  Lca= 1.52 mi.  S= 48 ft/mi.  Kn= .040  LAG= 54.23 min.
1297          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1298          BA  1.719
1299          BF     0
1300          LG   .345    .348    4.08    .419    1.39
1301          UI   107.    107.    107.    322.    415.    505.    568.    624.    694.    786.
1302          UI   883.   1116.   1341.   1279.   1081.    952.    861.    769.    677.    604.
1303          UI   533.    461.    353.    252.    189.    179.    175.    120.    107.    107.
1304          UI    56.     33.     33.     33.     33.     33.     33.     33.     33.     33.
1305          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1306          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1307          KK  HC250
1308          KM   COMBINE HYDROGRAPHS FROM SUB-BASINS 250 & 251.  ALSO, TOTAL FLOW IN
1309          KM   CAVE CREEK UPSTREAM OF THE C.A.P.
1310          HC     2

1311          KK  RM250
1312          KM   MUSKINGUM-CUNGE ROUTE FROM SUB-BASIN 250 THROUGH 252
1313          KM            1) Reach Length = 6960 ft.
1314          RD   6960   .0057    .045            TRAP      20       3

1315          KK   252S
1316          KM   RUNOFF GENERATED ON SUB-BASIN 252
1317          KM   THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1318          KM   L= 2.02 mi.  Lca= 0.86 mi.  S= 62 ft/mi.  Kn= .082  LAG= 66.49 min.
1319          KM   PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1320          BA   .858
1321          LG   .146    .342    4.08    .418    8.55
1322          UI    43.     43.     43.     61.    143.    167.    202.    221.    240.    261.
1323          UI   284.    316.    343.    399.    486.    562.    524.    454.    406.    371.
1324          UI   344.    311.    281.    257.    230.    209.    184.    147.    118.     77.
1325          UI    77.     71.     71.     53.     43.     43.     43.     18.     13.     13.
1326          UI    13.     13.     13.     13.     13.     13.     13.     13.     13.      0.
1327          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1328          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1329          KK   HC252
1330          KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 252 WITH ROUTED FLOW FROM 250
1331          HC      2

1332          KK   RM252
1333          KM    MUSKINGUM-CUNGE ROUTE FROM SUB-BASIN 252 THROUGH 253
1334          KM            1) Reach Length = 7240 ft.
1335          RD
1336          RC   .045    .040    .045    7240   .0054
1337          RX     60      70      75     100     125     155     160     170
1338          RY     16      14      14       6       6      14      14      16

1339          KK   253S
1340          KM    RUNOFF GENERATED ON SUB-BASIN 253
1341          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1342          KM    L= 2.64 mi.  Lca= 1.30 mi.  S= 59 ft/mi.  Kn= .076  LAG= 80.58 min.
1343          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1344          BA   .928
1345          LG   .248    .349    3.92    .384    3.03
1346          UI    39.     39.     39.     39.     71.    127.    148.    171.    187.    204.
1347          UI   218.    233.    249.    272.    293.    316.    363.    437.    479.    501.
1348          UI   439.    393.    360.    334.    313.    292.    268.    245.    229.    209.
1349          UI   192.    180.    153.    125.    110.     69.     69.     67.     64.     64.
1350          UI    49.     39.     39.     39.     39.     13.     12.     12.     12.     12.
1351          UI    12.     12.     12.     12.     12.     12.     12.     12.     12.     12.
1352          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
1353          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.

1354          KK   HC253
1355          KM    COMBINE HYDROGRAPHS FROM SUB-BASIN 253 WITH ROUTED FLOW FROM 252
1356          HC      2

1357          KK   RM253
1358          KM    MUSKINGUM-CUNGE ROUTE FLOW FROM SUB-BASIN 253 THROUGH 254
1359          KM            1) Reach Length = 4920 ft.
1360          RD
1361          RC   .045    .040    .045    4920   .0047
1362          RX      0       0      75      95     105     140     150     150
1363          RY     18      14      12       7       7      16      16      18

1364          KK   254S
1365          KM    RUNOFF GENERATED ON SUB-BASIN 254
1366          KM    THE FOLLOWING PARAMETERS WERE PROVIDED FOR THIS BASIN
1367          KM    L= 0.98 mi.  Lca= 0.55 mi.  S= 36 ft/mi.  Kn= .084  LAG= 48.41 min.
1368          KM    PHOENIX VALLEY S-GRAPH WAS USED FOR THIS BASIN
1369          BA   .174
1370          LG   .295    .328    4.19    .441    12.92
1371          UI    12.     12.     18.     42.     52.     62.     69.     78.     89.    103.
1372          UI   132.    157.    132.    113.    100.     89.     77.     68.     59.     49.
1373          UI    35.     22.     21.     20.     14.     12.     12.      4.      4.      4.
1374          UI     4.      4.      4.      4.      4.      4.      0.      0.      0.      0.
1375          UI     0.      0.      0.      0.      0.      0.      0.      0.      0.      0.
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1279                250S
                      .
                      .
   3                  .        251S
                      .          .
                      .          .
1307            HC250............
                    V
                    V
1311            RM250
                      .
                      .
1315                  .        252S
                      .          .
                      .          .
1329            HC252............
                    V
                    V
1332            RM252
                      .
                      .
1339                  .        253S
                      .          .
                      .          .
1354            HC253............
                    V
                    V
1357            RM253
                      .
                      .
1364                  .        254S
                      .          .
                      .          .
1376            HC254............
                    V
                    V
1379            RM254
                      .
                      .
1386                  .        336S
                      .          .
                      .          .
1404                  .          .-------->   337D
1399                  .      336RE
                      .          V
                      .          V
1407                  .      RM336
                      .          .
                      .          .
1411                  .          .       339S
                      .          .         .
                      .          .         .
1428                  .          .         .-------->   OR339
1423                  .          .      DT339
                      .          .         .
                      .          .         .
1431                  .      HC339............
                      .          .
                      .          .
   0                  .          .-------->   340D
1434                  .      339RE
                      .          V
                      .          V
1443                  .      RM339
                      .          .
```

DIVERSION TO	OR240	9.	12.73	5.	1.	1.	0.84
HYDROGRAPH AT	DT240	584.	12.73	133.	39.	18.	0.84
ROUTED TO	RM240	582.	12.87	133.	39.	18.	0.84
HYDROGRAPH AT	241S	1021.	12.33	181.	57.	26.	0.98
DIVERSION TO	OR241	26.	12.33	17.	5.	2.	0.98
HYDROGRAPH AT	DT241	1021.	12.33	181.	52.	23.	0.98
4 COMBINED AT	HC241	2263.	12.53	518.	153.	69.	3.01
DIVERSION TO	244D	297.	12.53	58.	15.	7.	3.01
HYDROGRAPH AT	241RE	1966.	12.53	460.	138.	62.	3.01
ROUTED TO	RM241A	1958.	12.60	460.	138.	62.	3.01
ROUTED TO	RM241B	1944.	12.73	460.	138.	62.	3.01
HYDROGRAPH AT	242S	499.	12.53	105.	34.	15.	0.55
DIVERSION TO	OR242	17.	12.53	11.	4.	2.	0.55
HYDROGRAPH AT	DT242	499.	12.53	105.	30.	14.	0.55
3 COMBINED AT	HC242A	6646.	12.67	1801.	589.	267.	13.25
HYDROGRAPH AT	243S	546.	12.20	93.	31.	14.	0.43
ROUTED TO	RM243	544.	12.40	93.	31.	14.	0.43
HYDROGRAPH AT	244S	341.	12.47	68.	22.	10.	0.35
DIVERSION TO	OR244	6.	12.47	4.	1.	0.	0.35
HYDROGRAPH AT	DT244	341.	12.47	68.	21.	9.	0.35
HYDROGRAPH AT	R241	297.	12.53	58.	15.	7.	0.00
ROUTED TO	RM241C	295.	12.73	58.	15.	7.	0.00
ROUTED TO	RM241D	295.	12.80	58.	15.	7.	0.00
3 COMBINED AT	HC244	1030.	12.53	219.	67.	30.	0.78
2 COMBINED AT	HC242B	7589.	12.67	2015.	655.	297.	14.03
ROUTED TO	RM242	7523.	12.80	2013.	655.	297.	14.03
HYDROGRAPH AT	R211	260.	12.07	136.	58.	26.	0.00
ROUTED TO	RM211B	264.	12.40	136.	58.	26.	0.00
HYDROGRAPH AT	245S	362.	12.73	84.	26.	12.	0.51
DIVERSION TO	OR245	5.	12.73	1.	0.	0.	0.51
HYDROGRAPH AT	DT245	362.	12.73	84.	26.	12.	0.51
3 COMBINED AT	HC245	8136.	12.80	2224.	738.	335.	14.54
HYDROGRAPH AT	250S	1972.	12.60	701.	495.	454.	2.40

HYDROGRAPH AT	251S	908.	12.67	160.	41.	18.	1.72
2 COMBINED AT	HC250	2879.	12.67	861.	535.	472.	4.11
ROUTED TO	RM250	2864.	12.80	860.	535.	472.	4.11
HYDROGRAPH AT	252S	437.	12.87	96.	26.	12.	0.86
2 COMBINED AT	HC252	3297.	12.80	956.	561.	484.	4.97
ROUTED TO	RM252	3268.	13.00	956.	561.	484.	4.97
HYDROGRAPH AT	253S	396.	13.07	96.	25.	11.	0.93
2 COMBINED AT	HC253	3659.	13.00	1052.	586.	495.	5.90
ROUTED TO	RM253	3619.	13.13	1052.	586.	495.	5.90
HYDROGRAPH AT	254S	109.	12.60	20.	6.	3.	0.17
2 COMBINED AT	HC254	3660.	13.13	1072.	592.	497.	6.07
ROUTED TO	RM254	3649.	13.27	1072.	592.	497.	6.07
HYDROGRAPH AT	336S	326.	12.67	63.	17.	8.	0.50
DIVERSION TO	337D	60.	12.67	25.	8.	4.	0.50
HYDROGRAPH AT	336RE	266.	12.67	38.	9.	4.	0.50
ROUTED TO	RM336	262.	12.87	38.	9.	4.	0.50
HYDROGRAPH AT	339S	261.	12.60	49.	14.	6.	0.35
DIVERSION TO	OR339	18.	12.60	4.	1.	1.	0.35
HYDROGRAPH AT	DT339	261.	12.60	48.	13.	6.	0.35
2 COMBINED AT	HC339	485.	12.73	86.	22.	10.	0.85
DIVERSION TO	340D	81.	12.73	10.	3.	1.	0.85
HYDROGRAPH AT	339RE	404.	12.73	75.	19.	9.	0.85
ROUTED TO	RM339	401.	12.93	75.	19.	9.	0.85
HYDROGRAPH AT	255S	466.	12.47	86.	26.	12.	0.51
2 COMBINED AT	HC255	657.	12.80	160.	46.	21.	1.36
ROUTED TO	RM255A	652.	12.87	160.	46.	21.	1.36
DIVERSION TO	261D1	245.	12.87	50.	13.	6.	1.36
HYDROGRAPH AT	255R1	406.	12.87	110.	33.	15.	1.36
ROUTED TO	RM255B	406.	13.00	110.	33.	15.	1.36
DIVERSION TO	261D2	139.	13.00	30.	7.	3.	1.36
HYDROGRAPH AT	255R2	267.	13.00	80.	25.	12.	1.36
ROUTED TO	RM255C	266.	13.13	80.	25.	12.	1.36
HYDROGRAPH AT	256S	181.	12.13	25.	8.	4.	0.14

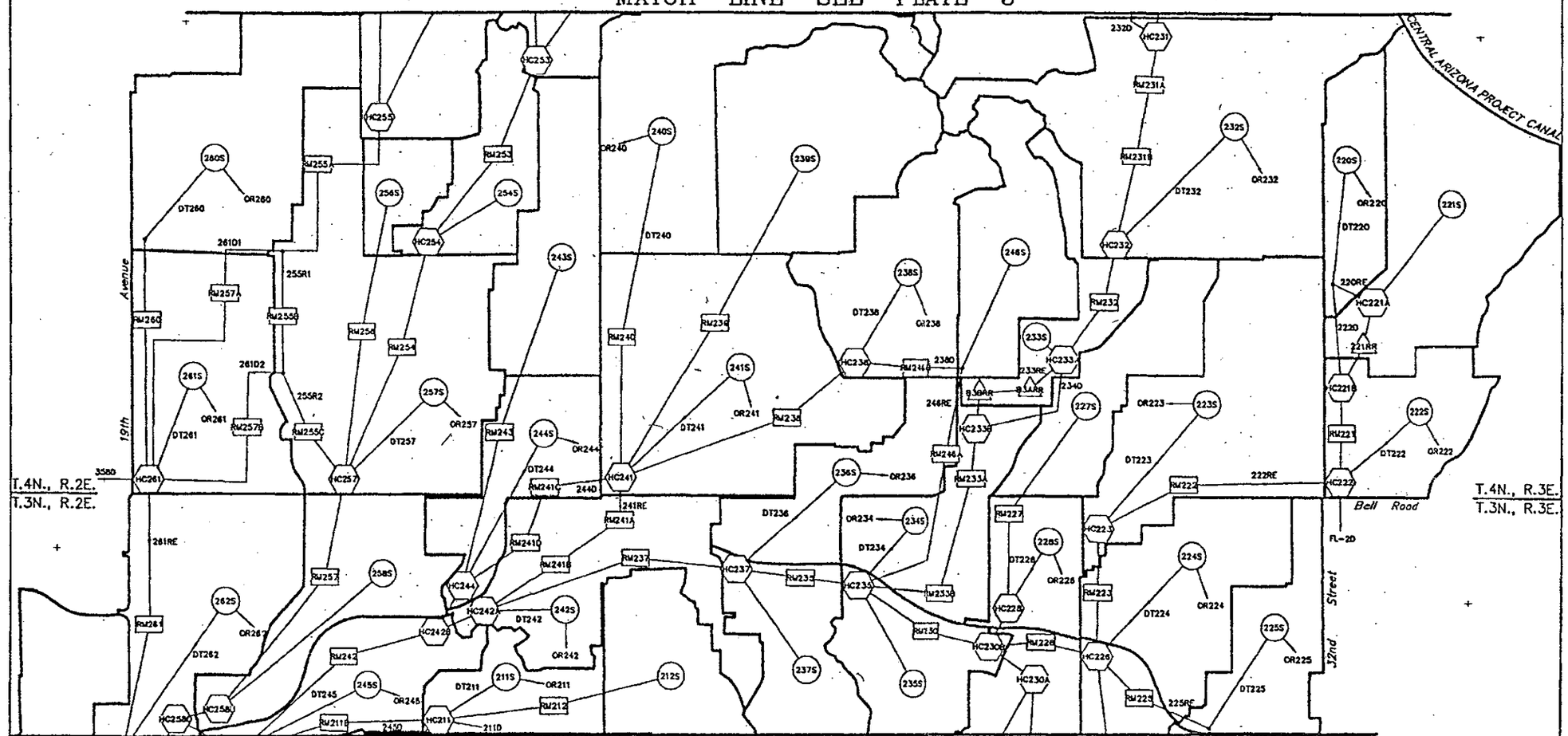
HYDROGRAPH AT	233RE	810.	13.07	199.	50.	22.	2.83		
ROUTED TO	B3ARR	517.	13.67	199.	50.	22.	2.83	1431.49	13.67
ROUTED TO	B3BRR	204.	14.93	153.	50.	22.	2.83	1425.22	14.93
HYDROGRAPH AT	R233	206.	12.07	176.	75.	34.	0.00		
2 COMBINED AT	HC233B	410.	14.93	317.	125.	57.	2.83		
ROUTED TO	RM233A	410.	15.00	317.	125.	57.	2.83		
ROUTED TO	RM233B	410.	15.13	317.	125.	57.	2.83		
HYDROGRAPH AT	246S	303.	12.53	59.	18.	8.	0.40		
DIVERSION TO	238D	122.	12.53	16.	4.	2.	0.40		
HYDROGRAPH AT	246RE	182.	12.53	43.	14.	6.	0.40		
ROUTED TO	RM246A	180.	12.80	43.	14.	6.	0.40		
HYDROGRAPH AT	234S	284.	12.60	60.	18.	8.	0.38		
DIVERSION TO	OR234	3.	12.60	1.	0.	0.	0.38		
HYDROGRAPH AT	DT234	284.	12.60	60.	18.	8.	0.38		
HYDROGRAPH AT	235S	391.	12.33	64.	19.	9.	0.35		
5 COMBINED AT	HC235	3676.	12.47	1127.	384.	175.	8.97		
ROUTED TO	RM235	3667.	12.53	1127.	384.	175.	8.97		
HYDROGRAPH AT	236S	283.	12.73	65.	20.	9.	0.34		
DIVERSION TO	OR236	5.	12.73	4.	1.	0.	0.34		
HYDROGRAPH AT	DT236	283.	12.73	65.	19.	9.	0.34		
HYDROGRAPH AT	237S	330.	12.53	62.	18.	8.	0.38		
3 COMBINED AT	HC237	4263.	12.53	1250.	421.	191.	9.70		
ROUTED TO	RM237	4243.	12.67	1249.	421.	191.	9.70		
HYDROGRAPH AT	R246	122.	12.53	16.	4.	2.	0.00		
ROUTED TO	RM246B	121.	12.67	16.	4.	2.	0.00		
HYDROGRAPH AT	238S	419.	12.53	85.	27.	12.	0.51		
DIVERSION TO	OR238	6.	12.53	2.	0.	0.	0.51		
HYDROGRAPH AT	DT238	419.	12.53	85.	27.	12.	0.51		
2 COMBINED AT	HC238	535.	12.53	101.	31.	14.	0.51		
ROUTED TO	RM238	530.	12.80	101.	31.	14.	0.51		
HYDROGRAPH AT	239S	640.	12.33	103.	31.	14.	0.67		
ROUTED TO	RM239	636.	12.53	103.	31.	14.	0.67		
HYDROGRAPH AT	240S	584.	12.73	133.	40.	18.	0.84		

DIVERSION TO	OR240	9.	12.73	5.	1.	1.	0.84
HYDROGRAPH AT	DT240	584.	12.73	133.	39.	18.	0.84
ROUTED TO	RM240	582.	12.87	133.	39.	18.	0.84
HYDROGRAPH AT	241S	1021.	12.33	181.	57.	26.	0.98
DIVERSION TO	OR241	26.	12.33	17.	5.	2.	0.98
HYDROGRAPH AT	DT241	1021.	12.33	181.	52.	23.	0.98
4 COMBINED AT	HC241	2263.	12.53	518.	153.	69.	3.01
DIVERSION TO	244D	297.	12.53	58.	15.	7.	3.01
HYDROGRAPH AT	241RE	1966.	12.53	460.	138.	62.	3.01
ROUTED TO	RM241A	1958.	12.60	460.	138.	62.	3.01
ROUTED TO	RM241B	1944.	12.73	460.	138.	62.	3.01
HYDROGRAPH AT	242S	499.	12.53	105.	34.	15.	0.55
DIVERSION TO	OR242	17.	12.53	11.	4.	2.	0.55
HYDROGRAPH AT	DT242	499.	12.53	105.	30.	14.	0.55
3 COMBINED AT	HC242A	6646.	12.67	1801.	589.	267.	13.25
HYDROGRAPH AT	243S	546.	12.20	93.	31.	14.	0.43
ROUTED TO	RM243	544.	12.40	93.	31.	14.	0.43
HYDROGRAPH AT	244S	341.	12.47	68.	22.	10.	0.35
DIVERSION TO	OR244	6.	12.47	4.	1.	0.	0.35
HYDROGRAPH AT	DT244	341.	12.47	68.	21.	9.	0.35
HYDROGRAPH AT	R241	297.	12.53	58.	15.	7.	0.00
ROUTED TO	RM241C	295.	12.73	58.	15.	7.	0.00
ROUTED TO	RM241D	295.	12.80	58.	15.	7.	0.00
3 COMBINED AT	HC244	1030.	12.53	219.	67.	30.	0.78
2 COMBINED AT	HC242B	7589.	12.67	2015.	655.	297.	14.03
ROUTED TO	RM242	7523.	12.80	2013.	655.	297.	14.03
HYDROGRAPH AT	R211	260.	12.07	136.	58.	26.	0.00
ROUTED TO	RM211B	264.	12.40	136.	58.	26.	0.00
HYDROGRAPH AT	245S	362.	12.73	84.	26.	12.	0.51
DIVERSION TO	OR245	5.	12.73	1.	0.	0.	0.51
HYDROGRAPH AT	DT245	362.	12.73	84.	26.	12.	0.51
3 COMBINED AT	HC245	8136.	12.80	2224.	738.	335.	14.54
HYDROGRAPH AT	250S	1972.	12.60	701.	495.	454.	2.40

T.4N., R.2E.

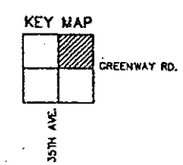
T.4N., R.3E.

MATCH LINE SEE PLATE 3



MATCH LINE SEE PLATE 1

KEY MAP



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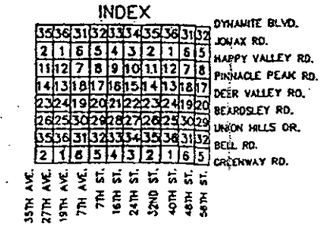

DATE FLOWN: 11-15-1990, 1-18-1991 & 2-15-1991

T.3N., R.2E.

T.3N., R.3E.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 CAVE CREEK HYDROLOGY STUDY

LEGEND

- Drainage Basin Boundary
- A — Compute Runoff from Sub-Basin A
- B — Compute Runoff from Sub-Basin B
- C — Combine Hydrographs
- D — Route Hydrograph
- E — Route Hydrograph through Retention Basin E
- G/F — Divide Hydrograph into F and G

DRAINAGE AREA MAP & HEC-1 SCHEMATIC

EXISTING CONDITIONS

PLATE 2
MAY 21, 1993

KAMINSKI HUBBARD engineering, inc.
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4550 N. BLACK CANYON HWY., SUITE C
PHOENIX, ARIZONA 85017
(602) 242-5588

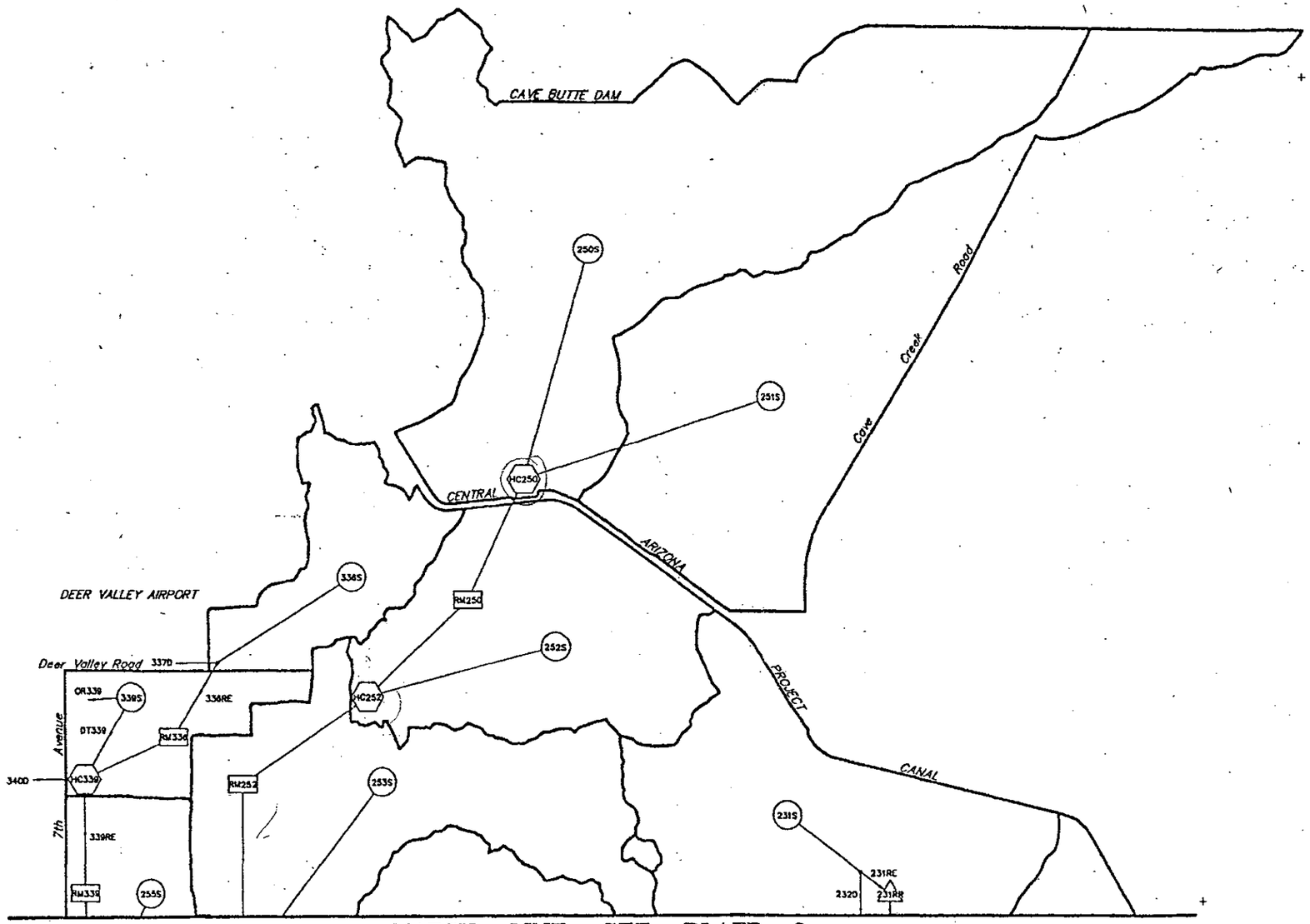
N

SCALE

1200 600 0 1200 2400

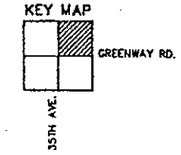
FEET

T.4N., R.3E.



MATCH LINE SEE PLATE 2

KEY MAP



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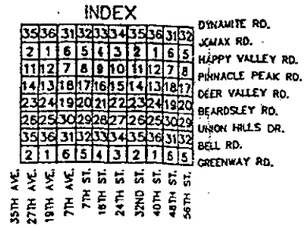

T.4N., R.3E.

DATE FLOWN: 9-7-1990 & 11-15-1990

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 CAVE CREEK HYDROLOGY STUDY

LEGEND

- Drainage Basin Boundary
- A — Compute Runoff from Sub-Basin A
- B — Compute Runoff from Sub-Basin B
- C — Combine Hydrographs
- D — Route Hydrograph
- E — Route Hydrograph through Retention Basin E
- G/F — Divide Hydrograph into F and G

DRAINAGE AREA MAP & HEC-1 SCHEMATIC

EXISTING CONDITIONS

PLATE 3
MAY 21, 1993

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PHOENIX, ARIZONA 85017
(602) 242-5588

N

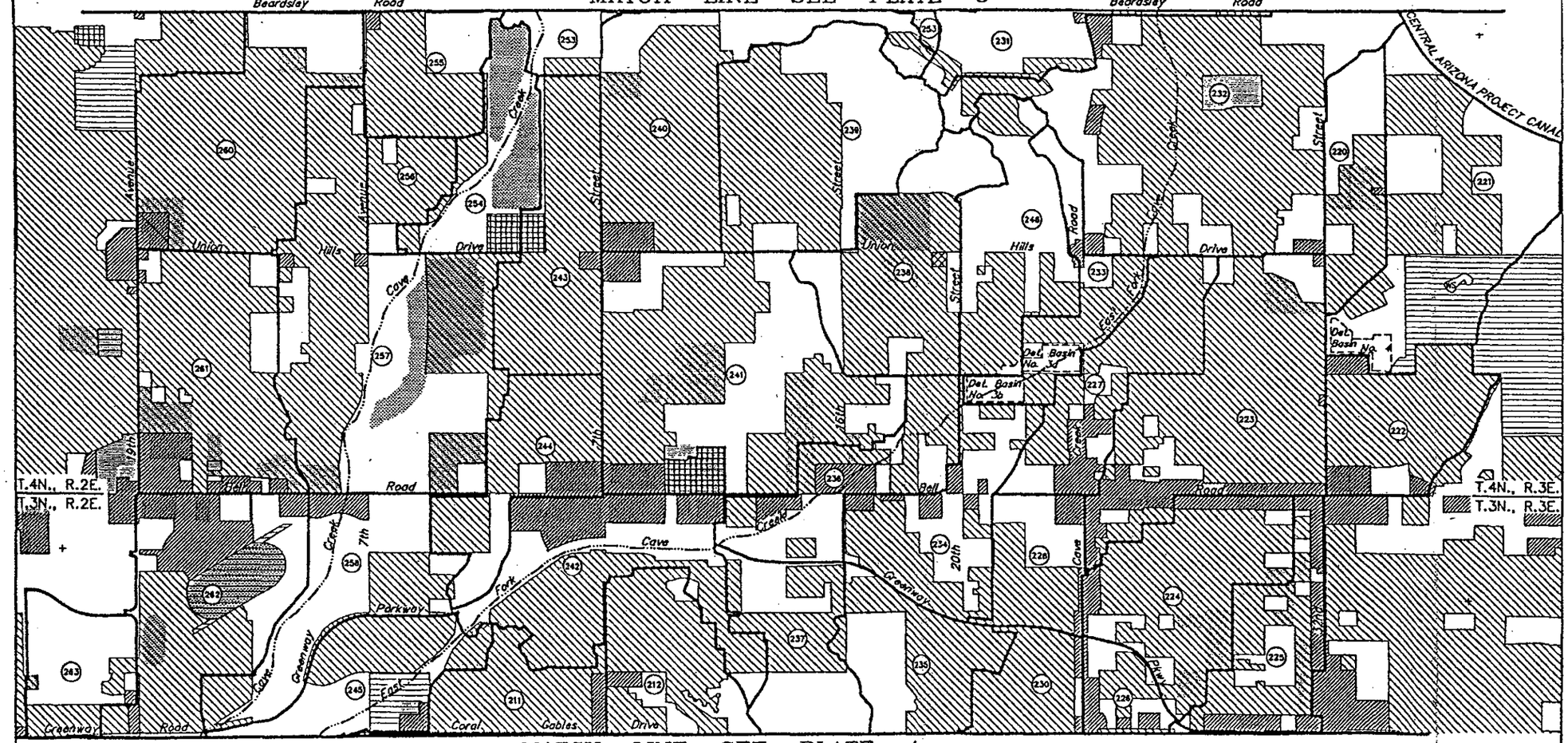
SCALE

1200 600 0 1200 2400

FEET

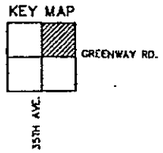
T.4N., R.2E. | T.4N., R.3E.

MATCH LINE SEE PLATE 6



MATCH LINE SEE PLATE 4

KEY MAP



INDEX

35	36	31	32	33	34	35	36	31	32	DYNAMITE BLVD.
2	1	6	5	4	3	2	1	6	5	JOMAX RD.
11	12	7	8	9	10	11	12	7	8	HAPPY VALLEY RD.
14	13	18	17	16	15	14	13	18	17	PINNACLE PEAK RD.
23	24	19	20	21	22	23	24	19	20	DEER VALLEY RD.
26	25	30	29	28	27	26	25	30	29	BEARDSLEY RD.
35	36	31	32	33	34	35	36	31	32	UNION HILLS DR.
2	1	6	5	4	3	2	1	6	5	BELL RD.
										GREENWAY RD.
35TH AVE.	27TH AVE.	19TH AVE.	7TH AVE.	7TH ST.	16TH ST.	24TH ST.	32ND ST.	40TH ST.	48TH ST.	

DATE FLOWN: 11-15-1990, 1-18-1991 & 2-15-1991

T.3N., R.2E. | T.3N., R.3E.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 CAVE CREEK HYDROLOGY STUDY

LEGEND

- Drainage Basin Boundary
- Residential Land Use
- Commercial Land Use
- Golf Course/Park
- Utility Land Use
- Industrial Land Use
- Significant Onsite Retention Area
- Noncontributing Area
- Vacant Land Use
- (140) Drainage Sub-Basin Number
- (WS) Water Surface

LAND USE MAP
EXISTING CONDITIONS

PLATE 5
MAY 21, 1993

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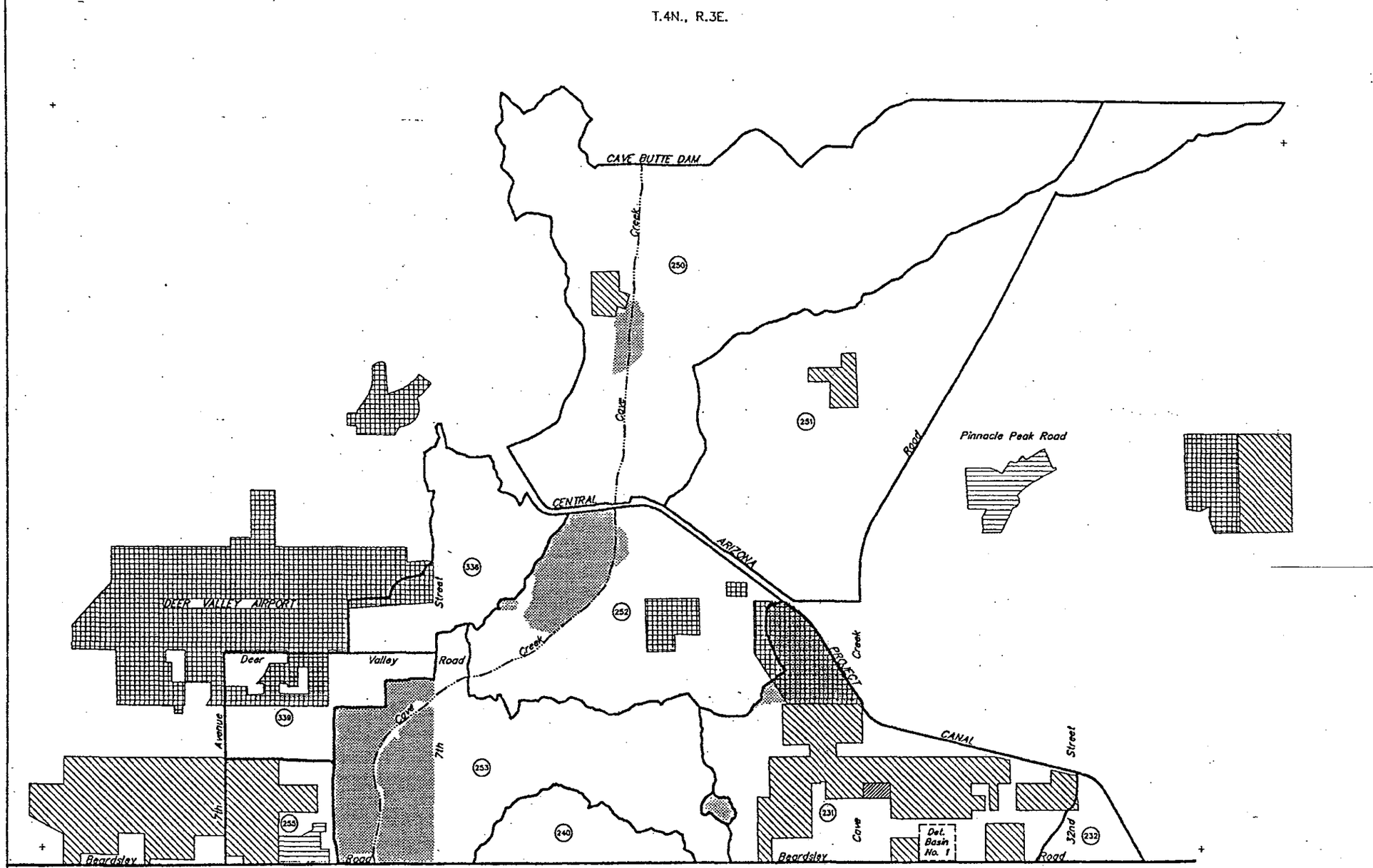
4550 N. BLACK CANYON HWY., SUITE C
PHOENIX, ARIZONA 85017
(602) 242-5588

N

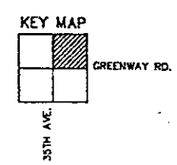
SCALE
1200 600 0 1200 2400
FEET

T.4N., R.3E.



MATCH LINE SEE PLATE 5

KEY MAP



INDEX

35	36	31	32	33	34	35	36	31	32		DYNAMITE RD.
2	1	6	5	4	3	2	1	6	5		JOMAX RD.
11	12	7	8	9	10	11	12	7	8		HAPPY VALLEY RD.
14	13	18	17	16	15	14	13	18	17		PINNACLE PEAK RD.
23	24	19	20	21	22	23	24	19	20		DEER VALLEY RD.
26	25	30	29	28	27	26	25	30	29		BEARDSLEY RD.
35	36	31	32	33	34	35	36	31	32		UNION HILLS DR.
2	1	6	5	4	3	2	1	6	5		BELL RD.
											GREENWAY RD.
35TH AVE.	27TH AVE.	19TH AVE.	7TH AVE.	7TH ST.	16TH ST.	24TH ST.	32ND ST.	40TH ST.	48TH ST.	56TH ST.	

DATE FLOWN: 9-7-1990 & 11-15-1990

T.4N., R.3E.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ACDC/ADMS PHASE 1 CAVE CREEK HYDROLOGY STUDY

LEGEND

- Drainage Basin Boundary
- Residential Land Use
- Commercial Land Use
- Golf Course/Park
- Utility Land Use
- Industrial Land Use
- Significant Onsite Retention Area
- Noncontributing Area
- Vacant Land Use
- (140) Drainage Sub-Basin Number

LAND USE MAP
EXISTING CONDITIONS

PLATE 6
MAY 21, 1993

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4550 N. BLACK CANYON HWY., SUITE C
PHOENIX, ARIZONA 85017
(602) 242-5588

N

SCALE
1200 600 0 1200 2400
FEET

E.1 Roughness Coefficient Estimation

CAVE CREEK
From CAP Canal to Loop 101 Highway
FLOODPLAIN DELINEATION STUDY

Maricopa County

Selection of Manning Roughness Coefficients

Contract Number: FCD 2004C024
PCN 014.27.01

Prepared for:

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

Prepared by:

WEST Consultants, Inc.
960 West Elliot Road, Suite 201
Tempe, Arizona 85284-1137

November 2005

Methodology

To select the Manning's roughness coefficient for Cave Creek, the components of Manning's *n* were estimated as outlined in U.S. Geological Survey (USGS) Water-Supply Paper (WSP) 2339 "Guide for Selecting Manning's Roughness Coefficients for Natural Channels and Flood Plains" by Arcement and Schneider (1989). Color aerial photographs, provided by the Flood Control District of Maricopa County, black and white orthophotos provided by Southwest Mapping Technologies, L.L.C., and photos taken during field reconnaissance were studied and used to assign Manning's *n* values in channel and overbank areas. In the procedure outlined by Arcement and Schneider (1989), the value of *n* for a channel may be computed by:

$$n = (n_b + n_1 + n_2 + n_3 + n_4)m \qquad (1)$$

where: n = Manning's roughness for the channel,
n_b = a base value of n for a straight uniform, smooth channel in natural materials,
n_1 = a value added to correct for the effect of surface irregularities,
n_2 = a value for variations in shape and size of the channel cross section,
n_3 = a value for obstructions,
n_4 = a value for vegetation and flow conditions, and
m = a correction factor for meandering of the channel.

Channel n-values

Cross sections are typically divided into subsections at points where major roughness or geometric changes occur. For example, at the lower end of the study reach, the sloping banks of the channels are protected by riprap, which has a higher roughness coefficient than the bed material. Since, in most places, the bank stations for the hydraulic model were set at the top of the sloping banks, the channel in the hydraulic model consists of both the bed and sloping banks. Thus, the channel banks and the channel bed were separated into subsections and a Manning's roughness coefficient was determined for each of these subsections. Next, an overall *n*-value was determined by compositing the *n*-values from the various subsections. Chow (1959) presents three methods that can be used for compositing roughness coefficients: 1) equal velocity, 2) equal force, and 3) equal conveyance. HEC-RAS uses the equal velocity method to determine composite *n*-values. However, this method can lead to unrealistically high composite *n*-values particularly if one of the *n*-values is significantly greater than the rest. We chose the conveyance method to composite the n-values. In this method, the conveyance of the section with the composited n-value is the same as the conveyance the section would have if the separate n-values were retained. In this method, the composite n-value can be found using the following equation (Chow 1959):

$$n = \frac{PR^{5/3}}{\frac{P_1 R_1^{5/3}}{n_1} + \frac{P_2 R_2^{5/3}}{n_2} + \cdots + \frac{P_N R_N^{5/3}}{n_N}} \tag{2}$$

where: R = the hydraulic radius,
P = the wetted perimeter, and
n = the Manning's roughness coefficients.

Note that the subscripts in Equation (2) refer to the various subsections of the cross section and not to the correction factors used to determine the n-values found in Equations (1) or (5). The composite n-value depends on the depth since the hydraulic radius of each subsection of the cross section and the total hydraulic radius appears in the formula. For simple channels, like the ones found in Cave Creek, Chow (1959) states that it can be assumed that all of the hydraulic radii are equal.

$$R_1 = R_2 = \cdots = R_N = R \tag{3}$$

Using this assumption, the composite n-value using the equal conveyance method can be found using the following equation:

$$n = \frac{P}{\frac{P_1}{n_1} + \frac{P_2}{n_2} + \cdots + \frac{P_N}{n_N}} \tag{4}$$

From the field visits, it appeared that in many sections of Cave Creek, the bed material was significantly smoother or rougher than the bank material. In addition, the amount of vegetation in the channel bed was also typically different than the amount of vegetation found on the channel banks. Thus, in each subreach of the study reach, separate base n-values (n_b) and vegetation n-values (n_3) were found for the bed and the channel banks. The bed and bank n-values were separately calculated from their components. From the hydraulic model, an estimate was made of the wetted perimeter in contact with the bed material and with the channel banks in a typical cross-section of each reach. Finally, the bed and bank n-values were composited using equation (4).

Overbank n-values

Roughness values for the overbank flood plains were calculated independently from the channel n-values. The overall Manning's roughness coefficient for the overbanks can be determined from:

$$n = (n_b + n_1 + n_2 + n_3 + n_4)m \quad (5)$$

where: n = Manning's roughness for the overbanks,
n_b = a base value of n for the overbanks' natural bare soil surface,
n_1 = a correction factor for the effect of surface irregularities on the overbanks,
n_2 = a value for variations in shape and size of the overbanks' cross section (assumed to be equal to 0.0),
n_3 = a value for obstructions in the overbanks,
n_4 = a value for vegetation in the overbanks, and
m = a correction factor for sinuosity of the overbanks (assumed to be equal to 1).

Details for selecting the various components of the overall Manning's roughness coefficients can be found in WSP 2339 (Arcement and Schneider 1989). Aerial photographs and field visits were used to help identify the adjustment factors found in above equations for both the main channel and the overbanks. The above equations were then used to calculate the overall Manning's roughness coefficient for the channel and the overbanks.

Determination of the Manning's Roughness Coefficients

From the aerial photographs and the field visits, it appears that the main Cave Creek channel can be divided into seven distinct subreaches for the purposes of calculating the Manning's roughness coefficients. These seven subreaches are shown in Figure 1. The approximate locations of the field photographs used to illustrate each reach are shown in Figure 1.

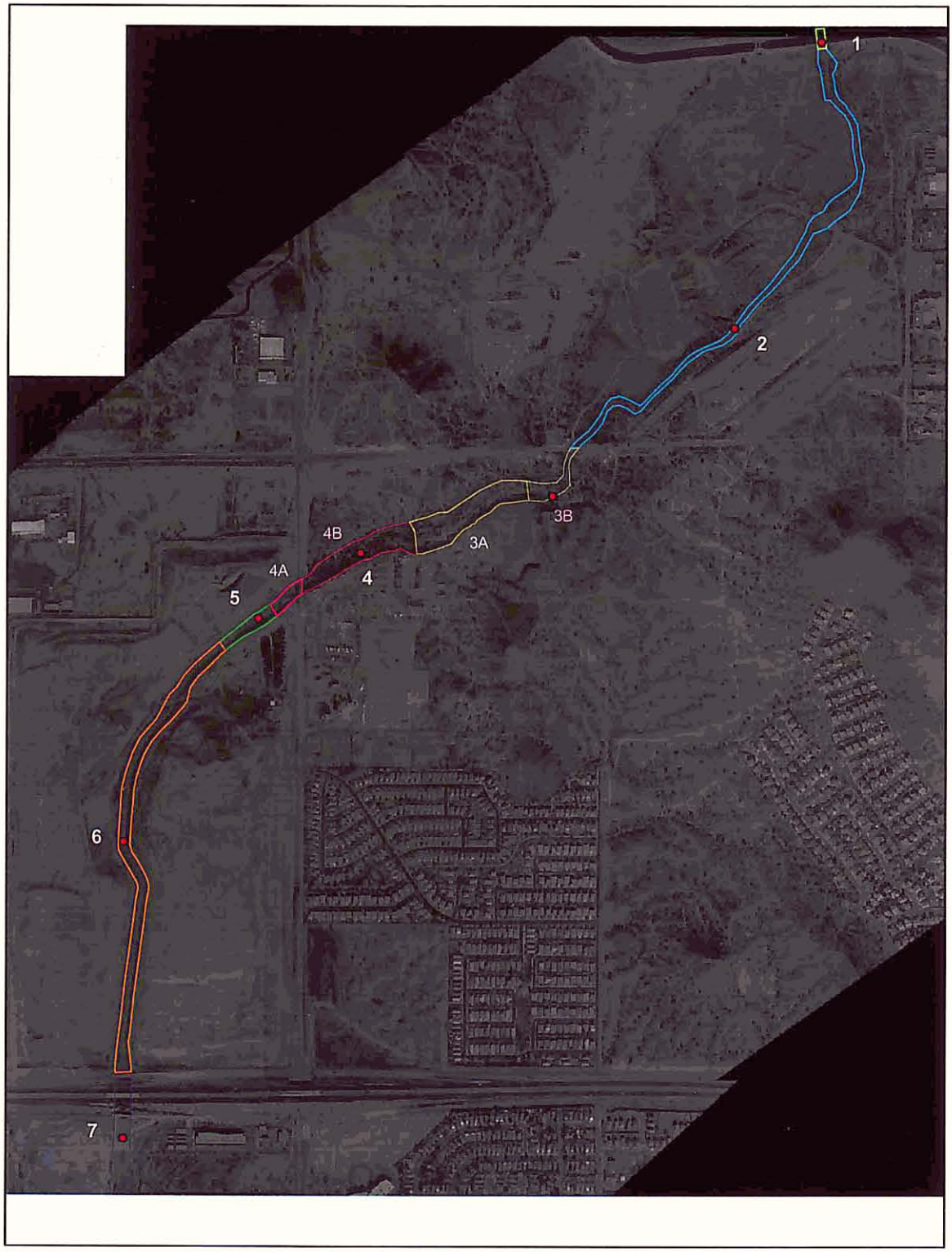

Figure 1. Subreaches in the Study Area and Location of Field Photographs for each Subreach.

Subreach 1 – CAP Canal Overshoot

The first subreach is the CAP Canal overshoot. It is anticipated that the overshoot will completely contain the 100-year flood, so no categorization of the overbanks was made at this location. Field photographs of the overshoot are shown in Figure 2. A Manning *n*-value of 0.015 was chosen for the concrete surface of the overshoot.

Table 1. Determination of Manning's Roughness Coefficient for Subreach 1

Project: Cave Creek from CAP Canal to Loop 101 Highway Floodplain
Stream: Cave Creek
Location: Subreach 1

Channel Conditions			Manning's n Adjustment	Left Overbank	Main Channel	Right Overbank
Channel Bed Material	Concrete	n_b	0.012-0.018		0.015	
	Rock Cut		0.025			
	Firm Soil		0.025-0.032			
	Fine Sand		0.023-0.036			
	Coarse Sand		0.026-0.035			
	Gravel		0.028-0.035			
	Cobble		0.030-0.050			
	Boulder		0.040-0.070			
Degree of Irregularity	Smooth	n_1	0.000		0	
	Minor		0.001-0.005			
	Moderate		0.006-0.010			
	Severe		0.011-0.020			
Variations in the Channel Cross Section	Gradual	n_2	0.000		0	
	Alternating (occasionally)		0.001-0.005			
	Alternating (frequently)		0.010-0.015			
Effect of Obstructions	Negligible	n_3	0.000-0.004		0	
	Minor		0.005-0.015			
	Appreciable		0.020-0.030			
	Severe		0.040-0.060			
Vegetation	Small	n_4	0.002-0.010		0	
	Medium		0.010-0.025			
	Large		0.025-0.050			
	Very Large		0.050-0.100			
Degree of Meandering	Minor	m	1		1	
	Appreciable		1.15			
	Severe		1.3			
$n = (n_b + n_1 + n_2 + n_3 + n_4)m$				N/A	0.015	N/A

(a) Looking upstream at CAP overshoot

(b) Close-up of overshoot, looking upstream

Figure 2. Field Photographs for Subreach 1

Subreach 2 – CAP to Deer Valley Road

Subreach 2 has its upstream limit at the CAP canal and its downstream limit at Deer Valley Road. The bed of this section of Cave Creek is a mixture of gravel and small cobbles. The channel banks are composed of firm soil with some gravel and cobbles mixed in. The bed material was assigned a base n-value of 0.032 while the bank material was assigned a base n-value of 0.027. The channel is fairly straight, trapezoidal, and uniform throughout the reach. Thus, n_1, n_2, and n_3 were assumed to be zero while m was assumed to be equal to one (1). The bed has little vegetation and the channel banks are lined with medium-sized bushes and shrubs that are moderately dense. For the bed, n_4 was assigned to be 0.002 while n_4 was assumed to be 0.007 for the channel banks. The composite n-value for this subreach was 0.034, which agrees well with the results presented in the USGS Professional Paper 1584 (Phillips and Ingersoll 1998). USGS Professional Paper 1584 reports n-values for the main channel of this section of Cave Creek to be approximately 0.033 to 0.034. USGS Open-File Report 73-03 (Aldridge and Garrett 1973) also reports n-values for Cave Creek. The study section of Cave Creek reported in USGS Open-File Report 73-03 is located where Cave Creek crosses Carefree Highway (SR 74), which is about six (6) miles upstream from the CAP canal. Aldridge and Garrett (1973) report n-values for Cave Creek that range from 0.032 to 0.040, which is slightly higher than the value reported by Phillips and Ingersoll (1998). Thomsen and Hjalmarson report an base n-value of 0.030, and a vegetative n-value of 0.002 for Cave Creek below Carefree highway, for a total of 0.032. This is just slightly below our composite n-value of 0.034.

Most of the right overbank of Cave Creek along Subreach 2 consists of gravel pits. These pits are highly irregular with many hummocks and swales. Because of the mining operation, there are many places in the overbanks that are lower than the bed of Cave Creek itself. The degree of irregularity, n_1, appears to be severe, and n_1 was chosen to be 0.015. The surface material of the right overbank is typically composed of a mixture of coarse gravel and small cobbles. The base n-value was chosen to be 0.029. The right overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the right overbank consists of small bushes and shrubs sparsely populated throughout the overbank. Although many of the areas of the right overbank have had vegetation removed due to the mining operations and activities, the right overbank has more vegetation than the channel bed does. The vegetative n-factor, n_4, was chosen to be equal to 0.008. The overall n-value for the right overbank was found to be equal to 0.052.

In Subreach 2, the left overbank is not as irregular as the right overbank because there is no gravel mine on the left overbank. However, there are still some hummocks and swales along the left overbank. The degree of irregularity, n_1, was chosen to be 0.008. The surface material of the left overbank is composed of a mixture of coarse gravel and small cobbles, often with significant amounts of sand as well. The base n-value was chosen to be 0.029. The left overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the left overbank consists of small bushes and shrubs sparsely populated throughout the overbank. Although many of the areas of the left overbank have had vegetation removed due to the various human activities, the left overbank has more vegetation

than the channel bed does. The vegetative n-factor, n_4, was chosen to be equal to 0.008. The overall n-value for the left overbank was found to be equal to 0.045.

Table 2. Determination of Manning's Roughness Coefficient for Subreach 2

Project: Cave Creek from CAP Canal to Loop 101 Highway Floodplain
Stream: Cave Creek
Location: Subreach 2

Channel Conditions			Manning's *n* Adjustment	Left Overbank	Main Channel		Right Overbank
					Bed	Banks	
Channel Bed Material	Concrete	n_b	0.012-0.018				
	Rock Cut		0.025				
	Firm Soil		0.025-0.032			0.027	
	Fine Sand		0.023-0.036				
	Coarse Sand		0.026-0.035				
	Gravel		0.028-0.035	0.029			0.029
	Cobble		0.030-0.050		0.032		
	Boulder		0.040-0.070				
Degree of Irregularity	Smooth	n_1	0.000		0	0	
	Minor		0.001-0.005				
	Moderate		0.006-0.010	0.008			
	Severe		0.011-0.020				0.015
Variations in the Channel Cross Section	Gradual	n_2	0.000	0	0	0	0
	Alternating (occasionally)		0.001-0.005				
	Alternating (frequently)		0.010-0.015				
Effect of Obstructions	Negligible	n_3	0.000-0.004	0	0	0	0
	Minor		0.005-0.015				
	Appreciable		0.020-0.030				
	Severe		0.040-0.060				
Vegetation	Small	n_4	0.002-0.010	0.008	0.002	0.007	0.008
	Medium		0.010-0.025				
	Large		0.025-0.050				
	Very Large		0.050-0.100				
Degree of Meandering	Minor	m	1	1	1	1	1
	Appreciable		1.15				
	Severe		1.3				
$n = (n_b + n_1 + n_2 + n_3 + n_4)m$				0.045	0.034	0.034	0.052
n, including composite channel n				0.045	0.034		0.052

a) Left overbank looking upstream

b) Bed material

c) Main channel looking upstream

d) Right overbank looking upstream

Figure 3. Field Photographs for Subreach 2

Subreach 3 – Deer Valley Road to RS 24.282

Subreach 3 has its upstream limit at Deer Valley Road and proceeds downstream for about 1,700 feet. The bed material for this subreach is a mixture of gravel and small cobbles. There is more gravel in this subreach than there is in Subreach 2, upstream. The channel banks are composed of firm soil with some gravel and cobbles mixed in. The bed material was assigned a base *n*-value of 0.030 while the bank material was assigned a base *n*-value of 0.028. The vegetation in the main channel is composed of medium to large sized bushes and shrubs that have a moderate density. Thus, the n_4 value for the bed assumed to be equal to 0.015. The vegetation on the channel banks consisted of small bushes and shrubs with a sparse density. The n_4 value for the channel banks was set equal to 0.008. There was more pronounced meandering in this reach. At the upstream end of the reach, the channel is wider and then turns. Although some of the increased hydraulic resistance is accounted for by the longer channel flowpath, the n_3 value (for variations in channel cross-section) was set at 0.003. The n_1 and n_2 parameters were set equal to zero. There is also some minor meandering of Cave Creek in this subreach. However, the ratio of the channel length to the valley length is approximately 1.08, so the *m*-factor can still be assumed to equal to one (1). The overall *n*-value for this subreach was found to be 0.047.

The right overbank is not as irregular south of Deer Valley Road as it is north of Deer Valley Road. However, there are still some hummocks and swales along the right overbank. The degree of irregularity, n_1, was chosen to be 0.010. The surface material of the right overbank is composed of a mixture of coarse gravel and small cobbles. The base *n*-value was chosen to be 0.028. The right overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the right overbank consists of small bushes and shrubs sparsely populated throughout the overbank. The vegetative *n*-factor, n_4, was chosen to be equal to 0.008. The overall *n*-value for the right overbank was found to be equal to 0.046.

The left overbank was divided into the low left overbank (Reach 3B) and high left overbank (Reach 3A). The low left overbank is found just downstream of Deer Valley road where the channel widens substantially. In this area, there is a region higher than the channel that is left of the hydraulic bank station, but not as high as the terrace above. This area looks much like the channel, except that it tends to have less gravel and cobbles; it also more irregular. The n-value for low left overbank (Reach 3B) was calculated as 0.053, and appears upstream of RS 24.494. The high left overbank (Reach 3A), which appears downstream of RS 24.494, appears to have been smoothed artificially. There are only minor irregularities, the degree of irregularity, n_1, was chosen to be 0.002. The surface material of the left overbank is composed of a mixture of gravel and firm soil. The base *n*-value was chosen to be 0.027. The left overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the left overbank is very sparse, consisting of a few small bushes and shrubs. The vegetative *n*-factor, n_4, was chosen to be equal to 0.004. The overall *n*-value for the high left overbank was found to be equal to 0.033.

Table 3. Determination of Manning's Roughness Coefficient for Subreach 3

Project: Cave Creek from CAP Canal to Loop 101 Highway Floodplain
Stream: Cave Creek
Location: Subreach 3

Channel Conditions			Manning's *n* Adjustment	Left Overbank		Main Channel		Right Overbank
				Low (Reach 3B)	High (Reach 3A)	Bed	Bank	
Channel Bed Material	Concrete	n_b	0.012-0.018					
	Rock Cut		0.025					
	Firm Soil		0.025-0.032					
	Fine Sand		0.023-0.036					
	Coarse Sand		0.026-0.035	0.028	0.027		0.028	0.028
	Gravel		0.028-0.035					
	Cobble		0.030-0.050			0.030		
	Boulder		0.040-0.070					
Degree of Irregularity	Smooth	n_1	0.000					
	Minor		0.001-0.005		0.002	0	0	
	Moderate		0.006-0.010	0.010				0.010
	Severe		0.011-0.020					
Variations in the Channel Cross Section	Gradual	n_2	0.000	0	0		0	0
	Alternating (occasionally)		0.001-0.005			0.003	0.003	
	Alternating (frequently)		0.010-0.015					
Effect of Obstructions	Negligible	n_3	0.000-0.004	0	0	0	0	0
	Minor		0.005-0.015					
	Appreciable		0.020-0.030					
	Severe		0.040-0.060					
Vegetation	Small	n_4	0.002-0.010		0.004		0.008	0.008
	Medium		0.010-0.025	0.015		0.015		
	Large		0.025-0.050					
	Very Large		0.050-0.100					
Degree of Meandering	Minor	m	1	1		1	1	1
	Appreciable		1.15					
	Severe		1.3					
$n = (n_b + n_1 + n_2 + n_3 + n_4)m$				0.053	0.033	0.048	0.039	0.046
n, including composite channel n				0.053	0.033	0.043		0.046

a) Low left overbank looking upstream

b) Bed material

c) Main channel looking downstream

d) Right overbank looking upstream

Figure 4. Field Photographs for Subreach 3

Subreach 4 – RS 24.282 to 300 Feet Downstream of the 7th Street Bridge

Subreach 4 has its upstream limit, at approximately RS 24.282 and continues until about 300 feet downstream from the 7th Street Bridge. The bed material in this reach consists of coarse sands and gravels. In some portions downstream of 7th Street, concrete appears to have been dumped into the channel, and there are more cobbles, but the vegetation is similar. The base *n*-value for the bed was chosen to be 0.027. The channel banks are composed of sand with some gravel and cobbles mixed in; they were assigned a base *n*-value of 0.027. The vegetation in the main channel is composed of medium to large sized bushes and shrubs that have a fairly heavy density. Thus, the n_4 value for the bed assumed to be equal to 0.022. The vegetation on the channel banks consisted of smaller bushes and shrubs with a medium density. The n_4 value for the channel banks was set equal to 0.010. The n_1, n_2, and n_3 parameters were set at zero. There is no meandering in this subreach, so the *m*-factor was set equal to equal to one (1). The composite *n*-value for the Subreach 4 channel was found to be equal to 0.044.

The *n*-value classifications for the overbanks of this reach apply upstream of 7th Street, which has been classified as reach 4B. For the area downstream of 7th Street, which has been classified as reach 4A, the left and overbank *n*-values for Subreach 5 were applied.

On the right overbank, there are some hummocks and swales. The degree of irregularity, n_1, was chosen to be 0.010. The surface material of the right overbank is composed primarily of a mixture of coarse gravel and small cobbles. The base *n*-value was chosen to be 0.029. The right overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the right overbank consists of small bushes and shrubs sparsely populated throughout the overbank. The vegetative *n*-factor, n_4, was chosen to be equal to 0.008. The overall *n*-value for the right overbank was found to be equal to 0.047.

The left overbank appears to have been smoothed artificially. This area is much higher than the channel and will not be flooded in the 100-year event. There are only minor irregularities, the degree of irregularity, n_1, was chosen to be 0.002. The surface material of the left overbank is composed of a mixture of gravel and firm soil. The base *n*-value was chosen to be 0.027. The left overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the left overbank is very sparse, consisting of a few small bushes and shrubs. The vegetative *n*-factor, n_4, was chosen to be equal to 0.004. The overall *n*-value for the left overbank was found to be equal to 0.033.

Table 4. Determination of Manning's Roughness Coefficient for Subreach 4

Project: Cave Creek from CAP Canal to Loop 101 Highway Floodplain
Stream: Cave Creek
Location: Subreach 4

Channel Conditions			Manning's *n* Adjustment	Left Overbank (4B only)	Main Channel Bed	Main Channel Bank	Right Overbank (4B only)
Channel Bed Material	Concrete	n_b	0.012-0.018				
	Rock Cut		0.025				
	Firm Soil		0.025-0.032				
	Fine Sand		0.023-0.036				
	Coarse Sand		0.026-0.035		0.027	0.027	
	Gravel		0.028-0.035	0.027			0.029
	Cobble		0.030-0.050				
	Boulder		0.040-0.070				
Degree of Irregularity	Smooth	n_1	0.000		0	0	
	Minor		0.001-0.005	0.002			
	Moderate		0.006-0.010				0.010
	Severe		0.011-0.020				
Variations in the Channel Cross Section	Gradual	n_2	0.000	0	0	0	0
	Alternating (occasionally)		0.001-0.005				
	Alternating (frequently)		0.010-0.015				
Effect of Obstructions	Negligible	n_3	0.000-0.004	0	0	0	0
	Minor		0.005-0.015				
	Appreciable		0.020-0.030				
	Severe		0.040-0.060				
Vegetation	Small	n_4	0.002-0.010	0.004		0.010	0.008
	Medium		0.010-0.025		0.022		
	Large		0.025-0.050				
	Very Large		0.050-0.100				
Degree of Meandering	Minor	m	1	1	1	1	1
	Appreciable		1.15				
	Severe		1.3				
$n = (n_b + n_1 + n_2 + n_3 + n_4)m$					0.049	0.037	
n, including composite channel n				0.033	0.042		0.047

a) Left overbank looking downstream

b) Bed material

c) Main channel looking downstream

d) Right overbank looking upstream

Figure 5. Field Photographs for Subreach 4

Subreach 5 – From 300 feet downstream of 7th Street Bridge to the Upstream Limit of Riprap

Subreach 5 starts at approximately 300 feet downstream from the 7th Street Bridge and has its downstream limit where the riprap portion of the channel begins. The bed material in this reach consists of a mixture of gravel, cobbles, and an occasional small boulder. The base *n*-value for the bed was chosen to be 0.030. The channel banks are composed of firm soil with some gravel and cobbles mixed in; the channel banks were assigned a base *n*-value of 0.027. The vegetation in the main channel is composed of small to medium sized bushes and shrubs with a fairly sparse density. Thus, the n_4 value for the bed assumed to be equal to 0.002. The vegetation on the channel banks is composed of medium to large sized bushes and shrubs that have a moderate density. Thus, the n_4 value for the channel banks was assumed to be equal to 0.015. It was assumed that the n_1, n_2, and n_3 parameters were equal to zero. There is no meandering in this subreach, so the *m*-factor was set equal to equal to one (1). The bed was found to have a total n-value of 0.032, while the channel banks had a total n-value of 0.042. The composite *n*-value for the Subreach 5 channel was found to be equal to 0.038.

The overbank n-values for Reach 5 were also applied to the overbanks in Reach 4A.

The right overbank in Subreach 5 has been drastically affected by the nearby landfill. There are many piles and mounds of soil, so the irregularity is severe. The degree of irregularity, n_1, was chosen to be 0.020. The surface material of the right overbank is composed of a mixture of coarse gravel and small cobbles. Occasional debris and boulders caused moderate obstructions, and n_3 was set equal to 0.010. The vegetation on the right overbank consists of small bushes and shrubs sparsely populated throughout the overbank. The vegetative *n*-factor, n_4, was chosen to be equal to 0.008. The overall *n*-value for the right overbank was found to be equal to 0.067.

The left overbank has been smoothed due to the landfill. There are only minor irregularities, the degree of irregularity, n_1, was chosen to be 0.002. The surface material of the left overbank is composed of a mixture of gravel and firm soil. The base *n*-value was chosen to be 0.027. There are a series of mobile dumpsters along the left overbank that would cause a significant obstruction to the flow, so n_3 was set equal to 0.025. The vegetation on the left overbank is very sparse, consisting of a few small bushes and shrubs. The vegetative *n*-factor, n_4, was chosen to be equal to 0.004. The overall *n*-value for the left overbank was found to be equal to 0.058.

Table 5. Determination of Manning's Roughness Coefficient for Subreach 5

Project: Cave Creek from CAP Canal to Loop 101 Highway Floodplain
Stream: Cave Creek
Location: Subreach 5

Channel Conditions			Manning's *n* Adjustment	Left Overbank (for reach 4A also)	Main Channel		Right Overbank (for reach 4A also)
					Bed	Bank	
Channel Bed Material	Concrete	n_b	0.012-0.018				
	Rock Cut		0.025				
	Firm Soil		0.025-0.032			0.027	
	Fine Sand		0.023-0.036				
	Coarse Sand		0.026-0.035	0.027			
	Gravel		0.028-0.035				0.029
	Cobble		0.030-0.050		0.030		
	Boulder		0.040-0.070				
Degree of Irregularity	Smooth	n_1	0.000		0	0	
	Minor		0.001-0.005	0.002			
	Moderate		0.006-0.010				
	Severe		0.011-0.020				0.020
Variations in the Channel Cross Section	Gradual	n_2	0.000	0	0	0	0
	Alternating (occasionally)		0.001-0.005				
	Alternating (frequently)		0.010-0.015				
Effect of Obstructions	Negligible	n_3	0.000-0.004		0	0	
	Minor		0.005-0.015				0.010
	Appreciable		0.020-0.030	0.025			
	Severe		0.040-0.060				
Vegetation	Small	n_4	0.002-0.010	0.004	0.002		0.008
	Medium		0.010-0.025			0.015	
	Large		0.025-0.050				
	Very Large		0.050-0.100				
Degree of Meandering	Minor	m	1	1	1	1	1
	Appreciable		1.15				
	Severe		1.3				
$n = (n_b + n_1 + n_2 + n_3 + n_4)m$				0.058	0.032	0.042	0.067
n, including composited channel				0.058	0.038		0.067

a) Left overbank looking downstream (from 7th Street Bridge)

b) Bed material

c) Main channel looking downstream

d) Right overbank looking upstream

Figure 6. Field Photographs for Subreach 5

Subreach 6 – Start of the Riprap to the North Face of the 101 Bridge

Subreach 6 is a channelized section of Cave Creek that has riprap protecting its banks. This section begins about 800 feet downstream from the 7th Street Bridge and continues to the 101 bridges. This section is very straight and uniform. The bed material is a mixture of gravel, cobbles, and few small boulders. The riprap on the channel banks consists of small boulders. There is very little vegetation in this portion of Cave Creek. Most of the vegetation consists of small bushes lining the lower portions of the riprap. A few small bushes are also scattered along the banks, typically near the toe of the banks. There is almost no vegetation in the channel bed itself.

In this section, the channel banks (composed of small boulders) are significantly rougher than the channel bed (composed of a mixture of gravel, cobbles, and a few small boulders). The channel banks were assigned a base roughness, n_b, of 0.040 while the channel bed was assigned a base roughness, n_b, of 0.032. The vegetation consists of small to medium sized shrubs and bushes in the bed and on the channel banks that have a sparse to medium density. It was assumed that the n_1, n_2, and n_4 parameters were equal to zero. There is no meandering in this subreach, so the m-factor was set equal to equal to one (1). The composite n-value for this subreach was estimated to be 0.044.

The right overbank in Subreach 6 is a landfill. The right overbank is defined as the small area between the bank station of Cave Creek and the landfill. There is a very steep and tall embankment leading up to the landfill; the 100-year flood will never reach the landfill. Thus, the right overbank is basically the access road along Cave Creek. It is very smooth and the degree of irregularity, n_1, was chosen to be 0.002. The surface material of the right overbank is composed of a mixture of gravel and firm soil. The base n-value was chosen to be 0.027. The right overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the right overbank consists of small bushes and shrubs sparsely populated throughout the overbank. The vegetative n-factor, n_4, was chosen to be equal to 0.008. The overall n-value for the right overbank was found to be equal to 0.037.

The left overbank is almost identical to the right overbank. The left overbank is defined as the small area between the bank station of Cave Creek and the landfill. There is a very steep and tall embankment leading up to the landfill so the water will never get up to the landfill. Thus, the left overbank is basically the access road along Cave Creek. It is very smooth and the degree of irregularity, n_1, was chosen to be 0.002. The surface material of the left overbank is composed of a mixture of gravel and firm soil. The base n-value was chosen to be 0.027. The left overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the left overbank consists of small bushes and shrubs sparsely populated throughout the overbank. The vegetative n-factor, n_4, was chosen to be equal to 0.008. The overall n-value for the left overbank was found to be equal to 0.037.

Table 6. Determination of Manning's Roughness Coefficient for Subreach 6

Project: Cave Creek from CAP Canal to Loop 101 Highway Floodplain
Stream: Cave Creek
Location: Subreach 6

Channel Conditions			Manning's *n* Adjustment	Left Overbank	Main Channel		Right Overbank
					Bed	Bank	
Channel Bed Material	Concrete	n_b	0.012-0.018				
	Rock Cut		0.025				
	Firm Soil		0.025-0.032				
	Fine Sand		0.023-0.036				
	Coarse Sand		0.026-0.035	0.027			0.027
	Gravel		0.028-0.035		0.032		
	Cobble		0.030-0.050				
	Boulder		0.040-0.070			0.040	
Degree of Irregularity	Smooth	n_1	0.000		0	0	
	Minor		0.001-0.005	0.002			0.002
	Moderate		0.006-0.010				
	Severe		0.011-0.020				
Variations in the Channel Cross Section	Gradual	n_2	0.000	0	0	0	0
	Alternating (occasionally)		0.001-0.005				
	Alternating (frequently)		0.010-0.015				
Effect of Obstructions	Negligible	n_3	0.000-0.004	0	0	0	0
	Minor		0.005-0.015				
	Appreciable		0.020-0.030				
	Severe		0.040-0.060				
Vegetation	Small	n_4	0.002-0.010	0.008	0.006	0.006	0.008
	Medium		0.010-0.025				
	Large		0.025-0.050				
	Very Large		0.050-0.100				
Degree of Meandering	Minor	m	1	1	1	1	1
	Appreciable		1.15				
	Severe		1.3				
$n = (n_b + n_1 + n_2 + n_3 + n_4)m$				0.037	0.038	0.046	0.037
n ,with composited channel				0.037	0.044		0.037

a) Left overbank looking upstream

b) Bed material

c) Main channel looking upstream

d) Right overbank looking upstream

Figure 7. Field Photographs for Subreach 6

Subreach 7 – North Face of the 101 Bridge to End of the Study Reach

The seventh subreach starts at the north-most face of the 101 bridges and continues down to the end of the study reach. This area has been channelized and is very straight and smooth. The bed material consists of gravels and cobbles, and the base *n*-value for the bed was chosen to be 0.029. The channel banks are composed of firm soil with some gravel and cobbles mixed in; the banks were assigned a base *n*-value of 0.027. There is almost no vegetation on the channel banks and the vegetation in the bed is composed of small to medium sized weeds sparsely scattered throughout the bed. It was assumed that the n_1, n_2, and n_3 parameters were equal to zero. There is no meandering in this subreach, so the *m*-factor was set equal to equal to one (1). The composite *n*-value for the channel in this subreach was 0.030.

The right overbank is very smooth; it appears to have been cleared at one point. The degree of irregularity, n_1, was chosen to be 0.002. The surface material of the right overbank is composed of a mixture of gravel and firm soil. The base *n*-value was chosen to be 0.027. The right overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the right overbank consists of small bushes and shrubs sparsely populated throughout the overbank. The vegetative *n*-factor, n_4, was chosen to be equal to 0.004. The overall *n*-value for the right overbank was found to be equal to 0.033.

The left overbank does not appear to have been significantly modified. There are some hummocks and swales running throughout the left overbank, so the degree of irregularity, n_1, was chosen to be 0.008. The surface material of the left overbank is composed of a mixture of gravel, cobbles, and firm soil. The base *n*-value was chosen to be 0.030. The left overbank is clear of any noticeable obstructions, so n_3 was set equal to zero. The vegetation on the left overbank is very sparse, consisting of a few small bushes and shrubs. However, it is more vegetated than the right overbank. The vegetative *n*-factor, n_4, was chosen to be equal to 0.008. The overall *n*-value for the left overbank was found to be equal to 0.046.

Table 7. Determination of Manning's Roughness Coefficient for Subreach 7

Project: Cave Creek from CAP Canal to Loop 101 Highway Floodplain
Stream: Cave Creek
Location: Subreach 7

Channel Conditions			Manning's *n* Adjustment	Left Overbank	Main Channel		Right Overbank
					Bed	Bank	
Channel Bed Material	Concrete	n_b	0.012-0.018				
	Rock Cut		0.025				
	Firm Soil		0.025-0.032			0.027	
	Fine Sand		0.023-0.036				
	Coarse Sand		0.026-0.035				0.027
	Gravel		0.028-0.035	0.030	0.029		
	Cobble		0.030-0.050				
	Boulder		0.040-0.070				
Degree of Irregularity	Smooth	n_1	0.000		0	0	
	Minor		0.001-0.005				0.002
	Moderate		0.006-0.010	0.008			
	Severe		0.011-0.020				
Variations in the Channel Cross Section	Gradual	n_2	0.000	0	0	0	0
	Alternating (occasionally)		0.001-0.005				
	Alternating (frequently)		0.010-0.015				
Effect of Obstructions	Negligible	n_3	0.000-0.004	0	0	0	0
	Minor		0.005-0.015				
	Appreciable		0.020-0.030				
	Severe		0.040-0.060				
Vegetation	Small	n_4	0.002-0.010	0.008	0.002	0.002	0.004
	Medium		0.010-0.025				
	Large		0.025-0.050				
	Very Large		0.050-0.100				
Degree of Meandering	Minor	m	1	1	1	1	1
	Appreciable		1.15				
	Severe		1.3				
$n = (n_b + n_1 + n_2 + n_3 + n_4)m$				0.046	0.031	0.029	0.033
n, including compositing				0.046	0.031		0.033

a) Left overbank looking downstream

b) Bed material

c) Main channel looking upstream

d) Right overbank looking downstream

Figure 8. Field Photographs for Subreach 7

References

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APPENDIX A

Composite Manning's Roughness Calculations

Cave Creek from CAP Canal to Loop 101 Highway Delineation
Calculations of composite channel n-values
March 25, 2005
Leo R. Kreymborg, P.E.

Notes:

1. Composite n-values calculated per:

$$n = \frac{P}{\frac{P_1}{n_1} + \frac{P_2}{n_2} + \cdots + \frac{P_N}{n_N}}$$

Which is formula 6-19 from page 136 of
Open Channel Hydraulics, Chow (1959)
using the assumption suggested by Chow that
$R_1 = R_2 = \ldots = R_N = R$

2. Wetted Perimeters calculated as difference between horizontal Stations

3. 100-year discharge was used

4. n-values used in model rounded to the nearest 0.001

Calculations

Reach 2

Typical Section	24.944	
Location	Station	Notes
Left Bank LR Station	9979.6	bank station submerged
Left Toe Station	9992.63	
Right Toe Station	10007.75	
Right Bank LR Station	10024.67	bank station submerged
Water Surface Elevation	1487.02	

	Wetted Perim	n-value
Left sloping bank	13.03	0.034
Channel	15.12	0.034
Right sloping bank	16.92	0.034
Total	45.07	
Composite		0.0340

Reach 3

Typical Section	24.495	
Location	Station	Notes
Leftmost wetted Station	9955.85	left bank station dry
Left Toe Station	9974.08	
Right Toe Station	10009.38	
Right Bank LR Station	10024.38	bank station submerged
Water Surface Elevation	1466.21	
	Wetted Perim	n-value
Left sloping bank	18.23	0.039
Channel	35.3	0.048
Right sloping bank	15	0.039
Total	68.53	
Composite		0.0432

Reach 4

Typical Section	24.103	
Location	Station	Notes
Leftmost wetted Station	9964.24	left bank station dry
Left Toe Station	9987.1	
Right Toe Station	10053.35	
Right Bank LR Station	*10115.35*	*bank station submerged*
Water Surface Elevation	1463.26	
	Wetted Perim	n-value
Left sloping bank	22.86	0.037
Channel	66.25	0.049
Right sloping bank	62	0.037
Total	151.11	
Composite		0.0415

Reach 5

Typical Section	23.953	

Location	Station	Notes
Leftmost wetted Station	9959.27	left bank station dry
Left Toe Station	9989.25	
Right Toe Station	10018.88	
Rightmost wetted station	10038.92	right bank station dry

Water Surface Elevation	1459.68	

	Wetted Perim	n-value
Left sloping bank	29.98	0.042
Channel	29.63	0.032
Right sloping bank	20.04	0.042
Total	79.65	
Composite		0.0376

Reach 6

Typical Section	23.379	

Location	Station	Notes
Leftmost wetted Station	9971.16	left bank station dry
Left Toe Station	9994.96	
Right Toe Station	10010.13	
Rightmost wetted station	10032.92	right bank station dry

Water Surface Elevation	1445.04	

	Wetted Perim	n-value
Left sloping bank	23.8	0.046
Channel	15.17	0.038
Right sloping bank	22.79	0.046
Total	61.76	
Composite		0.0437

Reach 7

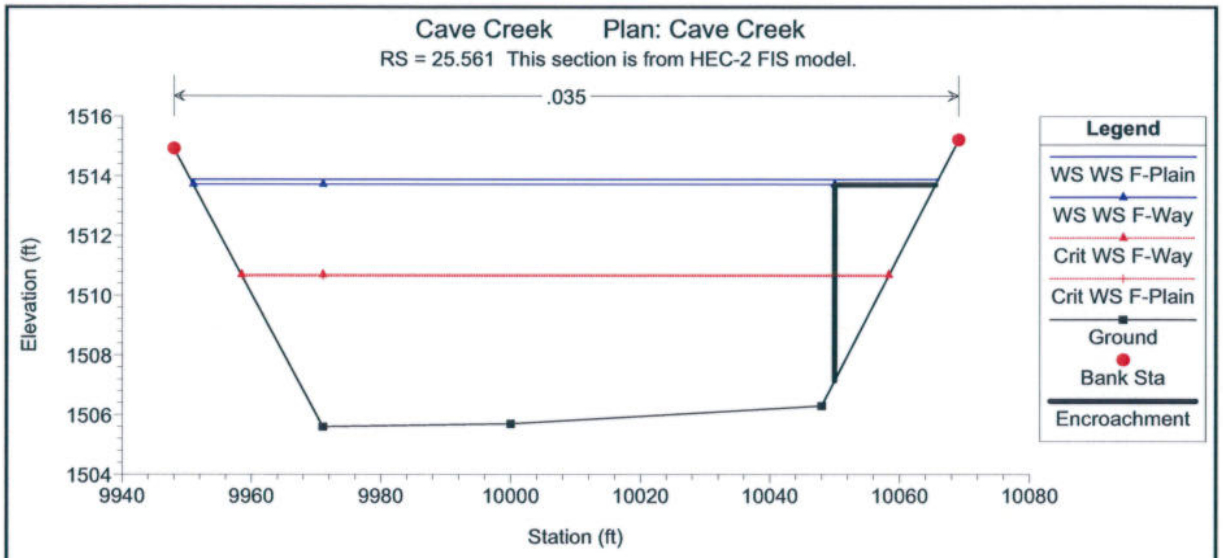
Typical Section	23.068	

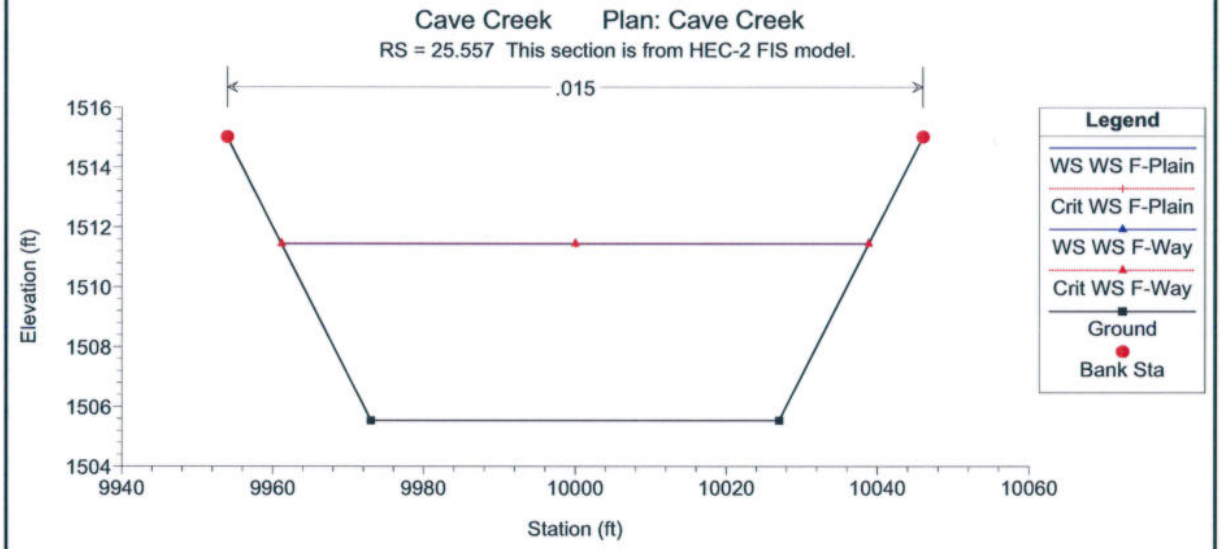
Location	Station	Notes
Leftmost wetted Station	9944.09	left bank station dry
Left Toe Station	9954.33	
Right Toe Station	10050.61	
Rightmost wetted station	10061.14	right bank station dry

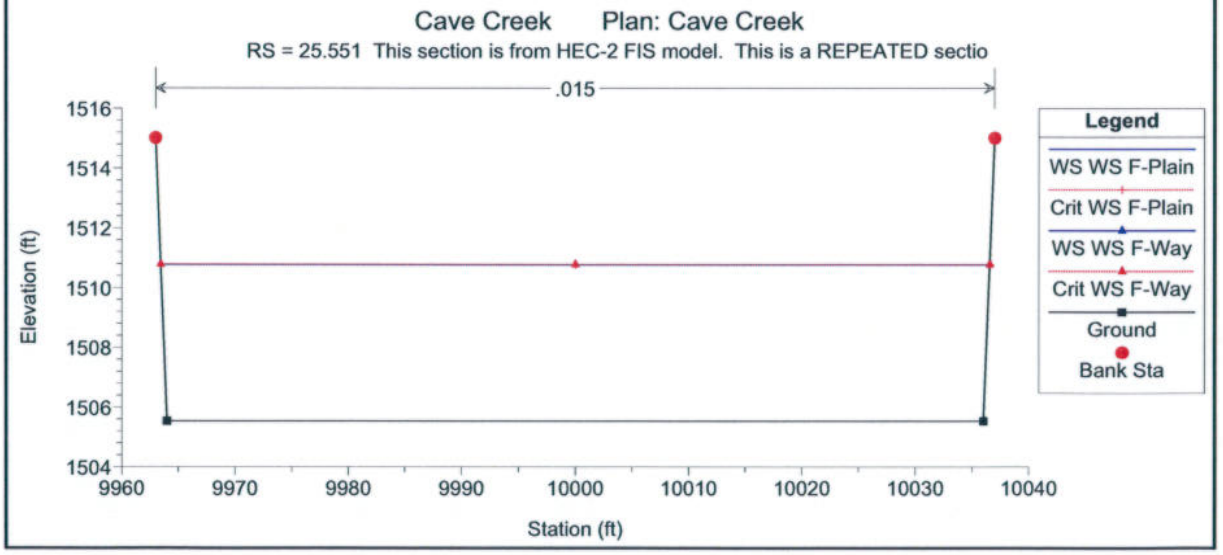
Water Surface Elevation	1431.24

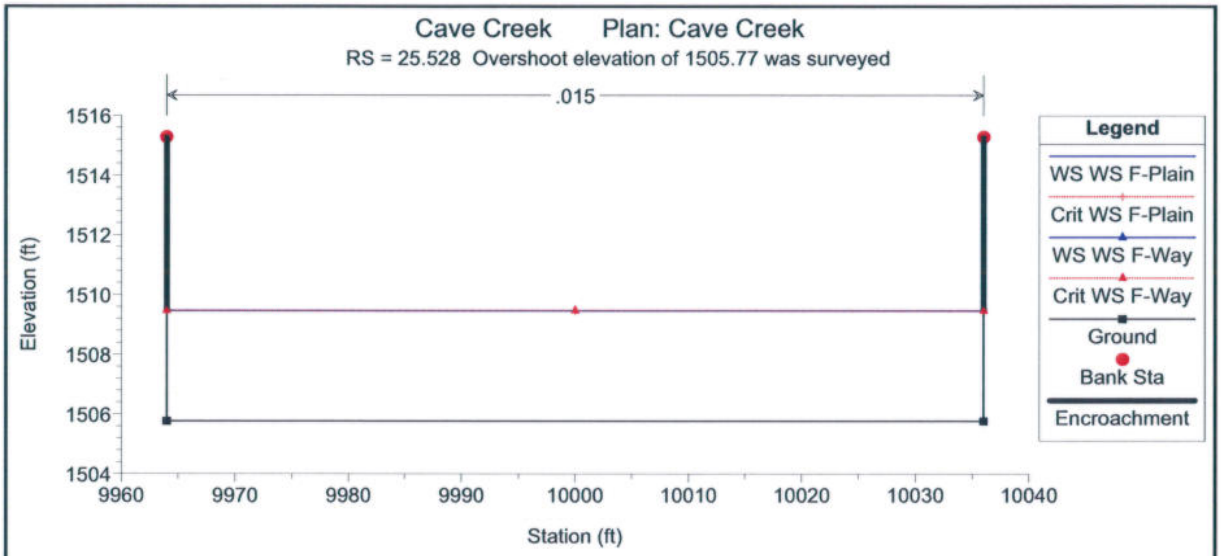
	Wetted Perim	n-value
Left sloping bank	10.24	0.029
Channel	96.28	0.031
Right sloping bank	10.53	0.029
Total	117.05	
Composite		0.0306

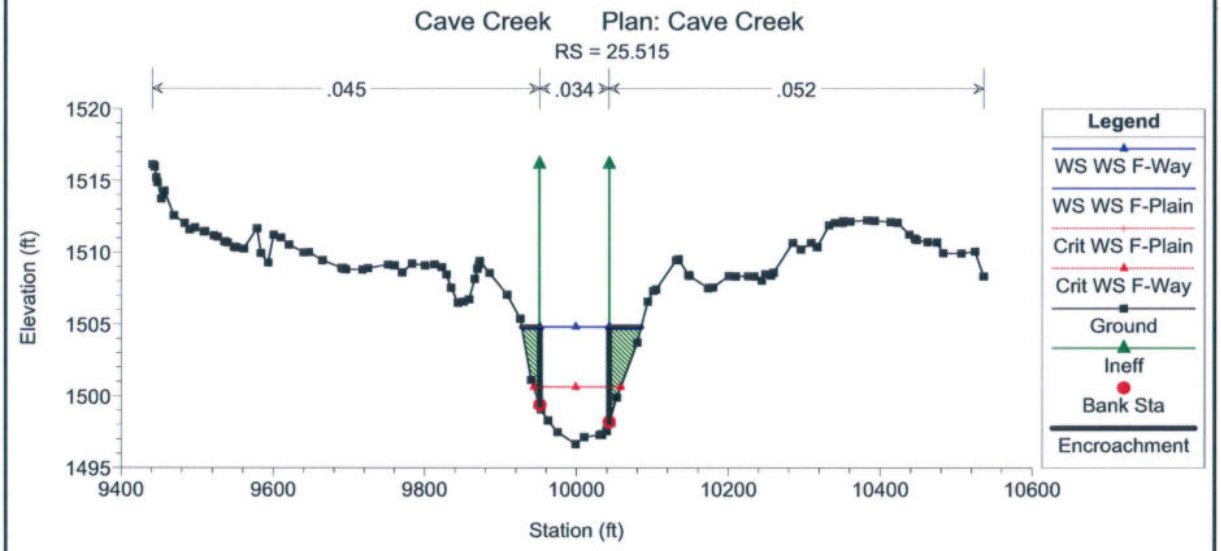
E.2 Cross Section Plots

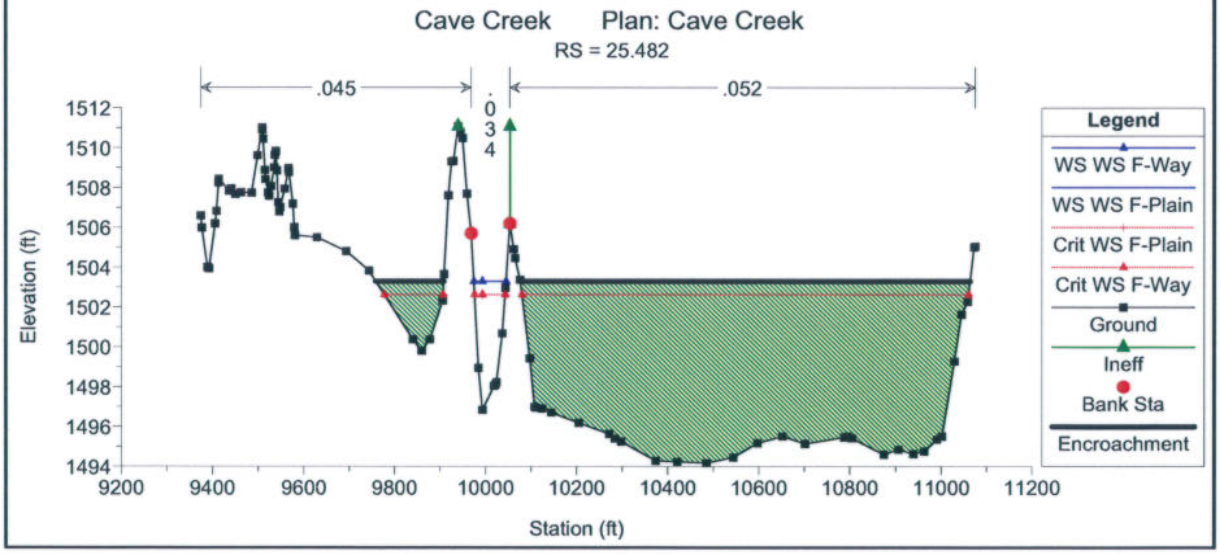

Cave Creek Plan: Cave Creek
RS = 25.561 This section is from HEC-2 FIS model.
.035
Elevation (ft)
1516
1514
1512
1510
1508
1506
1504
9940
9960
9980
10000
10020
10040
10060
10080
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Encroachment

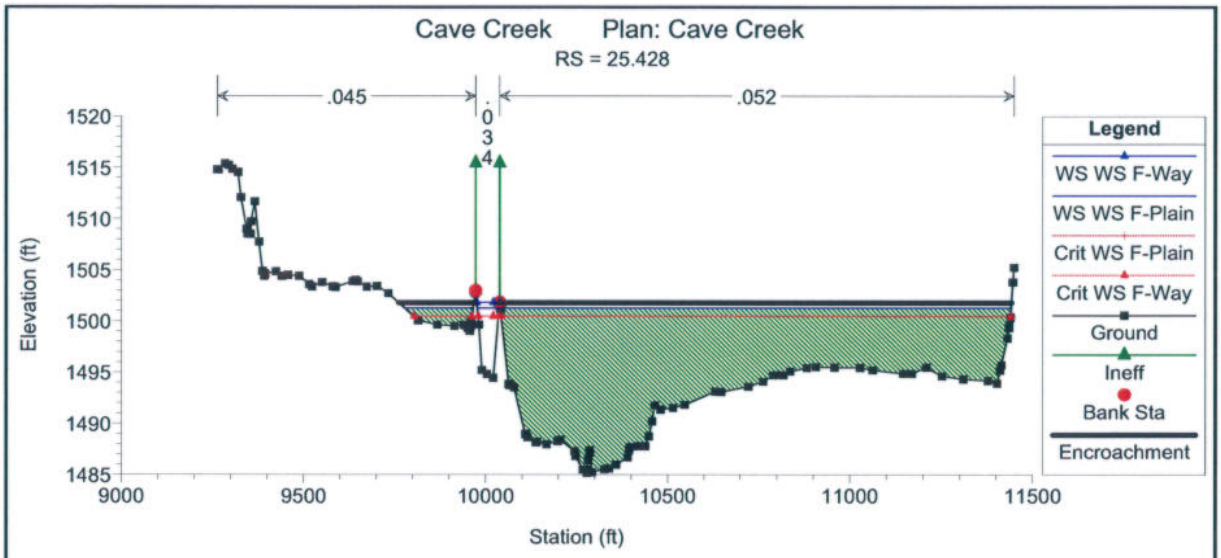

Cave Creek Plan: Cave Creek
RS = 25.557 This section is from HEC-2 FIS model.
.015
Elevation (ft)
1516
1514
1512
1510
1508
1506
1504
9940
9960
9980
10000
10020
10040
10060
Station (ft)
Legend
WS WS F-Plain
Crit WS F-Plain
WS WS F-Way
Crit WS F-Way
Ground
Bank Sta

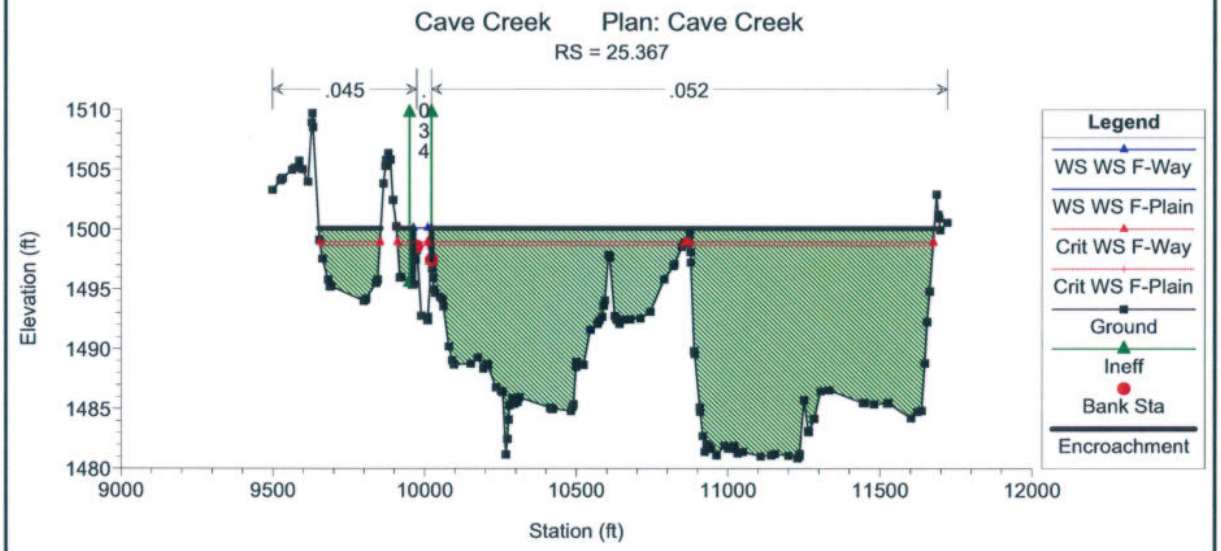

Cave Creek Plan: Cave Creek
RS = 25.551 This section is from HEC-2 FIS model. This is a REPEATED sectio
.015
Elevation (ft)
1516
1514
1512
1510
1508
1506
1504
9960
9970
9980
9990
10000
10010
10020
10030
10040
Station (ft)
Legend
WS WS F-Plain
Crit WS F-Plain
WS WS F-Way
Crit WS F-Way
Ground
Bank Sta

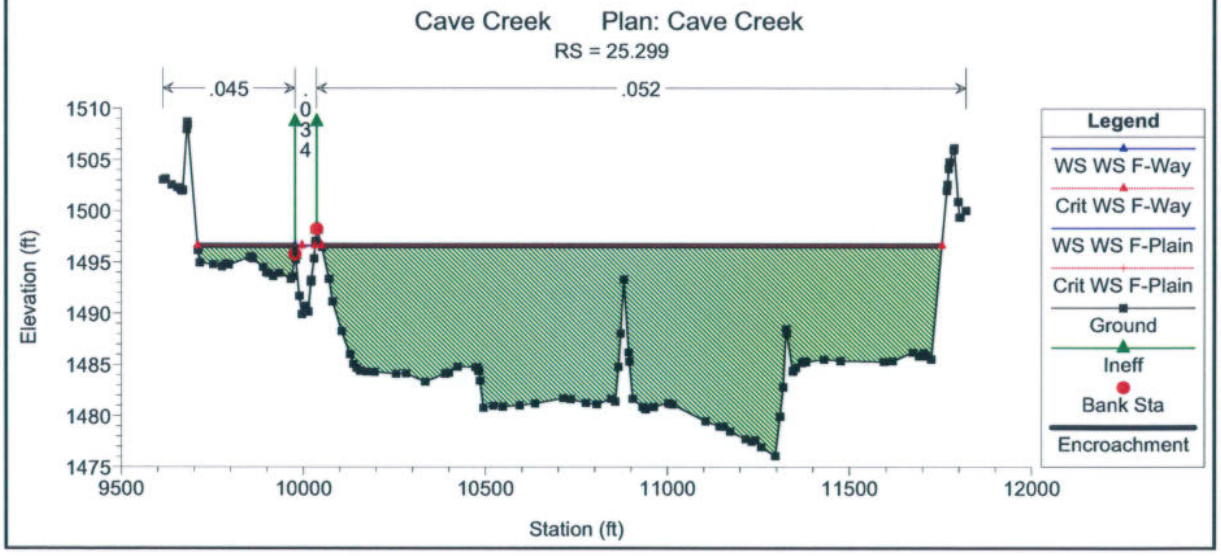

Cave Creek Plan: Cave Creek
RS = 25.528 Overshoot elevation of 1505.77 was surveyed
.015
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
Crit WS F-Plain
WS WS F-Way
Crit WS F-Way
Ground
Bank Sta
Encroachment

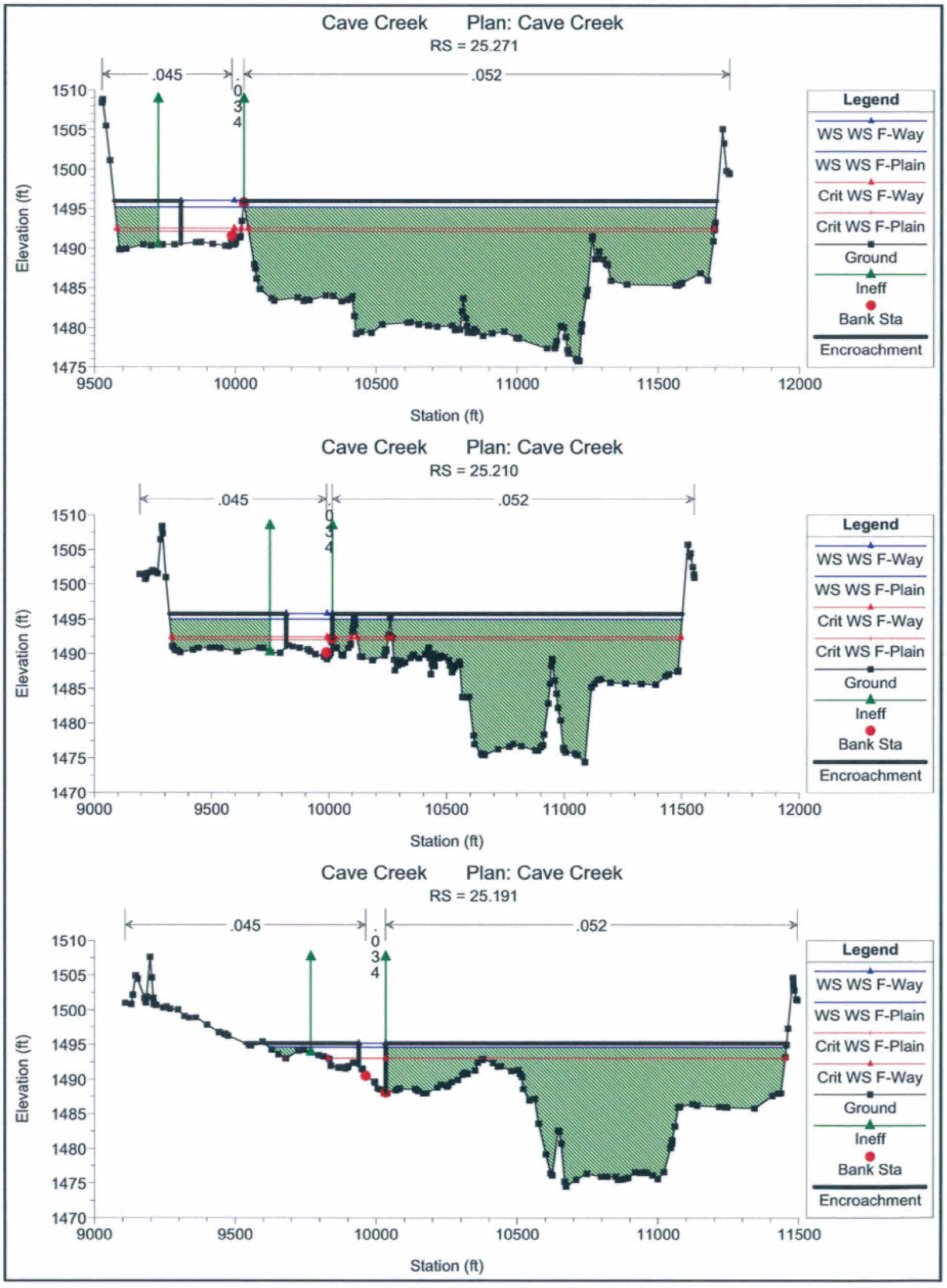

Cave Creek Plan: Cave Creek
RS = 25.515
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Ineff
Bank Sta
Encroachment

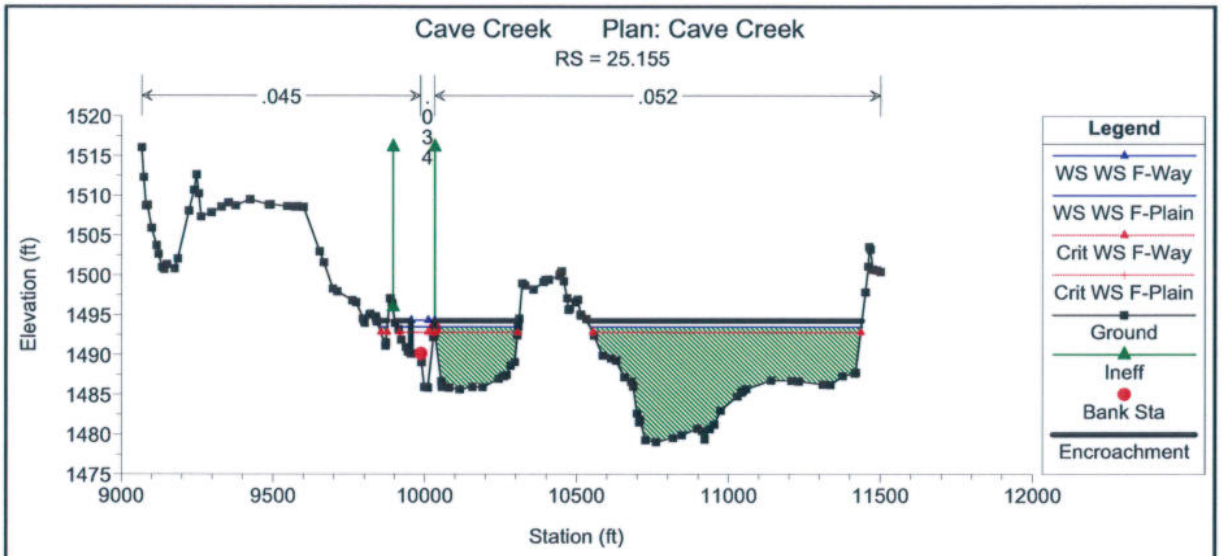

Cave Creek Plan: Cave Creek
RS = 25.482
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Ineff
Bank Sta
Encroachment

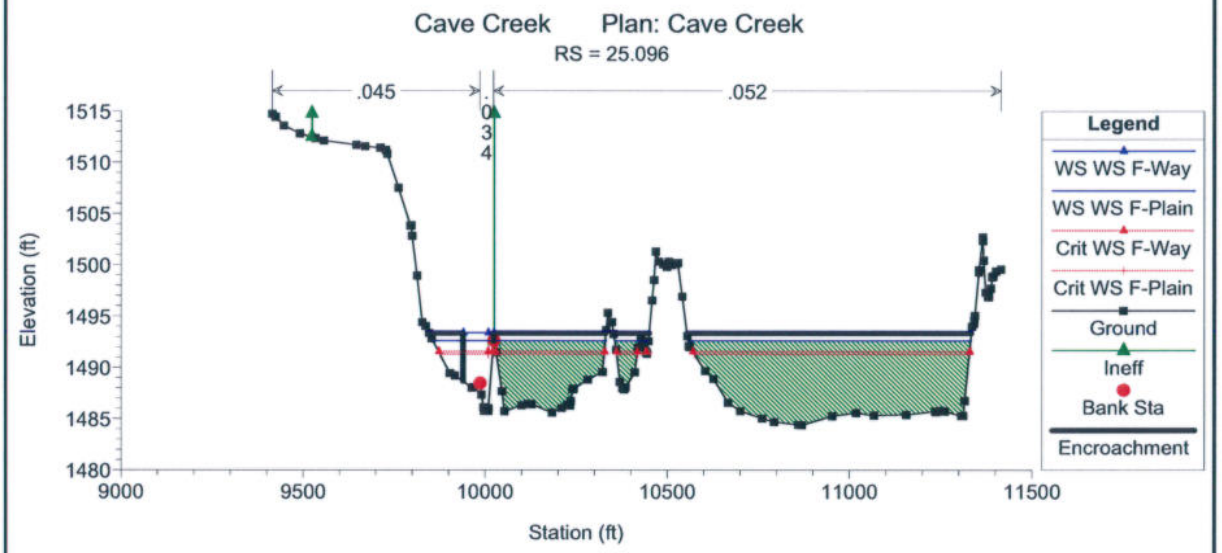

Cave Creek Plan: Cave Creek
RS = 25.428
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Ineff
Bank Sta
Encroachment

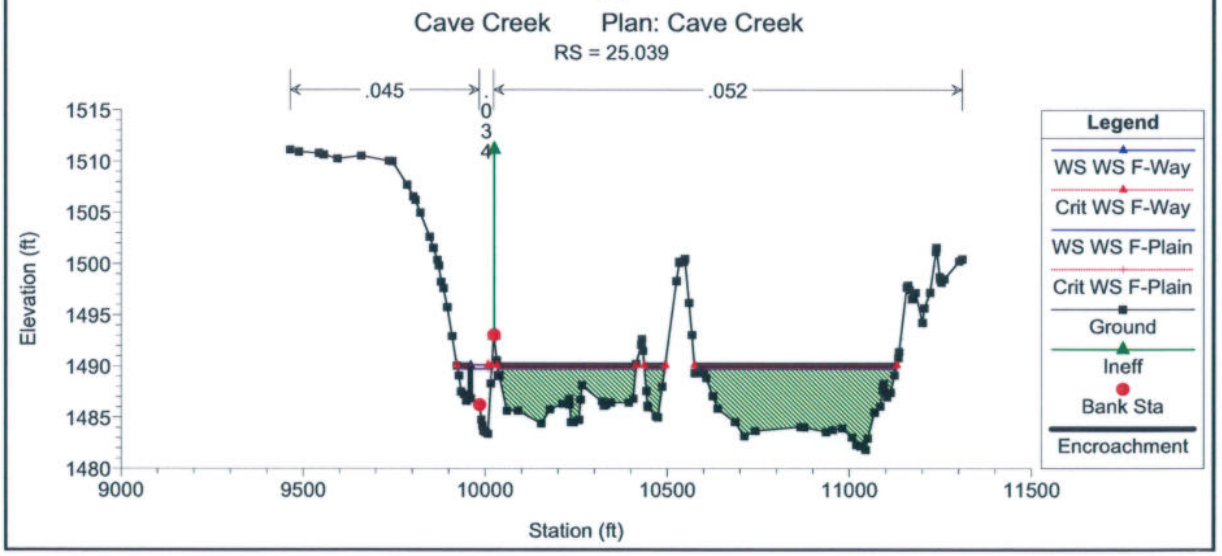

Cave Creek Plan: Cave Creek
RS = 25.367
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

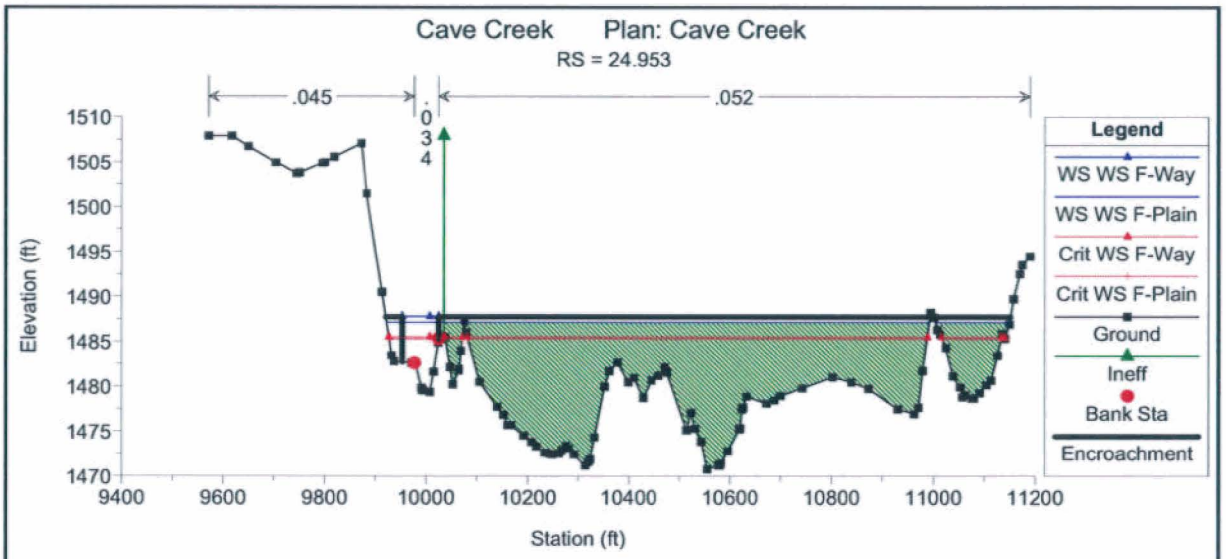

Cave Creek Plan: Cave Creek
RS = 25.299
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

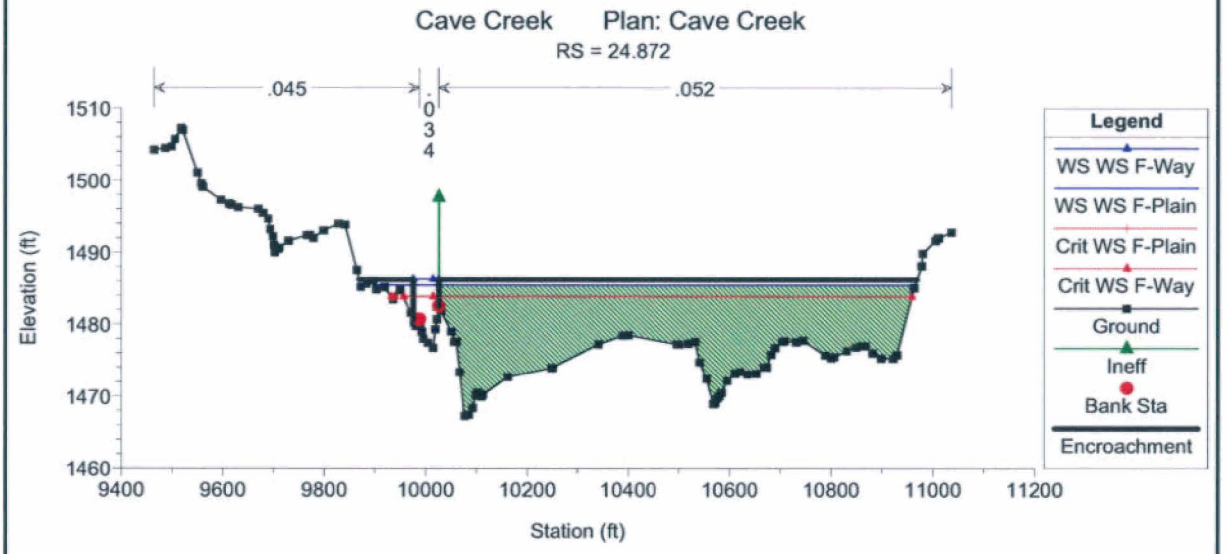

Cave Creek Plan: Cave Creek
RS = 25.271
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment
Cave Creek Plan: Cave Creek
RS = 25.210
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment
Cave Creek Plan: Cave Creek
RS = 25.191
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Ineff
Bank Sta
Encroachment

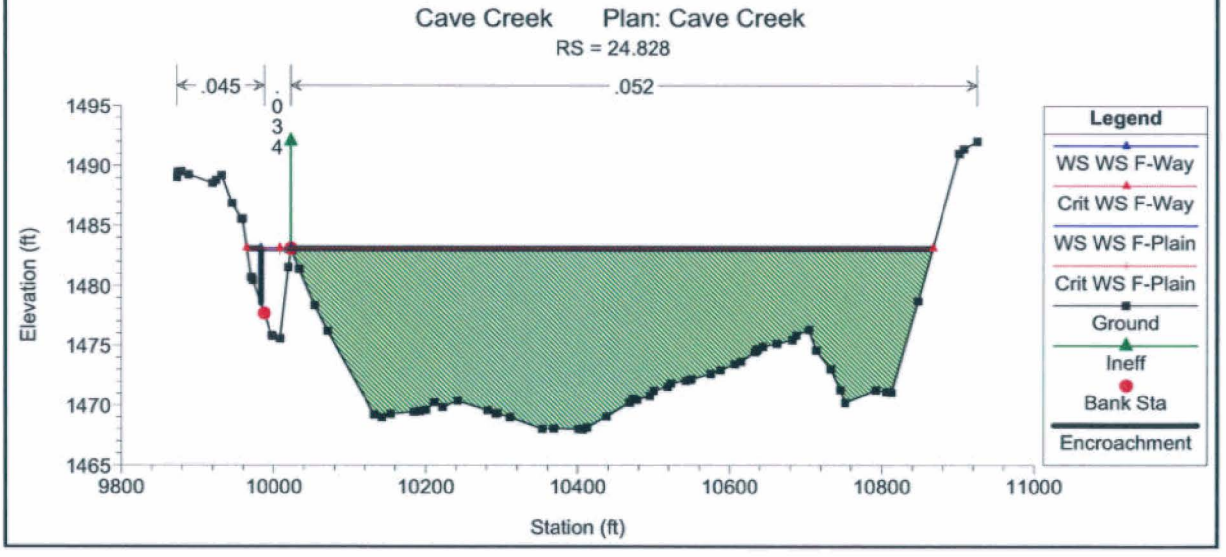

Cave Creek Plan: Cave Creek
RS = 25.155
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

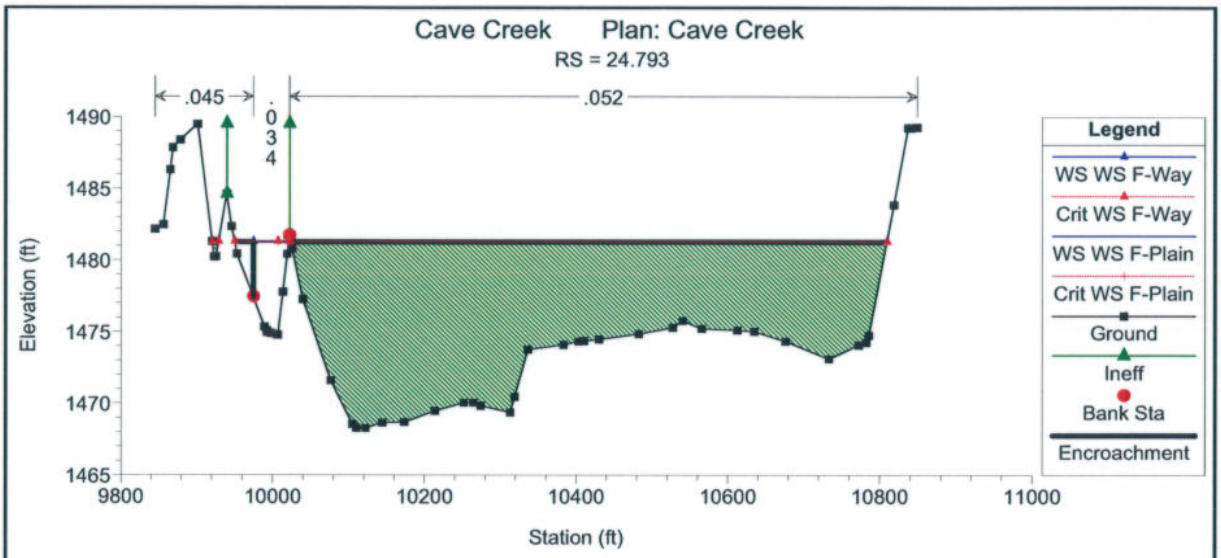

Cave Creek Plan: Cave Creek
RS = 25.096
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

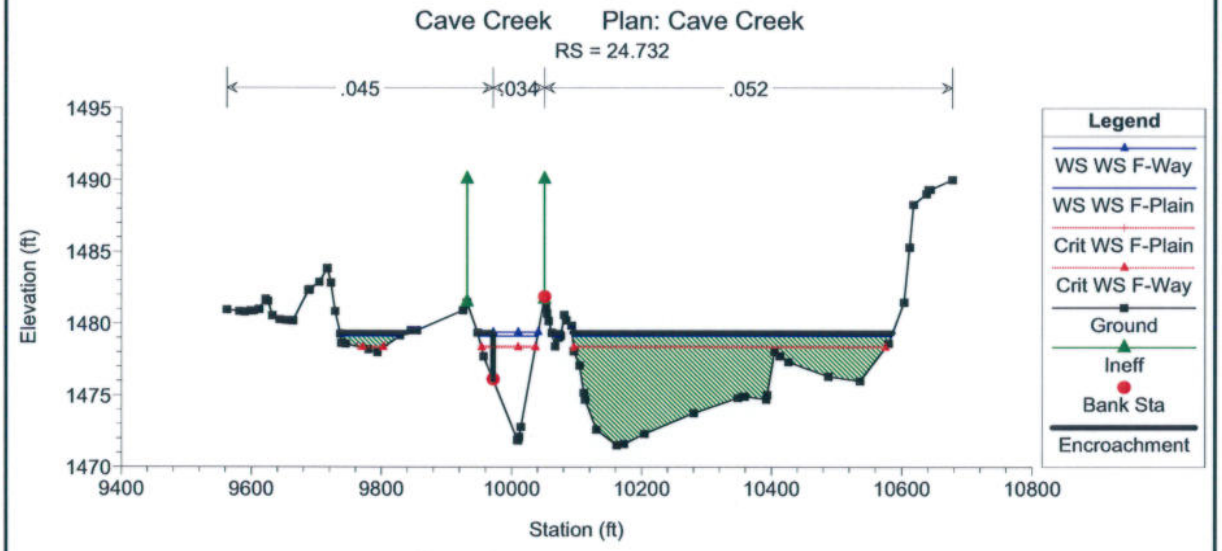

Cave Creek Plan: Cave Creek
RS = 25.039
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

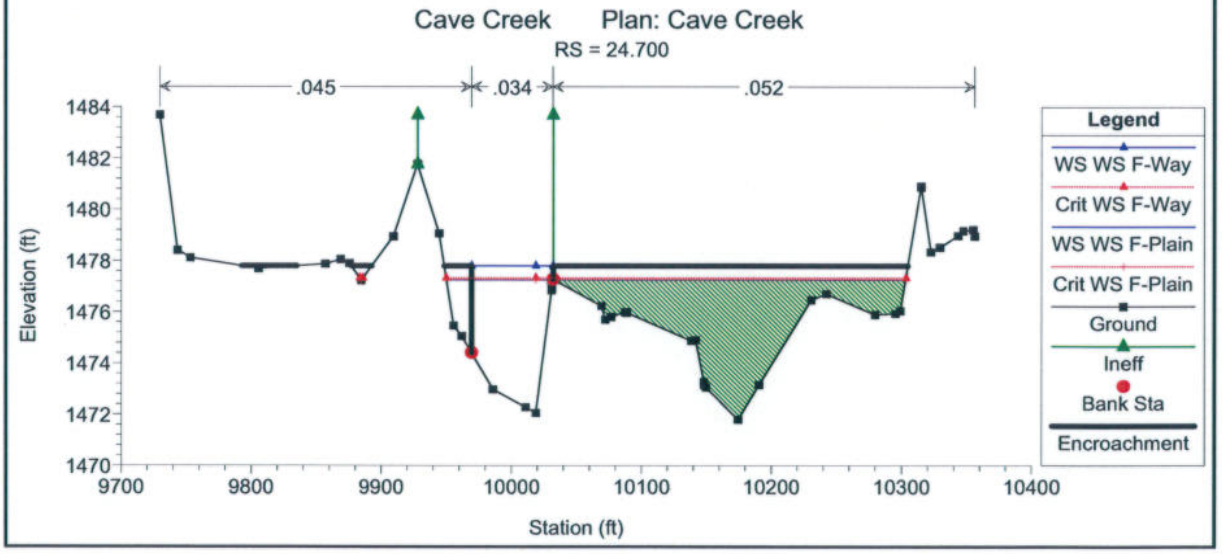

Cave Creek Plan: Cave Creek
RS = 24.953
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

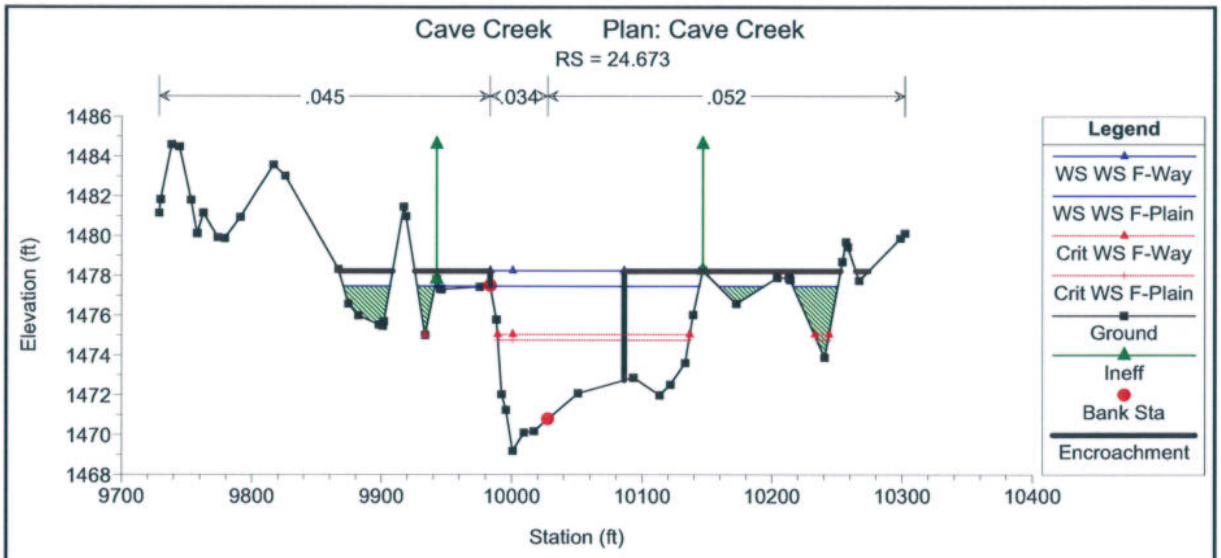

Cave Creek Plan: Cave Creek
RS = 24.872
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Ineff
Bank Sta
Encroachment

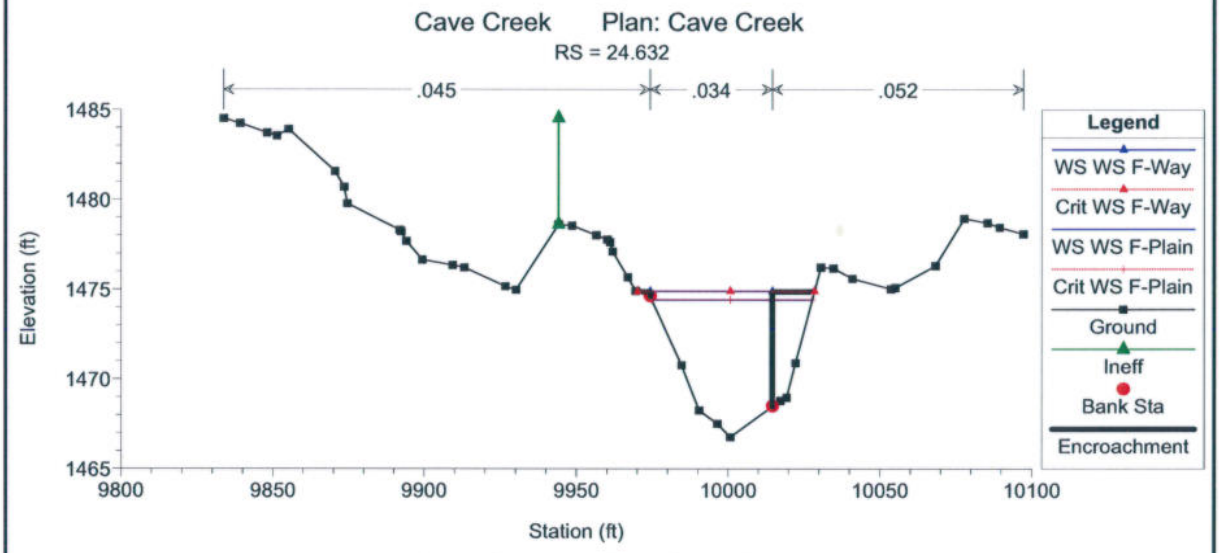

Cave Creek Plan: Cave Creek
RS = 24.828
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

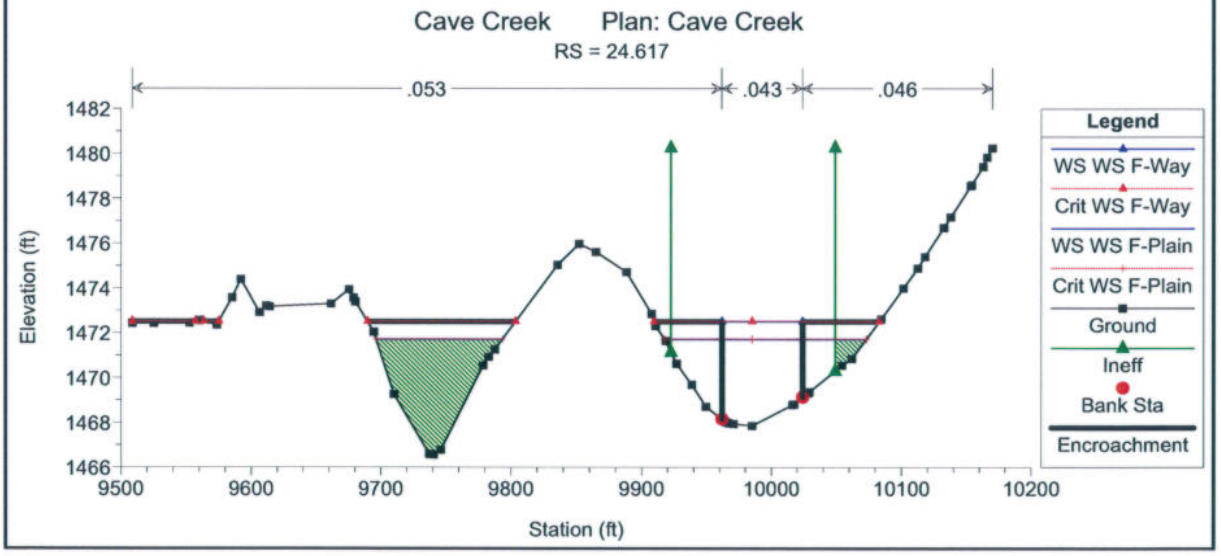

Cave Creek Plan: Cave Creek
RS = 24.793
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

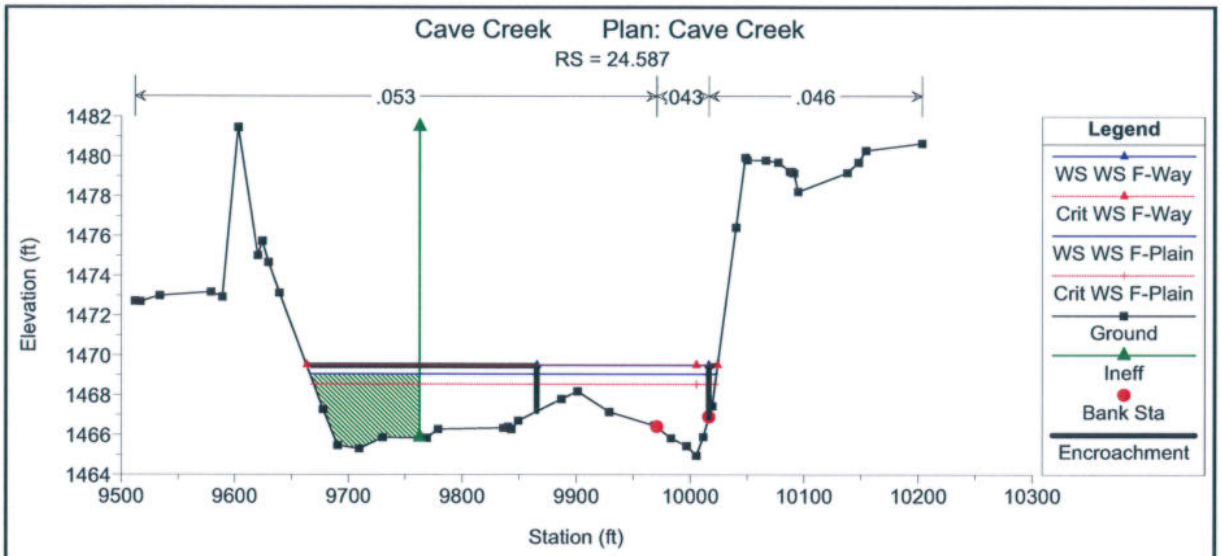

Cave Creek Plan: Cave Creek
RS = 24.732
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Ineff
Bank Sta
Encroachment

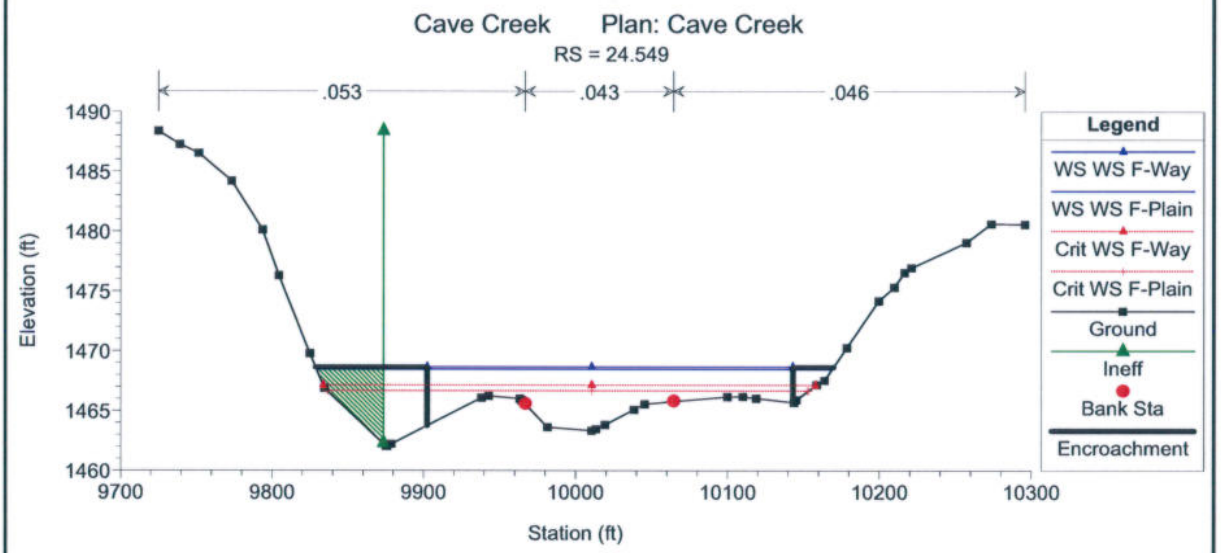

Cave Creek Plan: Cave Creek
RS = 24.700
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

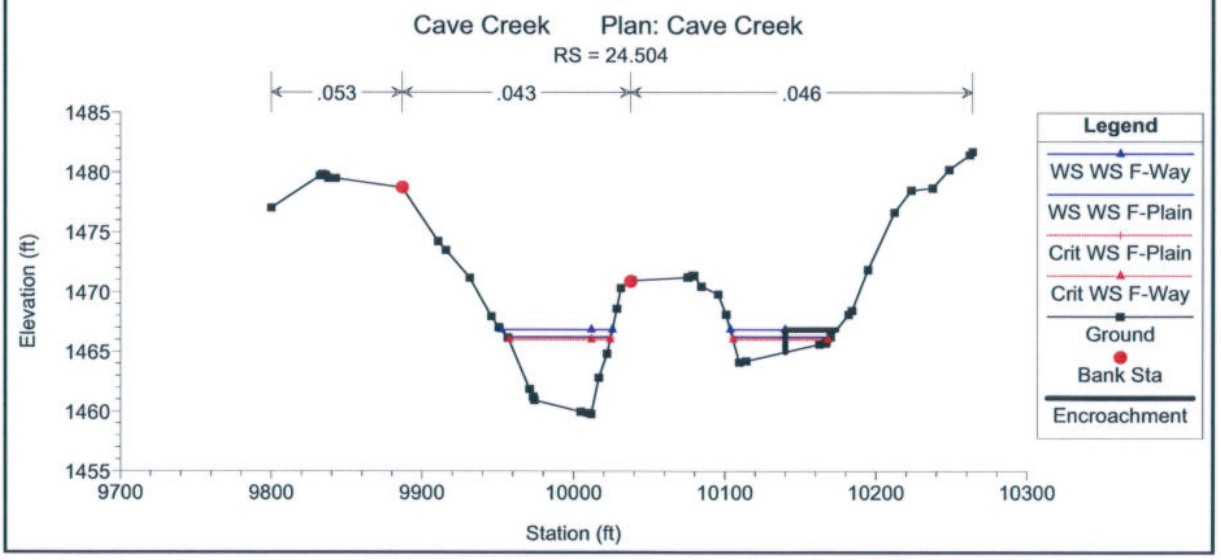

Cave Creek Plan: Cave Creek
RS = 24.673
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

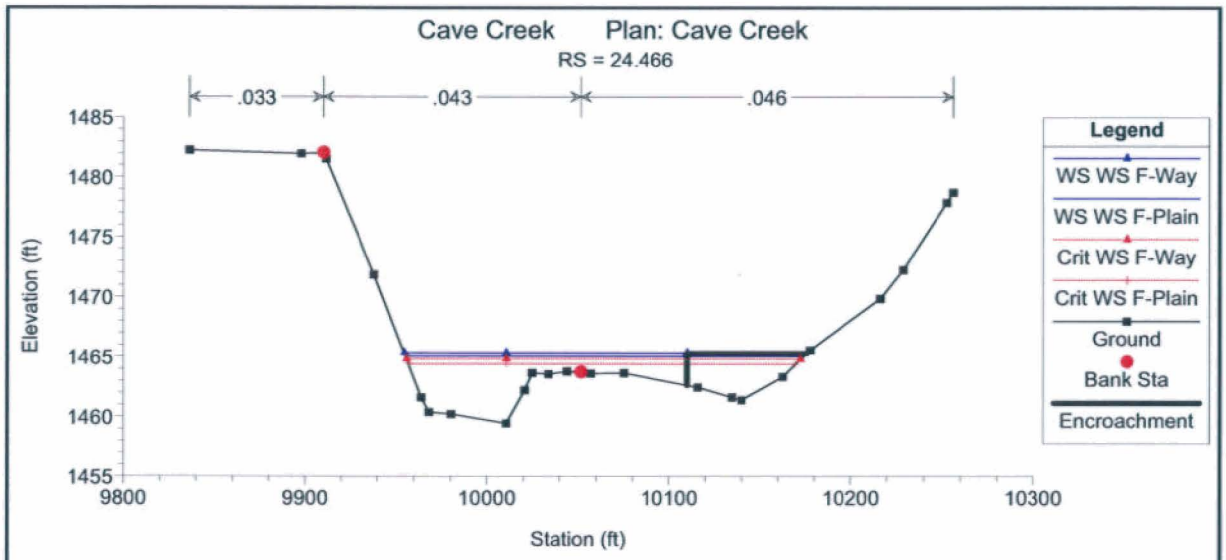

Cave Creek Plan: Cave Creek
RS = 24.632
.045
.034
.052
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

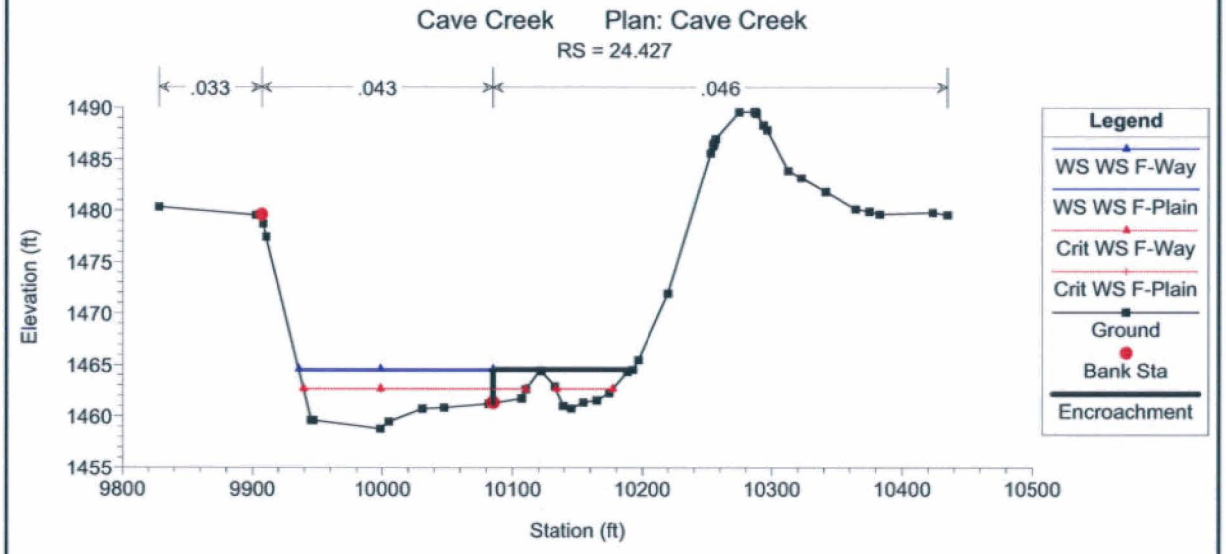

Cave Creek Plan: Cave Creek
RS = 24.617
.053
.043
.046
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

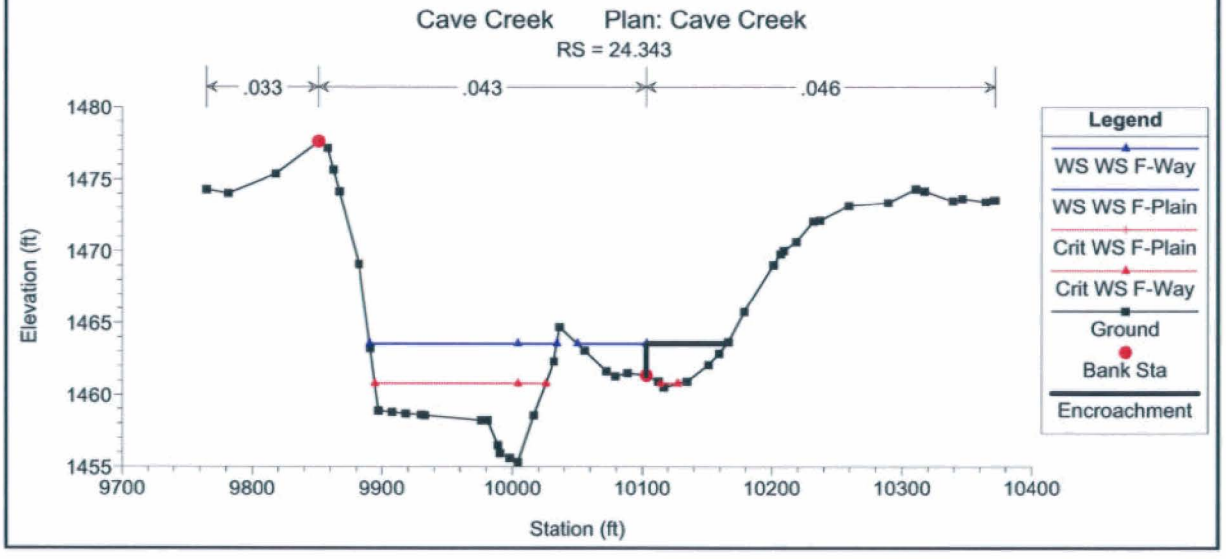

Cave Creek Plan: Cave Creek
RS = 24.587
.053
.043
.046
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

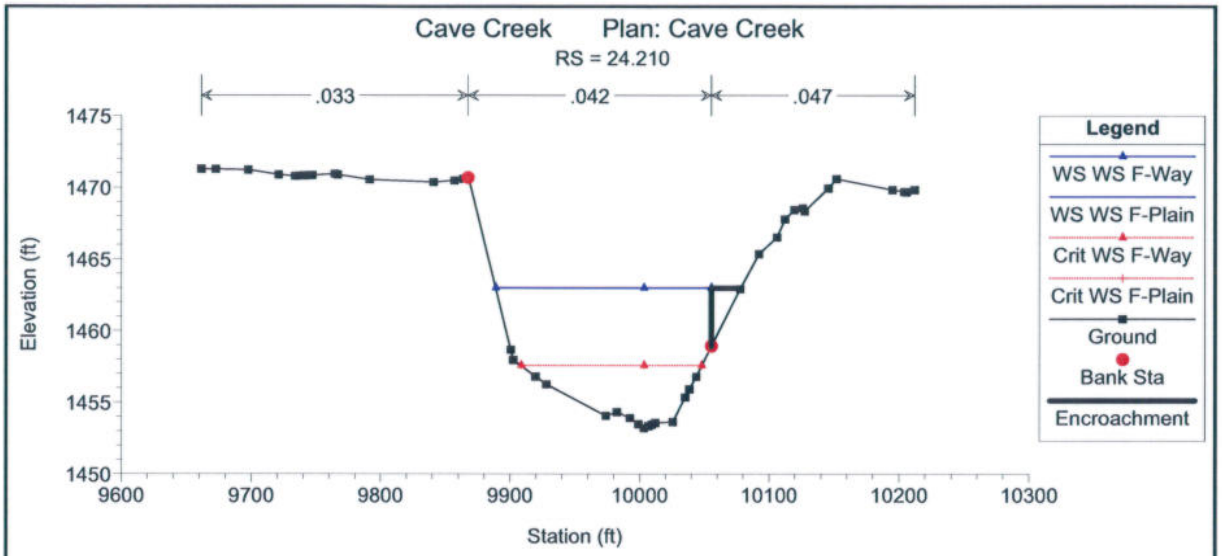

Cave Creek Plan: Cave Creek
RS = 24.549
.053
.043
.046
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

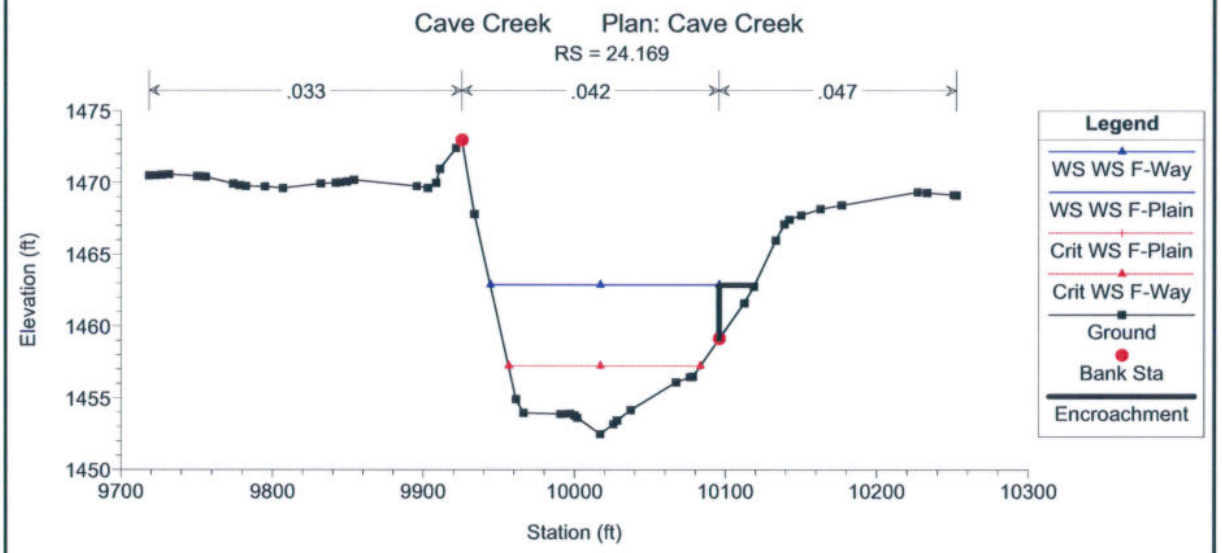

Cave Creek Plan: Cave Creek
RS = 24.504
.053
.043
.046
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta
Encroachment

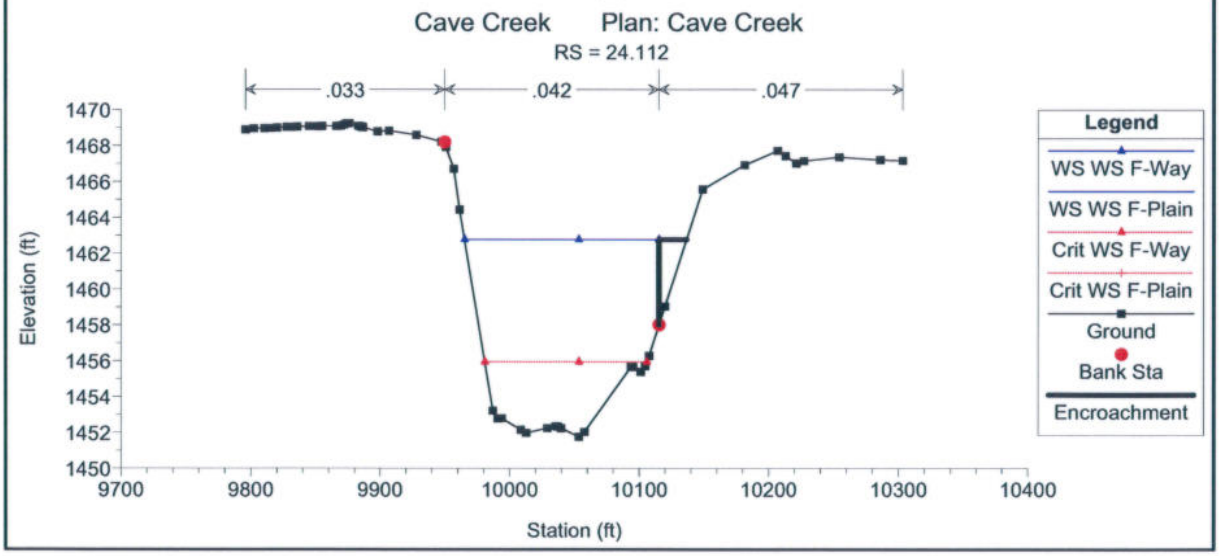

Cave Creek Plan: Cave Creek
RS = 24.466
.033
.043
.046
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Encroachment

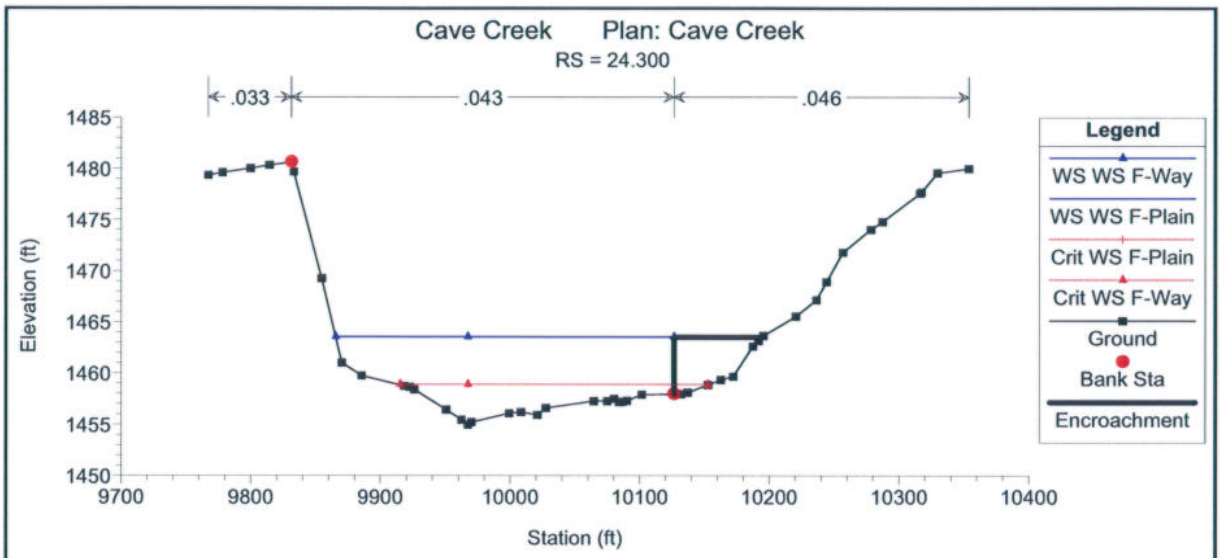

Cave Creek Plan: Cave Creek
RS = 24.427
.033
.043
.046
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Encroachment

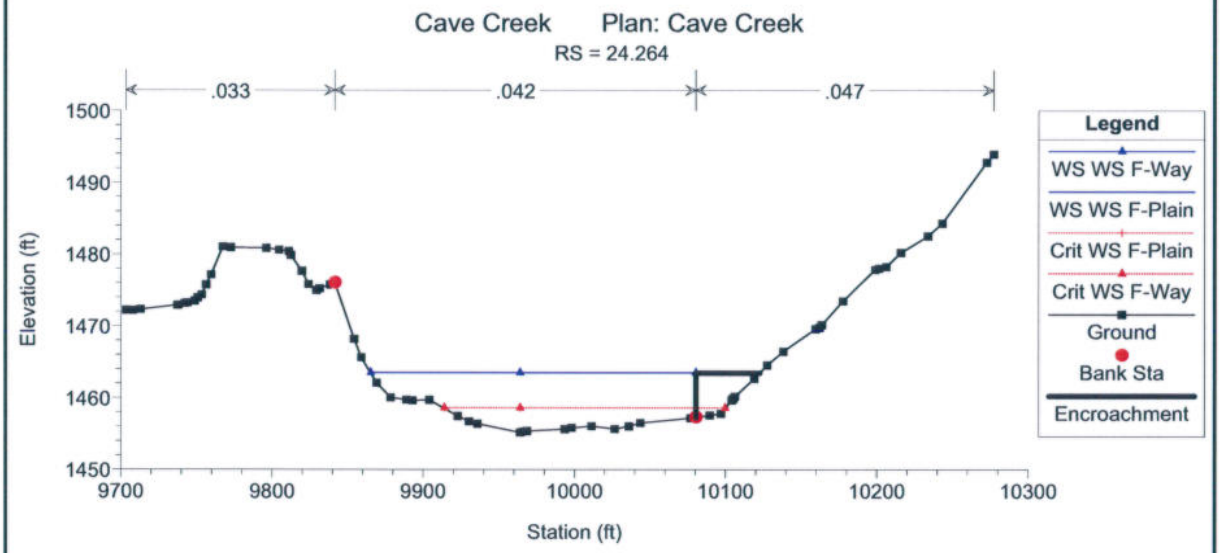

Cave Creek Plan: Cave Creek
RS = 24.343
.033
.043
.046
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta
Encroachment

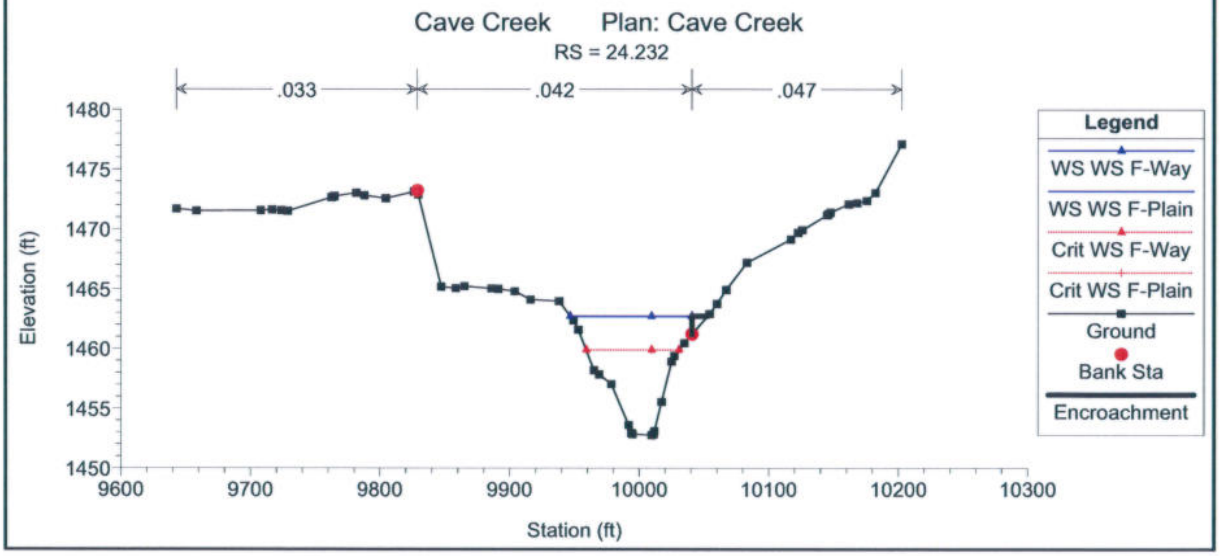

Cave Creek Plan: Cave Creek
RS = 24.210
.033
.042
.047
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Encroachment

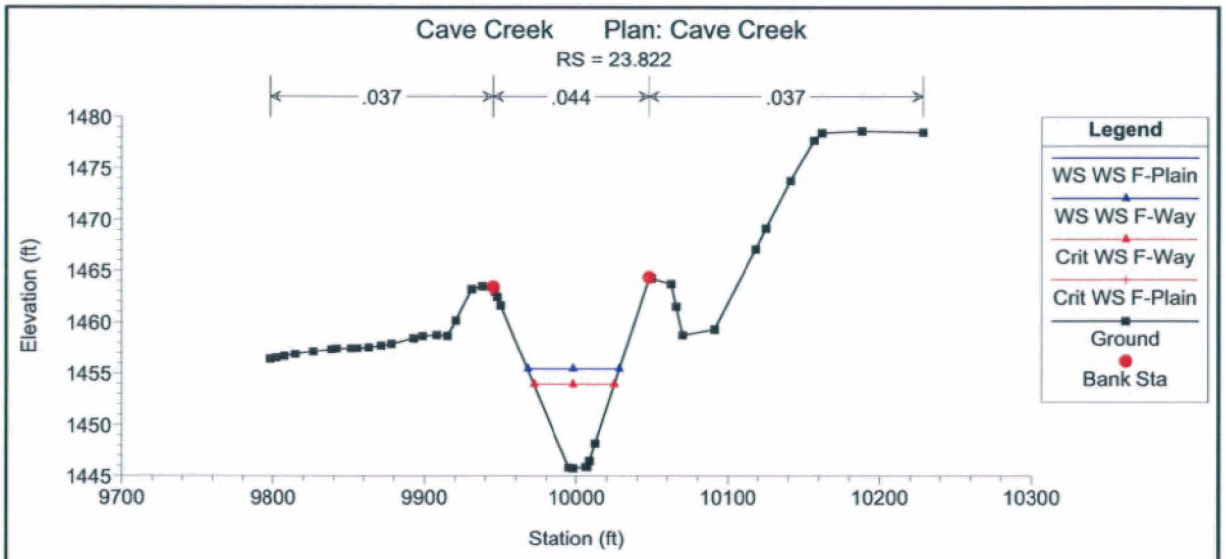

Cave Creek Plan: Cave Creek
RS = 24.169
.033
.042
.047
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta
Encroachment

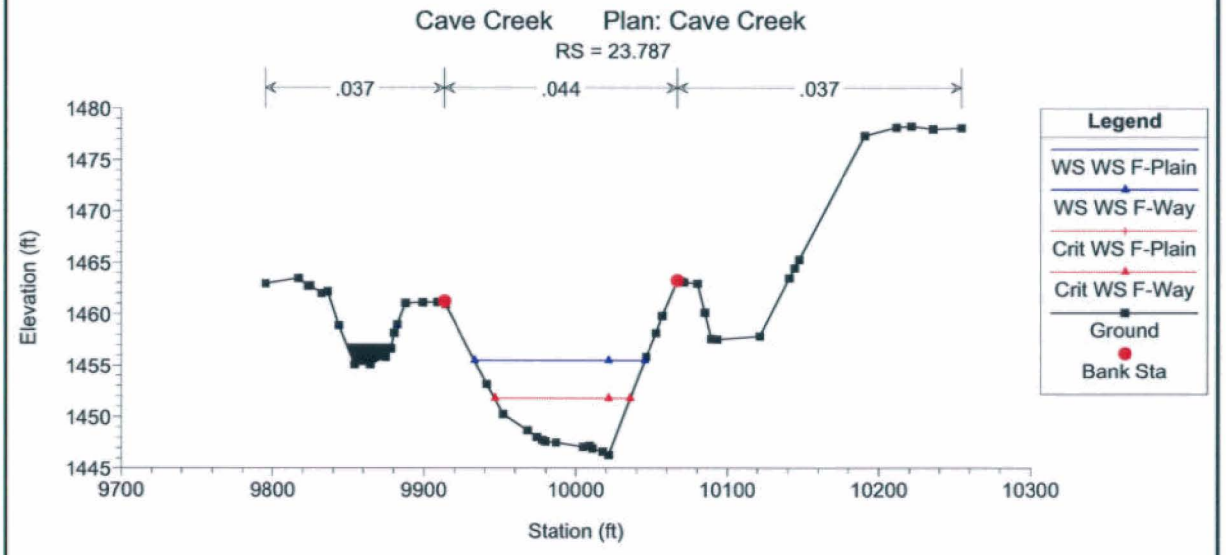

Cave Creek Plan: Cave Creek
RS = 24.112
.033
.042
.047
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Encroachment

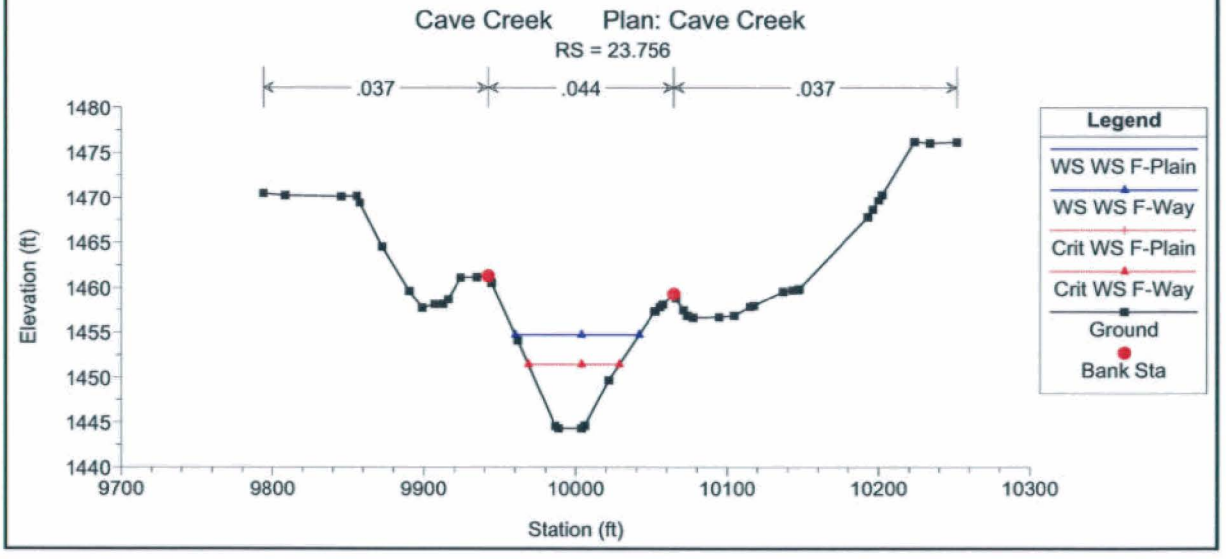

Cave Creek Plan: Cave Creek
RS = 24.300
.033
.043
.046
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta
Encroachment

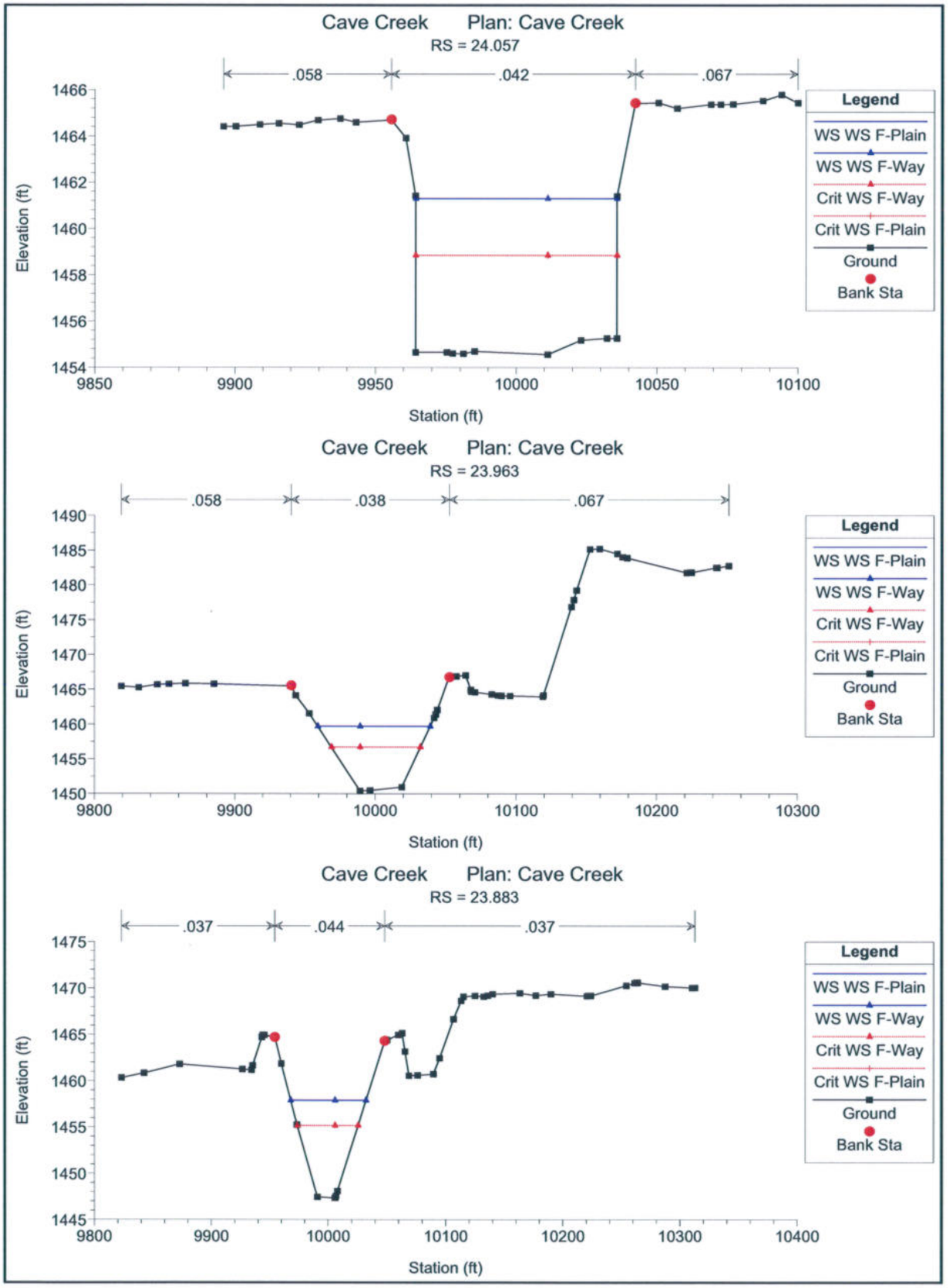

Cave Creek Plan: Cave Creek
RS = 24.264
.033
.042
.047
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta
Encroachment

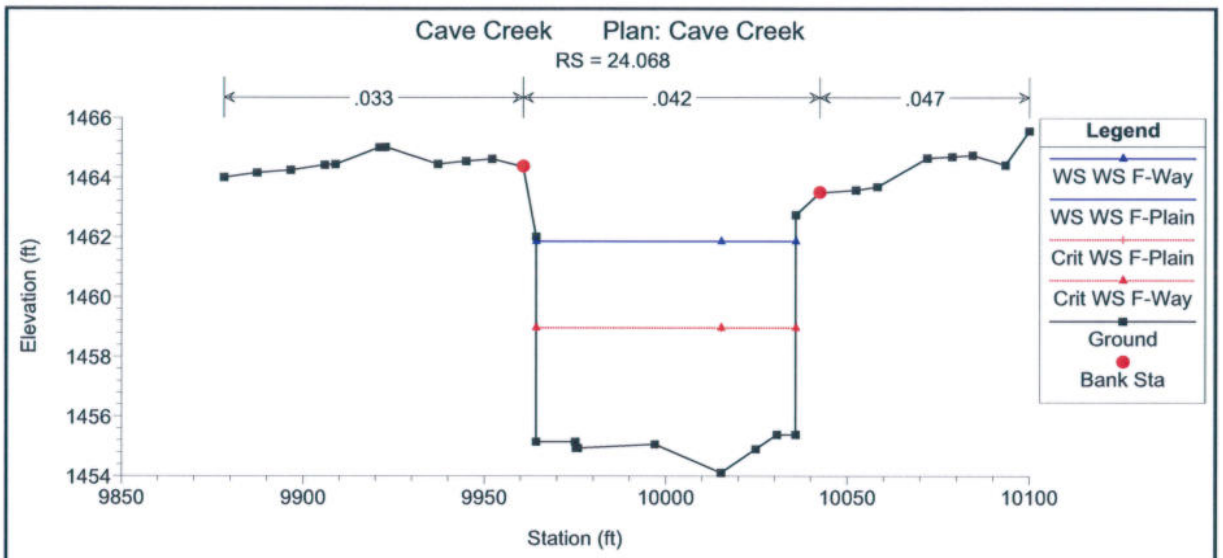

Cave Creek Plan: Cave Creek
RS = 24.232
.033
.042
.047
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Encroachment

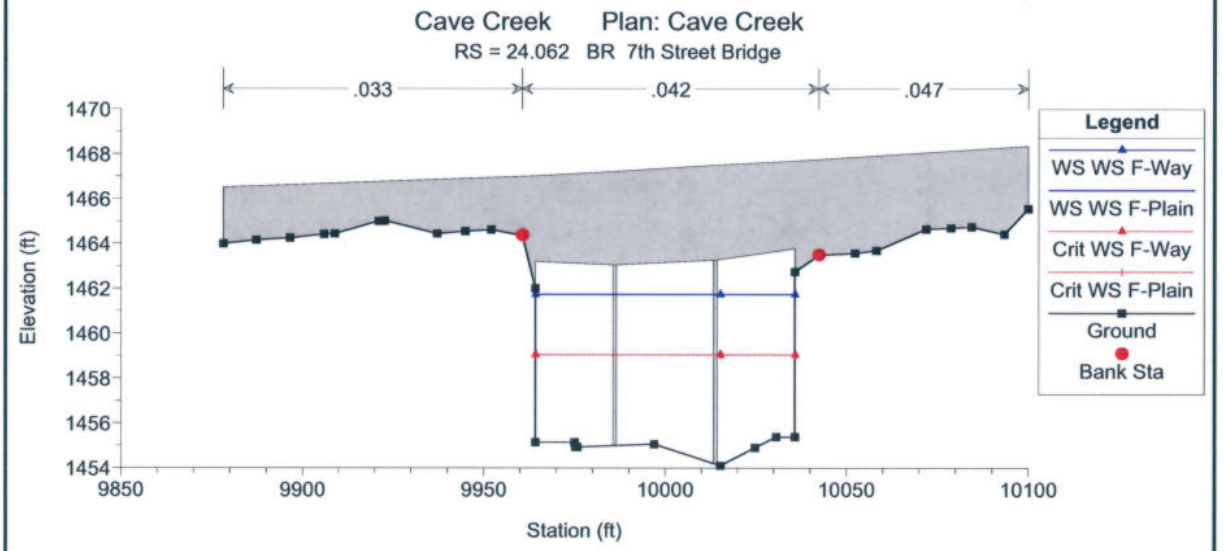

Cave Creek Plan: Cave Creek
RS = 23.822
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta

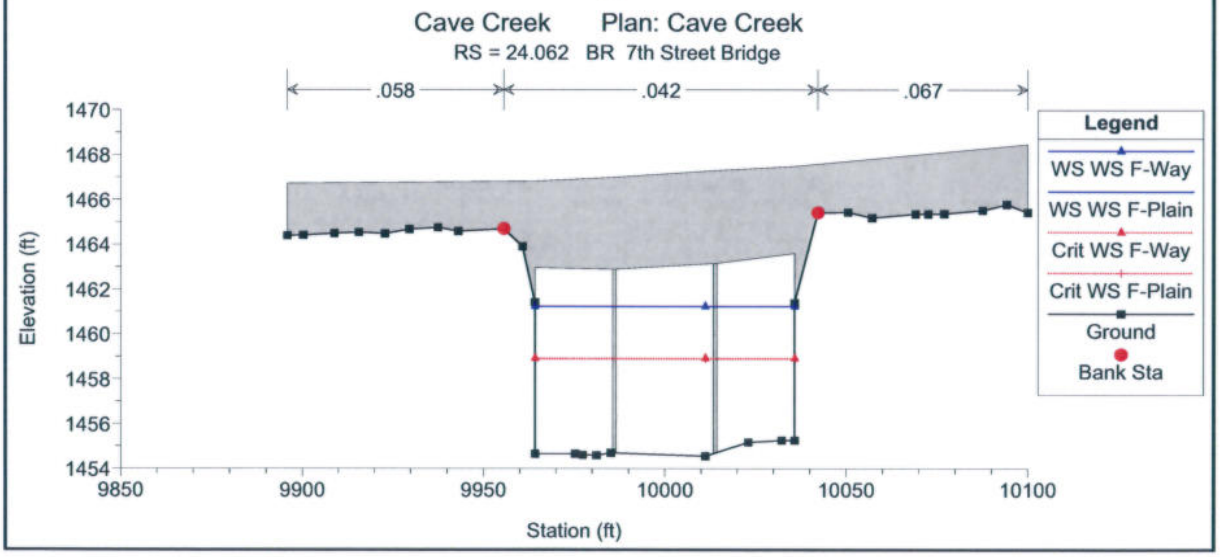

Cave Creek Plan: Cave Creek
RS = 23.787
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

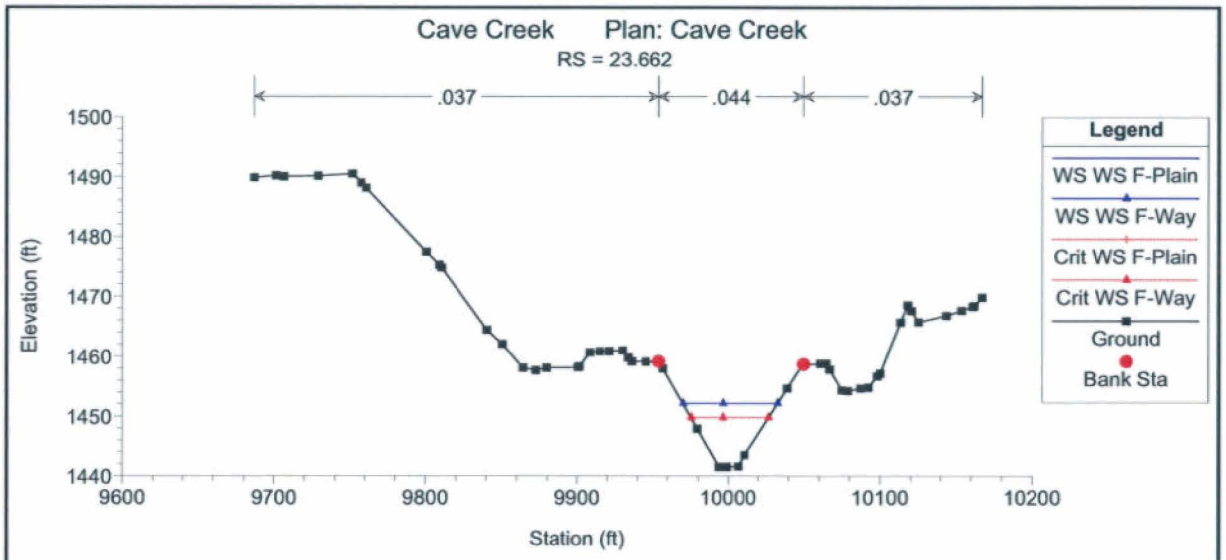

Cave Creek Plan: Cave Creek
RS = 23.756
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

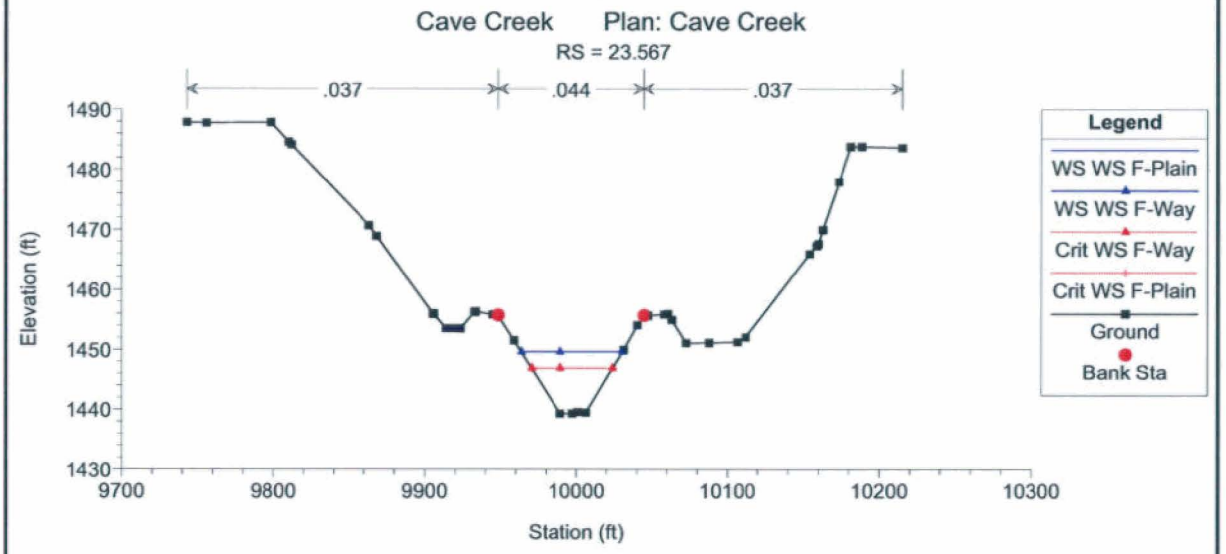

Cave Creek Plan: Cave Creek
RS = 24.057
.058
.042
.067
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Cave Creek Plan: Cave Creek
RS = 23.963
.058
.038
.067
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Cave Creek Plan: Cave Creek
RS = 23.883
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta

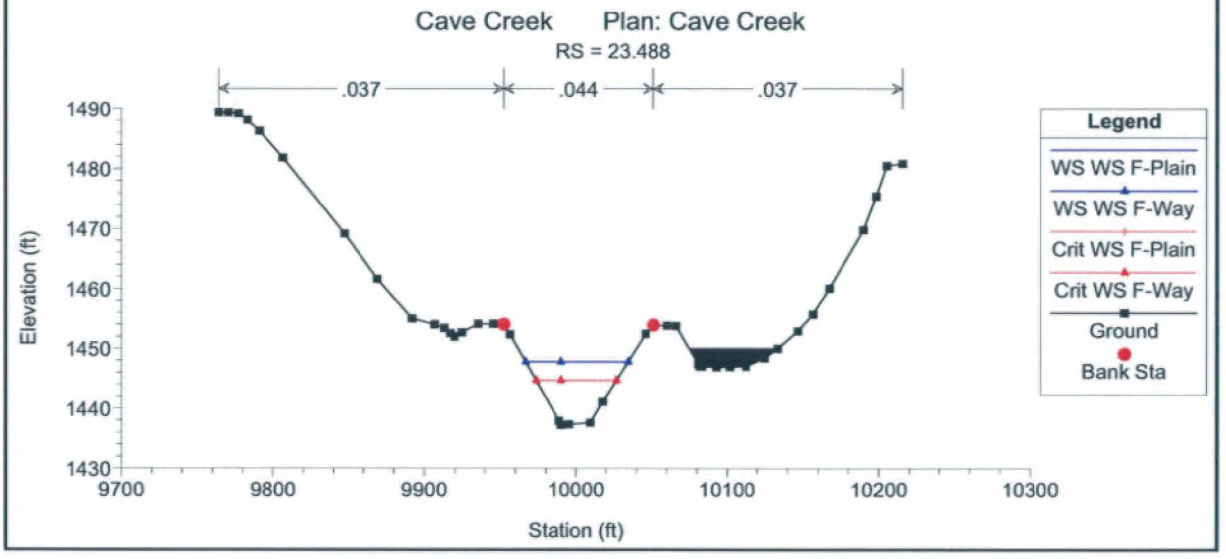

Cave Creek Plan: Cave Creek
RS = 24.068
.033
.042
.047
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

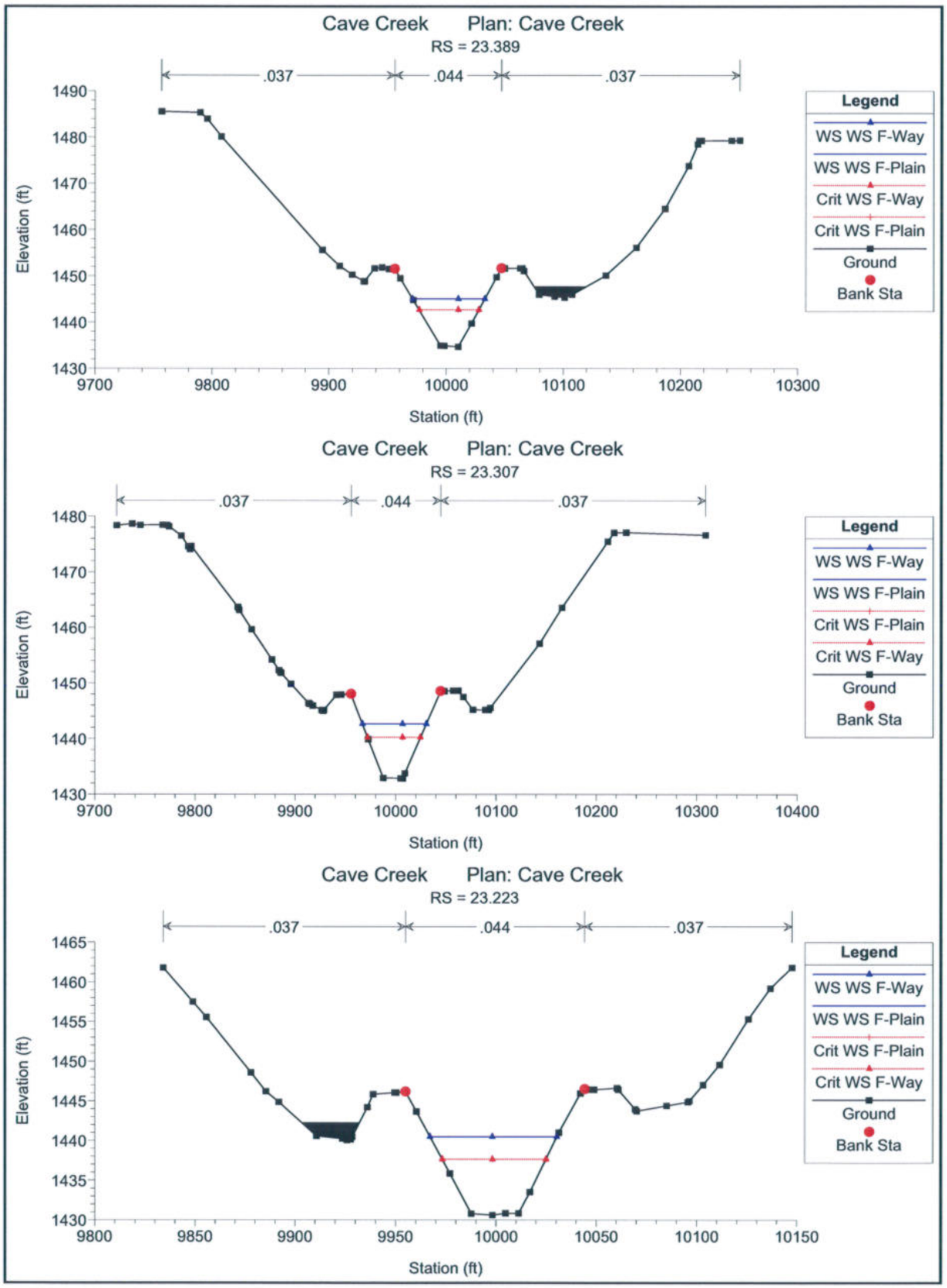

Cave Creek Plan: Cave Creek
RS = 24.062 BR 7th Street Bridge
.033
.042
.047
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta

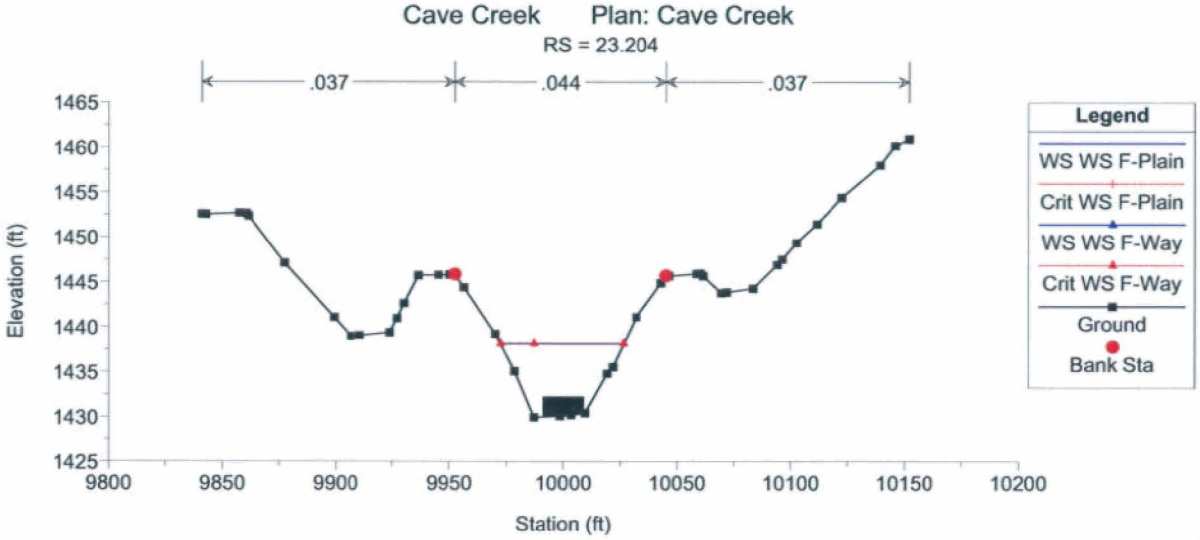

Cave Creek Plan: Cave Creek
RS = 24.062 BR 7th Street Bridge
.058
.042
.067
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta

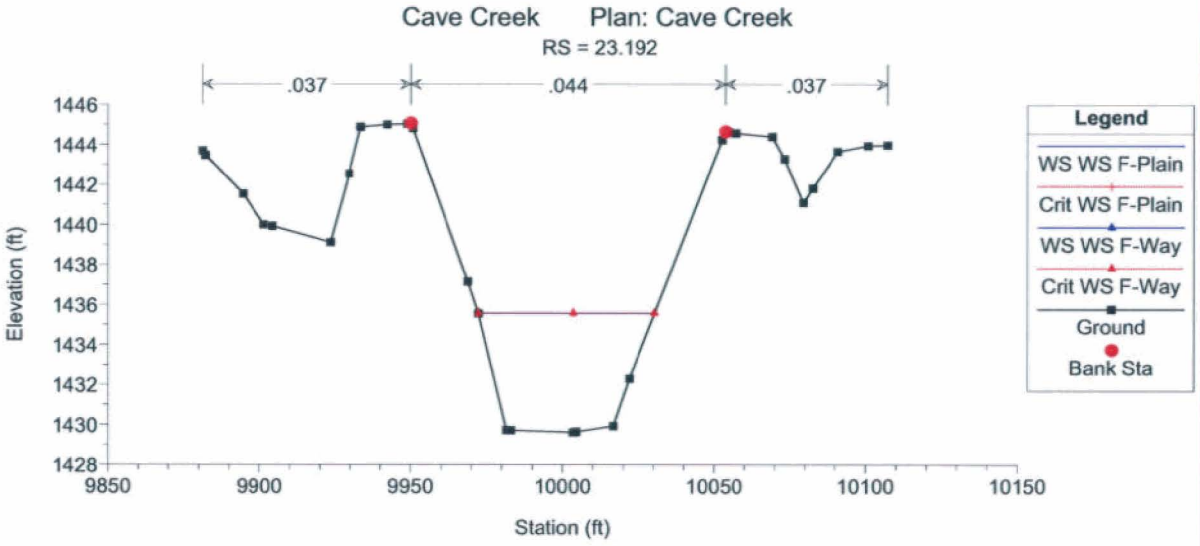

Cave Creek Plan: Cave Creek
RS = 23.662
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

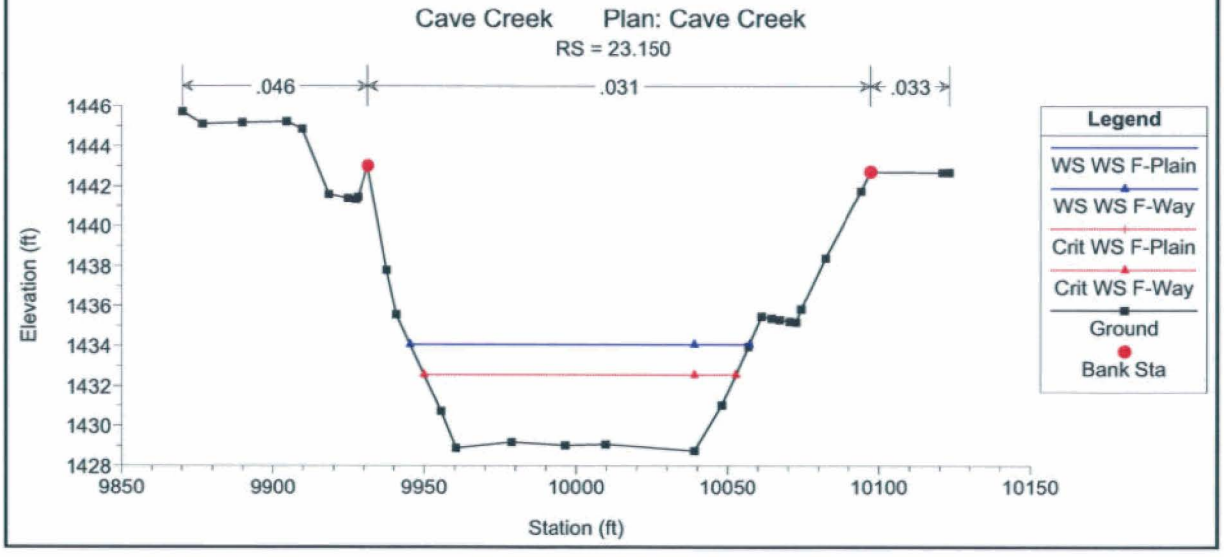

Cave Creek Plan: Cave Creek
RS = 23.567
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta

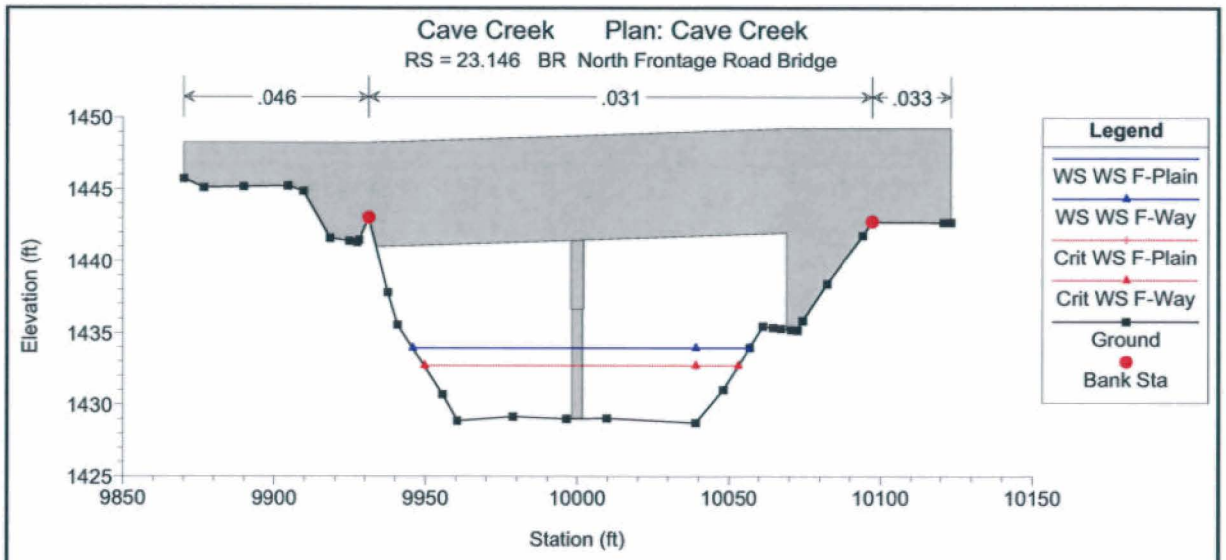

Cave Creek Plan: Cave Creek
RS = 23.488
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

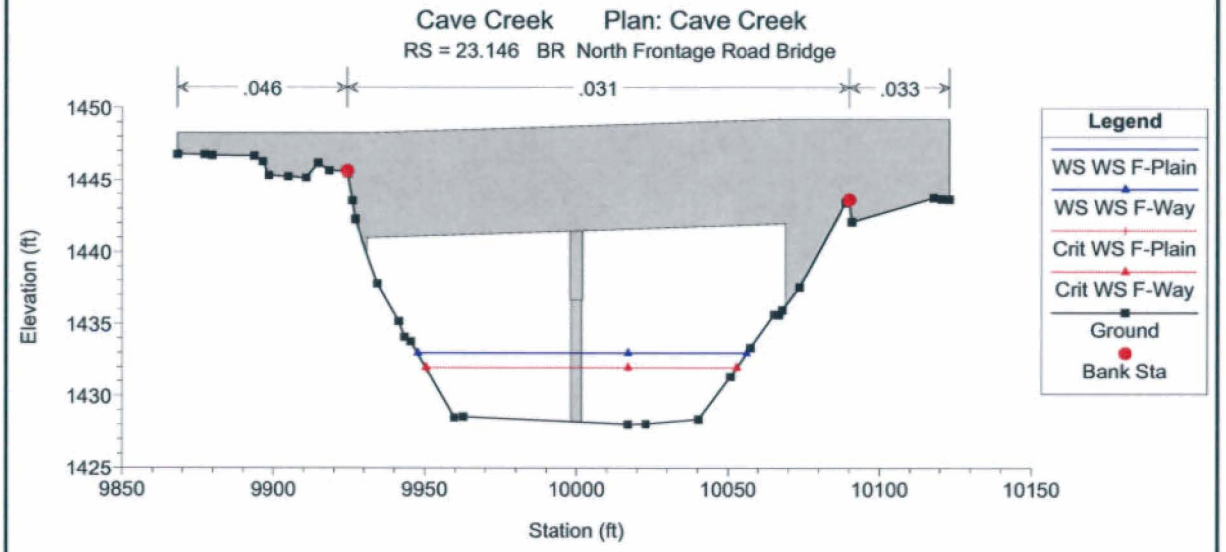

Cave Creek Plan: Cave Creek
RS = 23.389
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Cave Creek Plan: Cave Creek
RS = 23.307
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta
Cave Creek Plan: Cave Creek
RS = 23.223
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

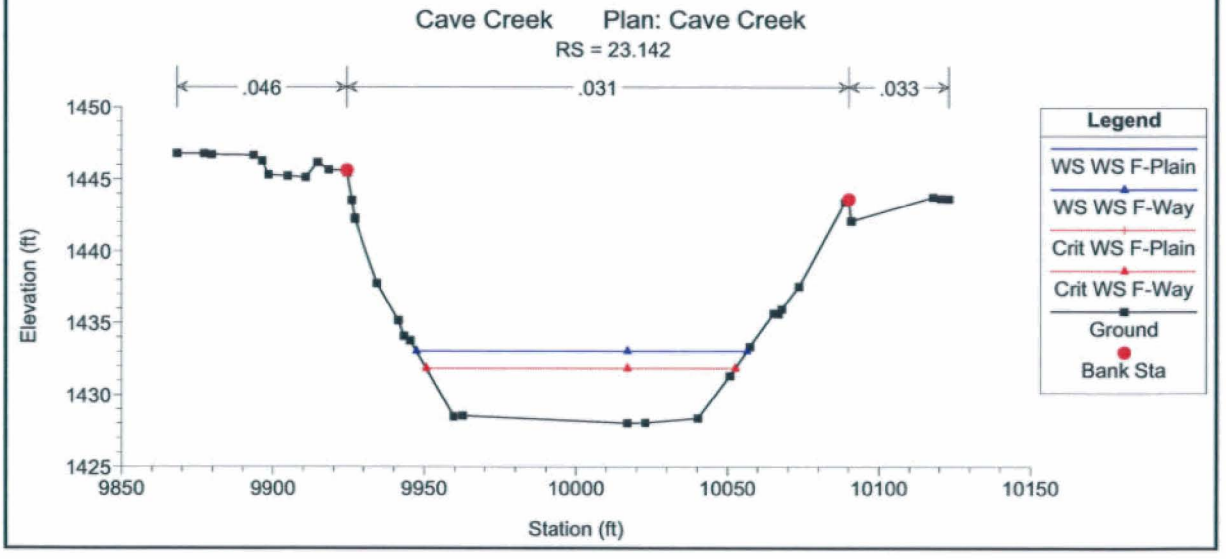

Cave Creek Plan: Cave Creek
RS = 23.204
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
Crit WS F-Plain
WS WS F-Way
Crit WS F-Way
Ground
Bank Sta

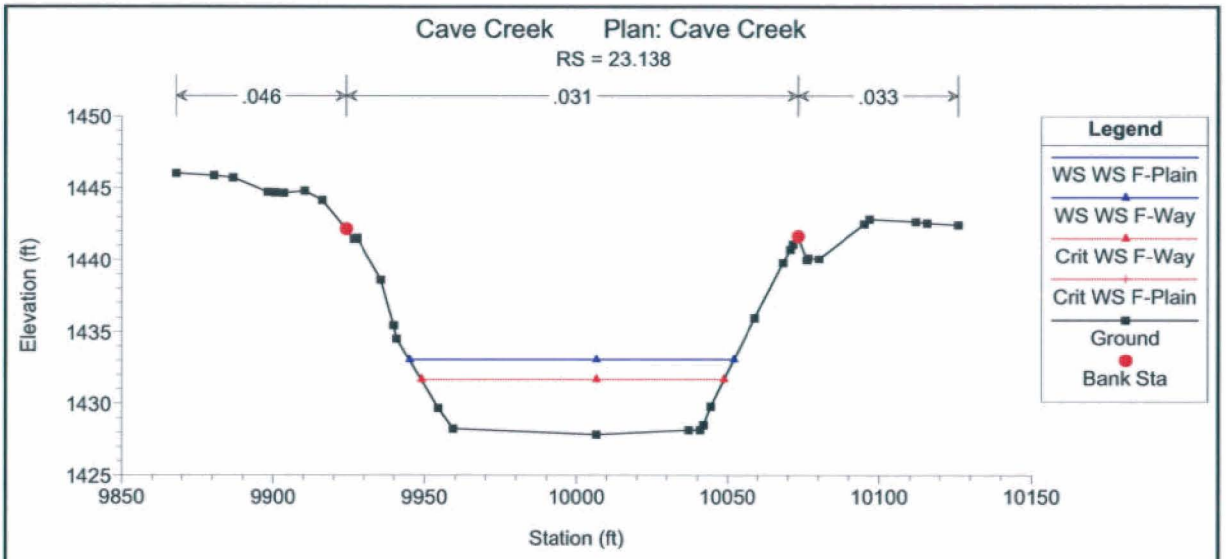

Cave Creek Plan: Cave Creek
RS = 23.192
.037
.044
.037
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
Crit WS F-Plain
WS WS F-Way
Crit WS F-Way
Ground
Bank Sta

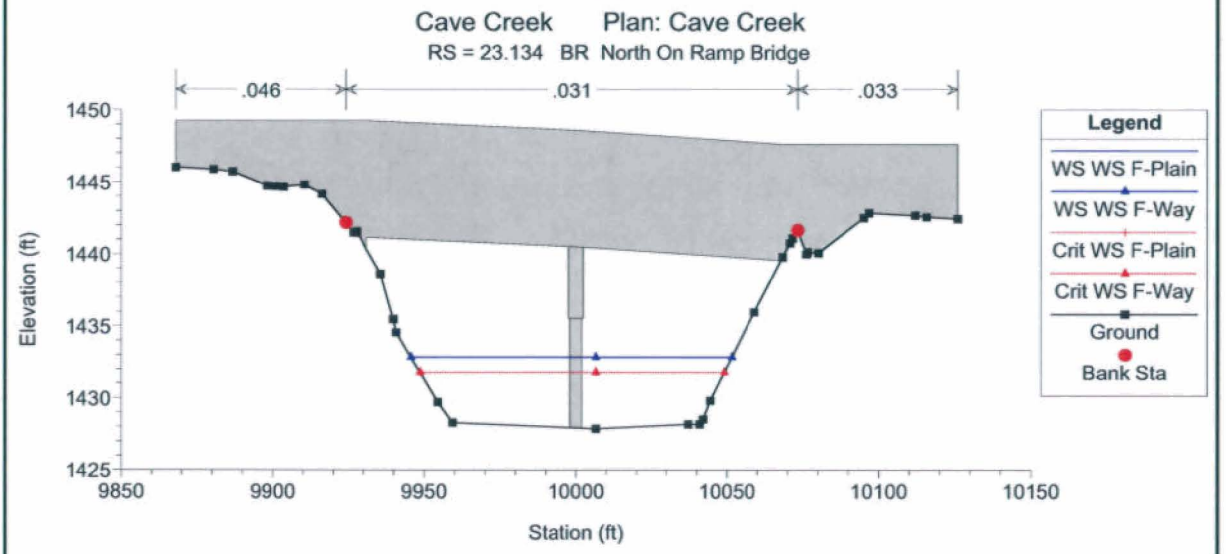

Cave Creek Plan: Cave Creek
RS = 23.150
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

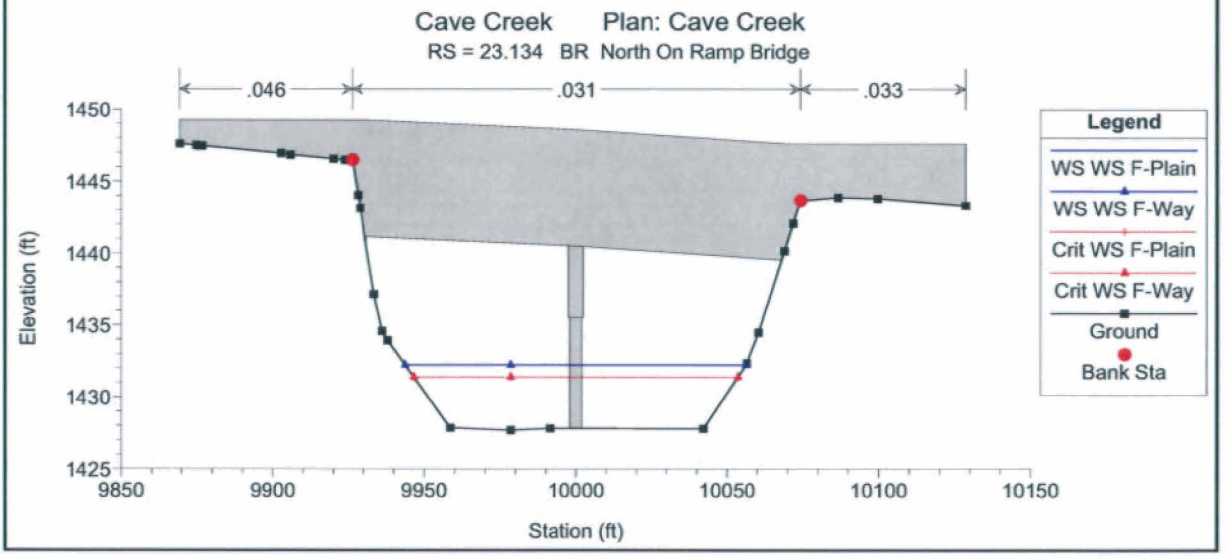

Cave Creek Plan: Cave Creek
RS = 23.146 BR North Frontage Road Bridge
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

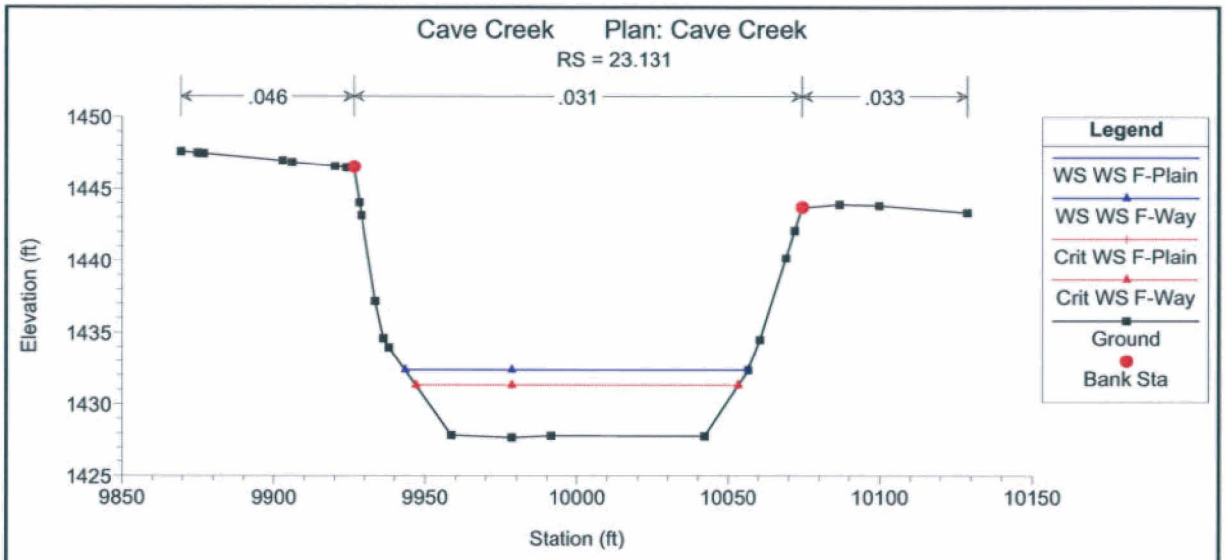

Cave Creek Plan: Cave Creek
RS = 23.146 BR North Frontage Road Bridge
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

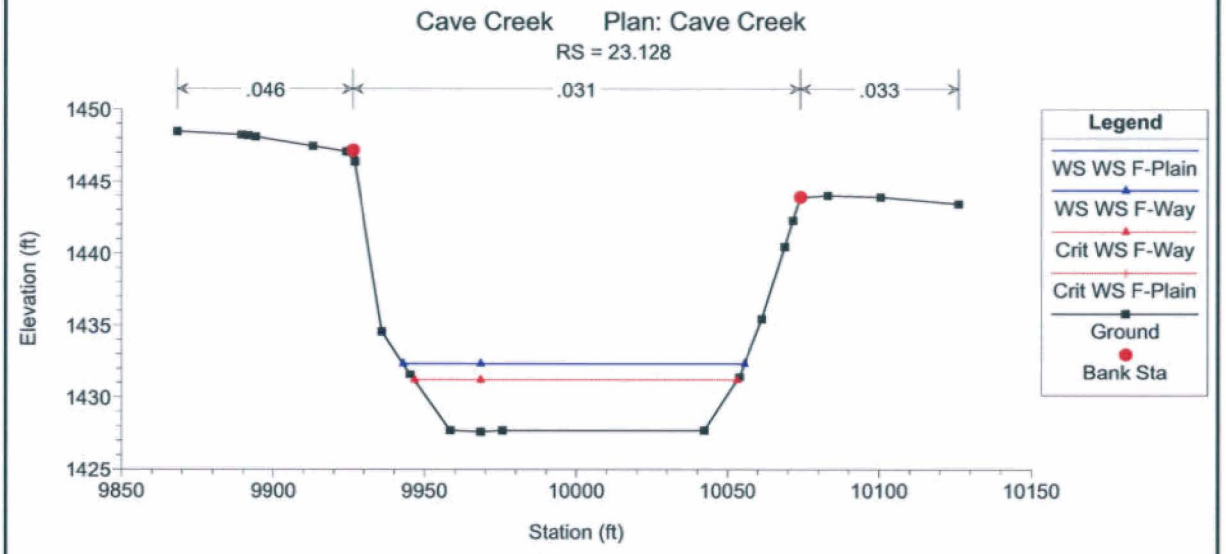

Cave Creek Plan: Cave Creek
RS = 23.142
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

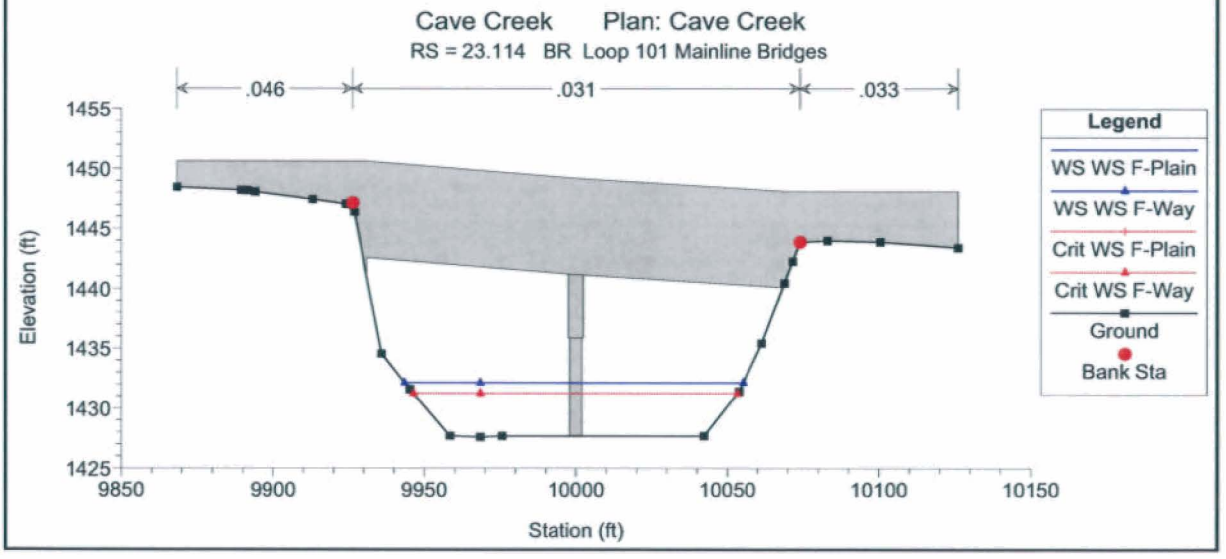

Cave Creek Plan: Cave Creek
RS = 23.138
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta

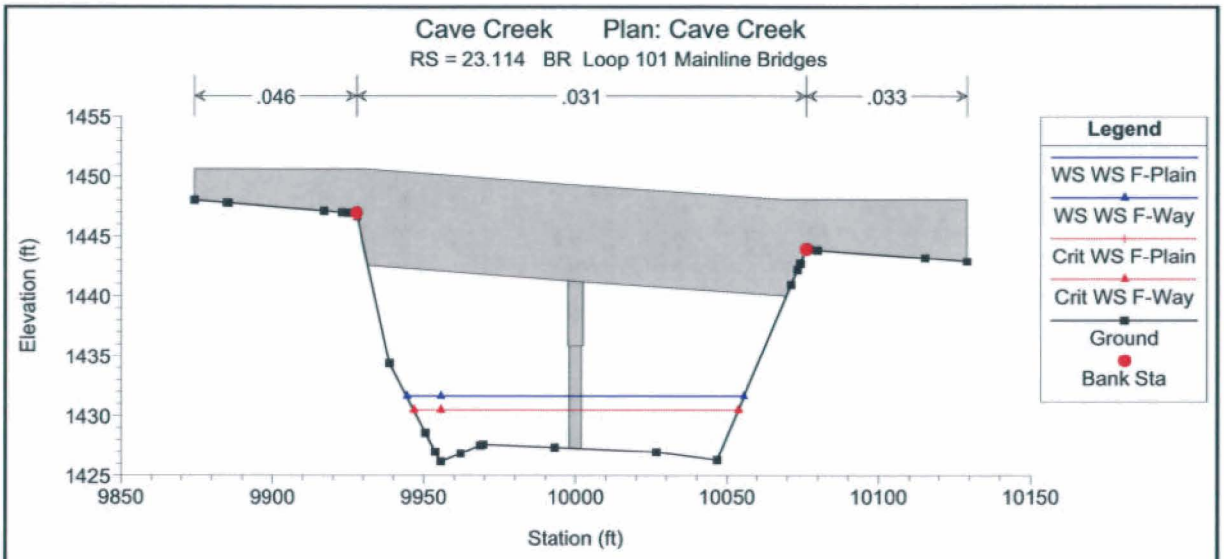

Cave Creek Plan: Cave Creek
RS = 23.134 BR North On Ramp Bridge
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

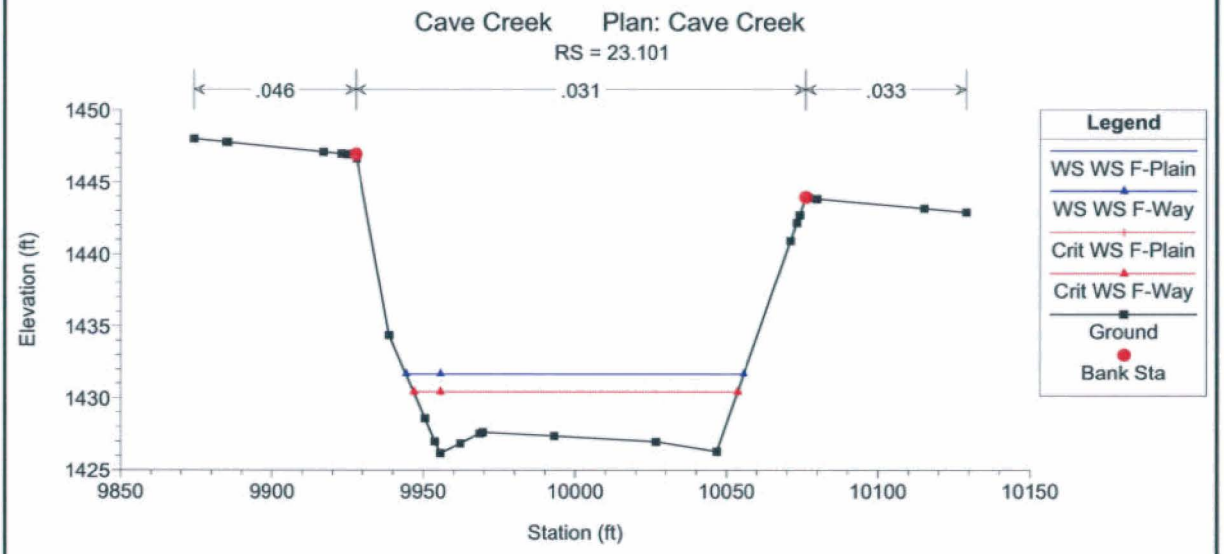

Cave Creek Plan: Cave Creek
RS = 23.134 BR North On Ramp Bridge
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

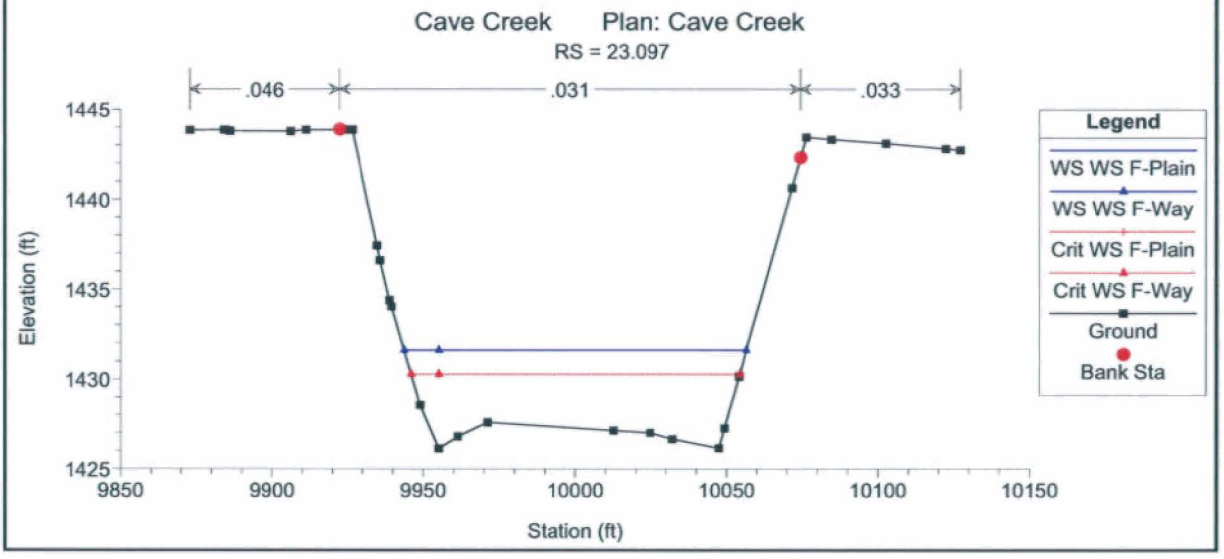

Cave Creek Plan: Cave Creek
RS = 23.131
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

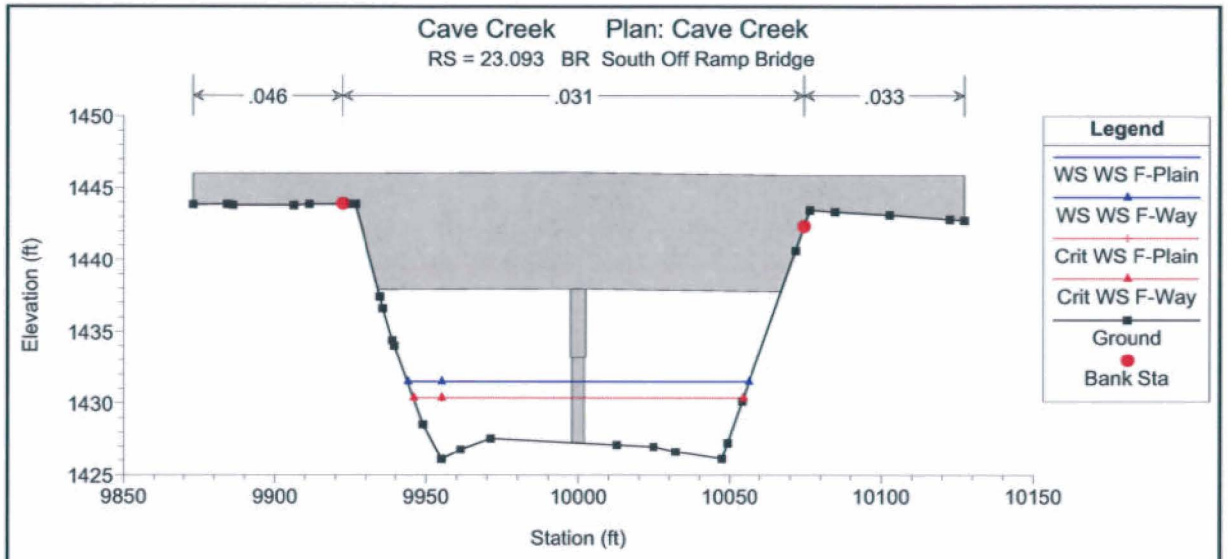

Cave Creek Plan: Cave Creek
RS = 23.128
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta

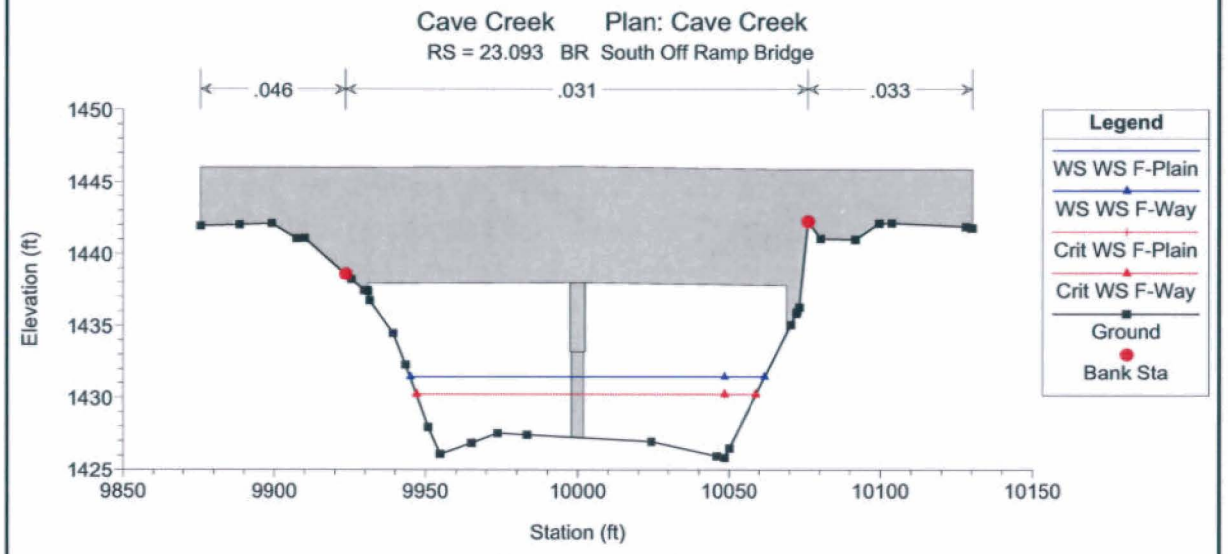

Cave Creek Plan: Cave Creek
RS = 23.114 BR Loop 101 Mainline Bridges
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

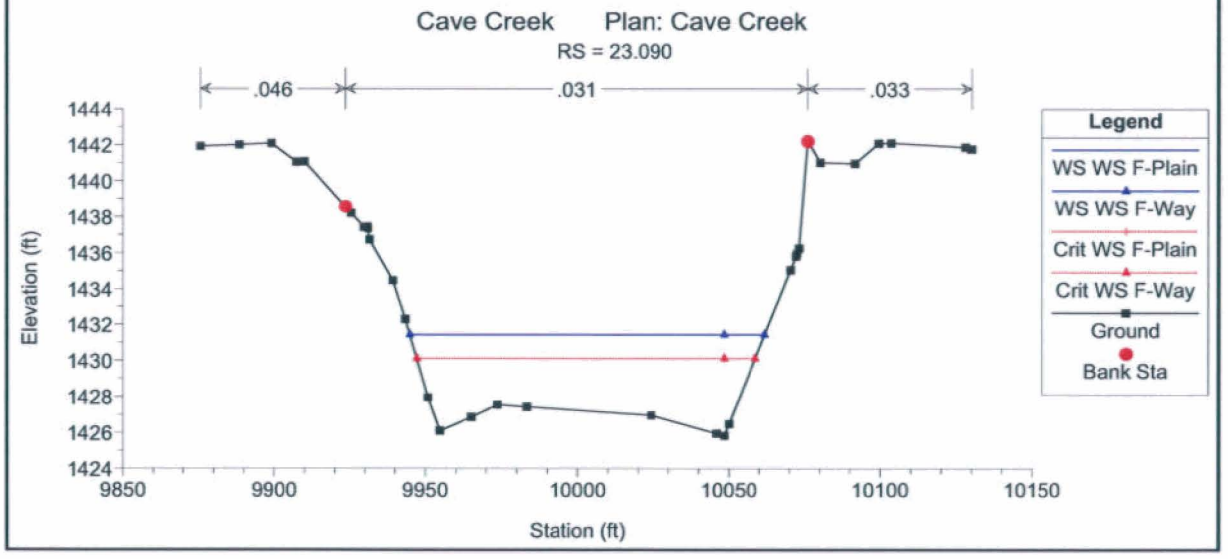

Cave Creek Plan: Cave Creek
RS = 23.114 BR Loop 101 Mainline Bridges
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

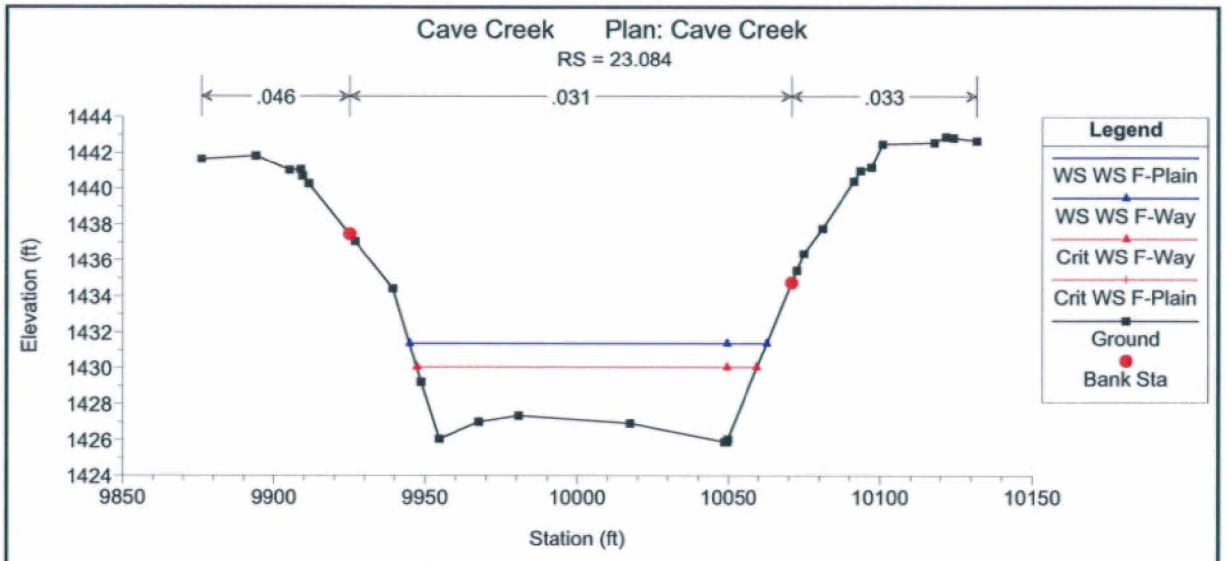

Cave Creek Plan: Cave Creek
RS = 23.101
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

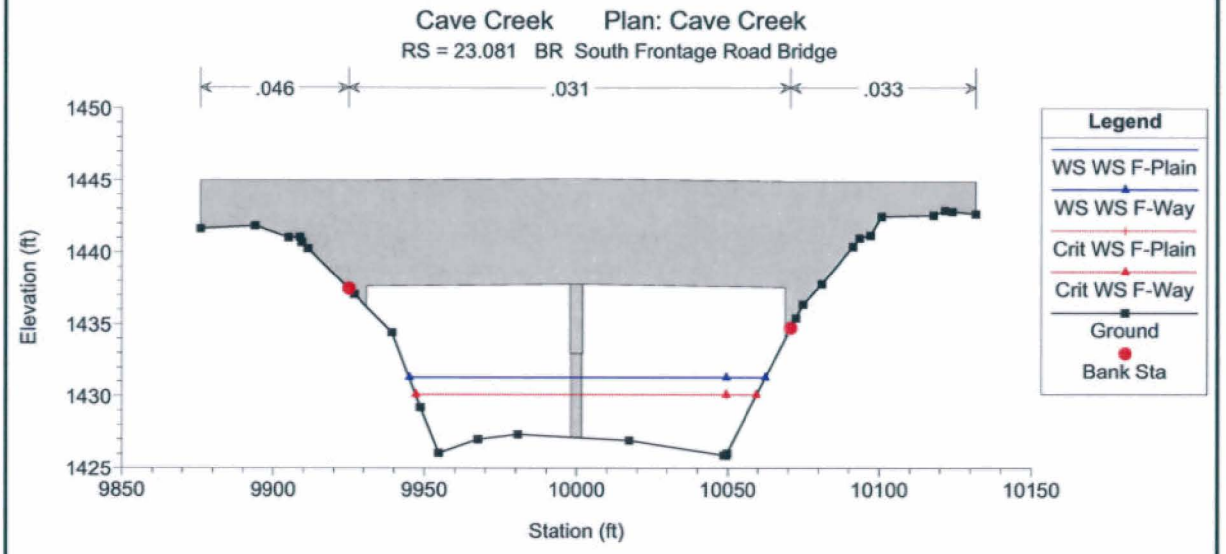

Cave Creek Plan: Cave Creek
RS = 23.097
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

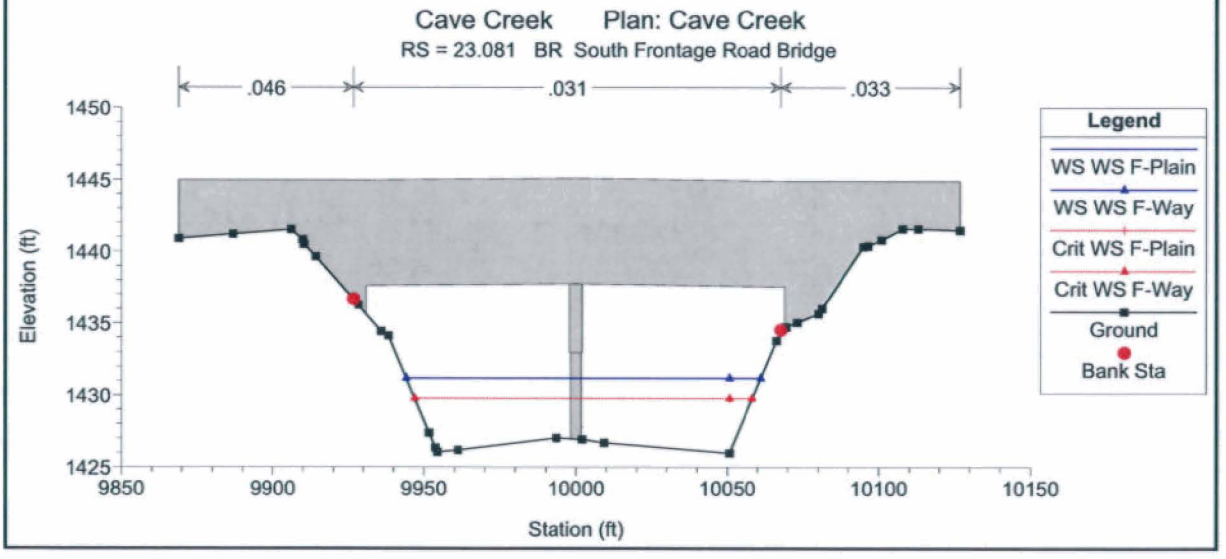

Cave Creek Plan: Cave Creek
RS = 23.093 BR South Off Ramp Bridge
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

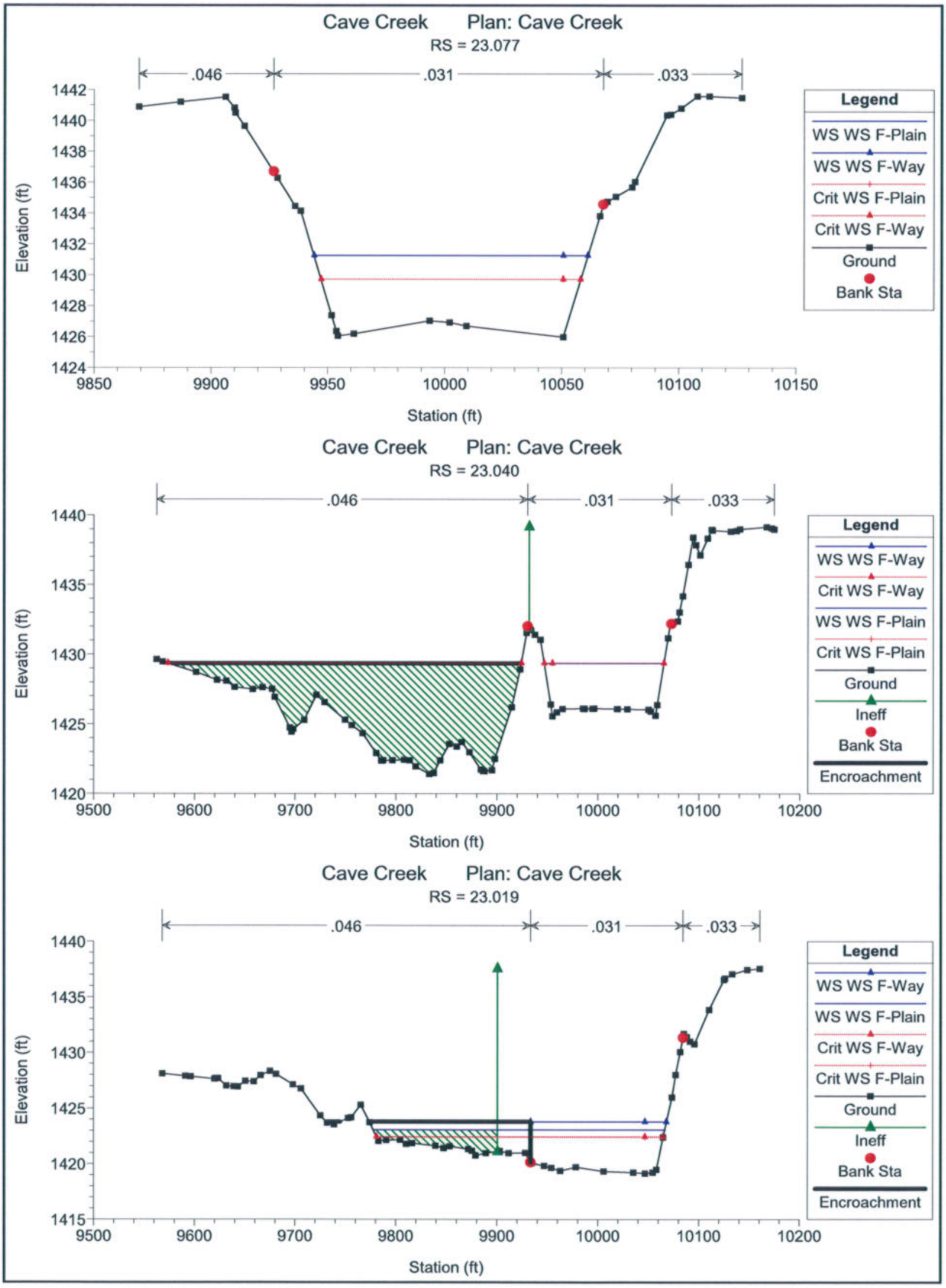

Cave Creek Plan: Cave Creek
RS = 23.093 BR South Off Ramp Bridge
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

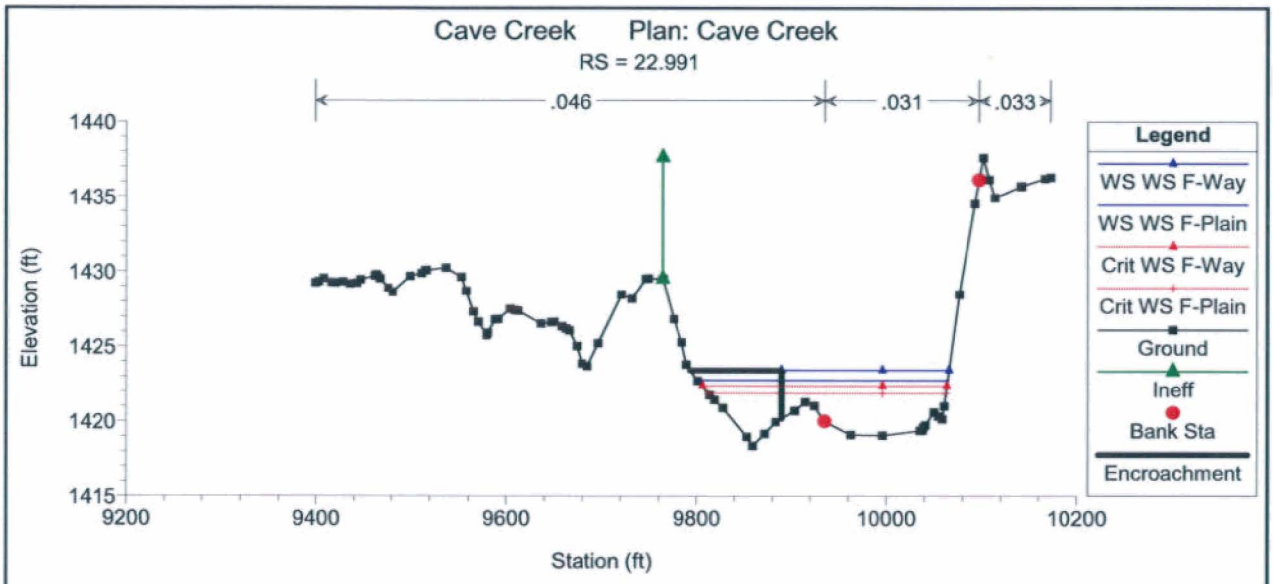

Cave Creek Plan: Cave Creek
RS = 23.090
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta

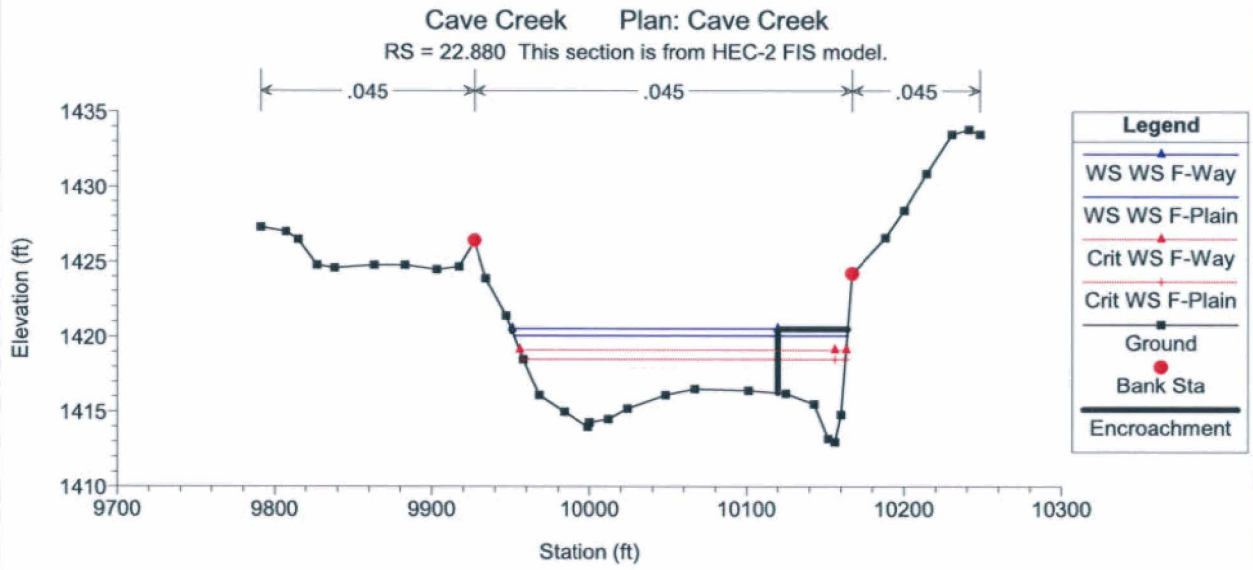

Cave Creek Plan: Cave Creek
RS = 23.084
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta


Cave Creek Plan: Cave Creek
RS = 23.081 BR South Frontage Road Bridge
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta


Cave Creek Plan: Cave Creek
RS = 23.081 BR South Frontage Road Bridge
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta


Cave Creek Plan: Cave Creek
RS = 23.077
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Plain
WS WS F-Way
Crit WS F-Plain
Crit WS F-Way
Ground
Bank Sta
Cave Creek Plan: Cave Creek
RS = 23.040
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
Crit WS F-Way
WS WS F-Plain
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment
Cave Creek Plan: Cave Creek
RS = 23.019
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

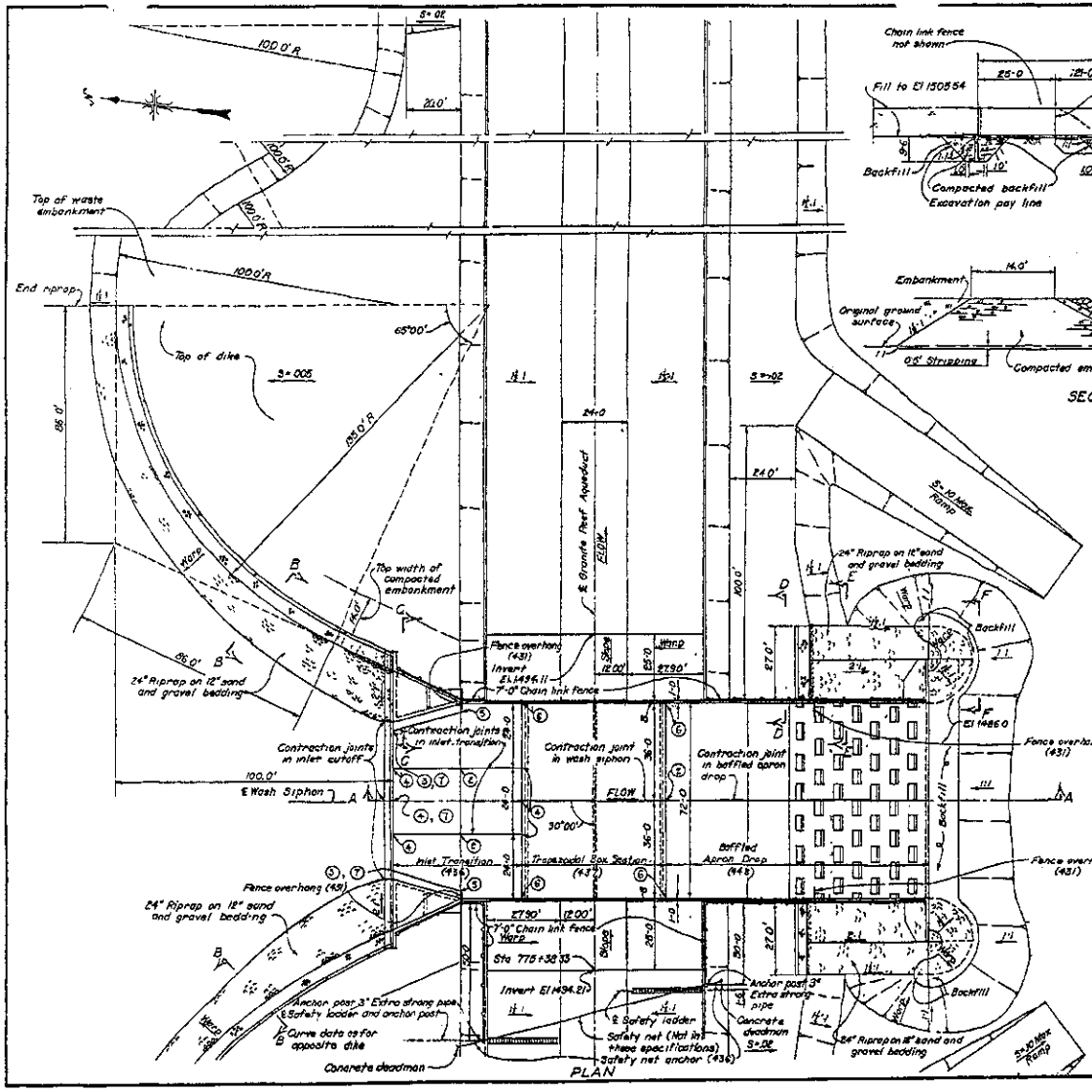

Cave Creek Plan: Cave Creek
RS = 22.991
.046
.031
.033
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Ineff
Bank Sta
Encroachment

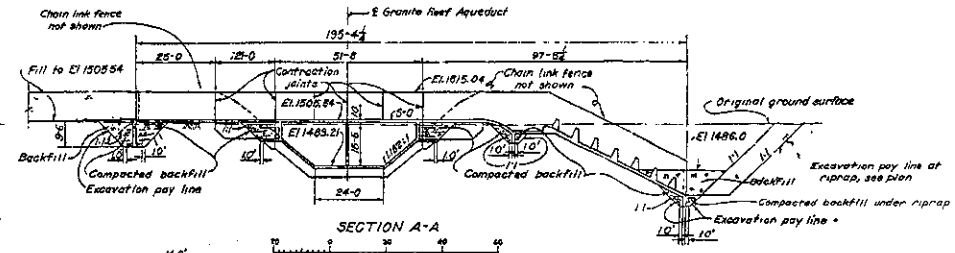

Cave Creek Plan: Cave Creek
RS = 22.880 This section is from HEC-2 FIS model.
.045
.045
.045
Elevation (ft)
Station (ft)
Legend
WS WS F-Way
WS WS F-Plain
Crit WS F-Way
Crit WS F-Plain
Ground
Bank Sta
Encroachment

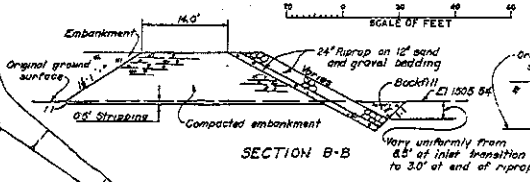
E.3 Expansion and Contraction Coefficients

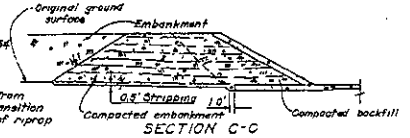
Not Applicable / Not Included

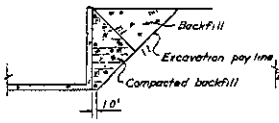
E.4 Analysis of Structures

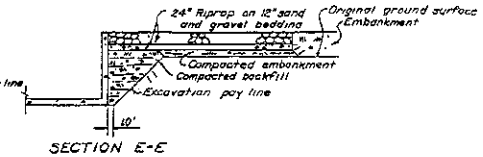


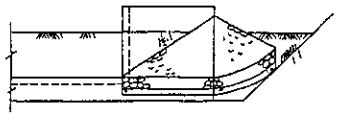












NOTES

For general notes, see 344-D-420.

(1) indicates type of waterstop intersection. For details, see 344-D-446.

For chain link fencing details, see 40-D-6260. EXCEPT barbed wire supporting arms shall be oriented vertically.

All parts of safety net anchors to be galvanized. For fencing and bracing adjacent to safety net anchor posts, see 40-D-6268. Anchor posts to be braced as end posts.

9-17-60	AS BUILT AT 350, LYN. 4-26-60
0-00	

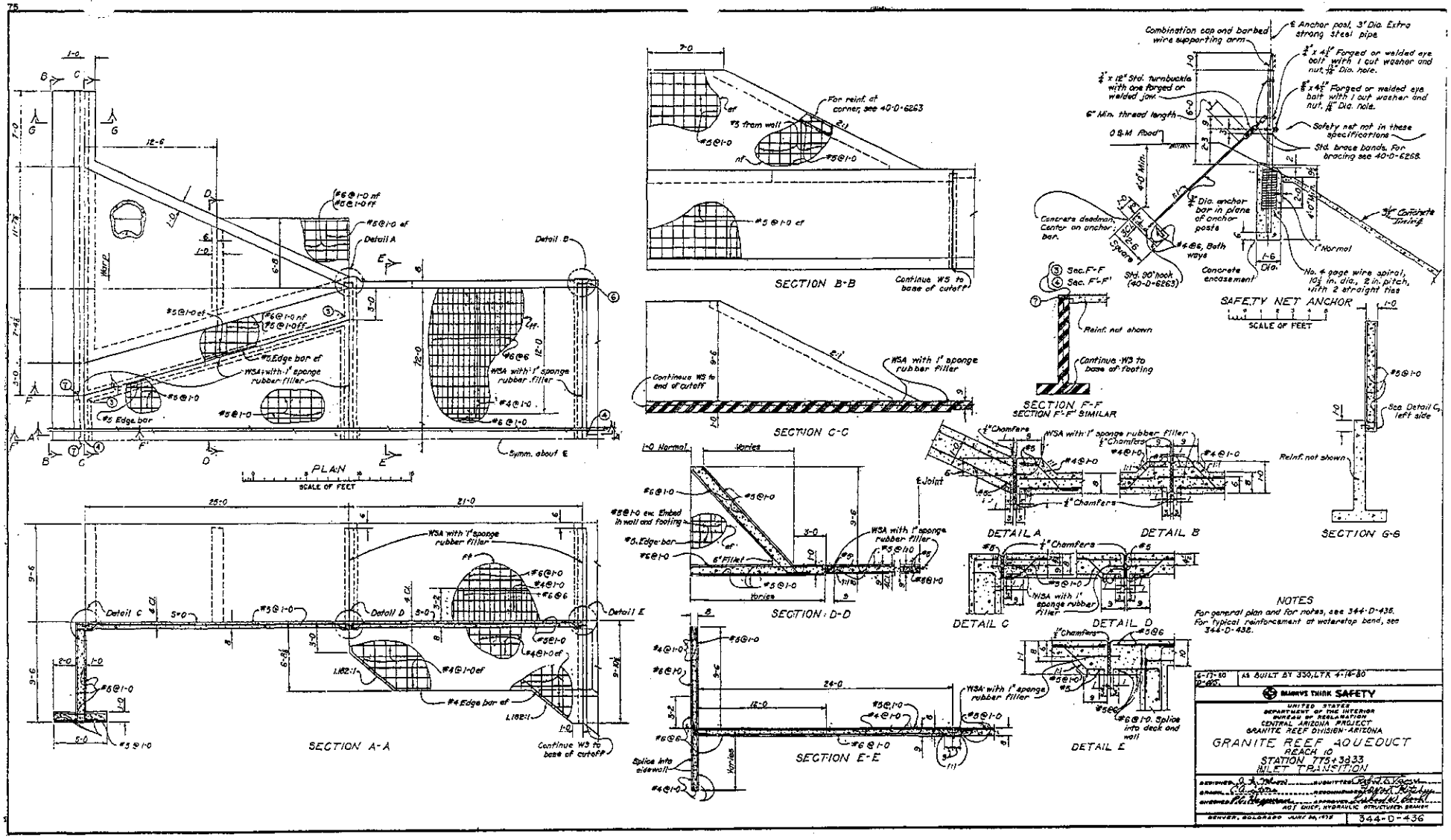
BUNNYS THINK SAFETY

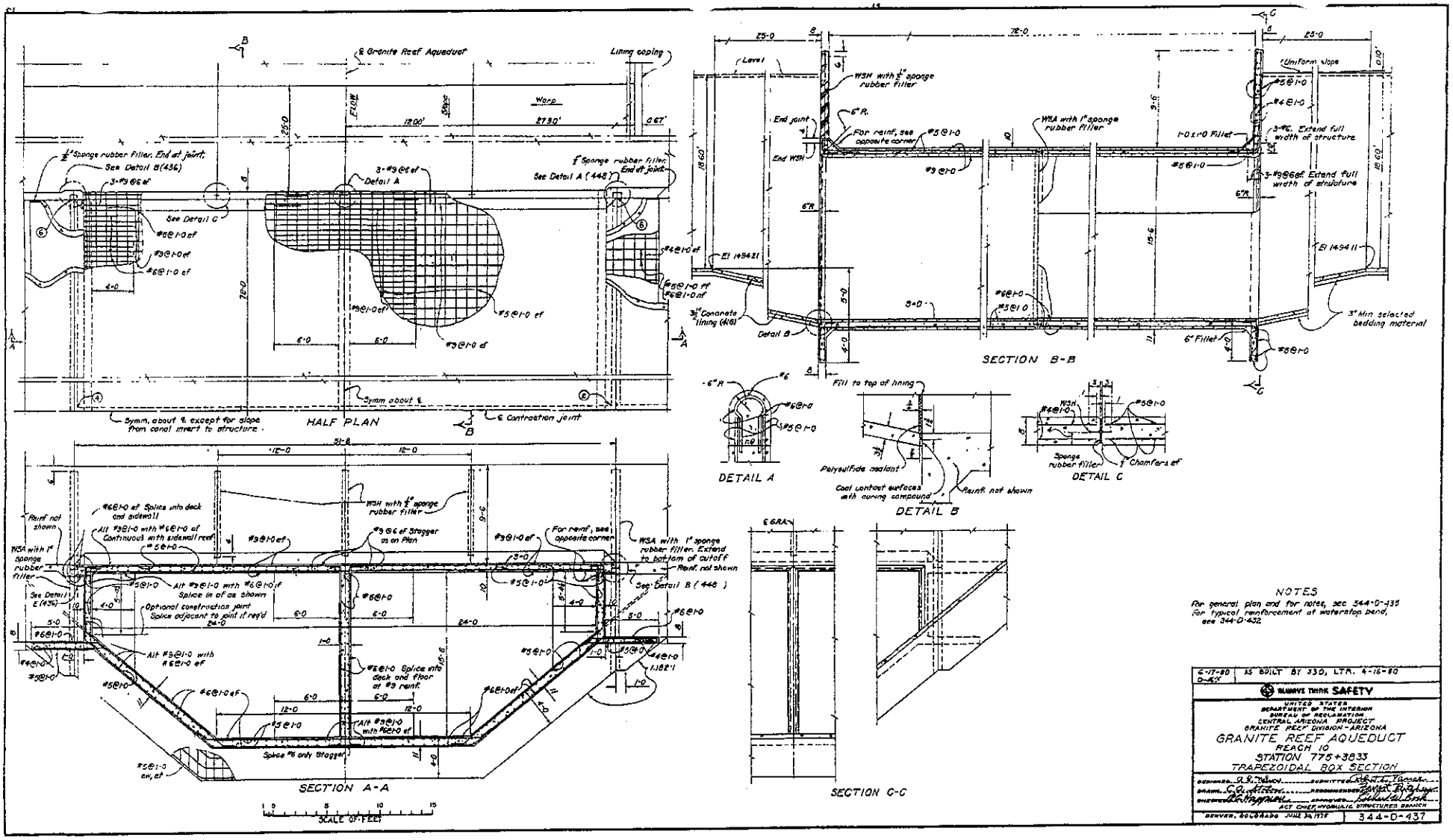
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA

GRANITE REEF AQUEDUCT
REACH 10
STATION 775+38.33
WASH SIPHON

DESIGNED G.S. Wood SUBMITTED Robert L. Kaufman
DRAWN C.C. Taylor RECOMMENDED Robert L. Lux
ENGINEER G.S. Wood APPROVED Robert L. Kaufman
ACT CHIEF, HYDRAULIC STRUCTURES BRANCH

DENVER, COLORADO JUNE 10, 1958 | 344-D-435


PLAN
SCALE OF FEET
Symm. about ℄
Detail A
Detail B
Detail C
Detail D
Detail E
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
SECTION F'-F' SIMILAR
SAFETY NET ANCHOR
SECTION G-G
DETAIL A
DETAIL B
DETAIL C
DETAIL D
DETAIL E
WSA with 1" sponge rubber filler
Continue W3 to base of cutoff
Continue W5 to base of cutoff
Reinf. not shown
Concrete deadman. Center on anchor bar.
Std. 90° hook (40-D-6263)
Concrete encasement
Combination cap and barbed wire supporting arm
℄ Anchor post, 3" Dia. Extra strong steel pipe
Safety net not in these specifications
Std. brace bands. For bracing see 40-D-6268.
NOTES
For general plan and for notes, see 344-D-435.
For typical reinforcement at waterstop band, see 344-D-438.
6-13-80 AS BUILT BY 330, LTR 4-14-80
D-85
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION-ARIZONA
GRANITE REEF AQUEDUCT
REACH 10
STATION 775+3833
INLET TRANSITION
DENVER, COLORADO JUNE 26, 1978
344-D-436



NOTES

For general plan and for notes, see 344-D-435
For typical reinforcement at waterstop bend, see 344-D-432

6-17-80 D-AK	AS BUILT BY 330, LTR. 4-16-80

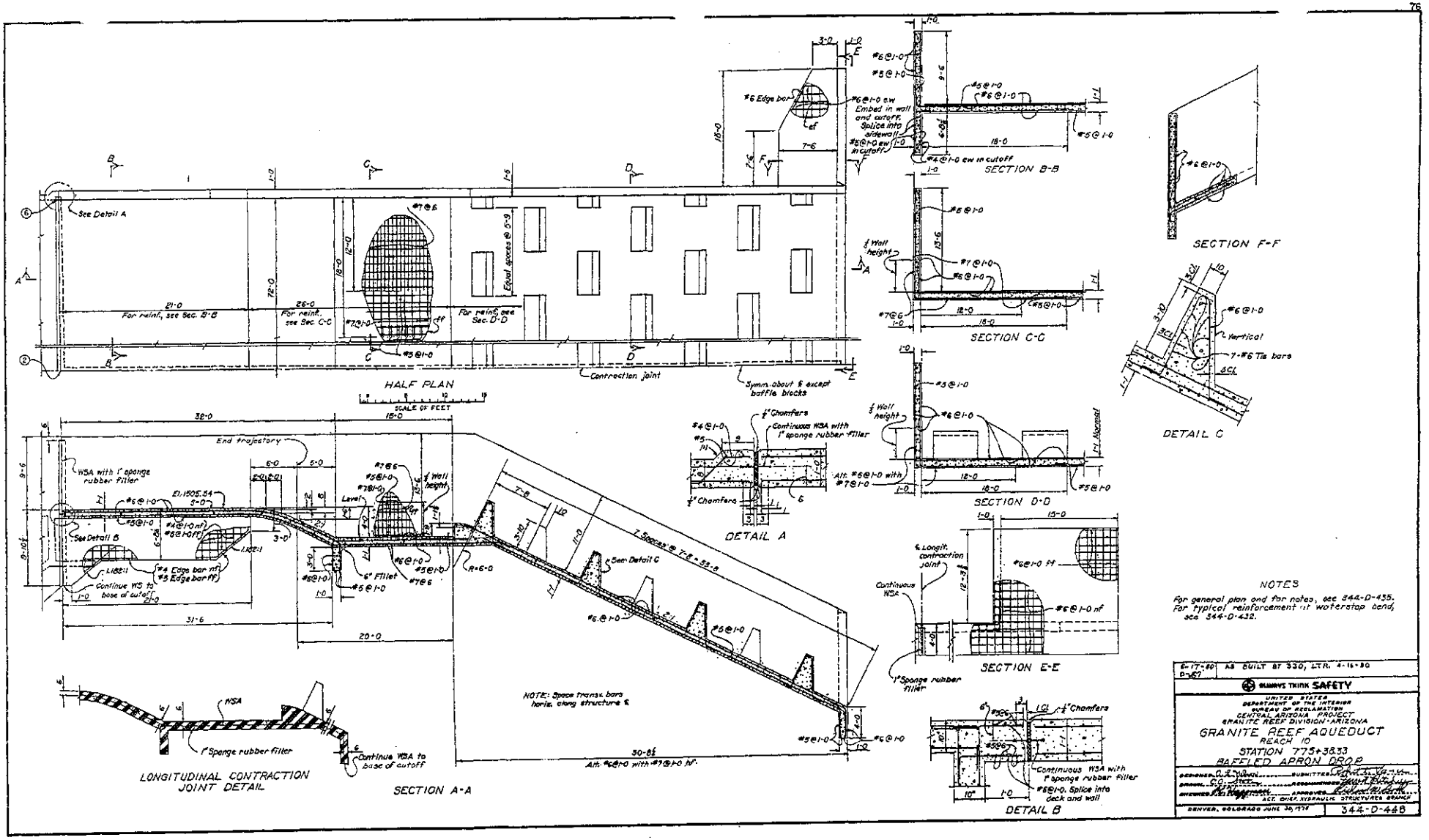
ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA

GRANITE REEF AQUEDUCT
REACH 10
STATION 775+3833
TRAPEZOIDAL BOX SECTION

DESIGNED G.S. Tulich — SUBMITTED Robert L. Tanner
DRAWN C.G. Hatch — RECOMMENDED Daniel Bishop
CHECKED [illegible] — APPROVED Richard L. Cook
ACT CHIEF HYDRAULIC STRUCTURES BRANCH

DENVER, COLORADO JUNE 24, 1978 — 344-D-437



NOTES

For general plan and for notes, see 344-D-435.
For typical reinforcement at waterstop bend, see 344-D-432.

6-17-80 D-167	AS BUILT BY 330, LTR. 4-16-80

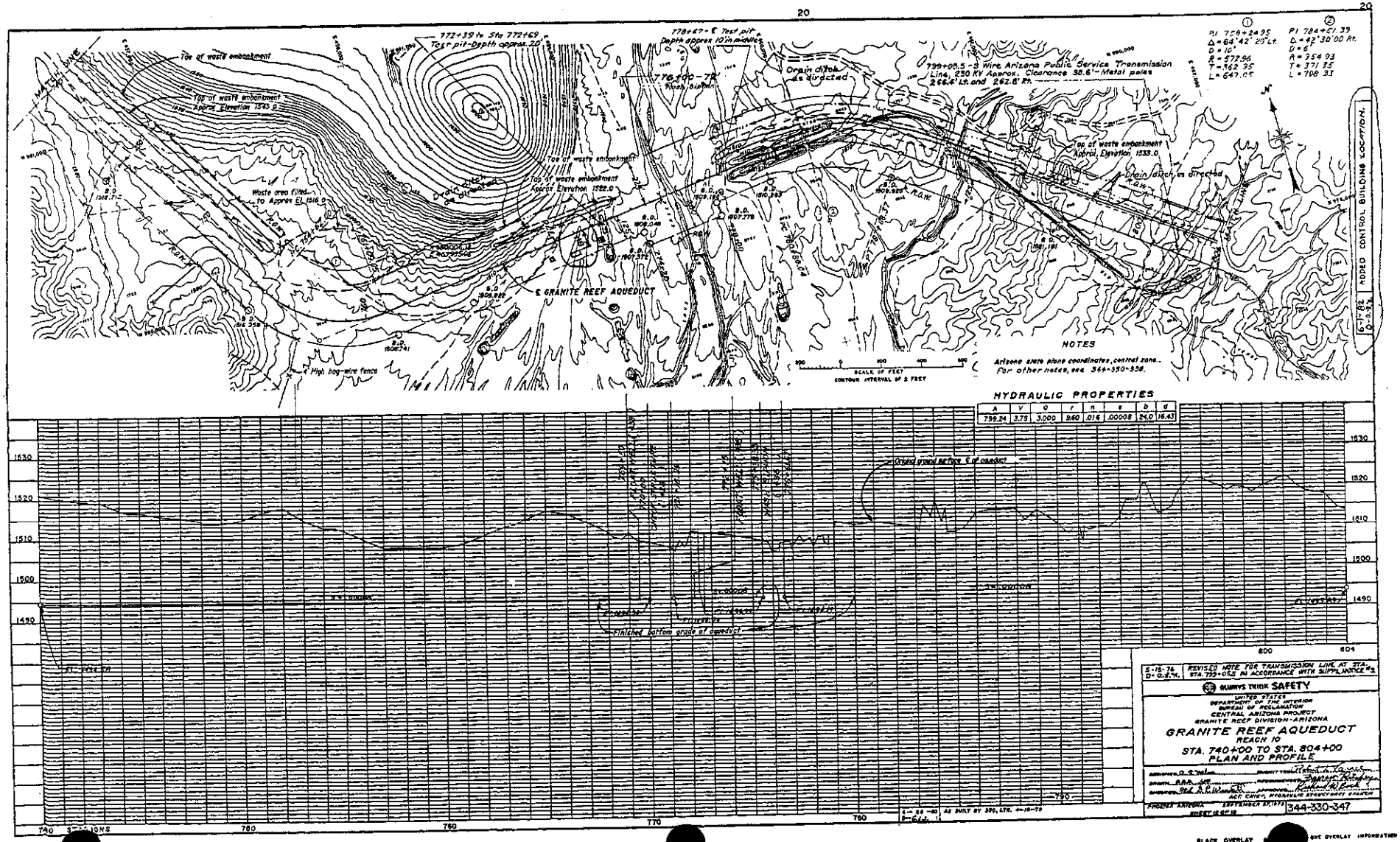
SUMMIT THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA

GRANITE REEF AQUEDUCT
REACH 10
STATION 775+38.33
BAFFLED APRON DROP

DESIGNED G.E. Yohn — SUBMITTED
DRAWN C.C. Tice — RECOMMENDED
CHECKED — APPROVED
ACT. CHIEF, HYDRAULIC STRUCTURES BRANCH

DENVER, COLORADO JUNE 30, 1978 — 344-D-448



BLACK OVERLAY

BLUE OVERLAY INFORMATION

NORTH 7TH STREET – MAJOR STREETS
PHOENIX STREETS – MARICOPA COUNTY

FHWA REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	BR-76198.00	1	14	5/5/78

LENGTH OF PROJECT
STA 13+00 – STA 20+00 = 700 Ft.
= 0.1326 Mi.

CITY OF PHOENIX
ENGINEERING DEPARTMENT
DIVISION OF DESIGN
PROJECT NO. BR-76198.00

MAYOR
MARGARET T. HANCE

CITY COUNCIL

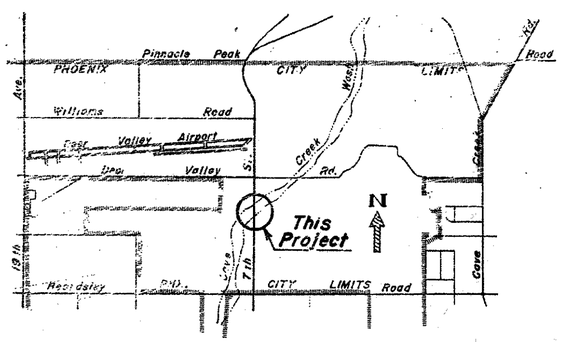
JOY W. CARTER
WILLIAM C. "BILL" DONAHUE
CALVIN C. GOODE
ROSENDO "ROSIE" GUTIERREZ
KEN O'DELL
AMY T. WORTHEN

CITY MANAGER — MARVIN A. ANDREWS
CITY ENGINEER & SUP'T. OF STREETS — JAMES E. ATTEBERY
CITY TRAFFIC ENGINEER (ACTING) — DONALD C. MORGAN
STREET MAINT. DIRECTOR — GARY P. FARMER

I HEREBY CERTIFY THAT THESE ARE OFFICIAL AS-BUILT PLANS
As-Built: Norman T. Stewart — 5/5/78 DATE
Inspectors: City of Phoenix; 11/21/77 to 1/15/78 (Russell N. Schoenick)
Hoffman-Miller Engr's; 1/16/78 To 5/5/78 (A.K. Matter)
Party Chiefs: City of Phoenix; 11/21/77 To 1/24/78 (Dick Field)
Hoffman-Miller Engr's.; 1/25/78 To 5/5/78 (Don Davis)
Contractor: Pulice Construction, Inc.

APPROVED J. E. Attebery — CITY ENGINEER — 9/21/77 DATE
APPROVED Donald C. Morgan — Acting CITY TRAFFIC ENGINEER — 9-22-77 DATE

NORTH 7TH STREET
BRIDGE OVER CAVE CREEK WASH



VICINITY MAP

INDEX OF SHEETS

SHEET	1	COVER SHEET (THIS SHEET)
SHEET	2	TYPICAL SECTIONS
SHEETS	3-5	DETOUR, PLAN & PROFILE
SHEETS	6-8	ROADWAY, PLAN & PROFILE
SHEET	9	BRIDGE LOCATION PLAN
SHEET	10	FLOOR DETAILS
SHEET	11	ABUTMENT DETAILS
SHEET	12	PIER DETAILS
SHEETS	13-14	DECK DETAILS

HOFFMAN-MILLER ENGINEERS INC.
PHOENIX ARIZONA

24X

AS-BUILT PLANS
DATE May 5, 1978

EDA-07-51-20228

	NO. SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZONA PUBLIC SERVICE			
SALT RIVER POWER DISTRICT			
S.R.V.W.U.A.			
MT. STATES TEL. & TEL. CO.			
COUNTY HIGHWAY DEPT.			
ARIZ. DEPT. OF TRANSPORTATION			
WATER & SEWERS DEP'T.			

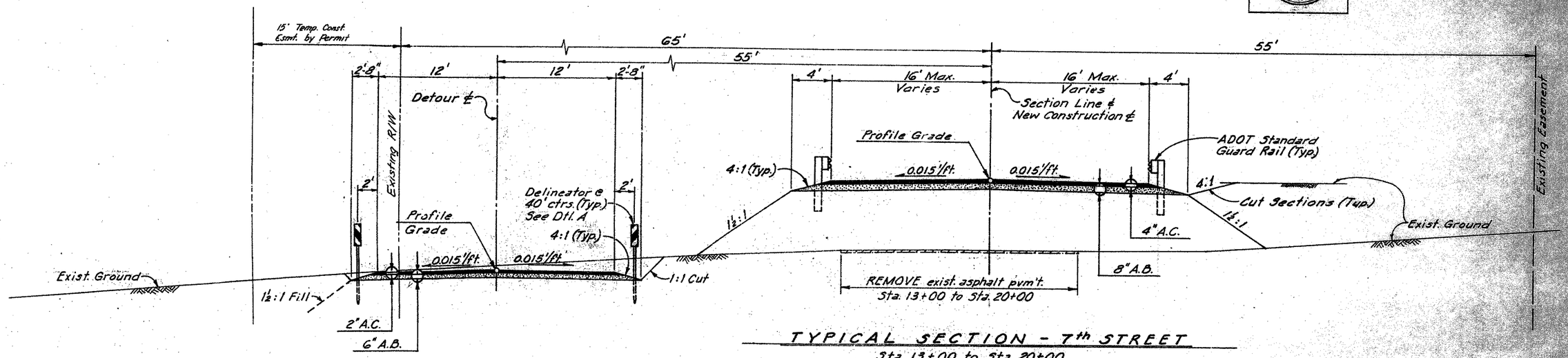
54917

PROJECT No. BR-76198.00

NORTH 7th STREET
PHOENIX STREETS-MARICOPA CO.

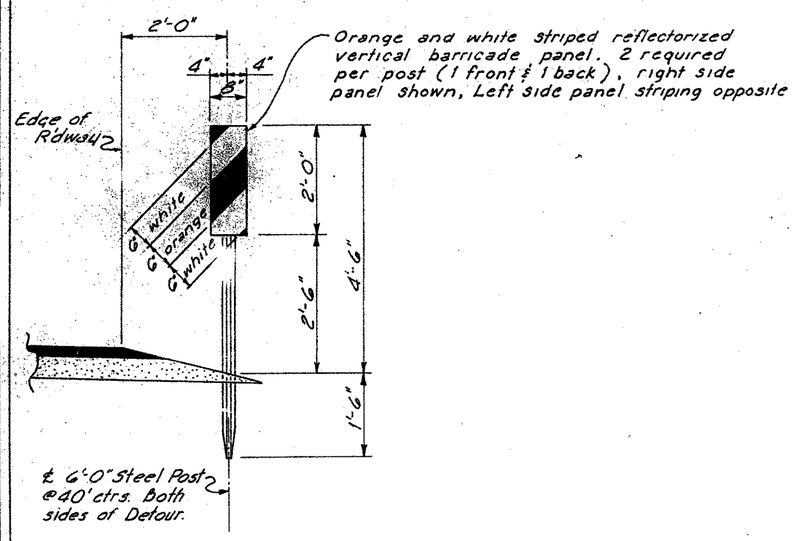
F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	BR-76198.00	2	14	A.K.M. 5/3/78

HOFFMAN-MILLER ENGINEERS, INC.
CONSULTING ENGINEER
DES. NTS DR. NTS CK. DRD DATE Feb. 77



TYPICAL SECTION - DETOUR
Sta. 1+18 to Sta. 9+78

TYPICAL SECTION - 7th STREET
Sta. 13+00 to Sta. 20+00



DETAIL A
(43 Req'd)

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D. BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D. BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D. BY	DATE

AS-BUILT PLANS
DATE May 5, 1978

24X

54918

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT
NORTH 7th STREET
BR-76198.00
Bridge Over Cave Creek Wash

DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE	2	14	

SCALE 1" = 3' HORIZONTAL, 3' VERTICAL

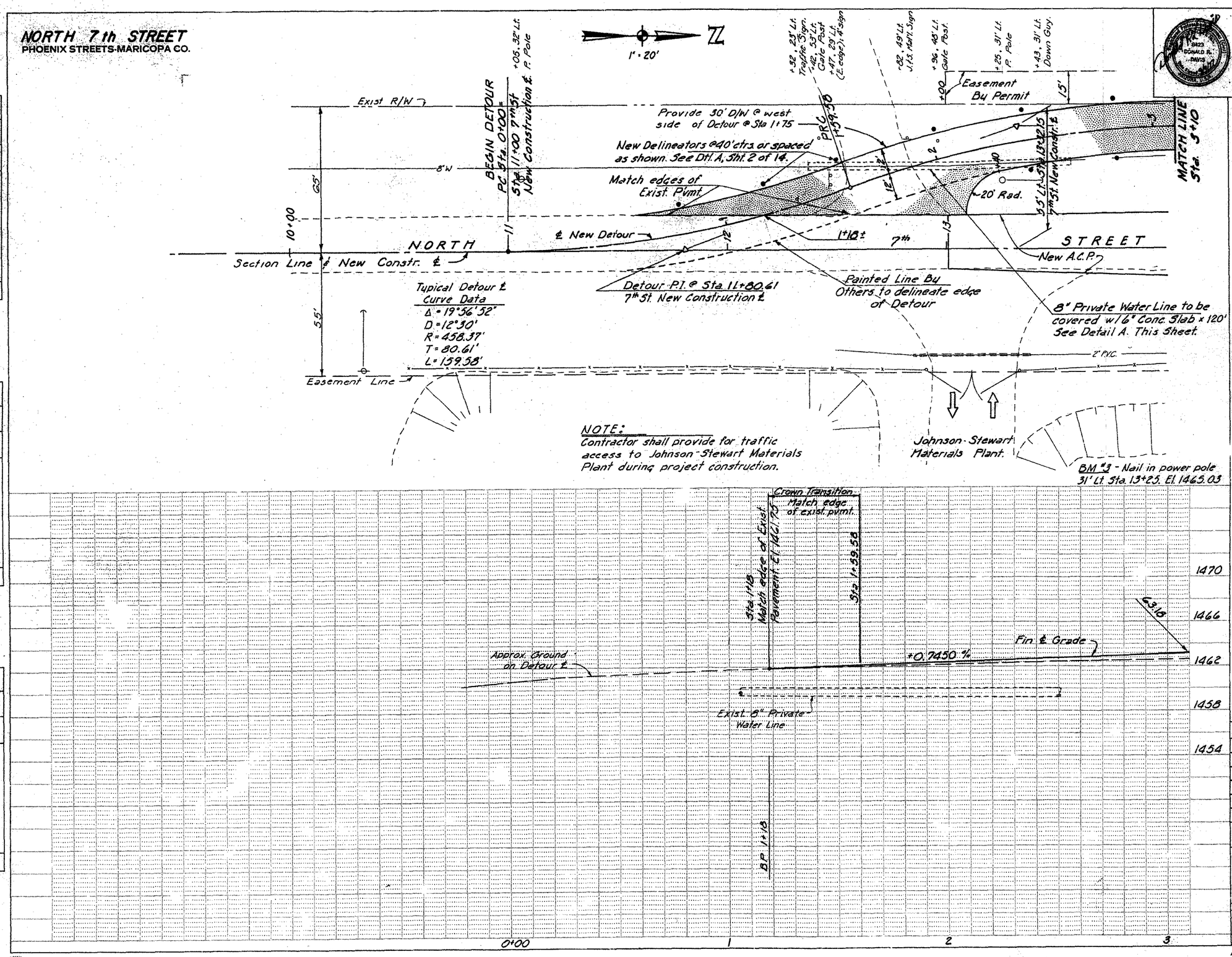
PROJECT No BR-76198.00

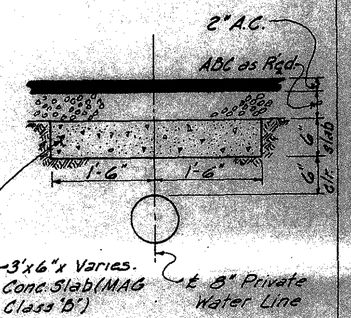
NORTH 7th STREET
PHOENIX STREETS-MARICOPA CO.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	BR-76198.00	3	14	A.F.M. 3/5/78

HOFFMAN-MILLER ENGINEERS INC
CONSULTING ENGINEER

DES. JVJ DR. JSW CK. DRD DATE Aug 77





DETAIL A

24X

AS-BUILT PLANS
DATE May 5, 1978

SHEET SUMMARY	
Item	Quantity
New A.C. Pavement	512 Sq. Yds.
Delineators	8 ea.
Class "B" Conc.	0.67 c.y.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

NORTH 7th STREET
BR-76198.00
Bridge Over Cave Creek Wash

DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE	3	14	

SCALE 1" = 20' HORIZONTAL, 4' VERTICAL

PROJECT NO. BR-76198.00

54919

REVISION BY CITY OF PHOENIX

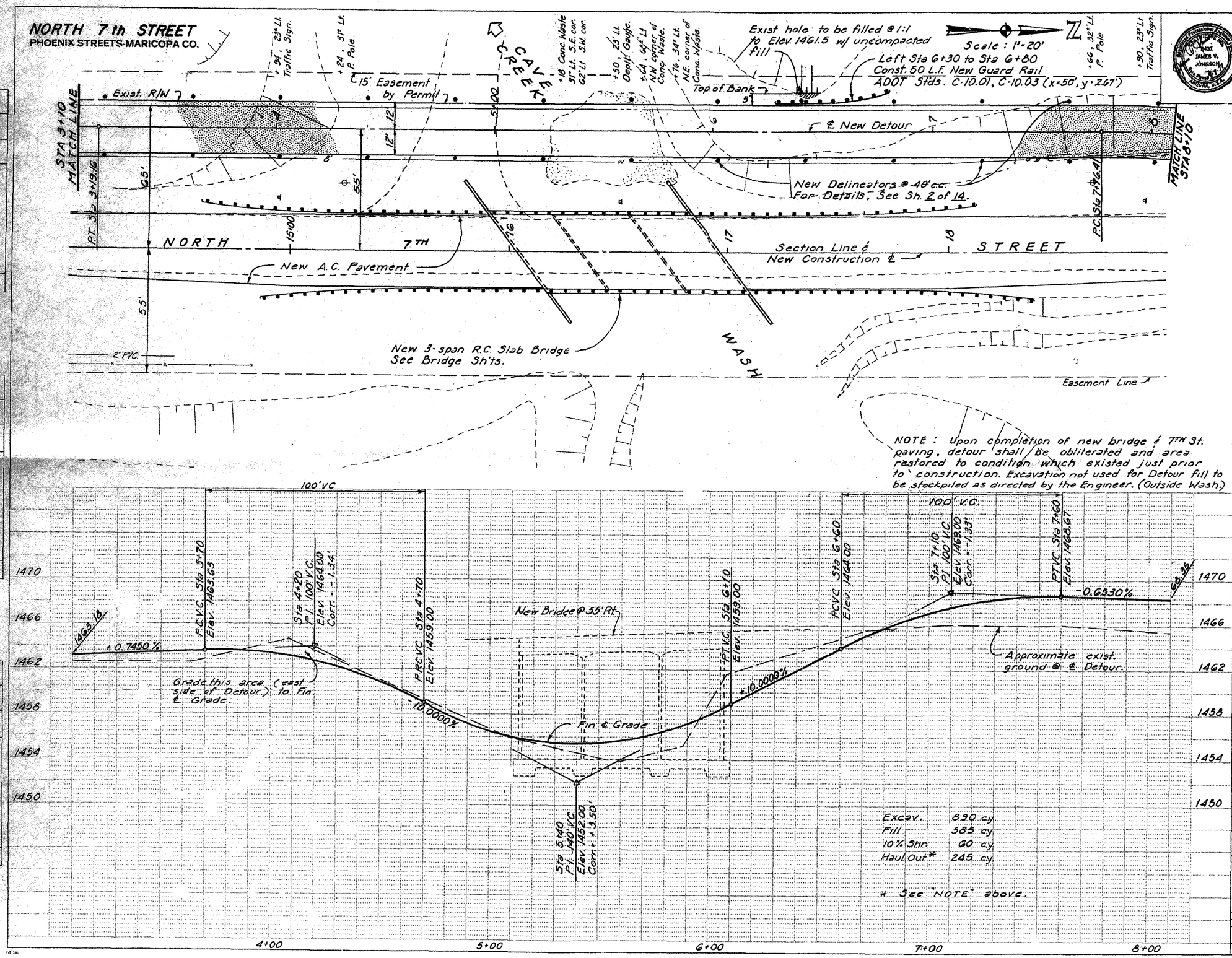
NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE



Item	Quantity
Excav.	890 cy.
Fill	585 cy.
10% Shr.	60 cy.
Haul Out*	245 cy.

* See "NOTE" above.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	BR-76198.00	4	14	A.K.M. 3/5/78

HOFFMAN-MILLER ENGINEERS, INC.
CONSULTING ENGINEER

DES: JVJ DR: JVJ CK: DED DATE: 8-77

24X

AS-BUILT PLANS
DATE May 5, 1978

SHEET SUMMARY

Item	Quantity
New A.C. Pavement	1,333 sq. yds.
Delineators	26 ea.
New Guard Rail	50 L.F.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

NORTH 7th STREET
BR-76198.00
Bridge Over Cave Creek Wash

DES. DATE	DR. DATE	CK. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE 1" = 20' HORIZONTAL, 4' VERTICAL			4	14	

PROJECT NO. BR-76198.00 54920

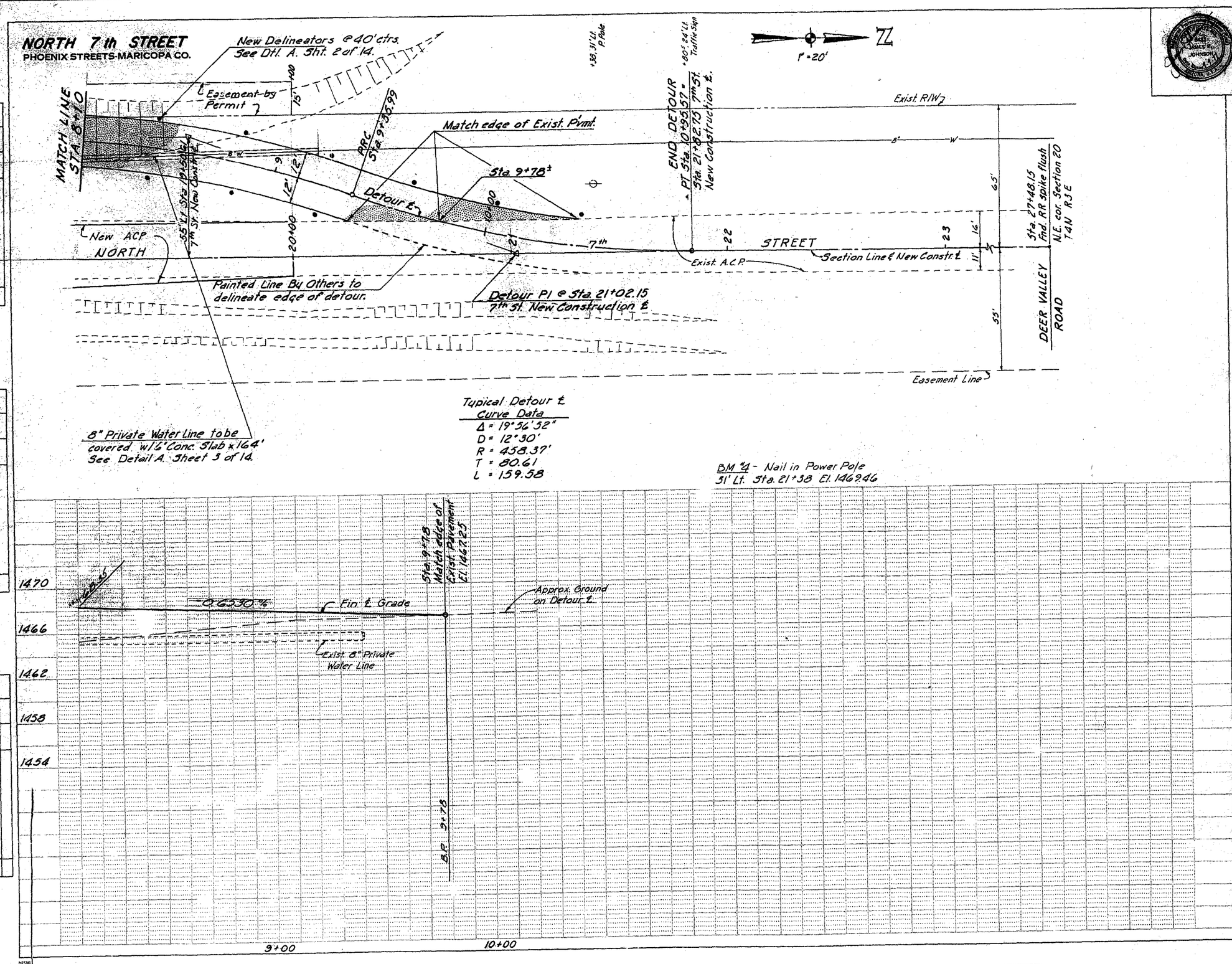
REVISION BY CITY OF PHOENIX
NO. | DESCRIPTION | REV. BY | CKD BY | DATE

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	BR-76198.00	5	14	J.K.M. 5/5/78

HOFFMAN-MILLER ENGINEERS INC.
CONSULTING ENGINEER

DES: JVJ DR: JSW CK: DRD DATE: Sept. 77

NORTH 7th STREET
PHOENIX STREETS-MARICOPA CO.



REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

24X

AS-BUILT PLANS
DATE May 5, 1978

SHEET SUMMARY

Item	Quantity
New A.C. Pavement	448 sq. yds.
Delineators	3 ea.
Class 'B' Conc.	9.11 cy.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

NORTH 7th STREET
BR-76198.00
Bridge Over Cave Creek Wash

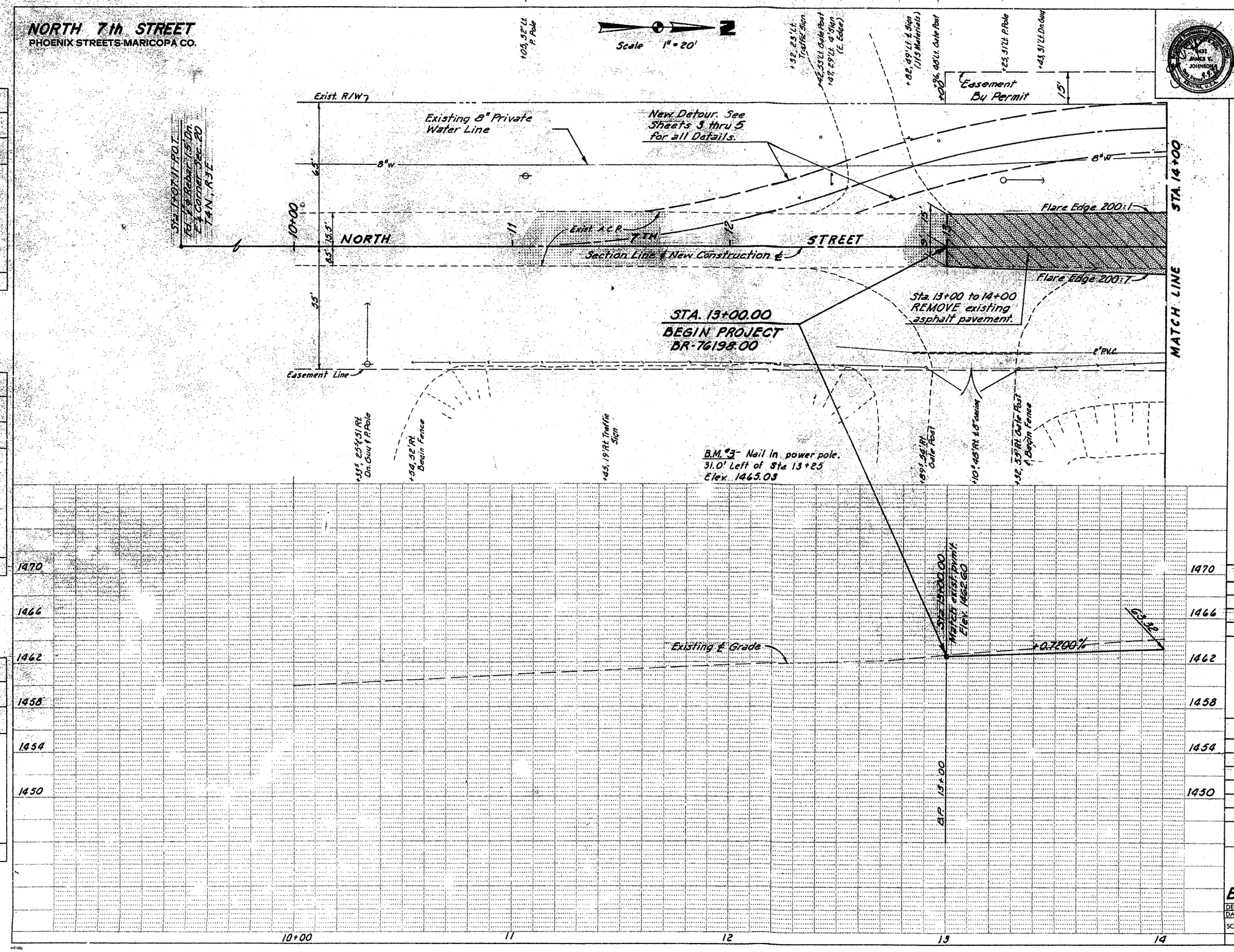
DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE	5	14	
SCALE 1" = 20' HORIZONTAL, 2' VERTICAL					

PROJECT No. BR-76198.00 54921

NORTH 7th STREET
PHOENIX STREETS-MARICOPA CO.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	BR-76198.00	6	14	A.K.M. 5/5/78

HOFFMAN-MILLER ENGINEERS INC.
CONSULTING ENGINEER
DES: NTS DR: NTS CK: AKM DATE: Feb. '77



24X

REMOVALS

Item	Quantity
Existing A.C. Pvm't.	270 Sq. Yds.

AS-BUILT PLANS
DATE May 5, 1978

SHEET SUMMARY

Item	Quantity
New A.C. Pavement	289 Sq. Yds.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

NORTH 7th STREET
BR-76198.00
Bridge Over Cave Creek Wash

DES. DATE	DR. DATE	CK. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE 1" = 20' HORIZONTAL, 2' VERTICAL			6	14	

PROJECT No BR-76198.00 54922

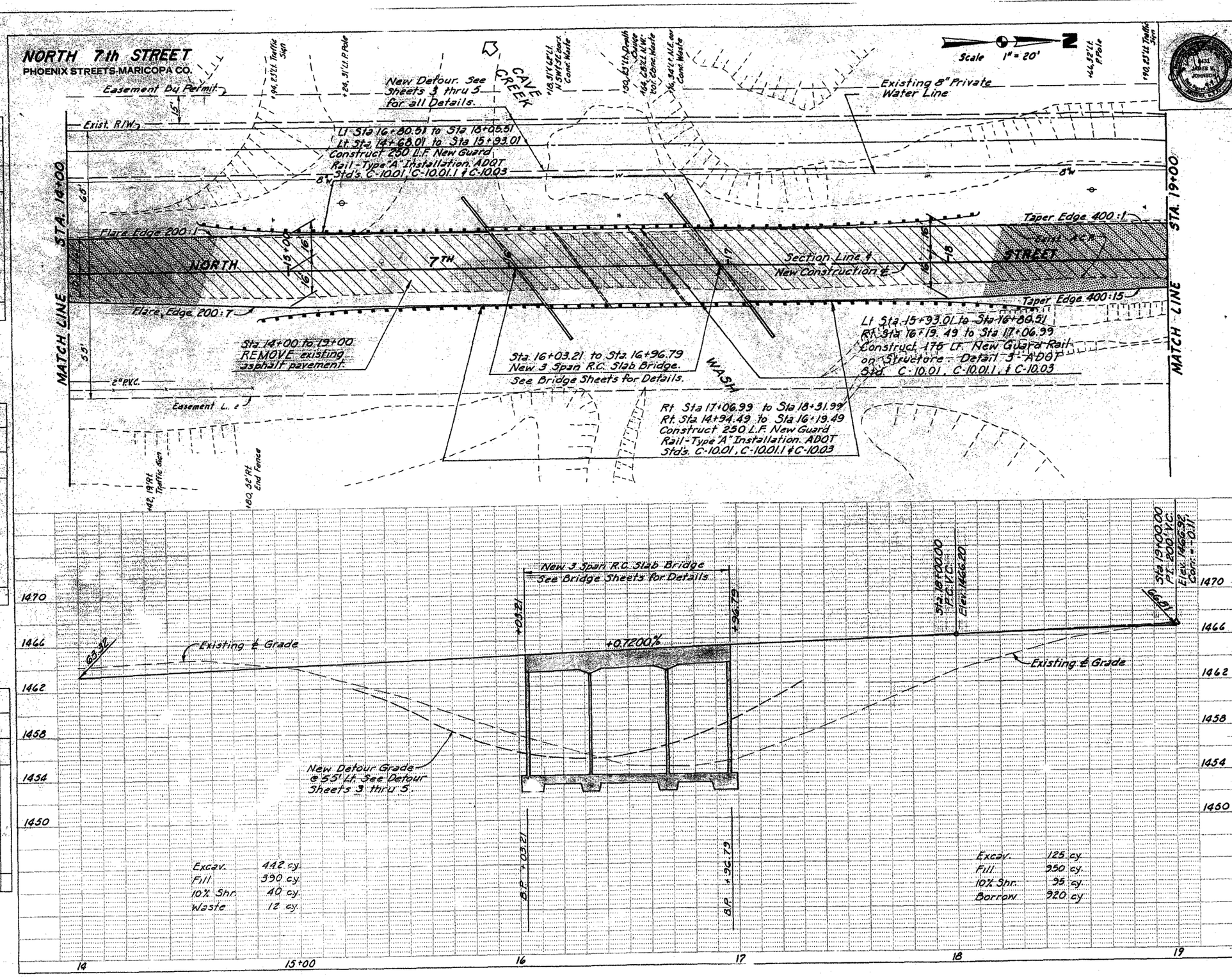
REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	BR-76198.00	7	14	A.R.M. 5/5/78

HOFFMAN-MILLER ENGINEERS INC.
CONSULTING ENGINEER

DES: NTS DR: NTS CK. ARM DATE: Feb. '77



24X

REMOVALS

Item	Quantity
Existing A.C. Pvm't.	1440 Sq. Yds.

AS-BUILT PLANS
DATE May 5, 1978

SHEET SUMMARY

Item	Quantity
New A.C. Pavement	1401 Sq. Yds.
New Guardrail	500 Lin. Ft.
" " Det. 3	175 Lin. Ft.
New Bridge	See Br. Sh'ts.

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

NORTH 7th STREET
BR-76198.00
Bridge Over Cave Creek Wash

DES.	DR.	CK.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE:	DATE:	DATE:	7	14	

SCALE 1" = 20' HORIZONTAL, 4' VERTICAL

PROJECT Nº BR-76198.00 54923

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

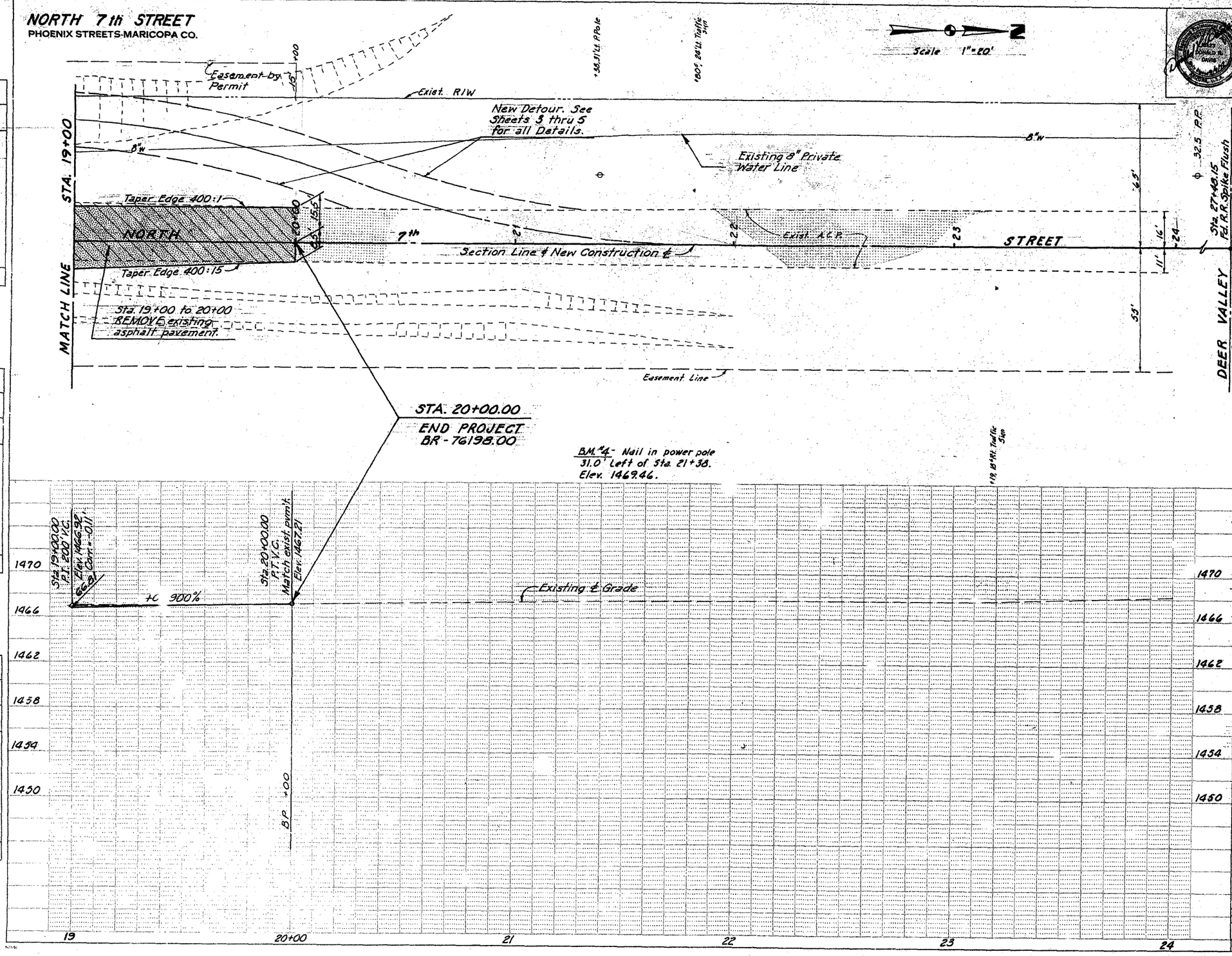
REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	BR-76198.00	8	14	5/5/78

HOFFMAN-MILLER ENGINEERS INC.
CONSULTING ENGINEER
DES. NTS DR. NTS CK. AKM DATE Feb. 77

NORTH 7th STREET
PHOENIX STREETS-MARICOPA CO.



REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

24X

REMOVALS

Item	Quantity
Existing A.C. Pvm't.	270 Sq.Yds.

AS-BUILT PLANS
DATE May 5, 1978

SHEET SUMMARY

Item	Quantity
New A.C. Pavement	289 Sq.Yds.

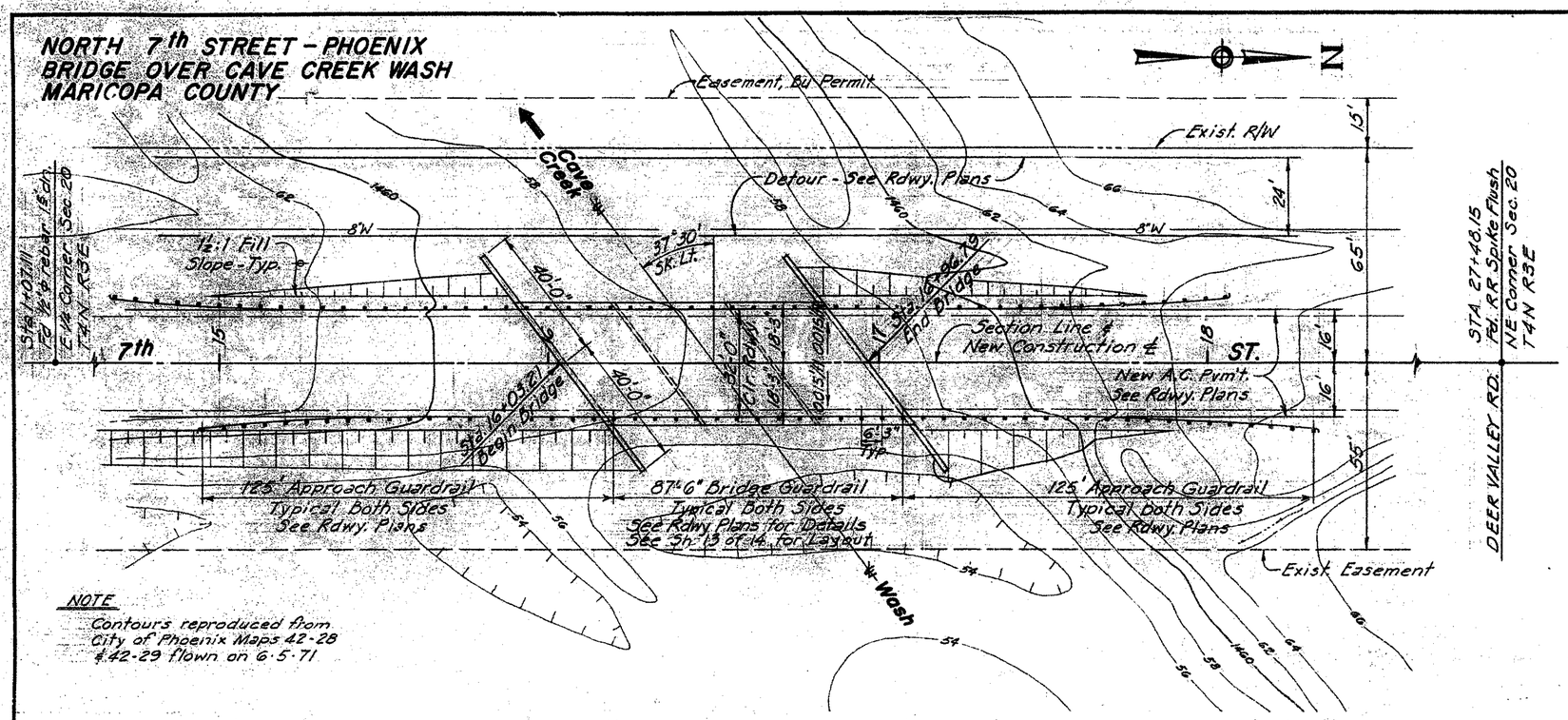
CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

NORTH 7th STREET
BR-76198.00
Bridge Over Cave Creek Wash

DES. DATE:	DR. DATE:	CK. DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE 1" = 20' HORIZONTAL, 4' VERTICAL			8	14	

PROJECT No BR-76198.00

54924



NOTE
Contours reproduced from City of Phoenix Maps 42-28 & 42-29 flown on 6-5-71

STA. 16+ LOCATION PLAN
New 3 Span Continuous RC Slab Bridge w/ Conc. Floor
32'-0" Clear Roadway 37°30' Skew Lt.
Scale ——— 1" = 20'

GENERAL NOTES

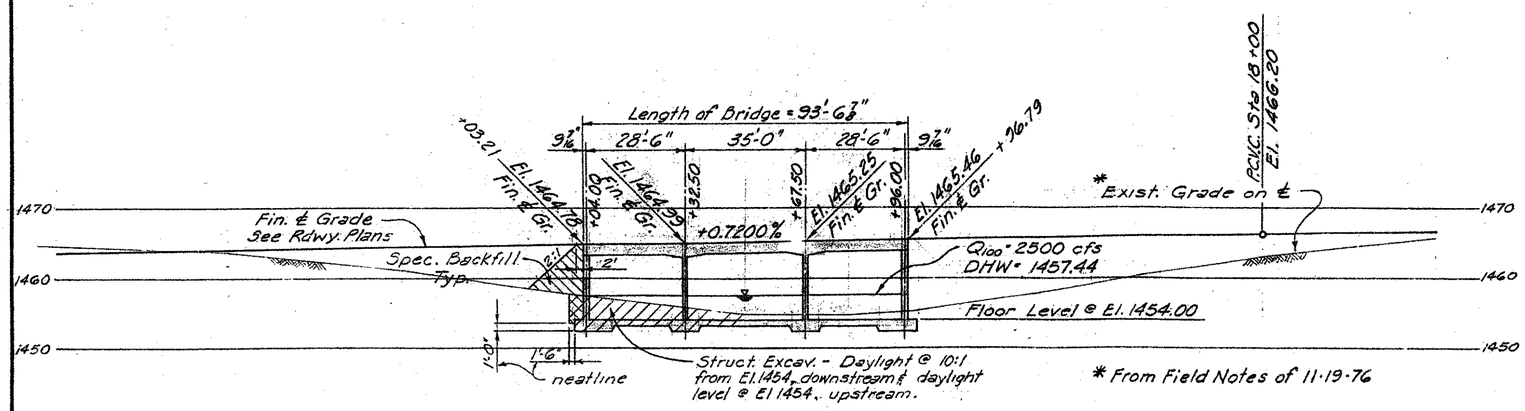
Construction:
Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction, 1974 Edition, including 1975 & 1976 Supplements.

Design:
A.A.S.H.T.O. Standard Specifications for Highway Bridges, 1973 Edition and Interim Specifications for Bridges 1974 thru 1976.

Loading Class:
HS 20-44 See As-Built Note on Sheet 14 of 14

Allowable Stresses:
Class "A" Concrete - f'_c = 3000 psi ; f_c = 1200 psi ; n = 10
Class "B" Concrete - f'_c = 2500 psi ; f_c = 1000 psi ; n = 12
Class "C" Concrete - f'_c = 2000 psi ; Reinf. St. - f_s = 20,000 psi.

Dimensions shall not be scaled from drawings.
All Reinforcing Steel shall conform to A.S.T.M. Specification A615 - Grade 40.
Structural Steel shall conform to A.S.T.M. Spec. A36
All welding shall conform to American Welding Society Specifications for structural welding, latest edition.
All placing dimensions for reinforcing shall be to center of bar unless otherwise noted.
All bend dimensions are out to out of bar.
Chamfer all exposed corners & edges 3/4" unless otherwise noted.
Special Backfill shall be in accordance with ADOT Std. Specs. 208-3.04(A) & 707 (A).



* From Field Notes of 11-19-76

SECTION ON NEW CONSTRUCTION ℄
Scales ——— 1" = 20' Horiz. 1" = 10' Vert.

APPROXIMATE QUANTITIES

ITEM	Struct. Excav. c.y.	Spec. Bk'fl. c.y.	Concrete Class "A" c.y.	Concrete Class "C" c.y.	Reinf. Steel lbs.
Floor Slab *	720	—	257.87	—	~~31,150~~ 32,806
Abutments +	—	400	57.77	6.80	~~4,890~~ 5,187
Piers	—	—	31.53	—	~~1,690~~ 1,780
Deck	—	—	190.25	—	Δ ~~49,350~~ 42,823
Totals	720	400	537.42	6.80	~~88,280~~ 82,596

* Includes all quantities below El. 1454.00; pier & abut. reinf. cast with floor slab included with floor slab quantities.
+ Includes wingwalls.

As-Built Note:
Δ Plans Quantity In Error - Total Should Have Been 36,059 Lbs.

24X

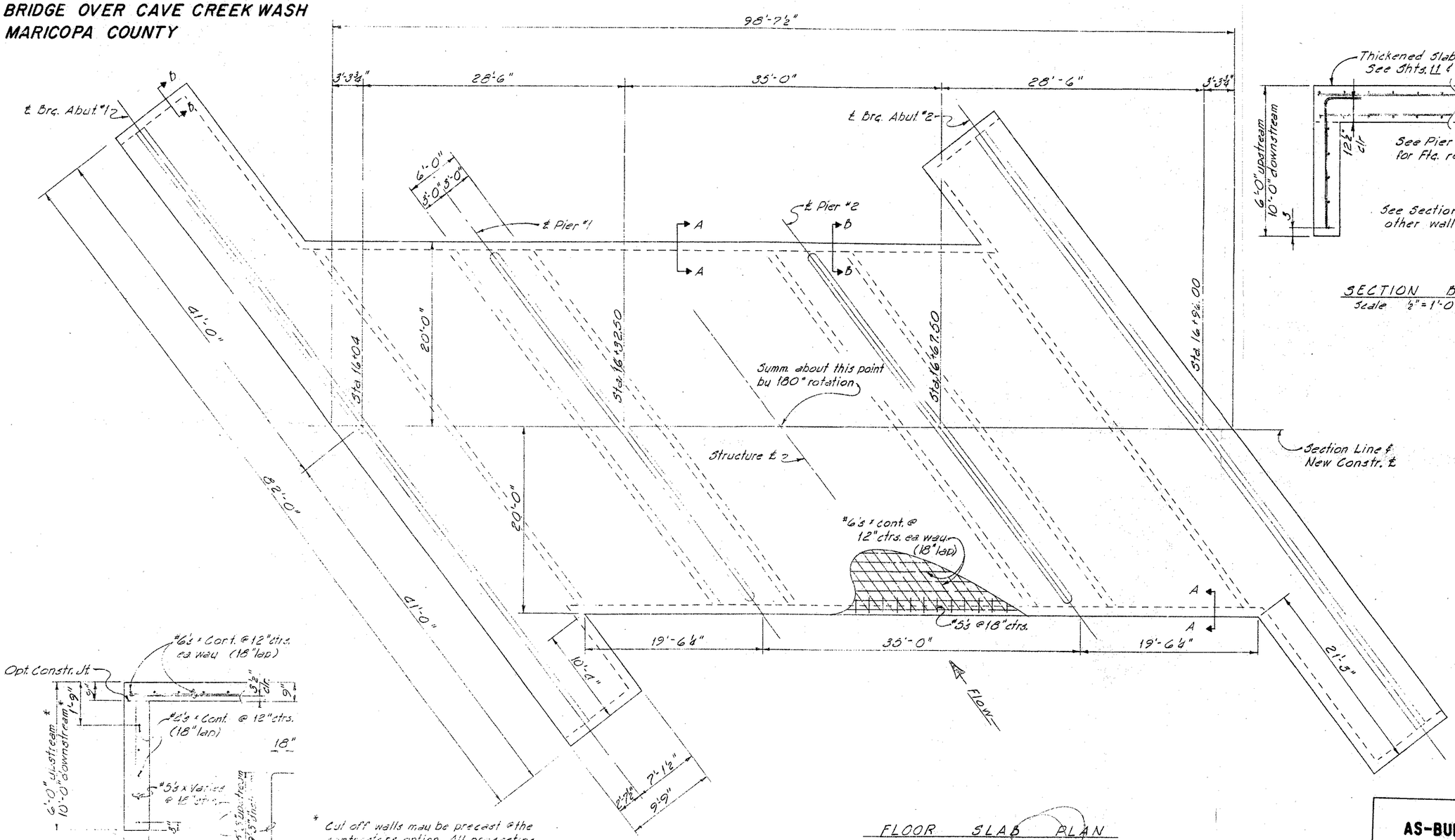
AS-BUILT PLANS
DATE May 5, 1978

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 8431 JAMES V. JOHNSON ARIZONA U.S.A.

CITY OF PHOENIX		
SCALE Noted / DATE Oct. '76	LOCATION PLAN	DRAWN BY NTS / REVISED 2/10/77
STA. 16 + NORTH 7th STREET BRIDGE OVER CAVE CREEK WASH		
HOFFMAN-MILLER ENGINEERS INC. PHOENIX ARIZONA		DRAWING NUMBER 9 of 14

PROJECT NO. BR-76198.00 54925

NORTH 7th STREET – PHOENIX
BRIDGE OVER CAVE CREEK WASH
MARICOPA COUNTY



* Cut off walls may be precast @ the contractors option. All precasting details to be submitted to the Engineer for approval prior to Constr.

Note:
All transverse floor slab Reinf. to be placed parallel to Abut. & Pier ℄'s and spaced parallel to Constr. ℄. All longitudinal slab Reinf. to be placed parallel to Constr. ℄ and spaced perpendicular to Constr. ℄.

24X

AS-BUILT PLANS
DATE May 5, 1978

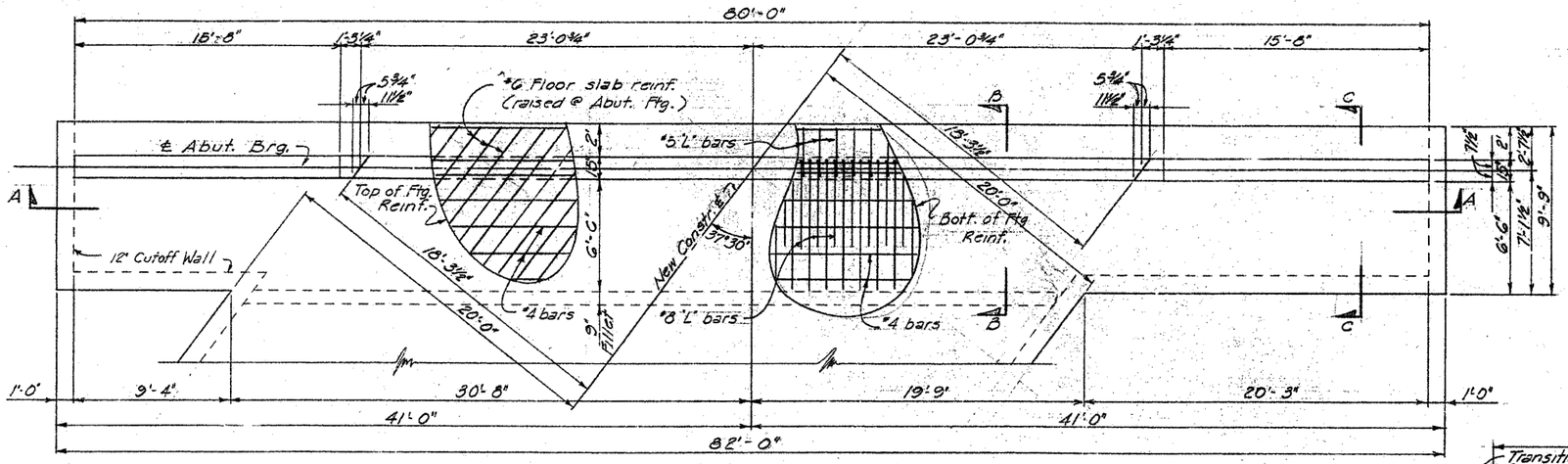
All Concrete Class "A"

CITY OF PHOENIX

SCALE Noted	FLOOR DETAILS	DRAWN BY JSW
DATE Jul. 77		REVISED
STA. 16 + NORTH 7th STREET BRIDGE OVER CAVE CREEK WASH		
HOFFMAN-MILLER ENGINEERS INC. PHOENIX ARIZONA		DRAWING NUMBER 10 of 14

PROJECT No BR-76198.00 54926

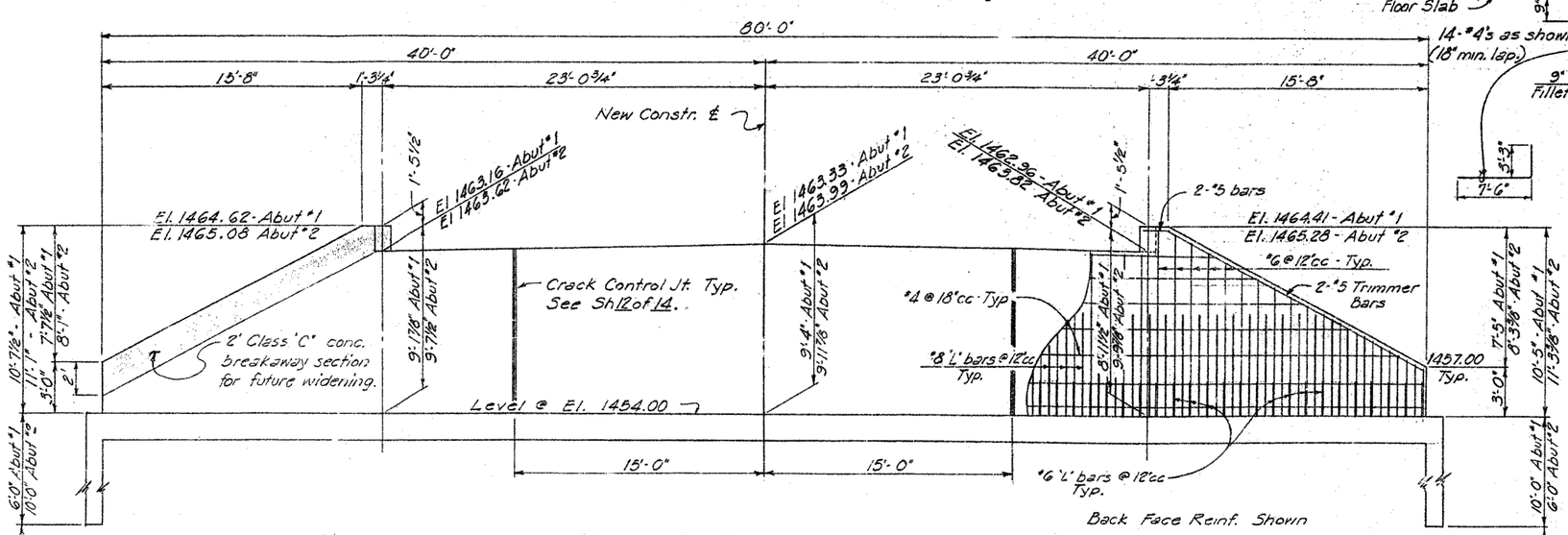
NORTH 7th STREET - PHOENIX
BRIDGE OVER CAVE CREEK WASH
MARICOPA COUNTY



A B U T M E N T P L A N

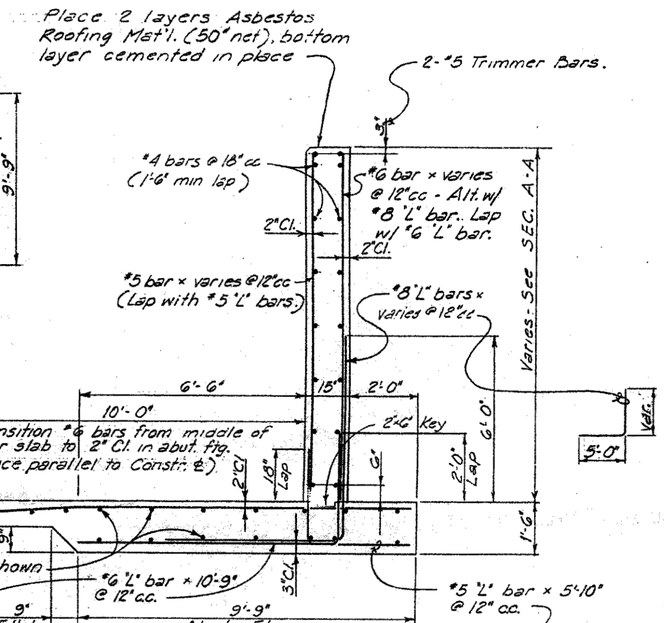
Scale: ¼"=1'-0"

Drawn for Abut. No. 2 (looking north) — Abut. No. 1 same by 180° rotation



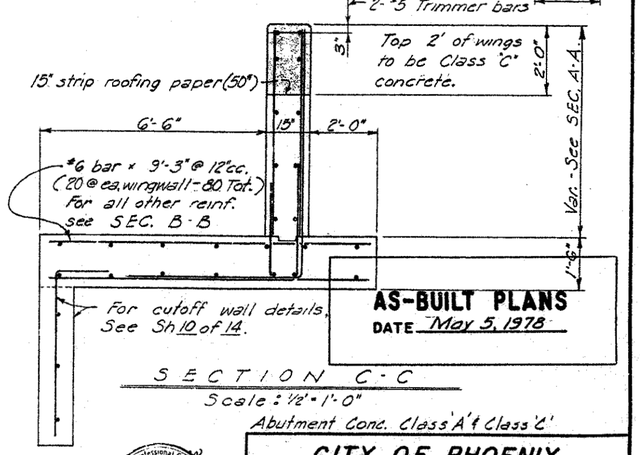
S E C T I O N A - A

Scale: ¼"=1'-0"



S E C T I O N B - B

Scale: ½"=1'-0"



S E C T I O N C - C

Scale: ½"=1'-0"

Abutment Conc. Class 'A' & Class 'C'

AS-BUILT PLANS
DATE May 5, 1978

Note:
All transverse Abut. Ftg. Reinf. to be placed normal to ℄ Abut. Brg. and spaced parallel to Constr. ℄. All longit. Abut. Ftg. Reinf. to be placed parallel to ℄ Brg. and spaced perpendicular to Constr. ℄.

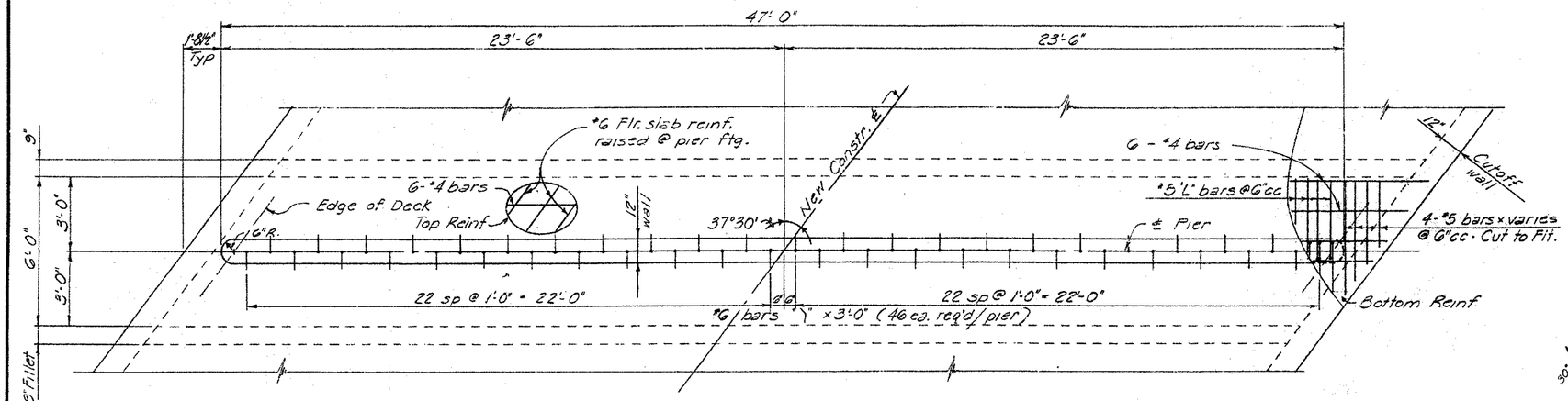
24X

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 12423 DONALD R. DAVIS STATE OF ARIZONA

CITY OF PHOENIX		
SCALE As Noted / DATE July '77	ABUTMENT DETAILS	DRAWN BY JVJ / REVISED
STA. 16+ NORTH 7th STREET		
BRIDGE OVER CAVE CREEK WASH		
HOFFMAN-MILLER ENGINEERS INC. PHOENIX ARIZONA		DRAWING NUMBER 11 of 14

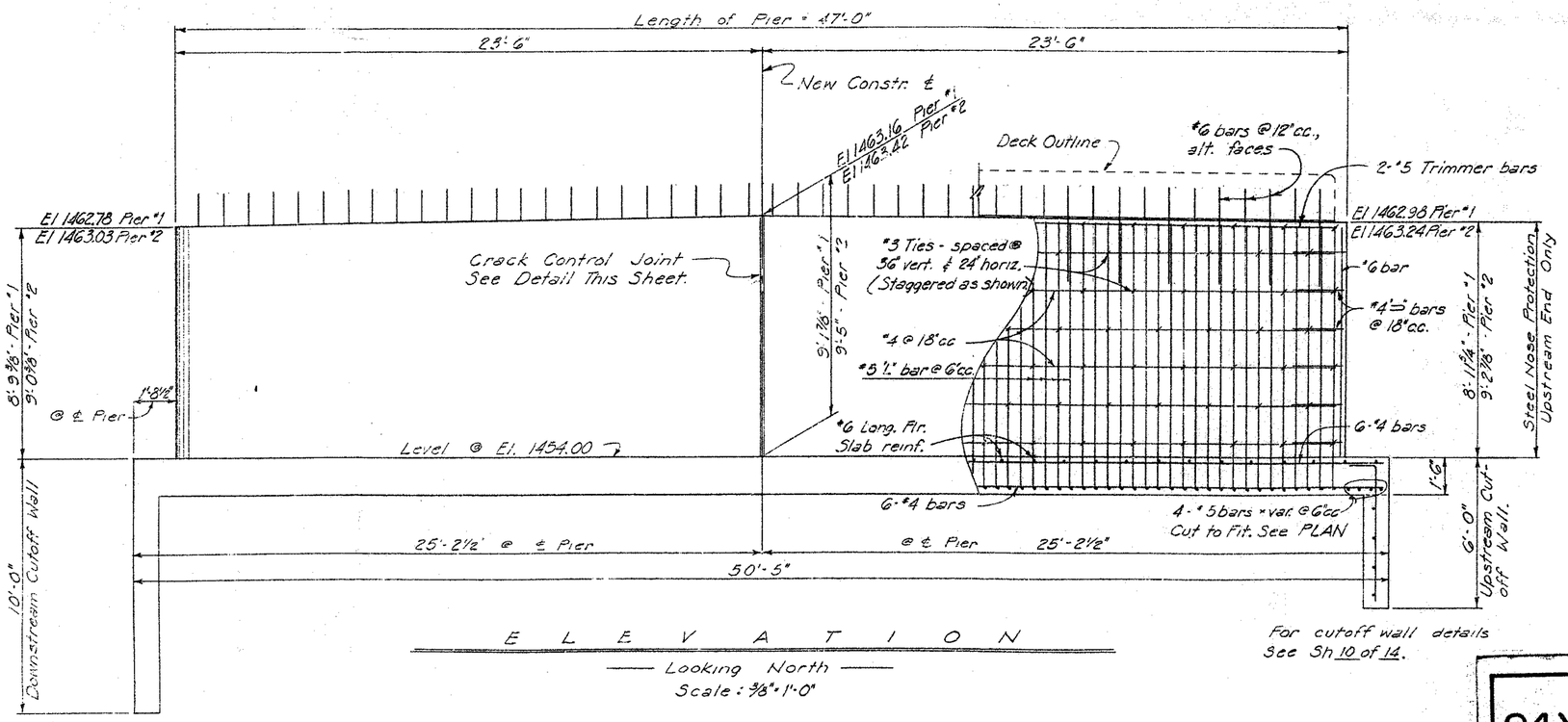
PROJECT Nº BR-76198.00 54927

NORTH 7th STREET - PHOENIX
BRIDGE OVER CAVE CREEK WASH
MARICOPA COUNTY



P L A N

Scale : ⅜" = 1'-0"

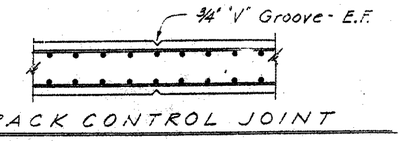


E L E V A T I O N

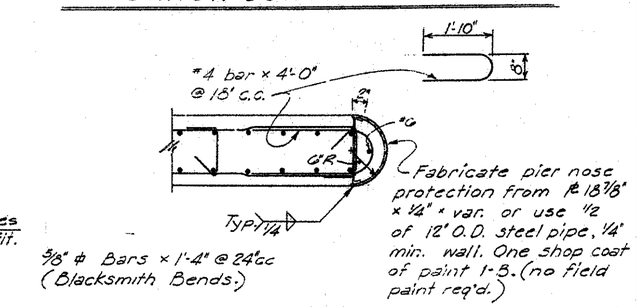
— Looking North —

Scale : ⅜" = 1'-0"

For cutoff wall details See Sh 10 of 14.

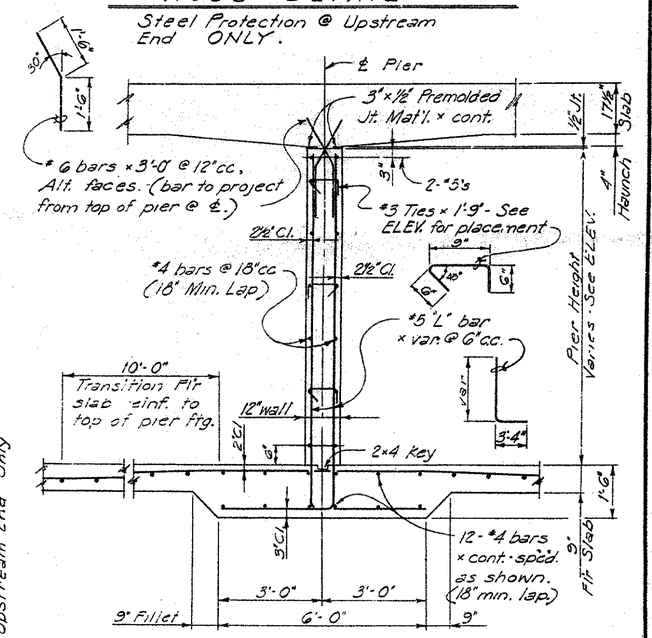


CRACK CONTROL JOINT



NOSE DETAIL

Steel Protection @ Upstream End ONLY.



S E C T I O N

Scale : ½" = 1'-0"

AS-BUILT PLANS
DATE May 5, 1978

All Pier Concrete Class 'A'

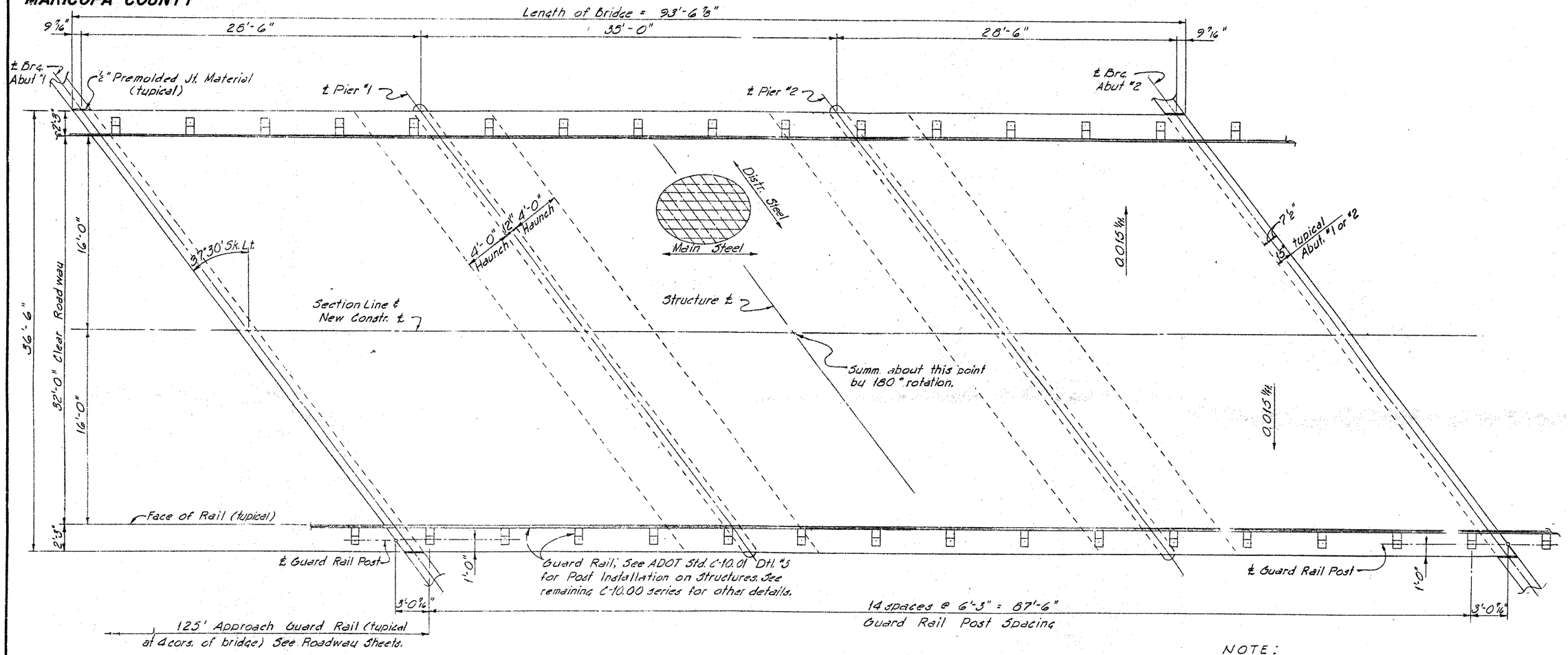
24X

CITY OF PHOENIX		
SCALE As Noted / DATE July 1977	PIER DETAILS	DRAWN BY JVJ / REVISED
STA. 16 + NORTH 7th STREET BRIDGE OVER CAVE CREEK WASH		
HOFFMAN-MILLER ENGINEERS INC. PHOENIX ARIZONA		DRAWING NUMBER 12 of 14

PROJECT Nº BR-76198.00

54928

NORTH 7th STREET - PHOENIX
BRIDGE OVER CAVE CREEK WASH
MARICOPA COUNTY



NOTE:
All main deck reinf. to be placed parallel to Constr. ℄. All temp. & distribution reinf. to be placed parallel to ℄ Abuts. & Piers.

DECK PLAN
37°30' Skew Lt. Scale; 1/4" = 1'-0"

AS-BUILT PLANS
DATE May 5, 1978

All Deck Concrete Class 'A'

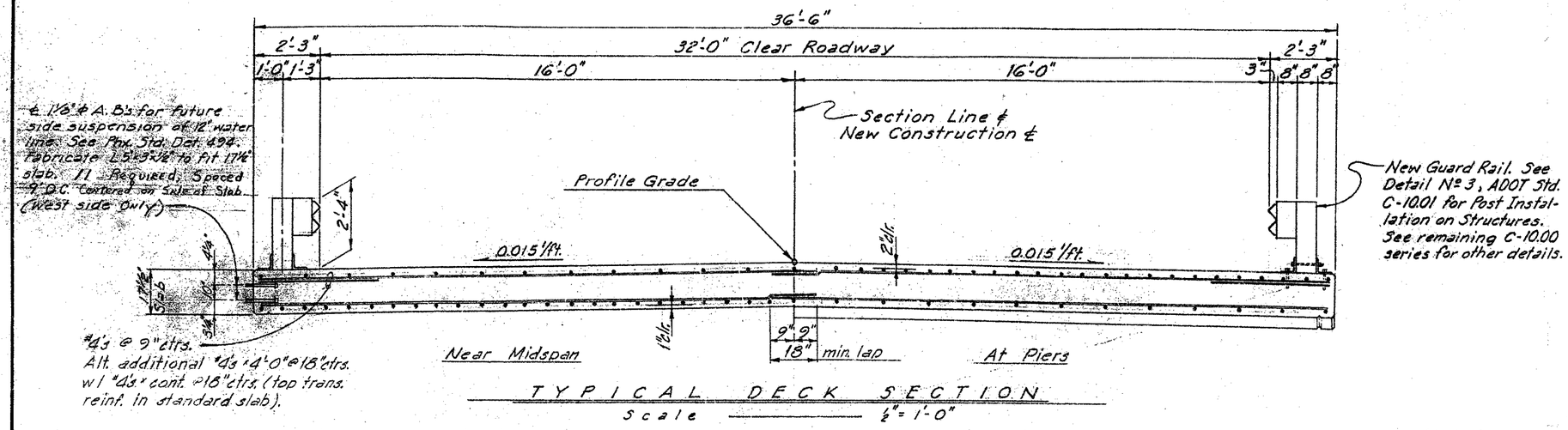
24X

NORMAN T. STEWARD 6675 REGISTERED PROFESSIONAL ENGINEER ARIZONA, U.S.A.

CITY OF PHOENIX		
SCALE Noted	DECK DETAILS	DRAWN BY JSW
DATE Jul 77		REVISED
STA. 16 + NORTH 7th STREET BRIDGE OVER CAVE CREEK WASH		
HOFFMAN-MILLER ENGINEERS INC. PHOENIX ARIZONA		DRAWING NUMBER 13 of 14

PROJECT No BR-76198.00 54929

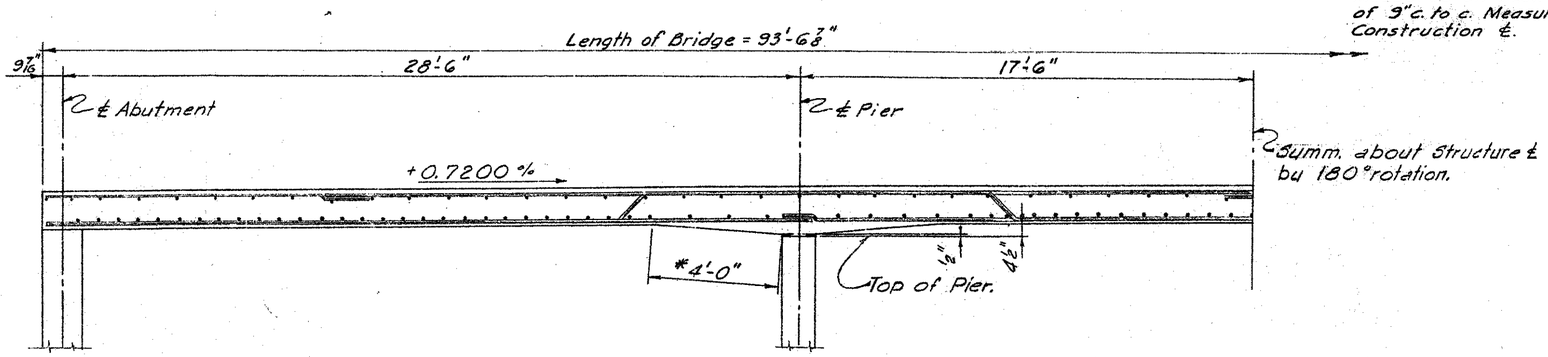
NORTH 7th STREET - PHOENIX
BRIDGE OVER CAVE CREEK WASH
MARICOPA COUNTY



TYPICAL DECK SECTION
Scale ——— ½" = 1'-0"

Note:
See ADOT Std. C5-20, Drawing #B-9.01 for Dead Load Camber & Deck Reinf. Dtls.

As-Built Note:
Deck Main Reinforcing Steel Was Furnished and Placed at 9" c. to c. Measured on Skew of Bridge Instead of 9" c. to c. Measured Normal To New Construction ℄.



* Normal to ℄ Abut. or Pier

HALF LONGITUDINAL SECTION
Scale ——— ⅜" = 1'-0"

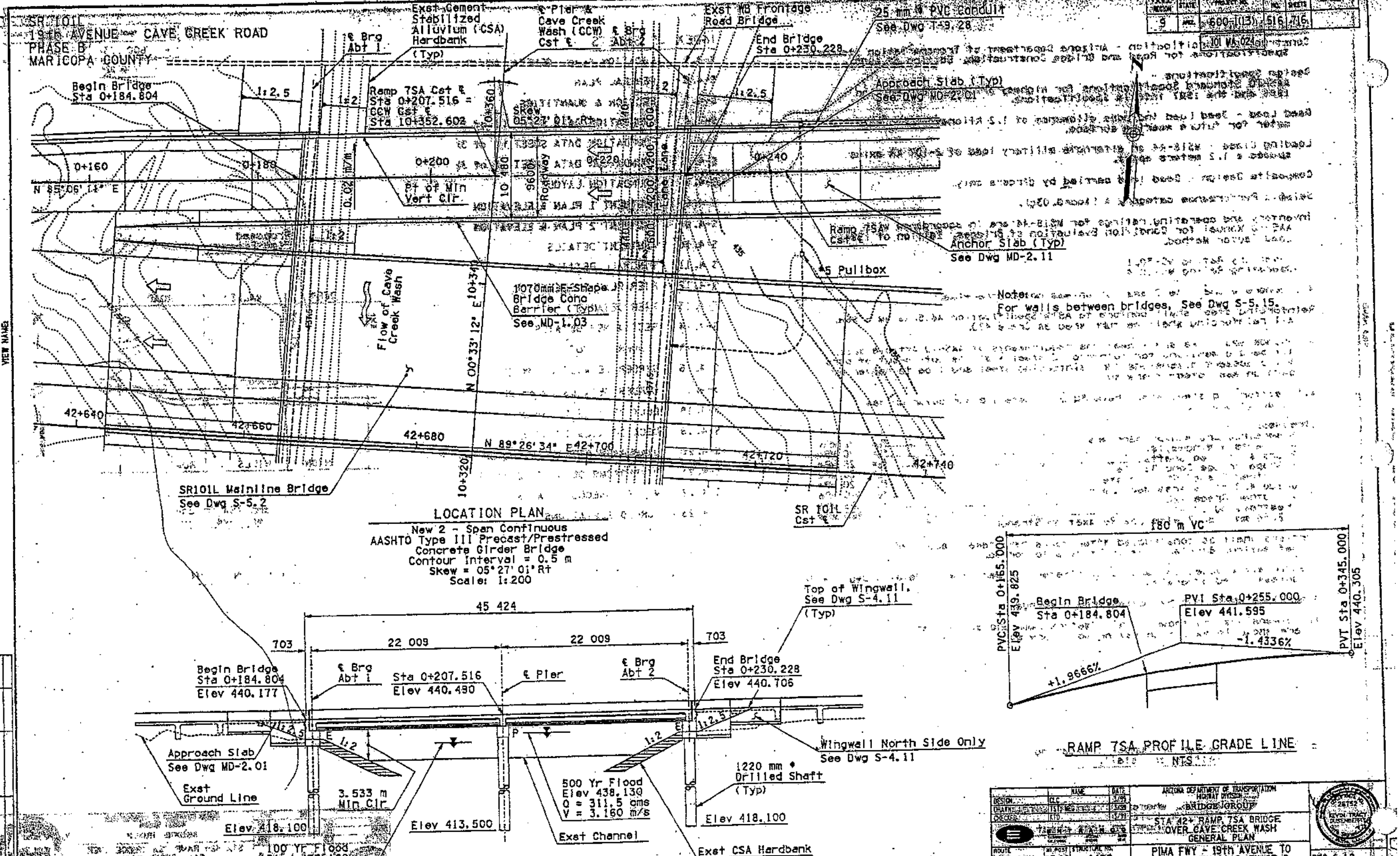
AS-BUILT PLANS
DATE May 5, 1978

24X

All Deck Concrete Class "A"

CITY OF PHOENIX			
SCALE Noted	DECK DETAILS	DRAWN BY NTS	
DATE Feb. '77		REVISED	
STA. 16 + NORTH 7th STREET BRIDGE OVER CAVE CREEK WASH			
HOFFMAN-MILLER ENGINEERS INC. PHOENIX ARIZONA		DRAWING NUMBER 14 of 14	

54930 PROJECT NO. BR-76198.00 54930



FHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	516	716	

101 MA 024

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TST	3/99
CHECKED	KTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SA BRIDGE
OVER CAVE CREEK WASH
GENERAL PLAN

ROUTE	MI. POST	STRUCTURE NO.
SR 101L	25.90	1466

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

TRACS NO. H 4830 01 C

600-1(13)

DWG S-4.2

___ OF ___

DESIGN FILE: P7SABR02.DGN PLOT DATE: 03/19/99 12:09:43

GENERAL NOTES

Construction Specification - Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Edition of 1996.

Design Specifications - AASHTO Standard Specifications for Highway Bridges, 16th Edition 1996 and the 1997 Interim Specifications.

Dead Load - Dead Load includes allowance of 1.2 kilonewton per square meter for future wearing surface.

Loading Class - MS18-44 or alternate military load of 2-107 KN axles spaced a 1.2 meters apart.

Composite Design - Dead load carried by girders only.

Seismic Performance category A (Aco=0.03g).

Inventory and operating ratings for MS18-44 are in accordance with AASHTO Manual for Condition Evaluation of Bridges, Edition of 1994, Load Factor Method.

Inventory Rating MS-30.1
Operating Rating MS-50.4

All concrete shall be Class 'S' unless noted otherwise.

Reinforcing steel shall conform to ASTM Specification A615/A615M - 96a. All reinforcing shall be furnished as Grade 420.

All bends and hooks shall meet the requirements of AASHTO Article 8.23. All bend dimensions for reinforcing steel shall be out-to-out of bars. All placement dimensions for reinforcing steel shall be to center of bars unless noted otherwise.

All reinforcing steel shall have 50 millimeters clear cover unless noted otherwise.

Stresses:

Superstructure except barriers	f_c=	31 MPa
Abutments & Wingwalls	f_c=	20 MPa
Piers & Drilled Shafts	f_c=	25 MPa
F-Shape Bridge Conc Barrier	f_c=	28 MPa
All other Class 'S' concrete	f_c=	20 MPa
Grade 420 transverse deck reinf	f_s=	140 MPa
All other Grade 420	f_s=	165 MPa
Prestressing steel (12.54 mm dia. 7-wire Low Relaxation Strand)	f_s=	1860 MPa

Barriers shall be constructed after spans have taken dead load deflection. Barriers shall not be slip formed.

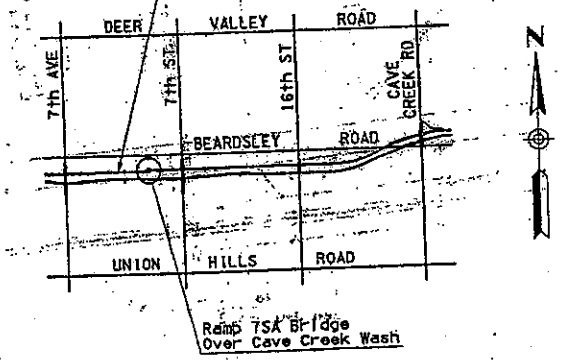
Chamfer all exposed corners 20 millimeters as per Chamfer Detail (Dwg S-4.3) unless noted otherwise.

Dimensions shall not be scaled from drawings.

All dimensions are shown in millimeters (mm) and all elevations are shown in meters unless noted otherwise.

INDEX OF SHEETS

S-4.1 LOCATION PLAN, GENERAL NOTES & INDEX
S-4.2 GENERAL PLAN
S-4.3 SECTION & QUANTITIES
S-4.4 FOUNDATION DATA SHEET (1 of 3)
S-4.5 FOUNDATION DATA SHEET (2 of 3)
S-4.6 FOUNDATION DATA SHEET (3 of 3)
S-4.7 FOUNDATION LAYOUT
S-4.8 ABUTMENT 1 PLAN & ELEVATION
S-4.9 ABUTMENT 2 PLAN & ELEVATION
S-4.10 ABUTMENT DETAILS
S-4.11 WINGWALL DETAILS
S-4.12 PIER PLAN & ELEVATION
S-4.13 PIER DETAILS
S-4.14 RESTRAINER DETAILS
S-4.15 GIRDER LAYOUT
S-4.16 GIRDER DETAILS (1 of 2)
S-4.17 GIRDER DETAILS (2 of 2)
S-4.18 DECK DETAILS (1 of 2)
S-4.19 DECK DETAILS (2 of 2)
S-4.20 DIAPHRAGM DETAILS (1 of 2)
S-4.21 DIAPHRAGMS DETAILS (2 of 2)
S-4.22 MISCELLANEOUS DETAILS
S-4.23 SCREED ELEVATIONS



LOCATION PLAN

LEGEND

Letter or number indicating section or detail.

Dwg. No. where section or detail shown or referred.
Dash '-' shown on same sheet.

9		600-1(13)	515

101 MA 024

DESIGN		
DRAWN		
CHECKED		

SR 101L 25.90 - 1466

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

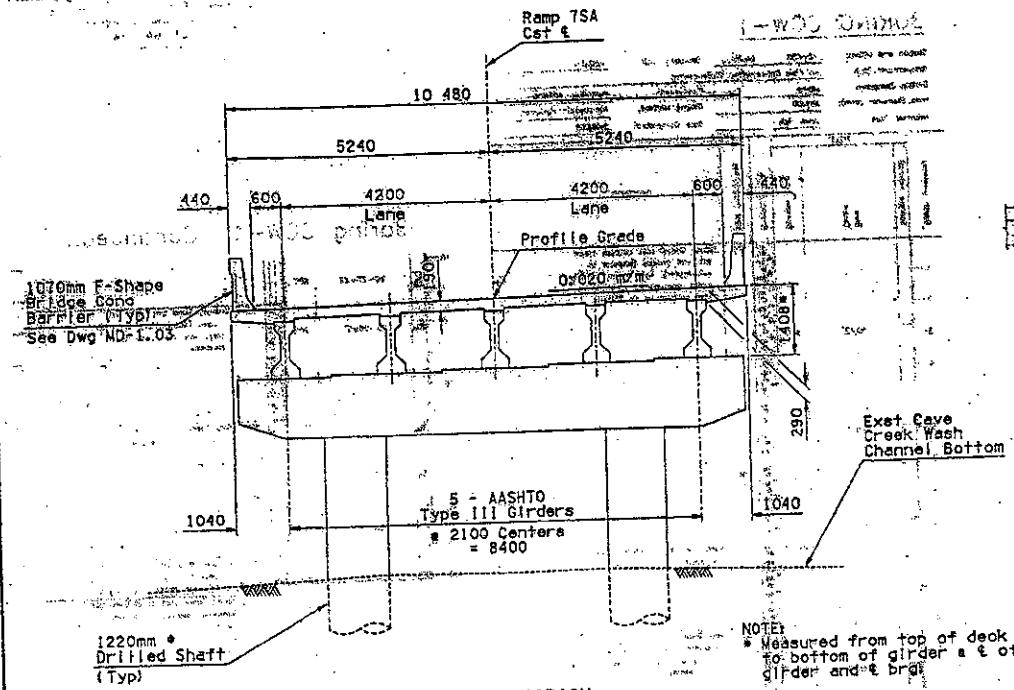
STA 42+ RAMP TSA BRIDGE OVER CAVE CREEK WASH
LOC. PLAN, GENERAL NOTES & INDEX

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-4.1

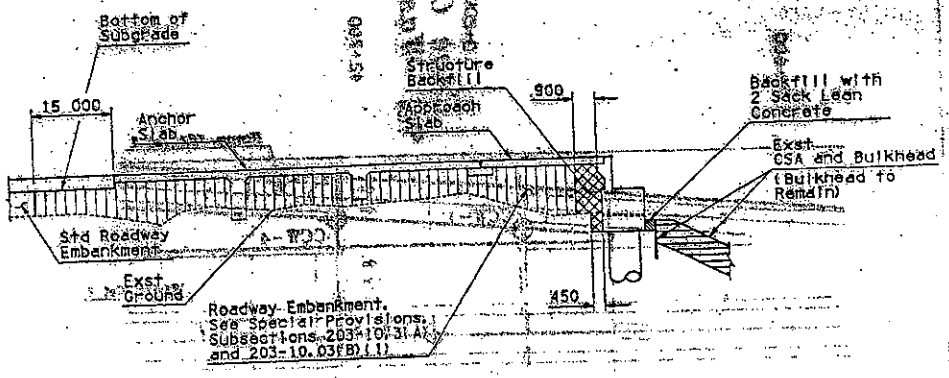
TRACS NO. H 4830 01 C — 600-1(13)

DESIGN FILE: PTSABR01.DGN PLOT DATE: 03/19/99 12:31:57

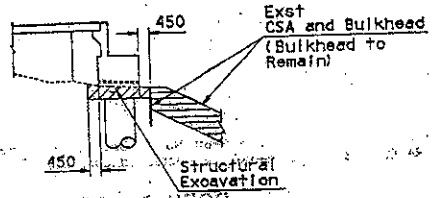


NOTE:
* Measured from top of deck to bottom of girder @ ℄ of girder and ℄ brg

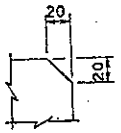
TYPICAL SECTION
Shown Looking Ahead On Station
Scale: 1:50



LIMITS OF STRUCTURE
BACKFILL AT ABUTMENTS
NTS



LIMITS OF STRUCTURAL
EXCAVATION AT ABUTMENTS
NTS



NOTE:
Chamfer all exposed corners unless otherwise noted. This note applicable to all sheets pertaining to the structures & walls.

CHAMFER DETAIL
NTS

Bearing Pads: Expansion 10 Ea, Fixed 10 Ea

Approach Slab: 74 m^2

Anchor Slab: 207 m^2

Restrainers: Expansion 16 Ea, Fixed 8 Ea

Bridge Conc Barrier: 89.8 m

APPROXIMATE QUANTITIES

ITEM	STR EX m^3	STR BACKFILL m^3	CLASS 'S' CONCRETE f'c=20 MPa m^3	f'c=25 MPa m^3	f'c=31 MPa m^3	REINFORCING STEEL Kg	AASHTO TYPE III GIRDERS m	COMPRESSION SEAL JOINT m	1220 * DRILLED SHAFTS m	Retaining Wall m^2
Abt 1	30	30	38		-	1830		9.7	38.2	12
Pier	-	-	-	28	-	2540	-		42.2	
Abt 2	60	30	46		-	1930		9.7	38.2	24
Superstructure	-	-			119	18,280	219.6		-	-
Total	90	60	84	28	119	24,580	219.6	19.4	118.6	36
As-Built Total	-	-	-	-	-	-	-			-

DESIGN			
CHECK			
DRAWN			
CHECKED			

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

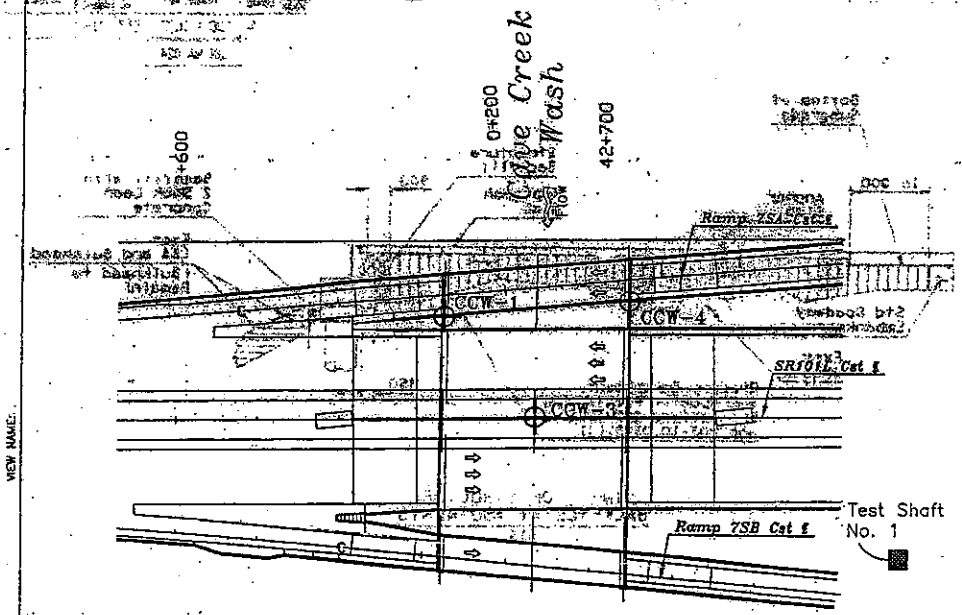
STA. 42+ RAMP TSA BRIDGE
OVER CAVE CREEK WASH
SECTION & QUANTITIES

PIMA FWY - 19TH AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	STATION	STRUCTURE NO.	DWG
SR 101L	25.90	1466	4.3

TRACS NO. H 4830 01 C | 600-1(13) | OF

DESIGN FILE: PTSABR03.DGN PLOT DATE: 03/19/99 12:10:53

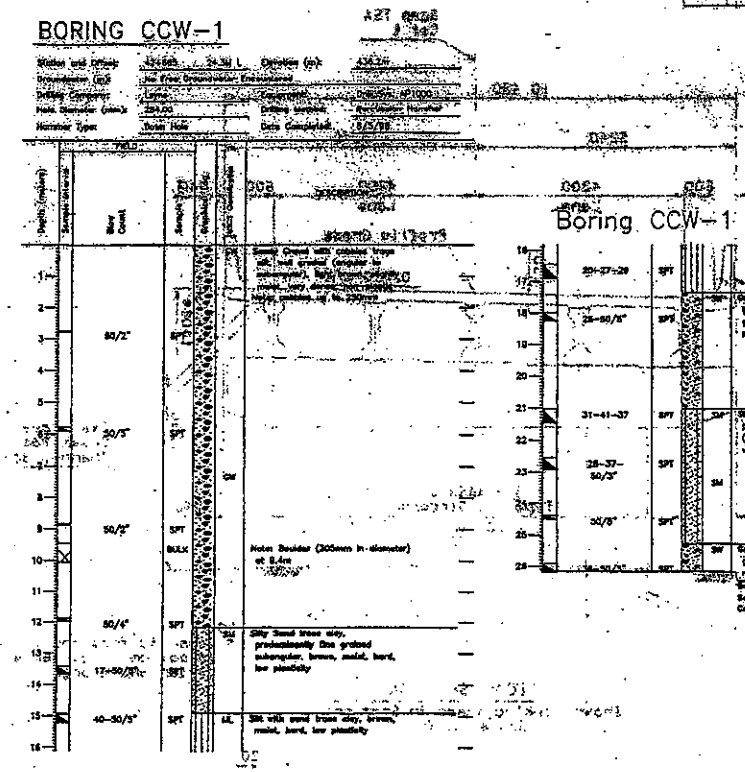


NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION MAP

No Scale



GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report & Foundations, Pima Freeway (101L) 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D; Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigations. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- SHELBY TUBE (3 inch outside diameter)
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- NQ SIZE CORE BARREL (1-7/8 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- WATER LEVEL (level after completion)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- WATER LEVEL (level where first encountered)

DESIGN			
DRAWN			
CHECKED			
KLEINFELDER			
SR 101L 25.50	1456		

ARIZONA DEPARTMENT OF TRANSPORTATION
MATERIALS GROUP
STA 428 (RAMP 7SA) BRIDGE OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (1 of 3)
PIMA FWY - 19TH AVENUE TO CAVE CREEK ROAD, PHASE B

TRACS NO. H 4830 01 C | 600-1(13B) | SHEET 318 OF 716

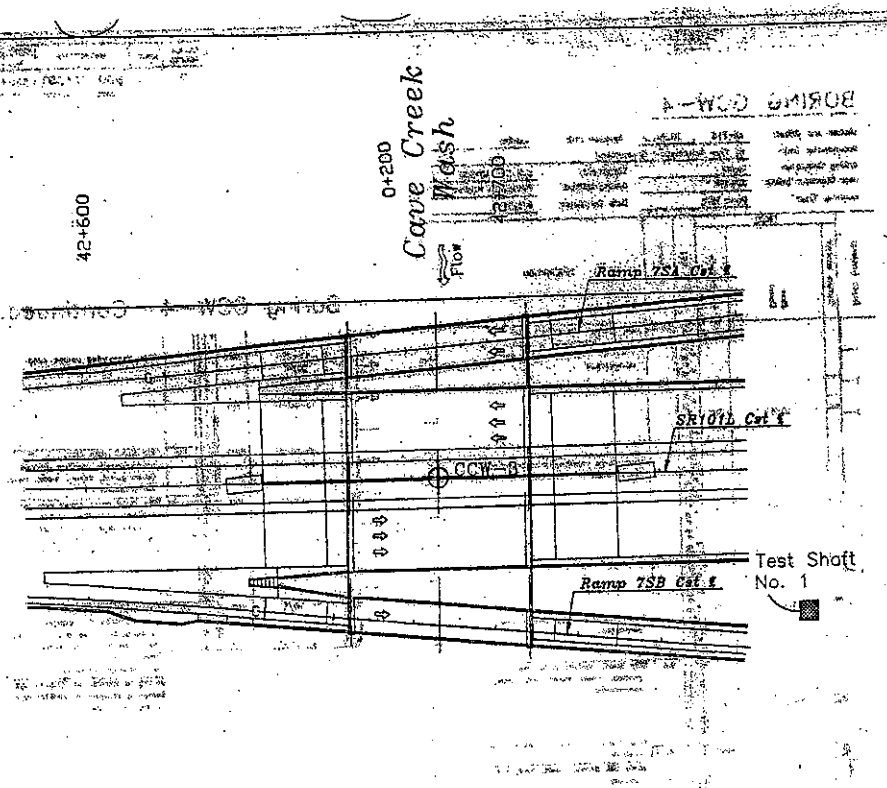
FINAL PLANS	CODE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	ARIZ	600-1(13B)	318	716

101 MA 024

DO NOT SCALE - REDUCED SIZE

DESIGN FILE: C:\PHOTOS\PROJECTS\5037\FOUNDATION_DATA\CAVE CREEK WASH\7SA-RAMP.DGN

PLOT DATE: 12/30/98

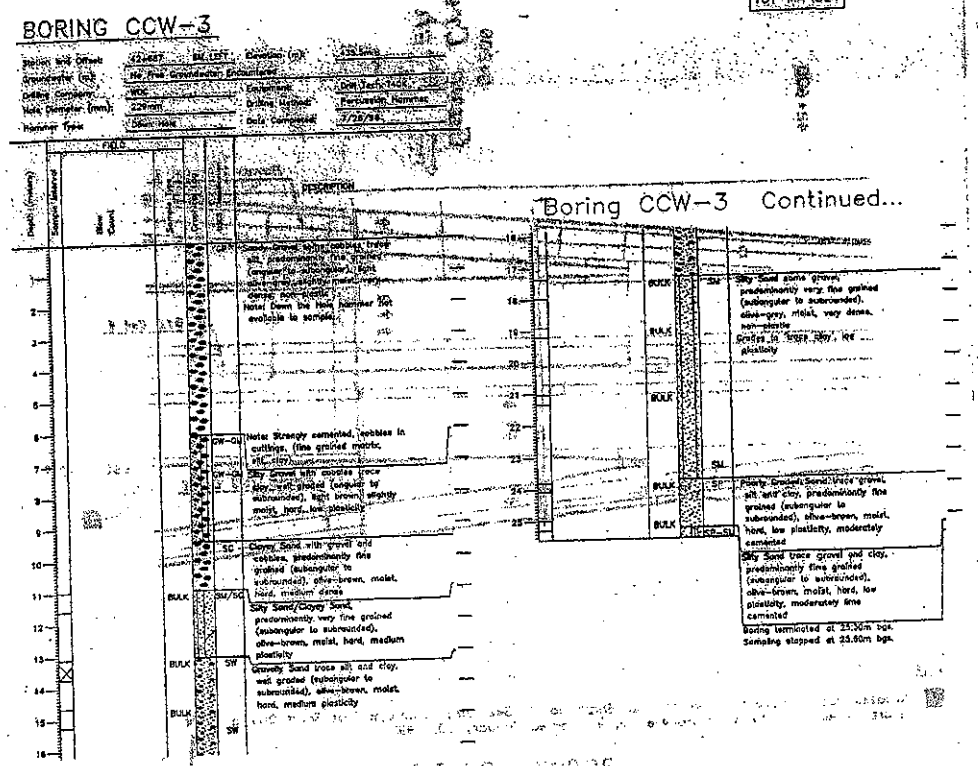


NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION MAP

No Scale



GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report – Foundations; Pima Freeway (101l) – 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (BORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter)
- NO SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

ARIZONA DEPARTMENT OF TRANSPORTATION
STRUCTURE DESIGN
MATERIALS GROUP

DESIGN KW 12/98
DRAWN SK 12/98
CHECKED CR 12/98

KLEINFELDER

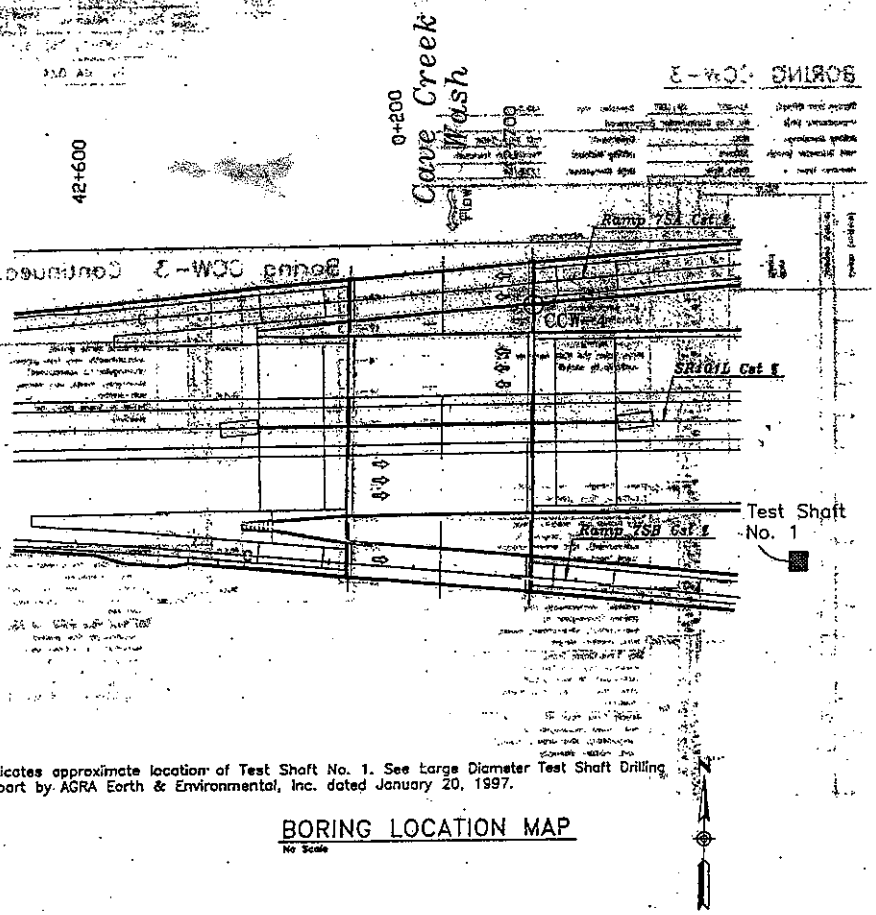
STA 42+ RAMP 7SA BRIDGE OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (2 of 5)

ROUTE	TM POST	STRUCTURE NO.	PROJECT NO.	DWG
SR 101L 25.90	1466	PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B	600-1(139)	S-4

TRACS NO. H 4830 01 C

PLOT DATE: 12/30/98

REDUCED SIZE - DO NOT SCALE



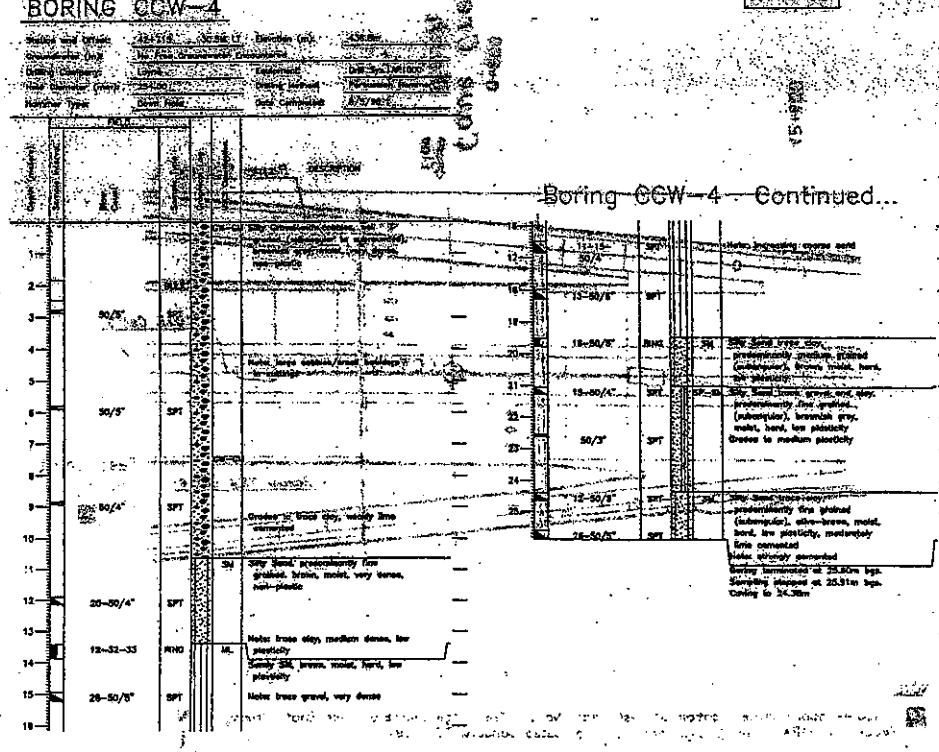
NOTE:

■ Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION MAP

No Scale

BORING CCW-4



GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report – Foundations, Pima Freeway (101) – 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

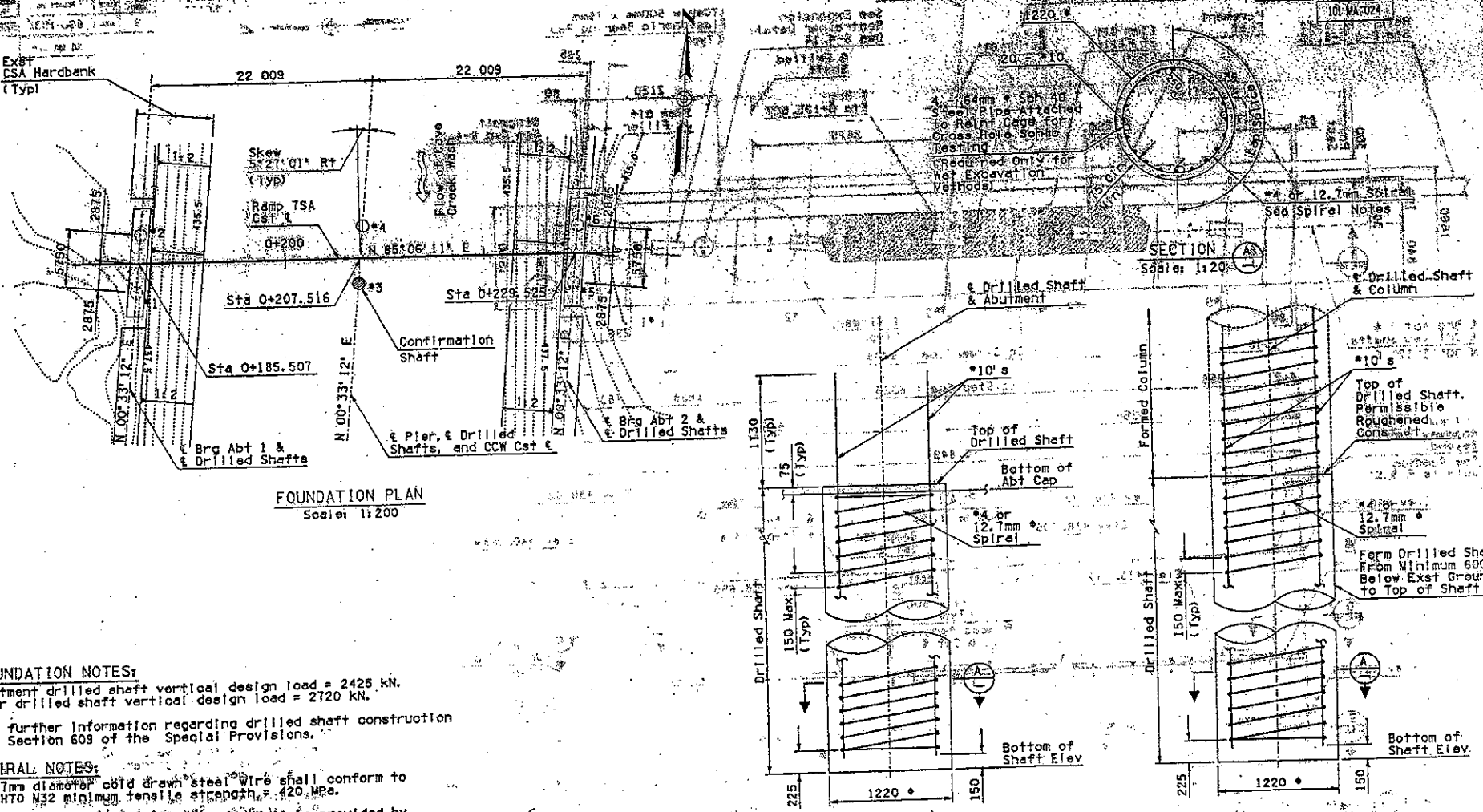
LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch-outside diameter)
- NQ SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

DESIGN				ARIZONA DEPARTMENT OF TRANSPORTATION	
DRAWN				MATERIALS GROUP	
CHECKED				STA. 42+ RAMP 7SA BRIDGE OVER CAVE CREEK WASH FOUNDATION DATA SHEET (Sheet 3)	
KLEINFELDER				PIMA FWY – 19th AVENUE TO CAVE CREEK ROAD, PHASE B	
SR 101L 25.90		7466			
TRACS NO. H 4830 01 C				600-1(13B)	520 OF 716

PLOT DATE: 12/20/98

REDUCED SIZE - DO NOT SCALE



FOUNDATION NOTES:

Abutment drilled shaft vertical design load = 2425 kN.
Pier drilled shaft vertical design load = 2720 kN.

For further information regarding drilled shaft construction see Section 609 of the Special Provisions.

SPIRAL NOTES:

12.7mm diameter cold drawn steel wire shall conform to AASHTO M32 minimum tensile strength = 420 MPa.

Anchorage of spiral reinforcement shall be provided by 1½ extra turns of the spiral at the end of a spiral unit.

Splices in spiral reinforcement shall be lap splices of 48 bar diameters but not less than 300mm or shall be welded.

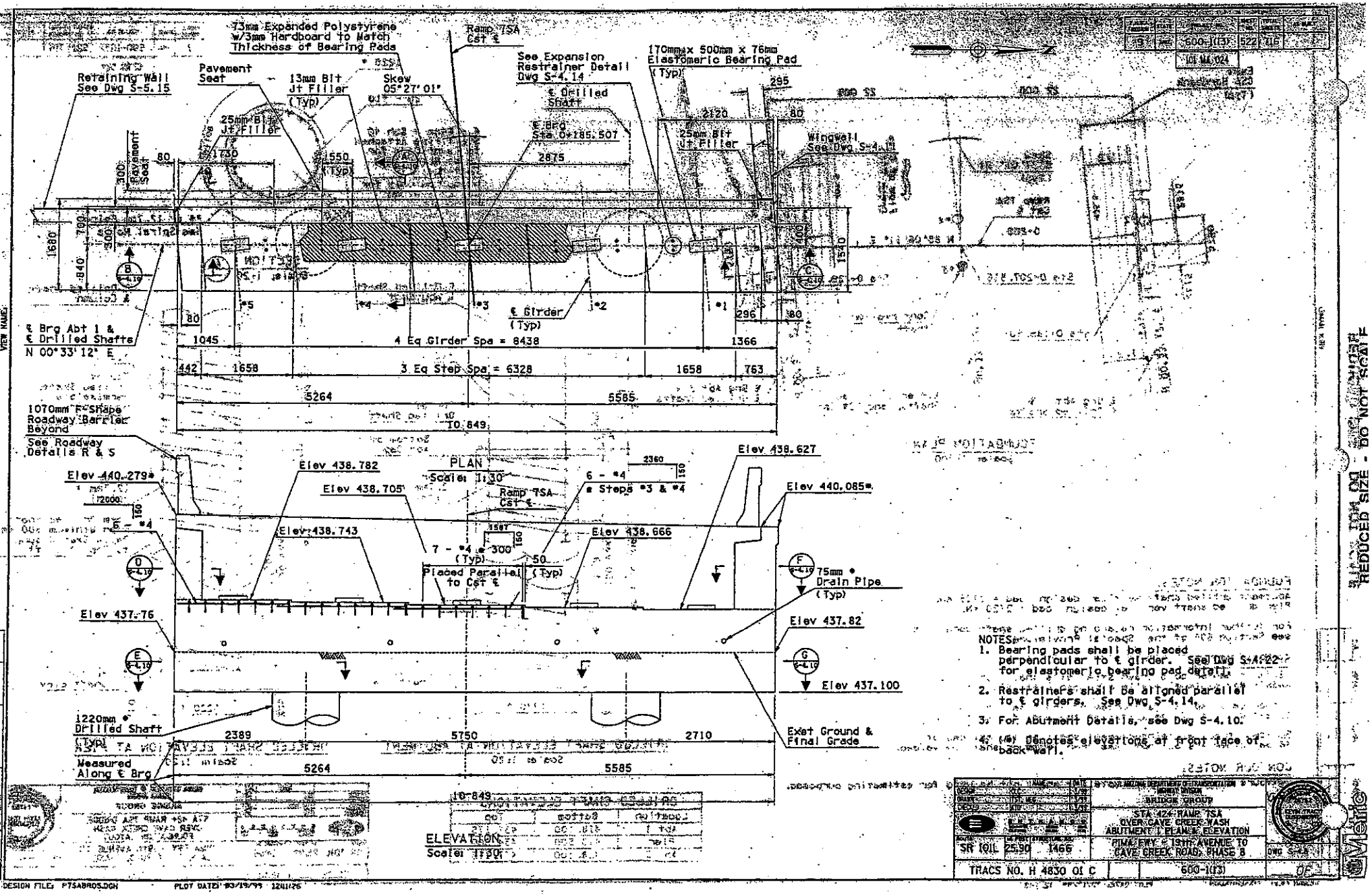
CONTOUR NOTES:

Contours shown are approximate and shall not be used for estimating purposes.

DRILLED SHAFT ELEVATIONS		
Location	Bottom	Top
Abt 1	418.100	437.175
Pier	413.500	434.600
Abt 2	418.100	437.175

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION BRIDGES GROUP			
STA 42+ RAMP TSA BRIDGE OVER CAVE CREEK WASH FOUNDATION LAYOUT			
PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B			
ROUTE	M.P.	STRUCTURE NO.	
SR 101L	25.90	1466	
TRACS NO. H 4830 01 C			
600-1(13)			
DWG SHEET			

DESIGN FILE: FTSABROAD.DGN PLOT DATE: 03/15/99 12:11:13



NOTES:

1. Bearing pads shall be placed perpendicular to ℄ girder. See Dwg S-4.22 for elastomeric bearing pad detail.
2. Restrainers shall be aligned parallel to ℄ girders. See Dwg S-4.14.
3. For Abutment Details, see Dwg S-4.10.
4. (*) Denotes elevations at front face of back wall.

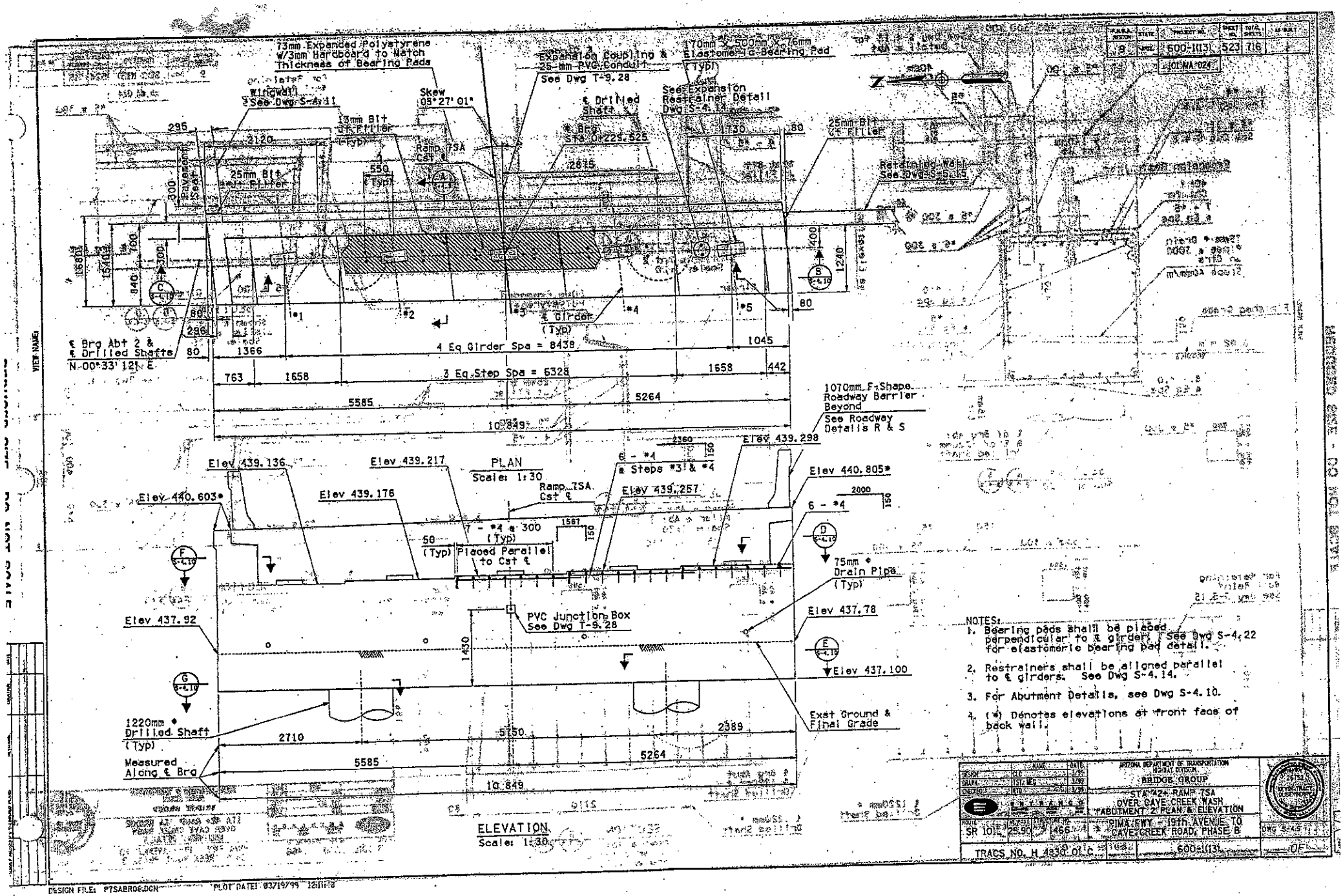
SR 101L	25.90	1466	PIMA/FRY ℄ 19th AVENUE TO CAVE CREEK ROAD, PHASE B
TRACS NO. H 4830 01 C			600-103

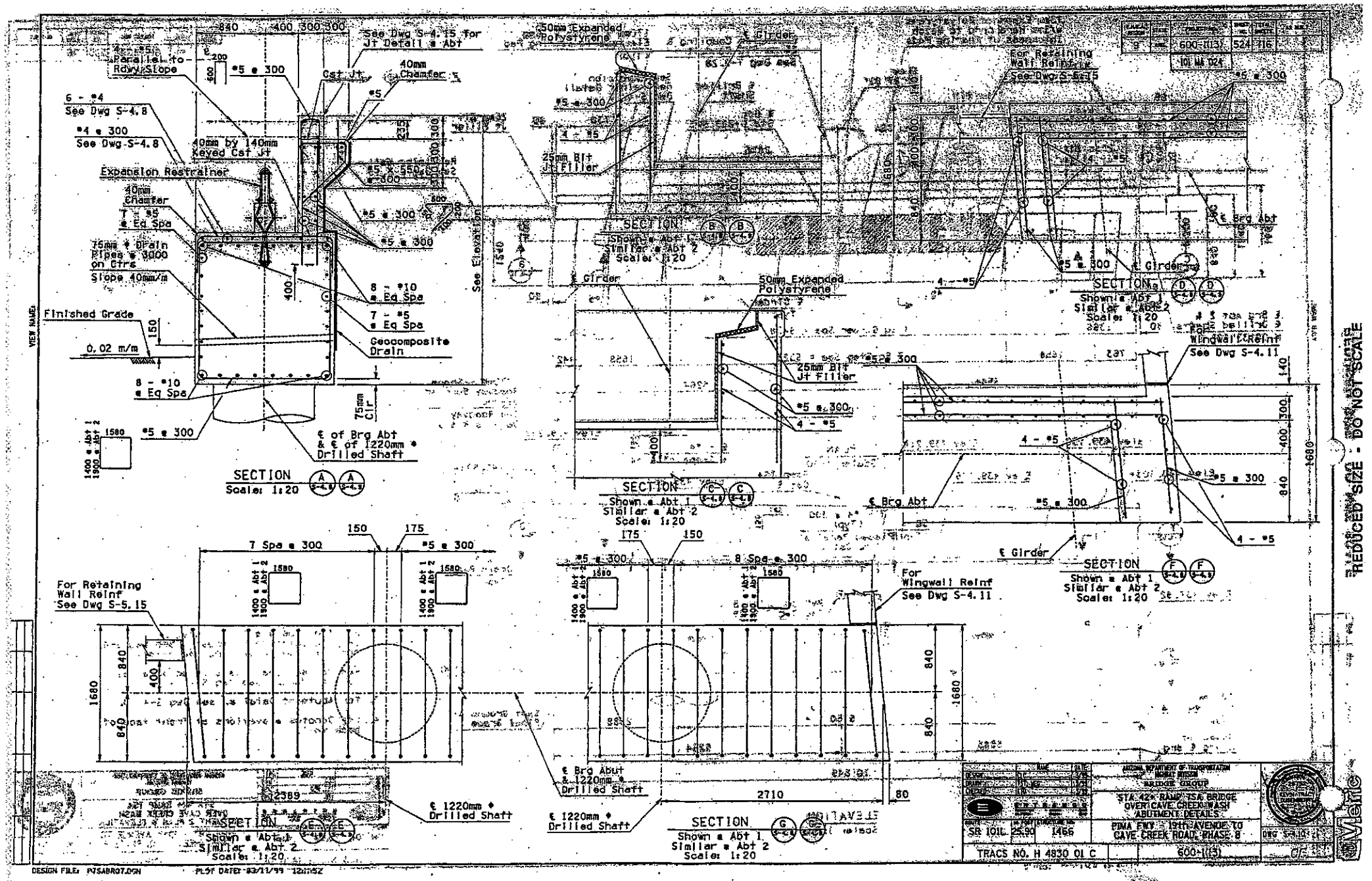
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP
STA 424 RAMP TSA
OVER CAVE CREEK WASH
ABUTMENT 1 PLAN & ELEVATION

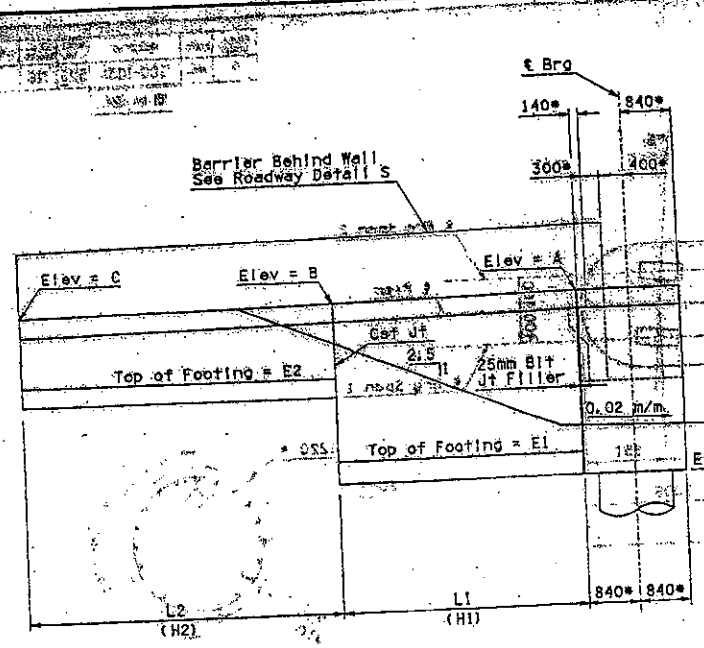
DWG S-4.9

REDUCED PLANS SIZE - DO NOT SCALE

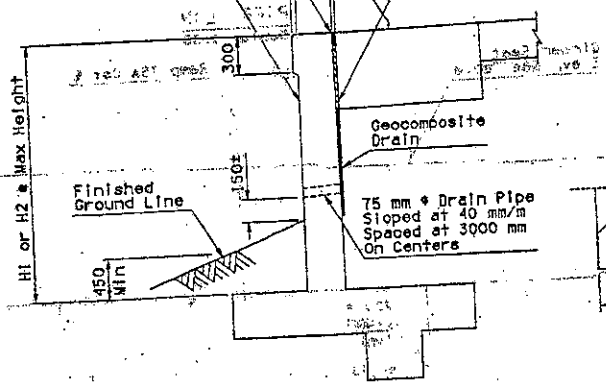
DESIGN FILE: P7SABROS.DGN PLOT DATE: 03/19/99 12:41:26


73mm Expanded Polystyrene W/3mm Hardboard to Match Thickness of Bearing Pads
Expansion Coupling & 25-mm PVC Conduit See Dwg T-9.28
170mm X 500mm X 76mm Elastomeric Bearing Pad (Typ)
Wingwall See Dwg S-4.11
Skew 09°27' 01"
13mm Bit Jt Filler (Typ)
℄ Drilled Shaft
See Expansion Restrainer Detail Dwg S-4.14
25mm Bit Jt Filler
Ramp TSA Cst ℄
℄ Brg Sta. 0+224.525
Retaining Wall See Dwg S-5.55
25mm Bit Jt Filler
Pavement Seal
℄ Brg Abt 2 & ℄ Drilled Shafts N-00°33' 12" E
℄ Girder (Typ)
4 Eq Girder Spa = 8438
3 Eq Step Spa = 6328
1070mm F-Shape Roadway Barrier Beyond
See Roadway Details R & S
Elev 439.298
Elev 439.136
Elev 439.217
PLAN
Scale: 1:30
6 - #4 @ Steps #3 & #4
Elev 440.805*
Elev 440.603*
Elev 439.176
Ramp TSA Cst ℄
Elev 439.257
6 - #4
7 - #4 @ 300 (Typ)
50 (Typ)
Placed Parallel to Cst ℄
75mm ϕ Drain Pipe (Typ)
Elev 437.78
PVC Junction Box See Dwg T-9.28
Elev 437.92
Elev 437.100
1220mm ϕ Drilled Shaft (Typ)
Measured Along ℄ Brg
Exst Ground & Final Grade
ELEVATION
Scale: 1:30
NOTES:
1. Bearing pads shall be placed perpendicular to ℄ girders. See Dwg S-4.22 for elastomeric bearing pad detail.
2. Restrainers shall be aligned parallel to ℄ girders. See Dwg S-4.14.
3. For Abutment Details, see Dwg S-4.10.
4. (*) Denotes elevations at front face of back wall.
ARIZONA DEPARTMENT OF TRANSPORTATION
BRIDGE GROUP
STA 42+ RAMP TSA
OVER CAVE CREEK WASH
ABUTMENT 2 PLAN & ELEVATION
SR 101L PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B
TRACS NO. H 4830 01 C
600-1(13)
DESIGN FILE: P7SABR06.DGN
PLOT DATE: 03/19/99

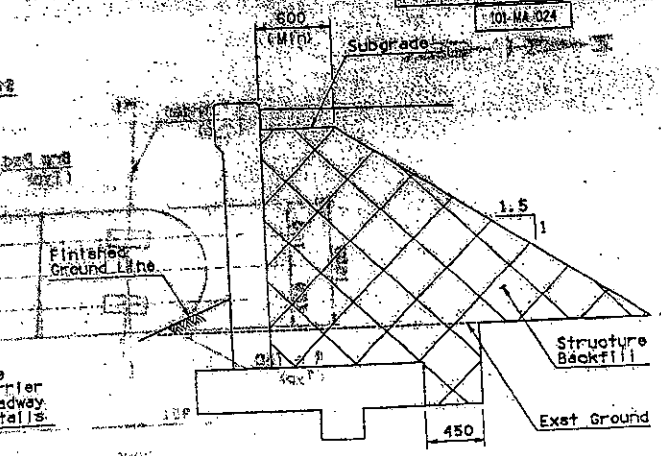

See Dwg S-4.15 For Jt Detail @ Abt
Parallel to Rdwy Slope
*5 @ 300
Cst Jt
40mm Chamfer
6 - *4
See Dwg S-4.8
*4 @ 300
See Dwg S-4.8
40mm by 140mm Keyed Cst Jt
Expansion Restrainer
40mm Chamfer
7 - *5 @ Eq Spa
75mm ϕ Drain Pipes @ 3000 on Ctrs
Slope 40mm/m
Finished Grade
0.02 m/m
8 - *10 @ Eq Spa
7 - *5 @ Eq Spa
Geocomposite Drain
8 - *10 @ Eq Spa
75mm Clr
℄ of Brg Abt & ℄ of 1220mm ϕ Drilled Shaft
SECTION A A
Scale: 1:20
50mm Expanded Polystyrene
℄ Girder
25mm Bit Jt Filler
4 - *5
SECTION B B
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20
See Elevation
For Retaining Wall Reinf See Dwg S-5.15
℄ Brg Abt
SECTION D D
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20
For Wingwall Reinf See Dwg S-4.11
SECTION C C
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20
SECTION F F
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20
7 Spa @ 300
8 Spa @ 300
For Retaining Wall Reinf See Dwg S-5.15
For Wingwall Reinf See Dwg S-4.11
℄ 1220mm ϕ Drilled Shaft
℄ Brg Abut & 1220mm ϕ Drilled Shaft
2710
2389
SECTION E E
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20
SECTION G G
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP
STA. 42+ RAMP 15A BRIDGE OVER CAVE CREEK WASH
ABUTMENT DETAILS
PIMA FWY 19th AVENUE TO CAVE CREEK ROAD, PHASE 8
SR 101L 25.90 1466
TRACS NO. H 4830 01 C
600-1(13)
DWG S-4.10
REDUCED SIZE - DO NOT SCALE
DESIGN FILE: PJSABR07.DGN
PLOT DATE: 03/11/99 12:17:52



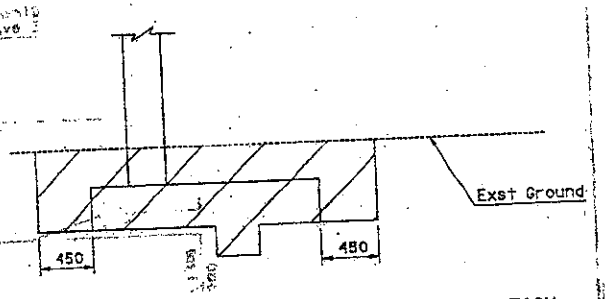
BACK OF WINGWALL ELEVATION
Shown at Abut 1.
Similar at Abut 2
Scale: 1:40



TYPICAL WINGWALL SECTION
Scale: 1:20



LIMITS OF WINGWALL STRUCTURE BACKFILL
Scale: 1:20



LIMITS OF WINGWALL STRUCTURAL EXCAVATION
Scale: 1:20

NOTES:
1. See ADOT Standard Dwg B-18.10 & B-18.20 Case II for wall dimensions and reinforcing. (English June 1992)
2. (*) Dimensions measured perpendicular to ℄ bearing.
3. (**) Looking ahead on stationing.

BRIDGE 7SA WINGWALL DIMENSIONS (m) & ELEVATIONS

Location **	L1	H1	L2	H2	A	B	C	E1	E2
Abt 1 (Left Side)	6.000	2.517(9 Ft)	5.000	1.203(4 Ft)	440.073	440.008	439.923	437.456	438.805
Abt 2 (Left Side)	6.000	3.146(10 Ft)	6.000	1.758(6 Ft)	440.600	440.627	440.663	437.481	438.905

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	Ariz	600-1(13)	525	716
		101-MA 024		

ROUTE	MILEPOST	FUNCTIONAL NO.
SR 101L	25.90	1466

TRACS NO. H 4830 01 C

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SA
OVER CAVE CREEK WASH
WINGWALL DETAILS

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

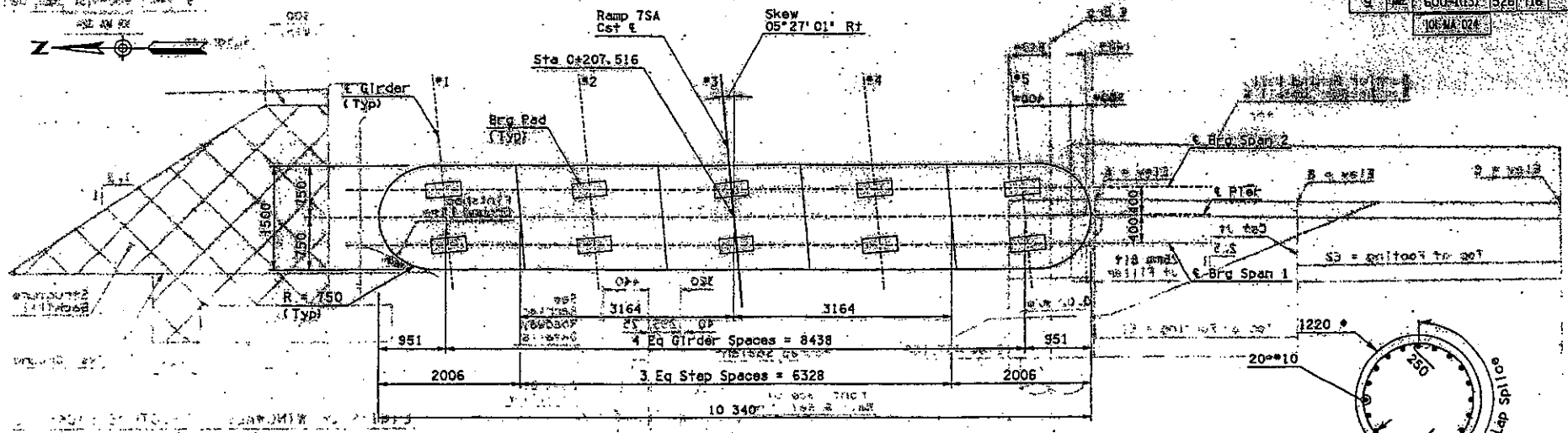
600-1(13)

DWG SCALE 1:1

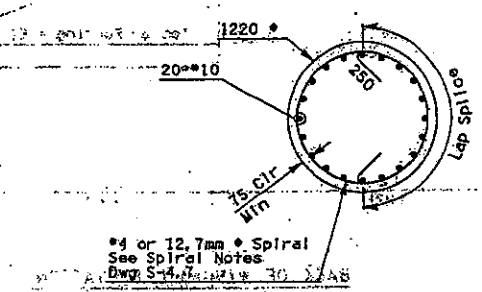
___ OF ___

DESIGN FILE: P7SA8B30.DGN PLOT DATE: 03/19/99 12:12:10

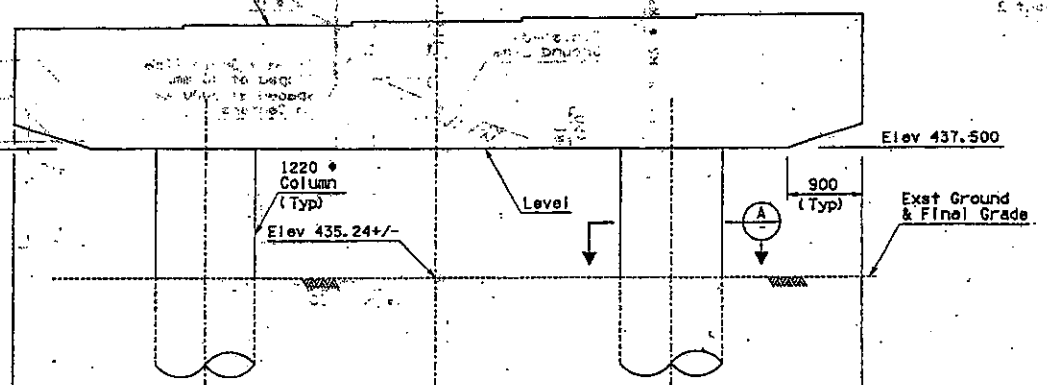
REDUCED SIZE : DO NOT SCALE



PIER PLAN
Scale: 1:30



SECTION A
Scale: 1:20



PIER ELEVATION
Scale: 1:30

GIRDER SEAT ELEVATIONS		
Girder #	Span 1 Elev	Span 2 Elev
#1	438.947	438.957
#2	438.987	438.996
#3	439.027	439.036
#4	439.066	439.076
#5	439.106	439.115

NOTE:
* Span 2 girder seat elevations may be lowered to match Span 1 elevations with the addition of galvanized steel plates 9 x 250 x 500 placed under the Span 2 bearing pads.

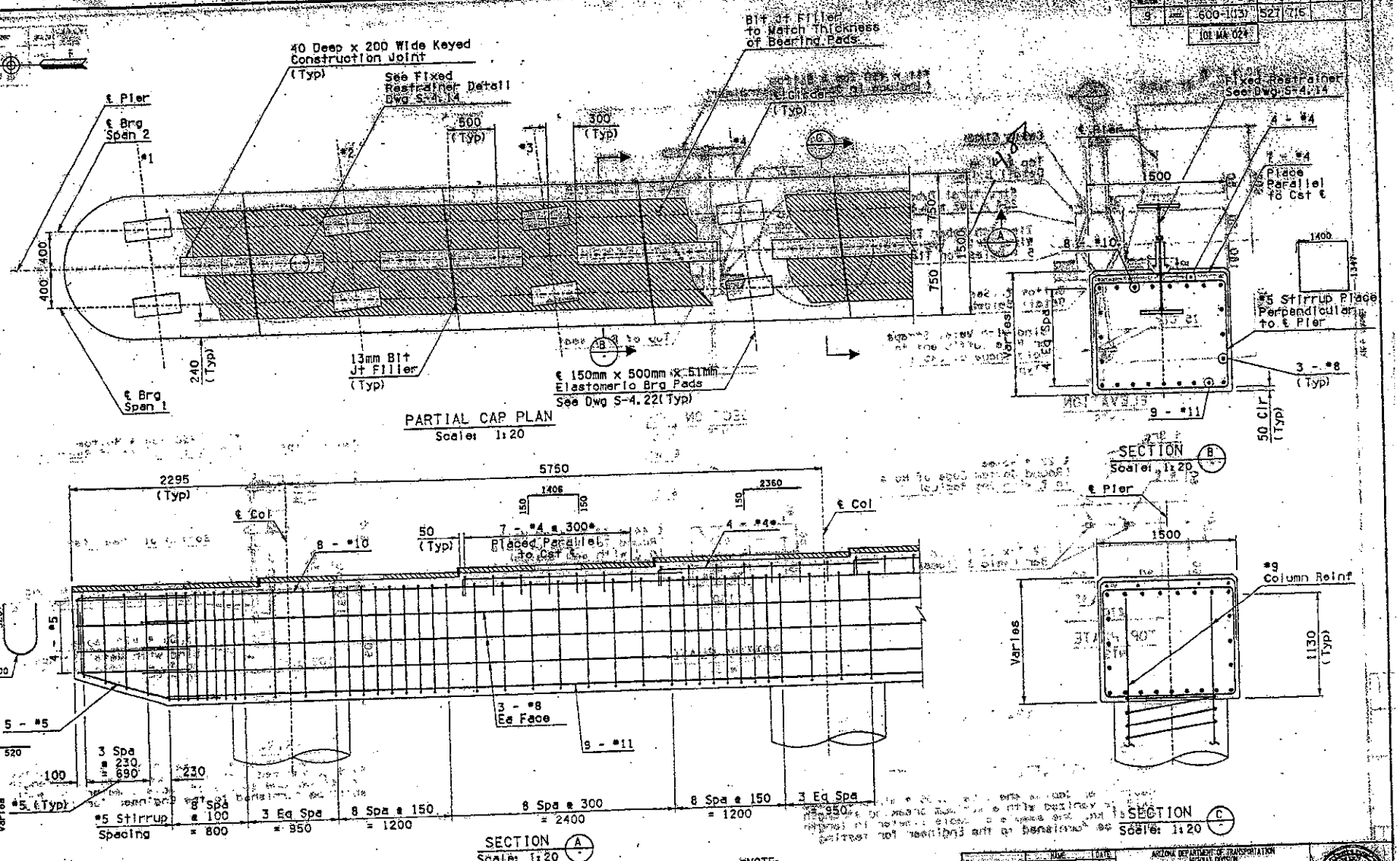
SR 101L	25.90	1466	PIMA CNTY. 19TH AVENUE TO CAVE CREEK ROAD, PHASE B
TRACS NO. H 4830-01-C			600-1(13)

ARIZONA DEPARTMENT OF TRANSPORTATION
STRUCTURE GROUP
BRIDGE GROUP
ST A-42+ RAMP 7SA BRIDGE
OVER CAVE CREEK WASH
PIER PLAN & ELEVATION

DWG S-12

REDUCED SIZE - DO NOT SCALE

DESIGN FILE: P7SABR09.DGN PLOT DATE: 03/19/99 12:12:27



SHEET NO.	TOTAL SHEETS	PROJECT NO.
527	716	600-103

101 MA 024

	NAME	DATE
DESIGN		
DRAWN		
CHECKED		

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP TSA BRIDGE
OVER CAVE CREEK WASH
PIER DETAILS

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1466

TRACS NO. H 4830 01 C

600-103

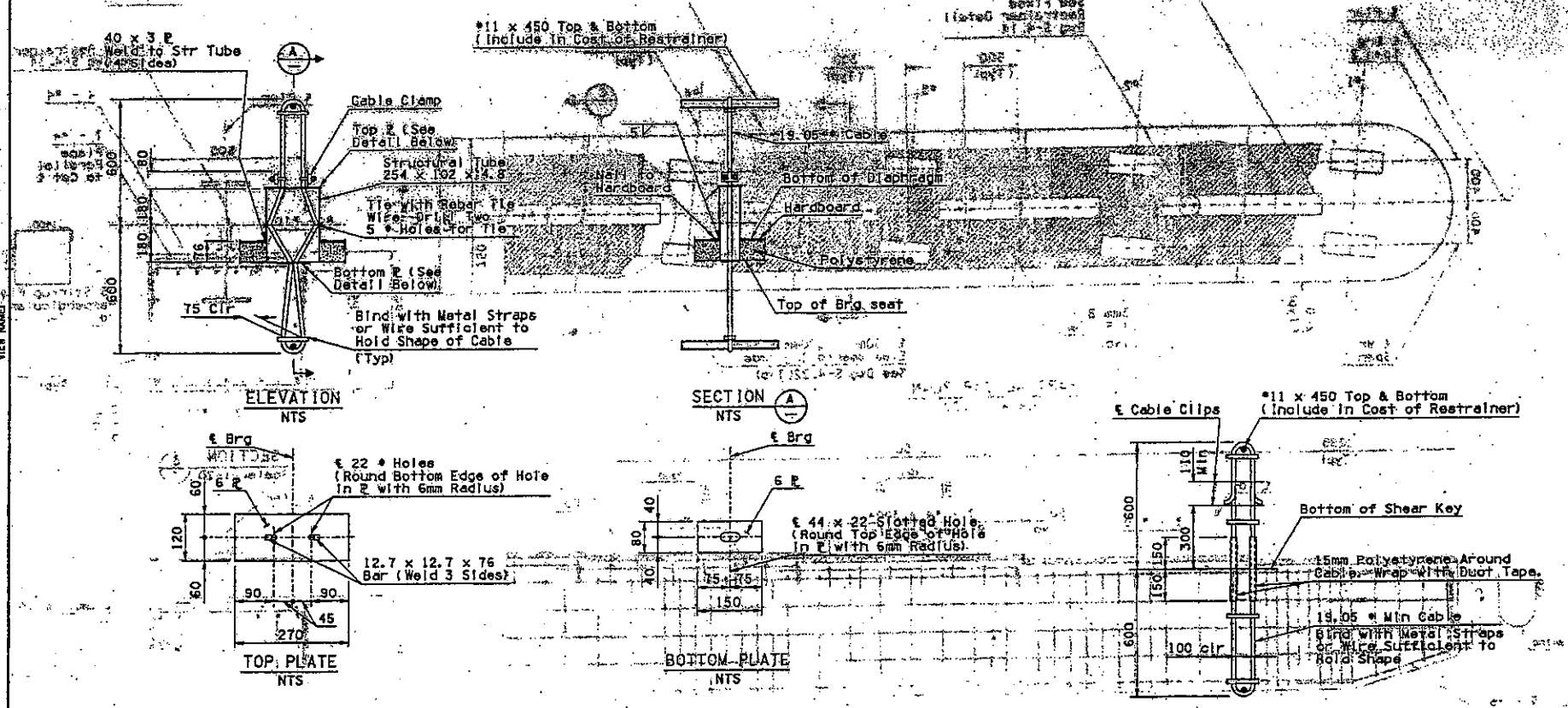
DWG S-4.13

OF

REDUCED SIZE - DO NOT SCALE

DESIGN FILE: PTSABRIO.DGN

PLOT DATE: 03/19/99 12:12:34



EXPANSION RESTRAINER DETAIL

NOTES:

Seal all openings in structural tube to prohibit concrete intrusion.

Restrainer Cables shall be 19.05 ϕ min preformed 6x19 galvanized with a minimum breaking strength of 187 kN. One sample of cable 1 meter in length shall be furnished to the Engineer for testing

FIXED RESTRAINER DETAIL

Restrainer Cables shall be 19.05 ϕ min preformed 6x19 galvanized with a minimum breaking strength of 187 kN. One sample of cable 1 meter in length shall be furnished to the Engineer for testing

9	600-103	528	116
	101 MA 024		

ARIZONA DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION
BRIDGE GROUP

STA. 42+ RAMP TSA BRIDGE OVER CAVE CREEK WASH
RESTRAINER DETAILS

SR 101L 25.90 1466

PIMA EWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

TRACS NO. H 4830 01 C

600-103

DWG S-4.74

REDUCED SIZE - DO NOT SCALE

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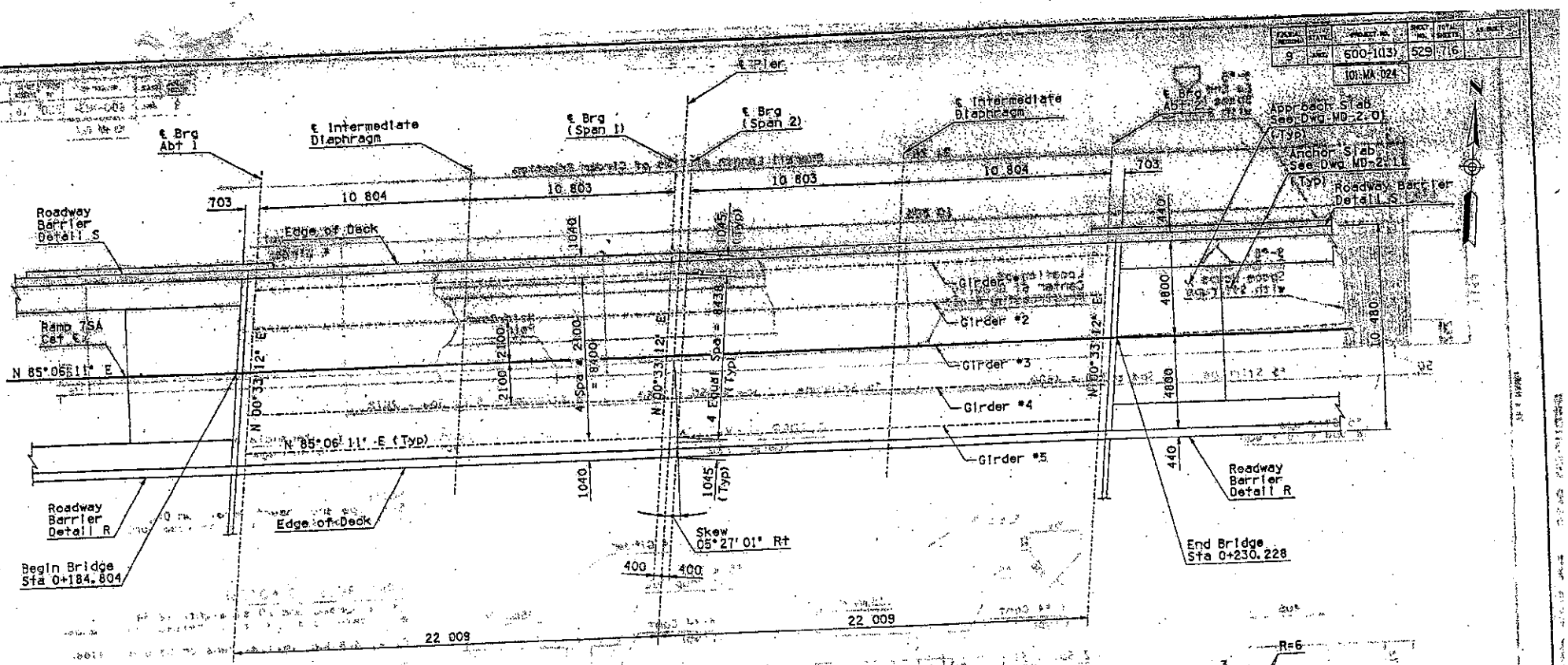
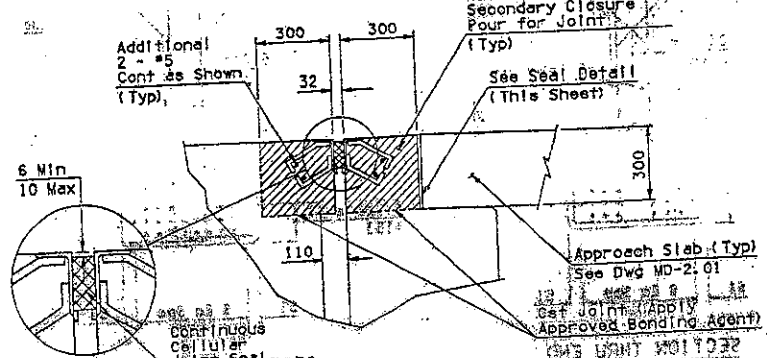
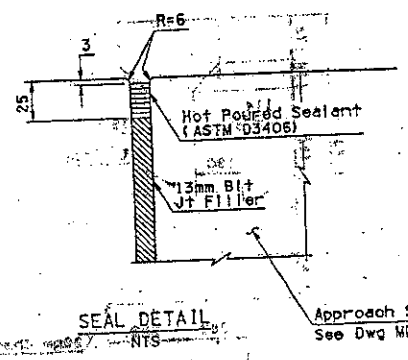


FRAMING PLAN
Scale: 1:100



JOINT DETAIL @ ABUTMENT
Dimensions shown are perpendicular to ℄ Brg
Scale: 1:10



SEAL DETAIL
NTS

NOTES:
1. Girders shall be placed parallel to Ramp 7SA Cat ℄.
2. 51 x 51 compression seal. ℄ = 80 joint opening @ 32 @ 16°C temp correction 2.4 per 10°C
3. For compression seal joint details not shown, see Dwg MD-3.01.
4. Provide through joint in barriers with 6mm bit joint filler at ℄ pier.

9		600-1(13)	529	716			
		101 MA 024					

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SA BRIDGE OVER CAVE CREEK WASH
GIRDER LAYOUT

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1466

TRACS NO. H 4830 01 C

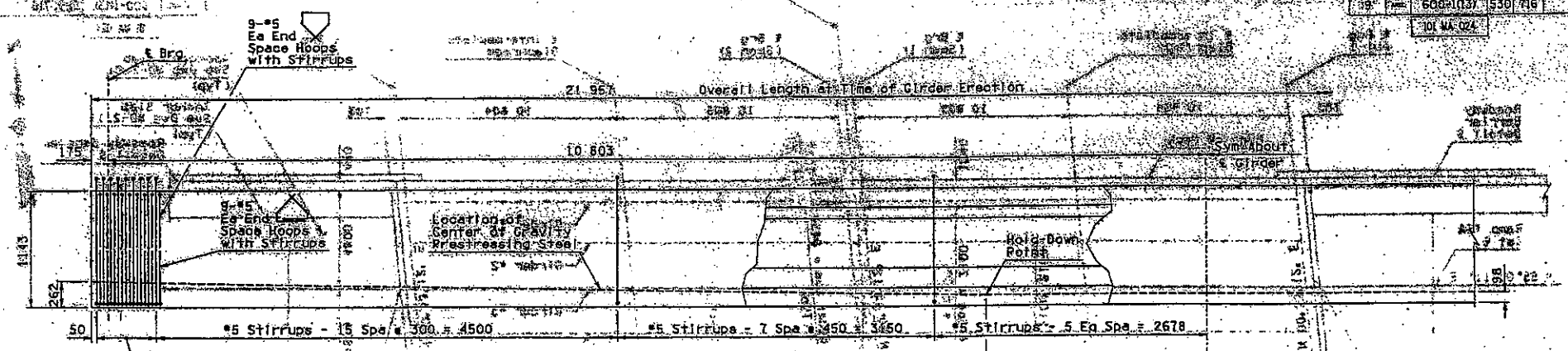
600-1(13)

DWG S-415

REVISE TRACE ON MYLAR

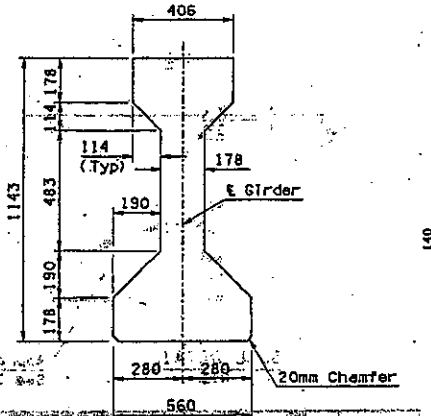
REDUCED SIZE - DO NOT SCALE

DESIGN FILE: P7SABRI2.DGN PLOT DATE: 03/19/99 12:13:01

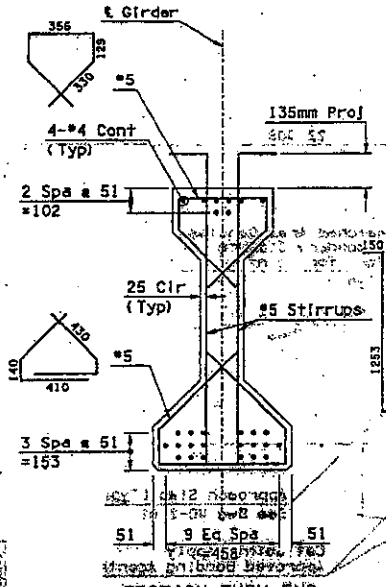


GIRDER ELEVATION
Scale: 1:20

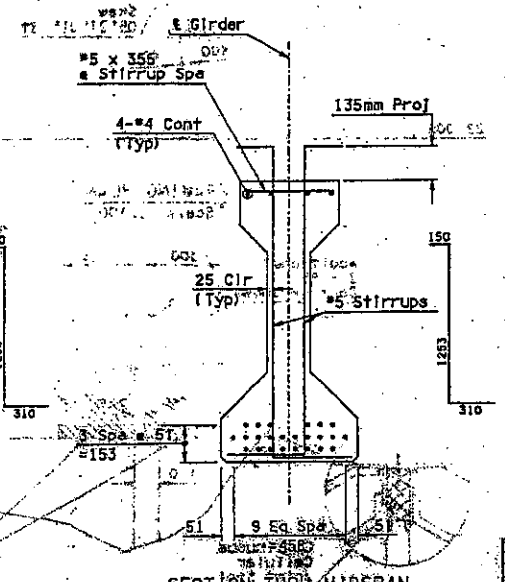
NOTE:
See pipe and insert detail on Dwg S-4. Insert and pipe locations.



TYPICAL SECTION
Scale: 1:10



SECTION THRU END
Scale: 1:10



SECTION THRU MIDSPAN
Scale: 1:10

AASHTO TYPE III GIRDER

PRESTRESSING NOTES:

24 (4 harped and 20 straight) 12.54 millimeter dia 7 wire low relaxation strands.

Pi = 3308 kN. Initial tension before losses.

Pw = 2521 kN. Working force remaining after all losses.

f'ci = 31.0 MPa. Minimum strength at transfer.

f'c = 41.0 MPa. Minimum strength at 28 days.

All low relaxation strands shall be stressed to 0.75f's. Girders shall be prestressed by the pretensioning method only. Use of masked strands will not be allowed.

Tops of girders shall be roughened transversely with a roughness amplitude of 6 mm.

DESIGN					
DRAWN					
CHECKED					
SR 101L	25.90	1466			

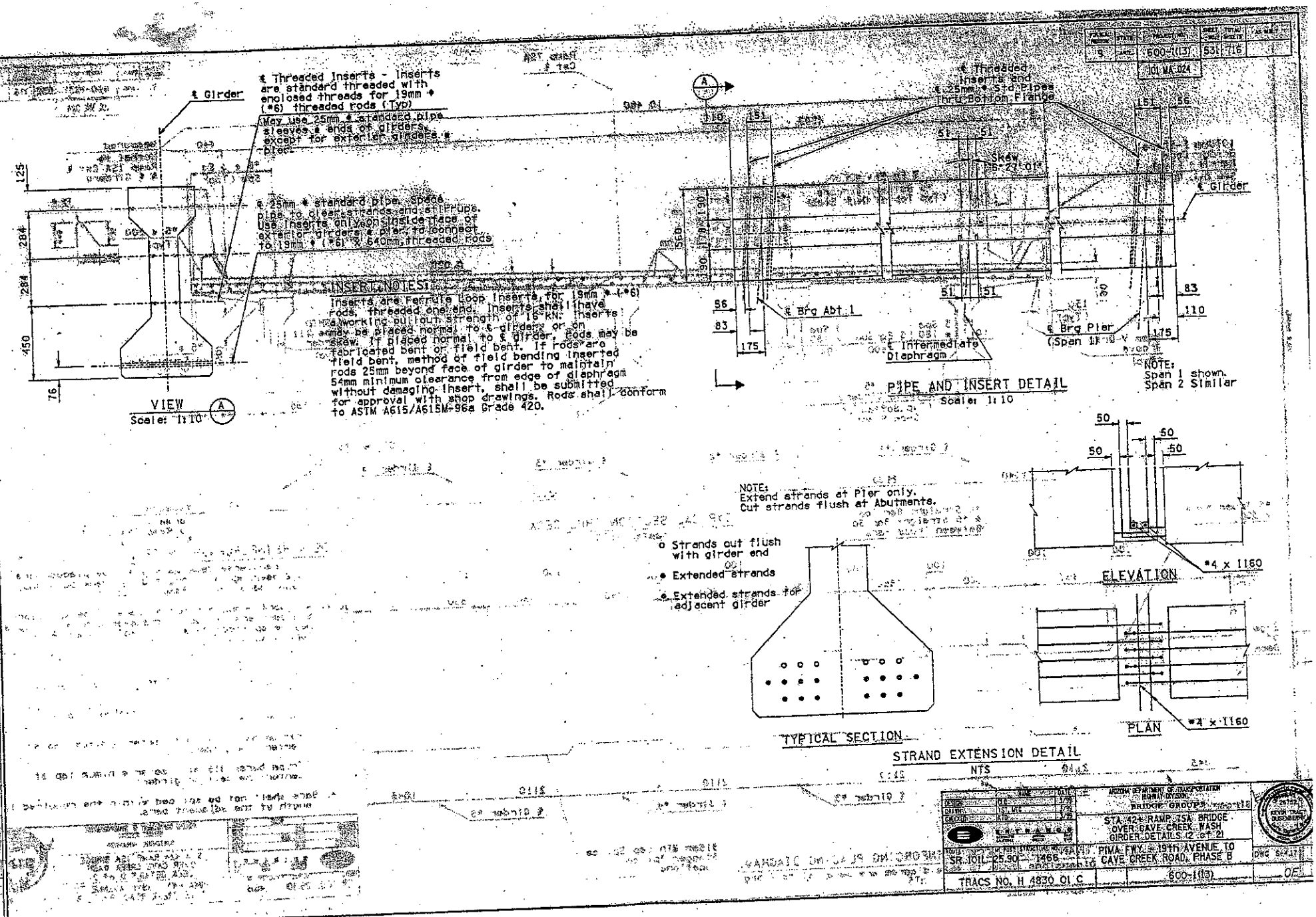
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 426, RAMP 1SA BRIDGE OVER CAVE CREEK WASH
GIRDER DETAILS SHEET 2 OF 2

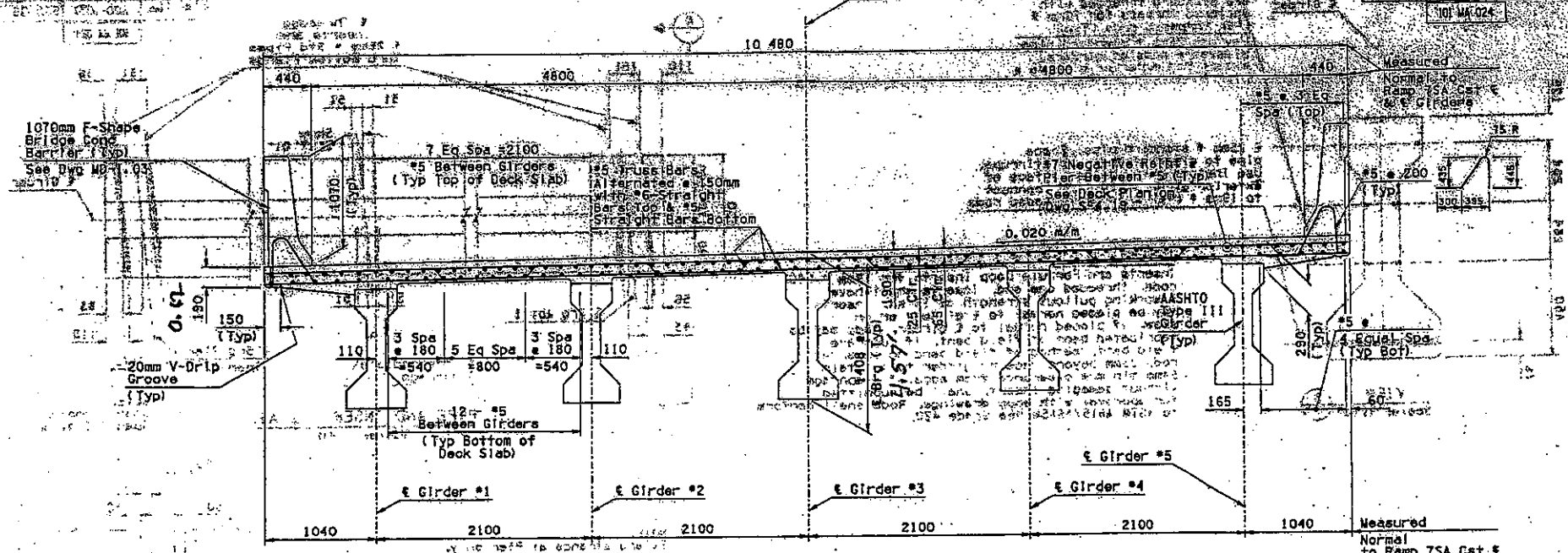
PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD PHASE B

TRACS NO. H 4830 01 C | 600-103 | OF

DESIGN FILE: PTSABRI3.DGN PLOT DATE: 03/19/99 12:13:11

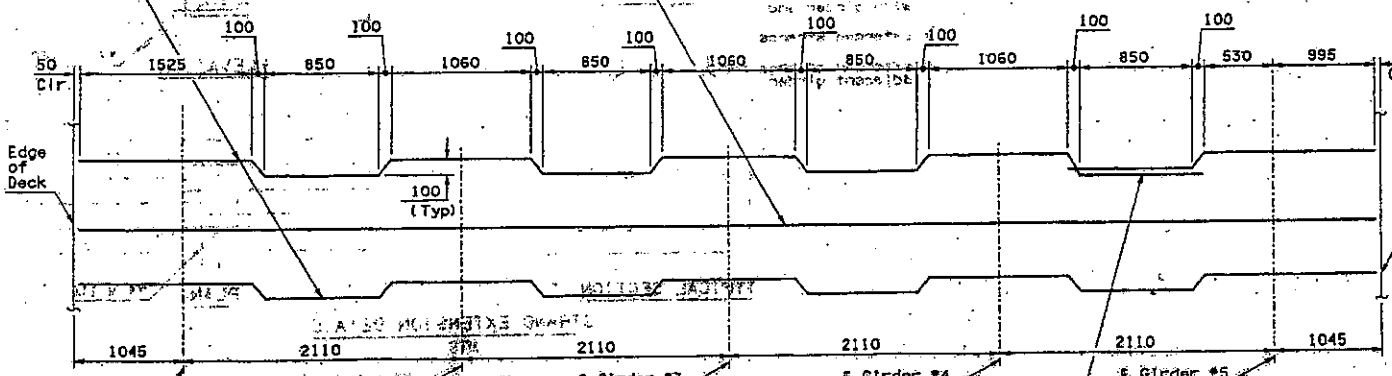

℄ Threaded Inserts - Inserts are standard threaded with enclosed threads for 19mm ϕ (#6) threaded rods (Typ)
May use 25mm ϕ standard pipe sleeves ϕ ends of girders, except for exterior girders ϕ pier.
℄ Girder
℄ 25mm ϕ standard pipe, space pipe to clear strands and stirrups. Use inserts only on inside face of exterior girders ϕ pier to connect to 19mm ϕ (#6) x 640mm threaded rods
INSERT NOTES:
Inserts are ferrule loop inserts for 19mm ϕ (#6) rods, threaded one end. Inserts shall have a working pullout strength of 15 kN. Inserts may be placed normal to ℄ girder or on skew. If placed normal to ℄ girder, rods may be fabricated bent or field bent. If rods are field bent, method of field bending inserted rods 25mm beyond face of girder to maintain 54mm minimum clearance from edge of diaphragm without damaging insert, shall be submitted for approval with shop drawings. Rods shall conform to ASTM A615/A615M-96a Grade 420.
VIEW A
Scale: 1:10
℄ Threaded Inserts and ℄ 25mm ϕ Std Pipes Thru Bottom Flange
Skew 5°-27'-01"
℄ Brg Abt 1
℄ Intermediate Diaphragm
℄ Brg Pier (Span 1)
℄ Girder
PIPE AND INSERT DETAIL
Scale: 1:10
NOTE:
Span 1 shown.
Span 2 Similar
NOTE:
Extend strands at Pier only.
Cut strands flush at Abutments.
o Strands cut flush with girder end
ϕ Extended strands
ϕ Extended strands for adjacent girder
TYPICAL SECTION
ELEVATION
#4 x 1160
PLAN
#4 x 1160
STRAND EXTENSION DETAIL
NTS
ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP
STA. 42+ RAMP 1SA BRIDGE OVER CAVE CREEK WASH GIRDER DETAILS (2 of 2)
PIMA FWY. 19th AVENUE TO CAVE CREEK ROAD, PHASE B
SR 101L-25.30 - 1466
TRACS NO. H 4830 01 C
600-1(13)
DWG S-41
REDUCED SIZE - DO NOT SCALE
DESIGN FILE: PTSA2814.DGN
PLOT DATE: 03/19/99 12:13:21

FEDERAL HIGHWAY	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	REVISION
9	AZ	600-1(13)	532	716	
		101 MA 024			



TYPICAL SECTION THRU DECK

Scale: 1:20



TRANSVERSE DECK REINFORCING PLACING DIAGRAM

Dimensions shown in this diagram are parallel to ℄ brg

NTS

DECK REINFORCEMENT NOTES:

1. All transverse deck bars shall be placed parallel to ℄ bearing. All longitudinal deck bars shall be placed parallel to Ramp TSA Cst ℄.
2. All continuous horizontal bars in deck, diaphragms and barriers excluding transverse bars in top slab may be spliced where required with minimum lap length as specified:

   *5 bars 520 millimeter

3. Top slab transverse reinforcing splices where required shall be:

   Top bars: 915 millimeter minimum lap at centerline cell.

   Bottom bars: 915 millimeter minimum lap at centerline girder.

   Truss bars: 915 millimeter minimum lap at centerline cell or girder.

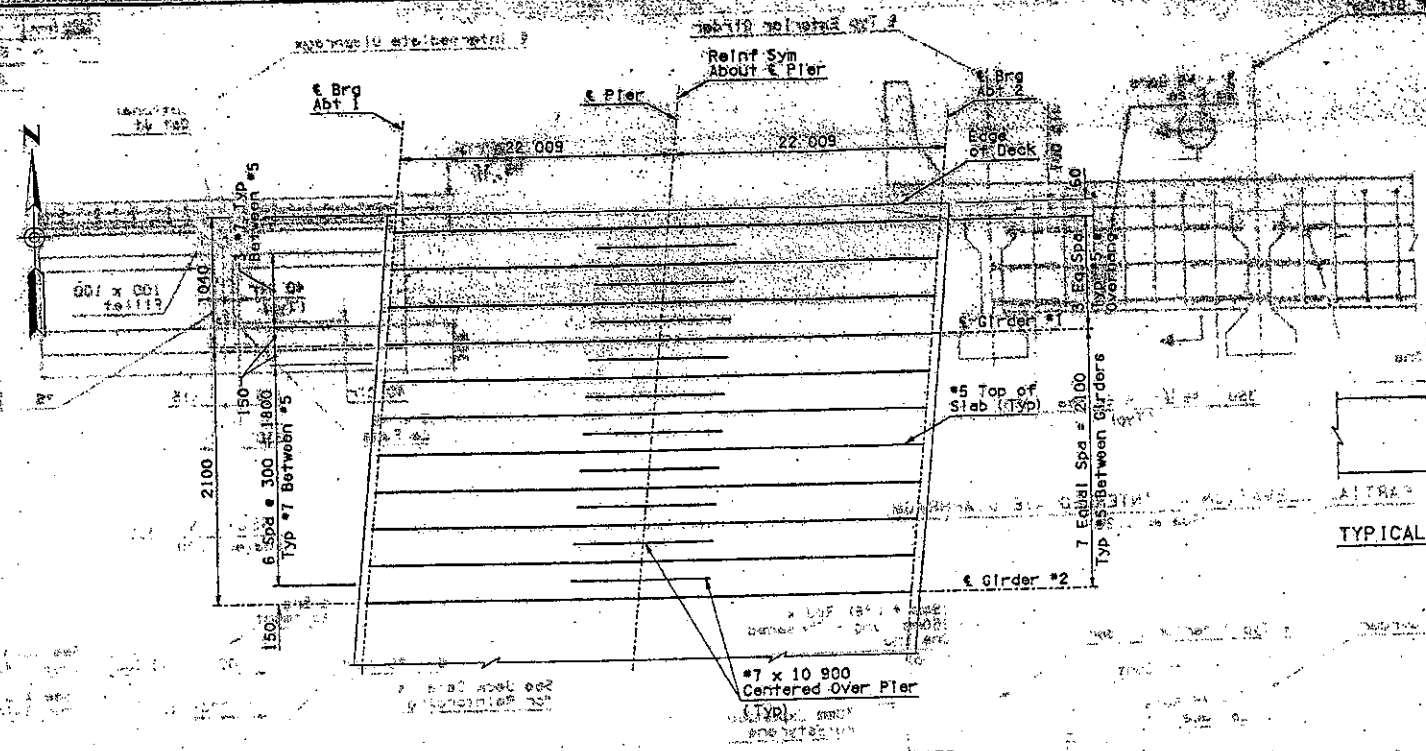
4. Bars shall not be spliced within the required lap length of the adjacent bars.

DESIGN		ARIZONA DEPARTMENT OF TRANSPORTATION BRIDGE DIVISION	
DRAWN		BRIDGE GROUP	
CHECKED		STA. 42+ RAMP TSA BRIDGE OVER CAVE CREEK WASH DECK DETAILS 0 of 21	
SR 101L	25.90	1466	PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B
TRACS NO. H 4830 01 C		600-1(13)	DWG S-4.161 OF

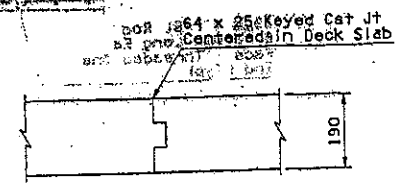
PLACE THIS SIGN - REDUCED SIZE - DO NOT SCALE

VIEW NAME:

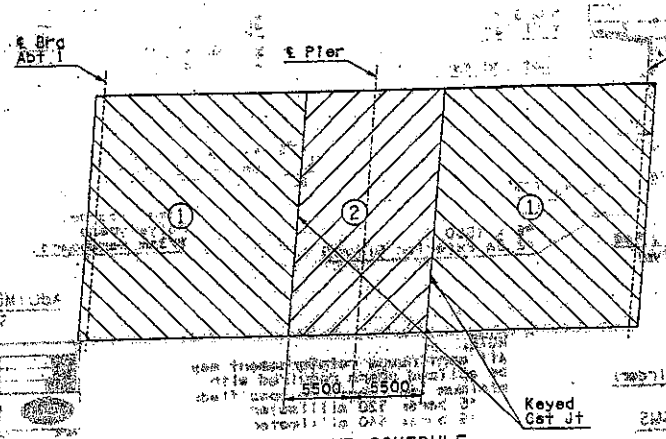
DESIGN FILE: P7SABRIS.DGN PLOT DATE: 03/19/99 12:13:36



PARTIAL DECK PLAN & TOP OF SLAB REINFORCEMENT AT PIER
NTS



TYPICAL KEYED CST JT
NTS



DECK POUR SCHEDULE
NTS

POUR NOTES:

1. Numbers ① & ② indicate placing sequence of deck concrete. Pour ② section a minimum of 12 hours after adjacent ① sections have been poured.
2. Intermediate diaphragms and expansion abutment diaphragms may be poured prior to or concurrent with the deck pour.
3. Pier diaphragms shall be poured concurrent with the deck pour.
4. The Contractor shall submit a Deck Pour Schedule to the Engineer for approval prior to placing concrete.

9		600-1(13)	533 716
101 MA 024			

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SA BRIDGE
OVER CAVE CREEK WASH
DECK DETAILS (2 of 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

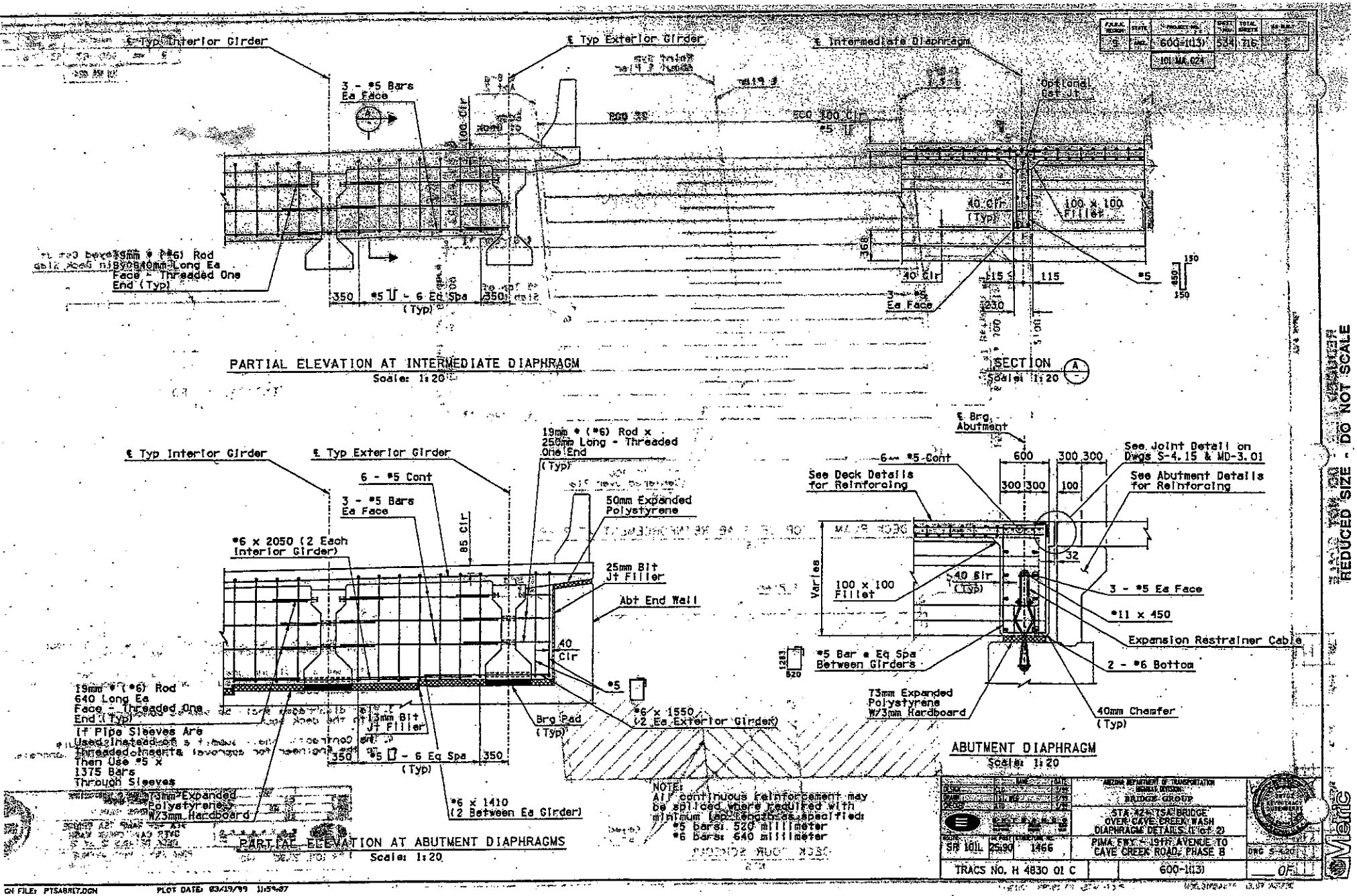
ROUTE	MP	FEDERAL AID NO.
SR 101L	25.90	1466

TRACS NO. H 4830 01 C

600-1(13)

DWG S-4.19

REDUCED SIZE - DO NOT SCALE



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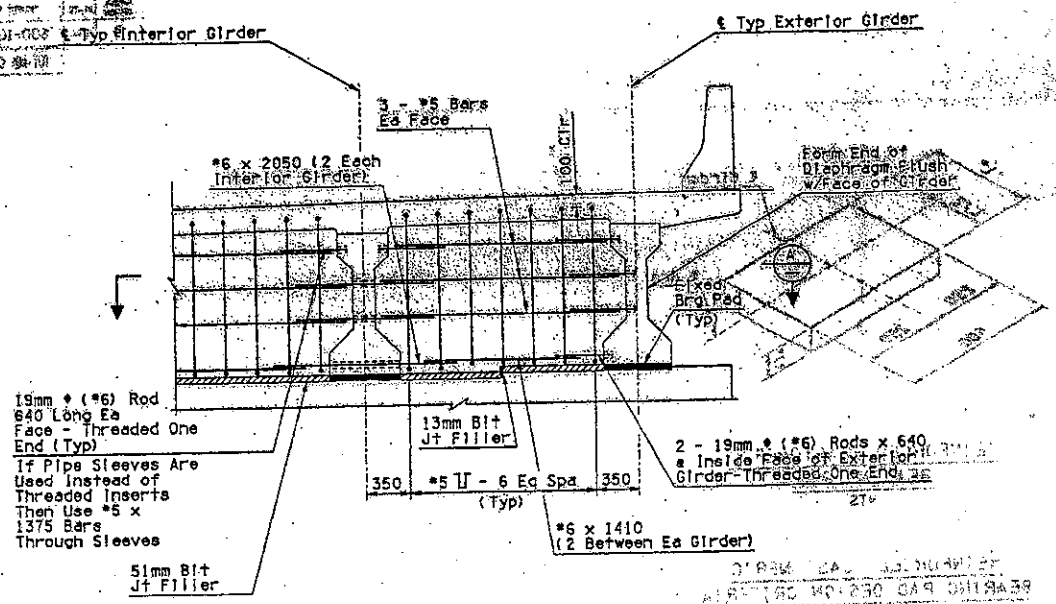
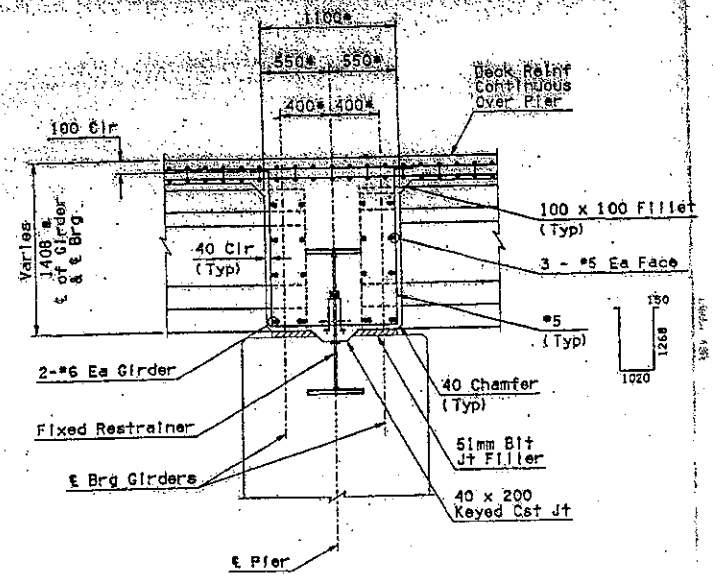
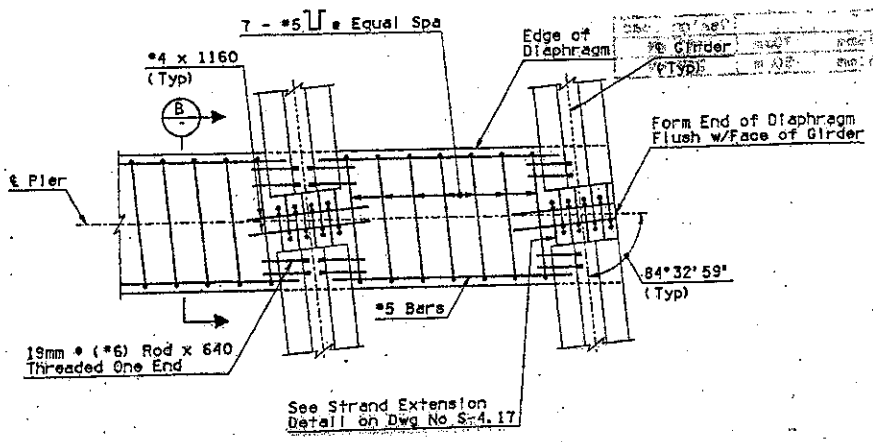


PARTIAL ELEVATION AT PIER DIAPHRAGM
Scale: 1:20



SECTION B
Scale: 1:20

NOTE:
ϕ Measured Normal to ℄ Brg



SECTION A
Scale: 1:20

F.A.P. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	ARIZ	600-1(13)	535	716
		101 MA 024		

	NAME	DATE
DESIGN	CLK	3/99
DRAWN	ST. JOE	3/99
CHECKED	KTP	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP

STA. 42nd-75A BRIDGE OVER CAVE CREEK WASH DIAPHRAGM DETAILS (2 of 2)

ROUTE	MP PROJ	STRUCTURE NO.	
SR 101L	25.90	1466	PIMA FWY. - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

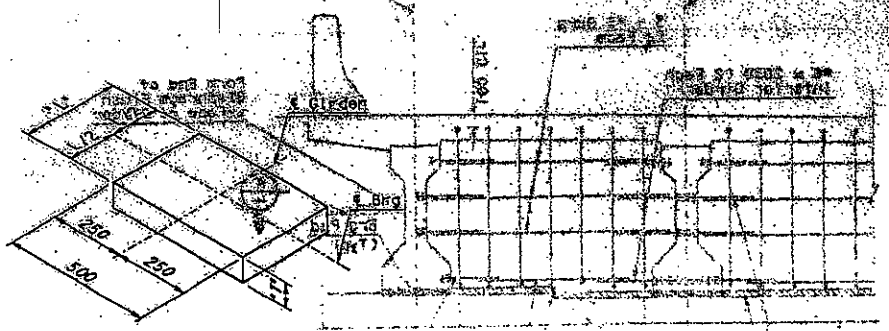
TRACS NO. H 4830 01 C | 600-1(13)

DWG S-4.21 OF

REVIEW PROJECT ENGINEER

REDUCED SIZE - DO NOT SCALE

DESIGN FILE: P75ARRIB.DGN PLOT DATE: 03/19/99 12:14:13



REINFORCED ELASTOMERIC
BEARING PAD
NTS

REINFORCED ELASTOMERIC
BEARING PAD DESIGN CRITERIA

Design Method A
Elastomer Grade 0

	T	L	Design Load
Abutment	76mm	170mm	467 kN
Pier	51mm	150mm	289 kN

600-1(13)	536	116	
10L MM 024			

DESIGN			
DRAWN			
CHECKED			
SR 10L	25.90	1466	

ARIZONA DEPARTMENT OF TRANSPORTATION
BRIDGE DIVISION
BRIDGE GROUP

STA 427 RAMP TSA BRIDGE
OVER CAVE CREEK WASH
MISCELLANEOUS DETAILS

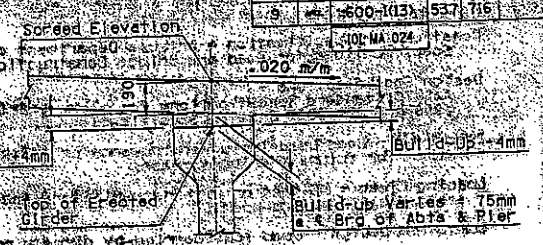
PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

TRACS NO. H 4830 01 C

600-1(13)

DWG S-422

DESIGN FILE: P7SABR19.DGN PLOT DATE: 03/19/99 12:14:23



TYPICAL SECTION

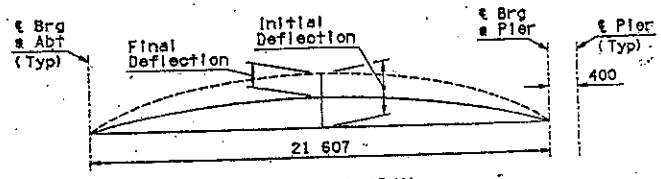
SCREED ELEVATION NOTES:

1. The top of Erected Girder Elevation shall be surveyed in the field at the 1/10 points along the span, by the Contractor, prior to placing deck forming. The Survey Information shall be provided to the Engineer a minimum of 15 working days prior to the deck pour, for Review and approval. If the top of erected girder encroaches into the deck slab, adjustments to the structure may be necessary.
2. The Screed Elevation includes an allowance for the deflection due to the dead load of the concrete deck slab, diaphragm, barriers, and the effects of long term creep.
3. Screed Elevations shall be used in setting screeds regardless of the measured top of erected girder elevations. DO NOT USE FINISHED GRADE ELEVATIONS FOR SETTING SCREEDS. Adjustments to the Screed Elevations, if necessary, shall be determined by the Engineer. Top of erected girder elevations taken @ ℄ of girders @ the 1/10 points, prior to placing steel reinforcing shall be supplied to the Engineer for review.
4. The Build-up shall be calculated based on measured top of erected Girder Elevations. The Build-up equals the (Screed Elevation) minus (measured Erected Girder Elevation) minus (the deck slab thickness). The Build-up dimensions at the edge of girder will be plus or minus 4mm as shown in the TYPICAL SECTION above.

BRIDGE SCREED ELEVATIONS

SPAN 1	℄ Brg Abt #1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	℄ Brg S1 Pier	℄ Pier
Lt Edge Deck	440.092	440.135	440.174	440.211	440.245	440.276	440.304	440.329	440.351	440.370	440.387	440.392
Girder #1	440.111	440.154	440.193	440.230	440.264	440.295	440.323	440.348	440.371	440.390	440.407	440.411
Girder #2	440.150	440.193	440.232	440.269	440.303	440.334	440.362	440.388	440.410	440.430	440.446	440.451
Girder #3/Cst ℄	440.189	440.232	440.271	440.308	440.342	440.373	440.402	440.427	440.450	440.469	440.486	440.491
Girder #4	440.228	440.271	440.310	440.347	440.382	440.413	440.441	440.467	440.489	440.509	440.526	440.530
Girder #5	440.267	440.309	440.349	440.386	440.421	440.452	440.480	440.506	440.529	440.548	440.565	440.570
Rt Edge Deck	440.286	440.329	440.369	440.406	440.440	440.471	440.500	440.525	440.548	440.568	440.585	440.590

SPAN 2	℄ Brg S2 Pier	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	℄ Brg Abt #2
Lt Edge Deck	440.396	440.430	440.460	440.488	440.512	440.534	440.553	440.569	440.582	440.592	440.600
Girder #1	440.416	440.449	440.480	440.507	440.532	440.554	440.573	440.589	440.602	440.612	440.620
Girder #2	440.456	440.489	440.520	440.547	440.572	440.594	440.613	440.629	440.642	440.653	440.660
Girder #3/Cst ℄	440.495	440.529	440.559	440.587	440.612	440.634	440.653	440.669	440.683	440.693	440.701
Girder #4	440.535	440.569	440.599	440.627	440.652	440.674	440.693	440.710	440.723	440.734	440.741
Girder #5	440.575	440.608	440.639	440.667	440.692	440.714	440.734	440.750	440.763	440.774	440.782
Rt Edge Deck	440.594	440.628	440.659	440.687	440.712	440.734	440.753	440.770	440.783	440.794	440.802



CAMBER DIAGRAM
NTS

DEFLECTION NOTES:

1. Initial Deflection equals the deflection the prestressed girder undergoes at the time of erection prior to the diaphragm and deck pours. The Initial Deflection includes the deflection due to the dead load of the girder, the initial prestressing and the effects of creep up to the time of erection.
2. Final Deflection equals the deflection due to the dead load of the deck slab, diaphragms, barriers and the effects of long term creep on the composite continuous girders.

CAMBER DEFLECTIONS

Deflections (m)									
Deflection	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Initial	.020	.035	.046	.053	.055	.053	.046	.035	.020
Final	.009	.016	.021	.024	.025	.024	.021	.016	.009

F.A.P. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	ARIZ	600-1(13)	537	716
		101 MA 024		

	NAME	DATE
DESIGN	LC	3/99
DRAWN	LC	3/99
CHECKED	MC	3/99
CHECKED	LC	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP
STA.42+ RAMP 7SA BRIDGE
OVER CAVE CREEK WASH
SCREED ELEVATIONS

ROUTE	MILEPOST	FEDERAL NO.
SR 101L	25.90	1466

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

TRACS NO. H 4830 01 C

600-1(13)

DWG S-429

OF

DESIGN FILE: P7SABR20.DGN PLOT DATE: 03/19/99 12:14:34

GENERAL NOTES

Construction Specification - Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Edition of 1996 Metric.

Design Specifications
AASHTO Standard Specifications for Highway Bridges, 16th Edition 1996 and the 1997 Interim Specifications.

Dead Load - Dead Load includes allowance of 1.2 kilonewton per square meter for future wearing surface.

Loading Class - MS18-44 or alternate military load of 2-107 KN axles spaced 1.2 meters apart.

Composite Design - Dead load carried by girders only.

Seismic Performance Category A (A=0.03g).

Inventory and operating ratings for MS18-44 are in accordance with AASHTO Manual for Condition Evaluation of Bridges, Edition of 1994, Load Factor Method.

Inventory Rating MS 50
Operating Rating MS 80

Concrete shall be Class "S" unless noted otherwise.

Reinforcing steel shall conform to ASTM Specification A615/A615M-96a.
All reinforcing shall be furnished as Grade 420.

All bends and hooks shall meet the requirements of AASHTO Article 8.23.
All bend dimensions for reinforcing steel shall be out-to-out of bars.
All placement dimensions for reinforcing steel shall be to center of bars unless noted otherwise.

All reinforcing steel shall have 50 millimeters clear cover unless noted otherwise.

Stresses:

Superstructure except barriers	f'_c =	31 MPa
Abutments & Windwalls	f'_c =	20 MPa
Piers & Drilled Shafts	f'_c =	25 MPa
F-Shape Bridge Cond. Barrier	f'_c =	28 MPa
All Other Class "S" Concrete	f'_c =	20 MPa
Grade 420 transverse deck reinf	f_s =	140 MPa
All other Grade 420	f_s =	165 MPa
Prestressing steel (12.54 mm dia. 7-wire Low Relaxation Strand)	f_s =	1860 MPa

Barriers shall be constructed after spans have taken dead load deflection. Barriers shall not be slip formed.

Chamfer all exposed corners 20 millimeters as per Chamfer Detail (Dwg S-5.28) unless noted otherwise.

Dimensions shall not be scaled from drawings.

All dimensions are shown in millimeters (mm) and all elevations are shown in meters unless noted otherwise.

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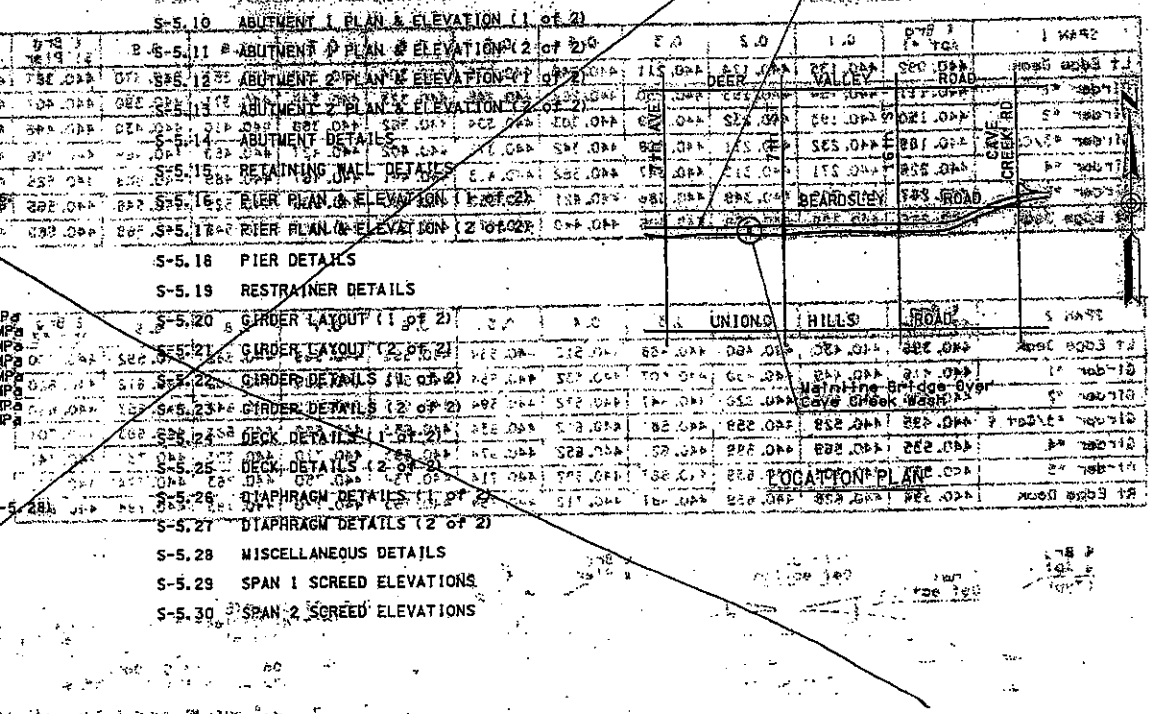
S-5.1 LOCATION PLAN, GENERAL NOTES & INDEX
S-5.2 GENERAL PLAN
S-5.3 SECTION & QUANTITIES
S-5.4 FOUNDATION DATA SHEET (1 of 5)
S-5.5 FOUNDATION DATA SHEET (2 of 5)
S-5.6 FOUNDATION DATA SHEET (3 of 5)
S-5.7 FOUNDATION DATA SHEET (4 of 5)
S-5.8 FOUNDATION DATA SHEET (5 of 5)
S-5.9 FOUNDATION LAYOUT
S-5.10 ABUTMENT 1 PLAN & ELEVATION (1 of 2)
S-5.11 ABUTMENT 1 PLAN & ELEVATION (2 of 2)
S-5.12 ABUTMENT 2 PLAN & ELEVATION (1 of 2)
S-5.13 ABUTMENT 2 PLAN & ELEVATION (2 of 2)
S-5.14 ABUTMENT DETAILS
S-5.15 RETAINING WALL DETAILS
S-5.16 PIER PLAN & ELEVATION (1 of 2)
S-5.17 PIER PLAN & ELEVATION (2 of 2)
S-5.18 PIER DETAILS
S-5.19 RESTRAINER DETAILS
S-5.20 GIRDER LAYOUT (1 of 2)
S-5.21 GIRDER LAYOUT (2 of 2)
S-5.22 GIRDER DETAILS (1 of 2)
S-5.23 GIRDER DETAILS (2 of 2)
S-5.24 DECK DETAILS (1 of 2)
S-5.25 DECK DETAILS (2 of 2)
S-5.26 DIAPHRAGM DETAILS (1 of 2)
S-5.27 DIAPHRAGM DETAILS (2 of 2)
S-5.28 MISCELLANEOUS DETAILS
S-5.29 SPAN 1 SCREED ELEVATIONS
S-5.30 SPAN 2 SCREED ELEVATIONS



LEGEND

Letter or number indicating section or detail.

Dwg No. where section or detail shown or referred.

Sheet No. where shown on same sheet.

5	600-1(43)	638	219

101 MA 024

ARIZONA DEPARTMENT OF TRANSPORTATION
GENERAL SECTION
BRIDGE GROUP

STA 422 MAINLINE BRIDGE OVER CAVE CREEK WASH
PLAN, GENERAL NOTES & INDEX

DMA-PIMA-101-A(194) AVENUE 10 on CAVE CREEK ROAD, PHASE B

SH 101 | DBA 1490 | WB 1491

TRACS NO. H 4836 01 C | 600-1(43) | OF

REDUCED SIZE : DO NOT SCALE

DESIGN FILE: PCCWBRDLDGN 09/01/98

PLOT DATE: 03/19/99 12:47:49

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	515	716	

101 MA 024

GENERAL NOTES

Construction Specification - Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Edition of 1996.

Design Specifications - AASHTO Standard Specifications for Highway Bridges, 16th Edition 1996 and the 1997 Interim Specifications.

Dead Load - Dead Load includes allowance of 1.2 kilonewton per square meter for future wearing surface.

Loading Class - MS18-44 or alternate military load of 2-107 KN axles spaced @ 1.2 meters apart.

Composite Design - Dead load carried by girders only.

Seismic Performance category A (Acc=0.03g).

Inventory and operating ratings for MS18-44 are in accordance with AASHTO Manual for Condition Evaluation of Bridges, Edition of 1994, Load Factor Method.

Inventory Rating MS-30.1
Operating Rating MS-50.4

All concrete shall be Class 'S' unless noted otherwise.

Reinforcing steel shall conform to ASTM Specification A615/A615M - 96a. All reinforcing shall be furnished as Grade 420.

All bends and hooks shall meet the requirements of AASHTO Article 8.23. All bend dimensions for reinforcing steel shall be out-to-out of bars. All placement dimensions for reinforcing steel shall be to center of bars unless noted otherwise.

All reinforcing steel shall have 50 millimeters clear cover unless noted otherwise.

Stresses:

Superstructure except barriers	f_c'= 31 MPa
Abutments & Wingwalls	f_c'= 20 MPa
Piers & Drilled Shafts	f_c'= 25 MPa
F-Shape Bridge Conc Barrier	f_c'= 28 MPa
All other Class 'S' concrete	f_c'= 20 MPa
Grade 420 transverse deck reinf	f_s= 140 MPa
All other Grade 420	f_s= 165 MPa
Prestressing steel (12.54 mm dia. 7-wire Low Relaxation Strand)	f_s'= 1860 MPa

Barriers shall be constructed after spans have taken dead load deflection. Barriers shall not be slip formed.

Chamfer all exposed corners 20 millimeters as per Chamfer Detail (Dwg S-4.3) unless noted otherwise.

Dimensions shall not be scaled from drawings.

All dimensions are shown in millimeters (mm) and all elevations are shown in meters unless noted otherwise.

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S-4.1 LOCATION PLAN, GENERAL NOTES & INDEX
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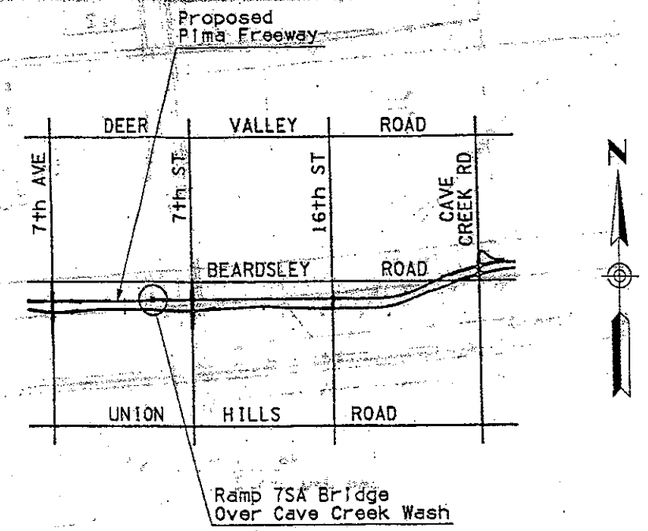
S-4.4 FOUNDATION DATA SHEET (1 of 3)
S-4.5 FOUNDATION DATA SHEET (2 of 3)
S-4.6 FOUNDATION DATA SHEET (3 of 3)
S-4.7 FOUNDATION LAYOUT
S-4.8 ABUTMENT 1 PLAN & ELEVATION
S-4.9 ABUTMENT 2 PLAN & ELEVATION
S-4.10 ABUTMENT DETAILS
S-4.11 WINGWALL DETAILS
S-4.12 PIER PLAN & ELEVATION
S-4.13 PIER DETAILS
S-4.14 RESTRAINER DETAILS
S-4.15 GIRDER LAYOUT
S-4.16 GIRDER DETAILS (1 of 2)
S-4.17 GIRDER DETAILS (2 of 2)
S-4.18 DECK DETAILS (1 of 2)
S-4.19 DECK DETAILS (2 of 2)
S-4.20 DIAPHRAGM DETAILS (1 of 2)
S-4.21 DIAPHRAGMS DETAILS (2 of 2)
S-4.22 MISCELLANEOUS DETAILS
S-4.23 SCREED ELEVATIONS



LOCATION PLAN

LEGEND

Letter or number indicating section or detail.

C / S-4.1 — Dwg No. where section or detail shown or referred. Dash if shown on same sheet.

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TST, MCG	3/99
CHECKED	KTO	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SA BRIDGE OVER CAVE CREEK WASH
LOC. PLAN, GENERAL NOTES & INDEX

ROUTE	MI POST	STRUCTURE NO.
SR 101L	25.90	1466

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-4.1

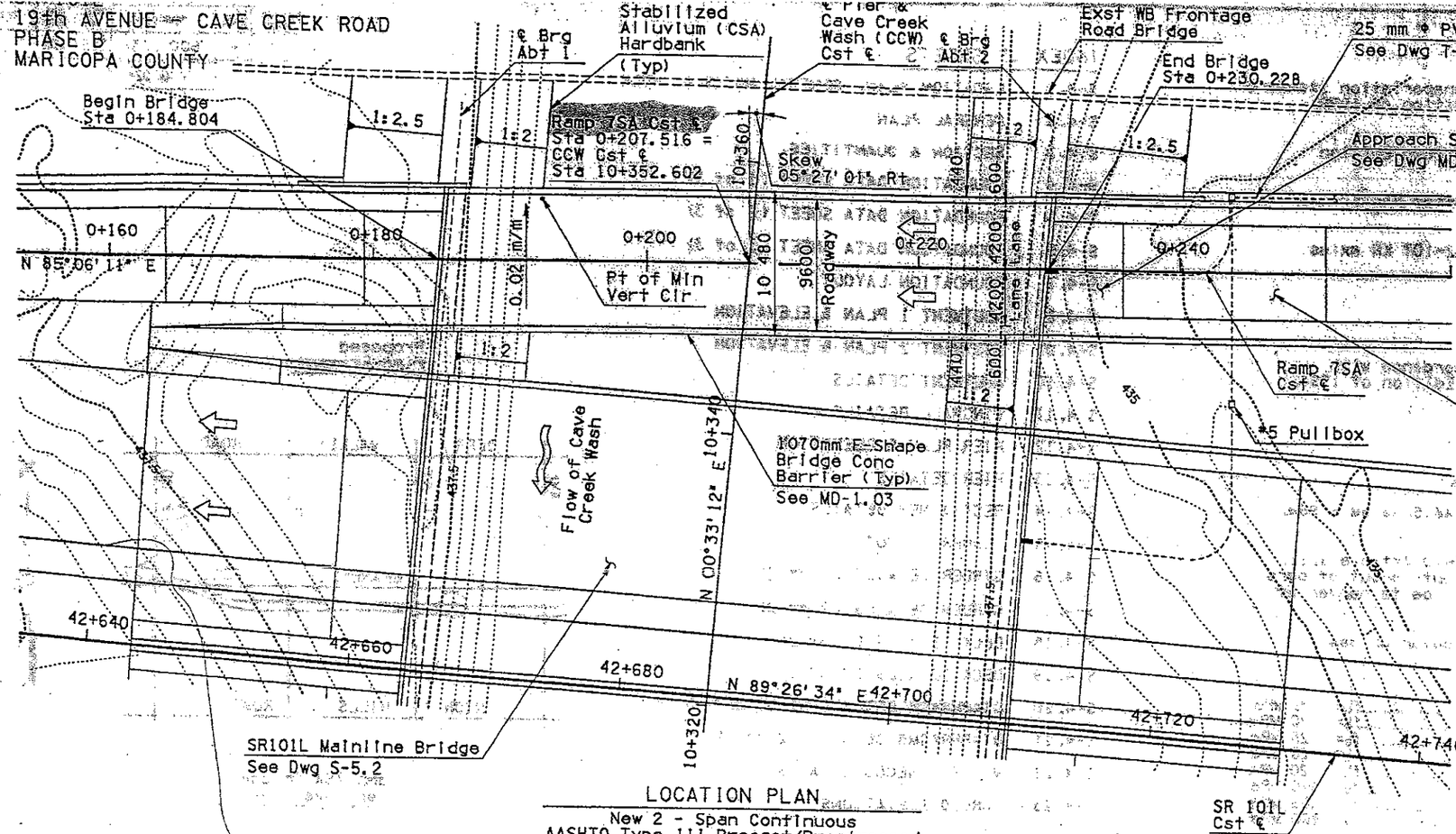
TRACS NO. H 4830 01 C — 600-1(13) — OF

REDUCED SIZE - DO NOT SCALE

DESIGN FILE: P7SABR01.DGN PLOT DATE: 03/19/99 12:09:57

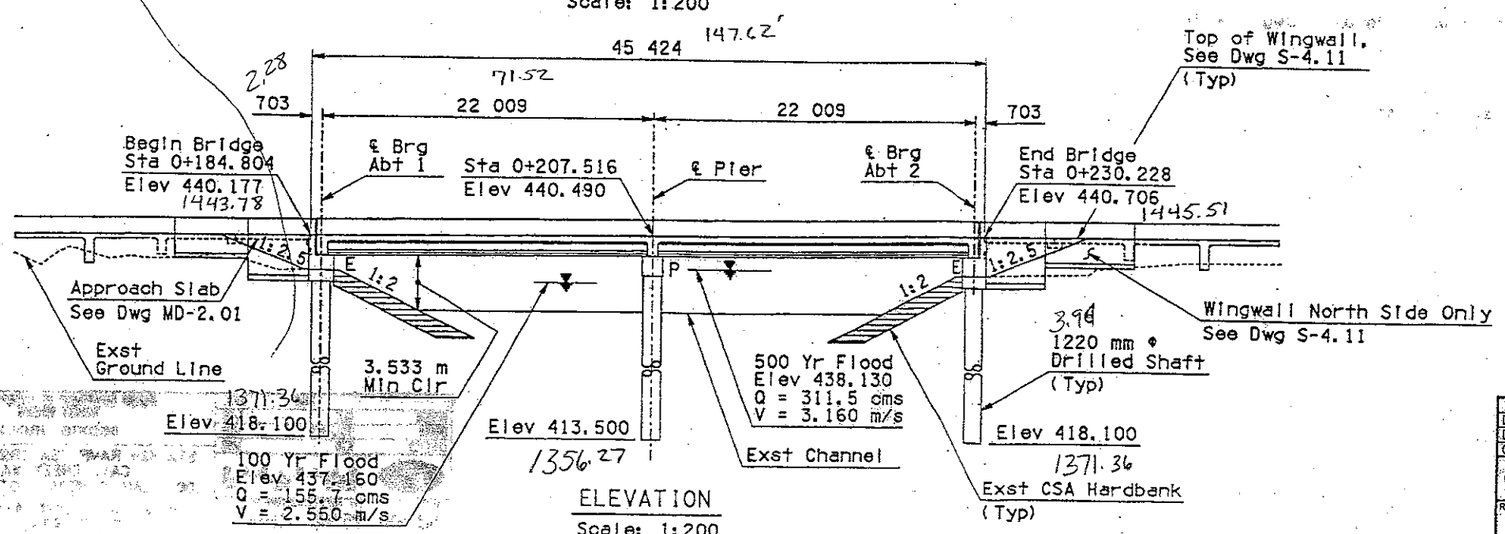
19th AVENUE — CAVE CREEK ROAD
PHASE B
MARICOPA COUNTY

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	516	716	
		101 MA 024			

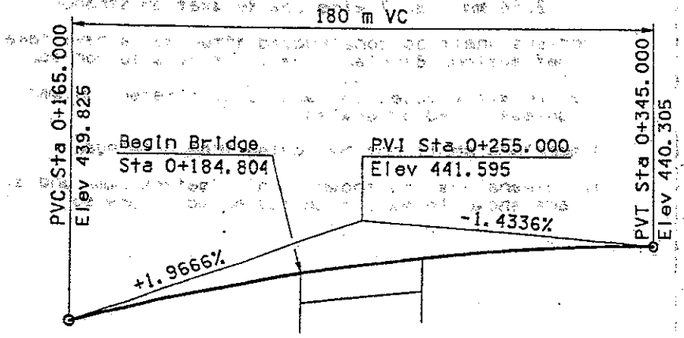


Note:
For walls between bridges, See Dwg S-5.15.

LOCATION PLAN
New 2 - Span Continuous
AASHTO Type III Precast/Prestressed
Concrete Girder Bridge
Contour Interval = 0.5 m
Skew = 05°27'01" Rt
Scale: 1:200



ELEVATION
Scale: 1:200



RAMP 7SA PROFILE GRADE LINE
NTS

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TST MEG	3/99
CHECKED	KTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SA BRIDGE
OVER CAVE CREEK WASH
GENERAL PLAN

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP/POST	STRUCTURE NO.
SR 101L	25.90	1466

TRACS NO. H 4830 01 C

600-1(13)

DWG S-4.2

OF

DESIGN FILE: P7SA8R02.DGN PLOT DATE: 03/19/99 12:50:43

VIEW NAME:

REDUCED SIZE - DO NOT SCALE

F.A.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	538	716	
		101 MA 024			

GENERAL NOTES

Construction Specification - Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, Edition of 1996 Metric.

Design Specifications -
AASHTO Standard Specifications for Highway Bridges, 16th Edition 1996 and the 1997 Interim Specifications.

Dead Load - Dead Load includes allowance of 1.2 kilonewton per square meter for future wearing surface.

Loading Class - MS18-44 or alternate military load of 2-107 KN axles spaced @ 1.2 meters apart.

Composite Design - Dead load carried by girders only.

Seismic Performance category A (Aoc=0.03g).

Inventory and operating ratings for MS18-44 are in accordance with AASHTO Manual for Condition Evaluation of Bridges, Edition of 1994, Load Factor Method.

Inventory Rating MS-30.1
Operating Rating MS-50.4

All concrete shall be Class 'S' unless noted otherwise.

Reinforcing steel shall conform to ASTM Specification A615/A615M-96a. All reinforcing shall be furnished as Grade 420.

All bends and hooks shall meet the requirements of AASHTO Article 8.23. All bend dimensions for reinforcing steel shall be out-to-out of bars. All placement dimensions for reinforcing steel shall be to center of bars unless noted otherwise.

All reinforcing steel shall have 50 millimeters clear cover unless noted otherwise.

Stresses:

Superstructure except barriers	f_b=	31 MPa
Abutments & Wingwalls	f_b=	20 MPa
Piers & Drilled Shafts	f_b=	25 MPa
F-Shape Bridge Conc Barrier	f_b=	28 MPa
All other Class 'S' concrete	f_b=	20 MPa
Grade 420 transverse deck reinf	f_s=	140 MPa
All other Grade 420	f_s=	165 MPa
Prestressing steel (12.54 mm dia. 7-wire Low Relaxation Strand)	f_s=	1860 MPa

Barriers shall be constructed after spans have taken dead load deflection. Barriers shall not be slip formed.

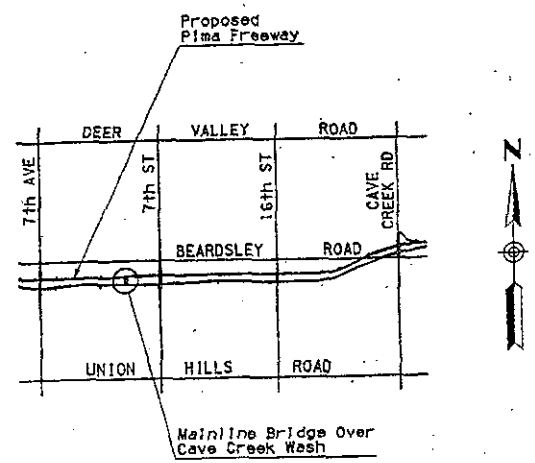
Chamfer all exposed corners 20 millimeters as per Chamfer Detail (Dwg S-5.28) unless noted otherwise.

Dimensions shall not be scaled from drawings.

All dimensions are shown in millimeters (mm) and all elevations are shown in meters unless noted otherwise.

INDEX OF SHEETS

S-5.1	LOCATION PLAN, GENERAL NOTES & INDEX
S-5.2	GENERAL PLAN
S-5.3	SECTION & QUANTITIES
S-5.4	FOUNDATION DATA SHEET (1 of 5)
S-5.5	FOUNDATION DATA SHEET (2 of 5)
S-5.6	FOUNDATION DATA SHEET (3 of 5)
S-5.7	FOUNDATION DATA SHEET (4 of 5)
S-5.8	FOUNDATION DATA SHEET (5 of 5)
S-5.9	FOUNDATION LAYOUT
S-5.10	ABUTMENT 1 PLAN & ELEVATION (1 of 2)
S-5.11	ABUTMENT 1 PLAN & ELEVATION (2 of 2)
S-5.12	ABUTMENT 2 PLAN & ELEVATION (1 of 2)
S-5.13	ABUTMENT 2 PLAN & ELEVATION (2 of 2)
S-5.14	ABUTMENT DETAILS
S-5.15	RETAINING WALL DETAILS
S-5.16	PIER PLAN & ELEVATION (1 of 2)
S-5.17	PIER PLAN & ELEVATION (2 of 2)
S-5.18	PIER DETAILS
S-5.19	RESTRAINER DETAILS
S-5.20	GIRDER LAYOUT (1 of 2)
S-5.21	GIRDER LAYOUT (2 of 2)
S-5.22	GIRDER DETAILS (1 of 2)
S-5.23	GIRDER DETAILS (2 of 2)
S-5.24	DECK DETAILS (1 of 2)
S-5.25	DECK DETAILS (2 of 2)
S-5.26	DIAPHRAGM DETAILS (1 of 2)
S-5.27	DIAPHRAGM DETAILS (2 of 2)
S-5.28	MISCELLANEOUS DETAILS
S-5.29	SPAN 1 SCREED ELEVATIONS
S-5.30	SPAN 2 SCREED ELEVATIONS



LOCATION PLAN

LEGEND

C / S-5.1 — Letter or number indicating section or detail. Dwg No. where section or detail shown or referred. Dash if shown on same sheet.

	NAME	DATE
DESIGN	DCO	3/99
DRAWN	TST, MEC	3/99
CHECKED	KTD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH
LOC. PLAN, GENERAL NOTES & INDEX

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

TRACS NO. H 4830 01 C

600-1(13)

DWG S-5.1

___ OF ___

REDUCED SIZE - DO NOT SCALE

VIEW NAME:

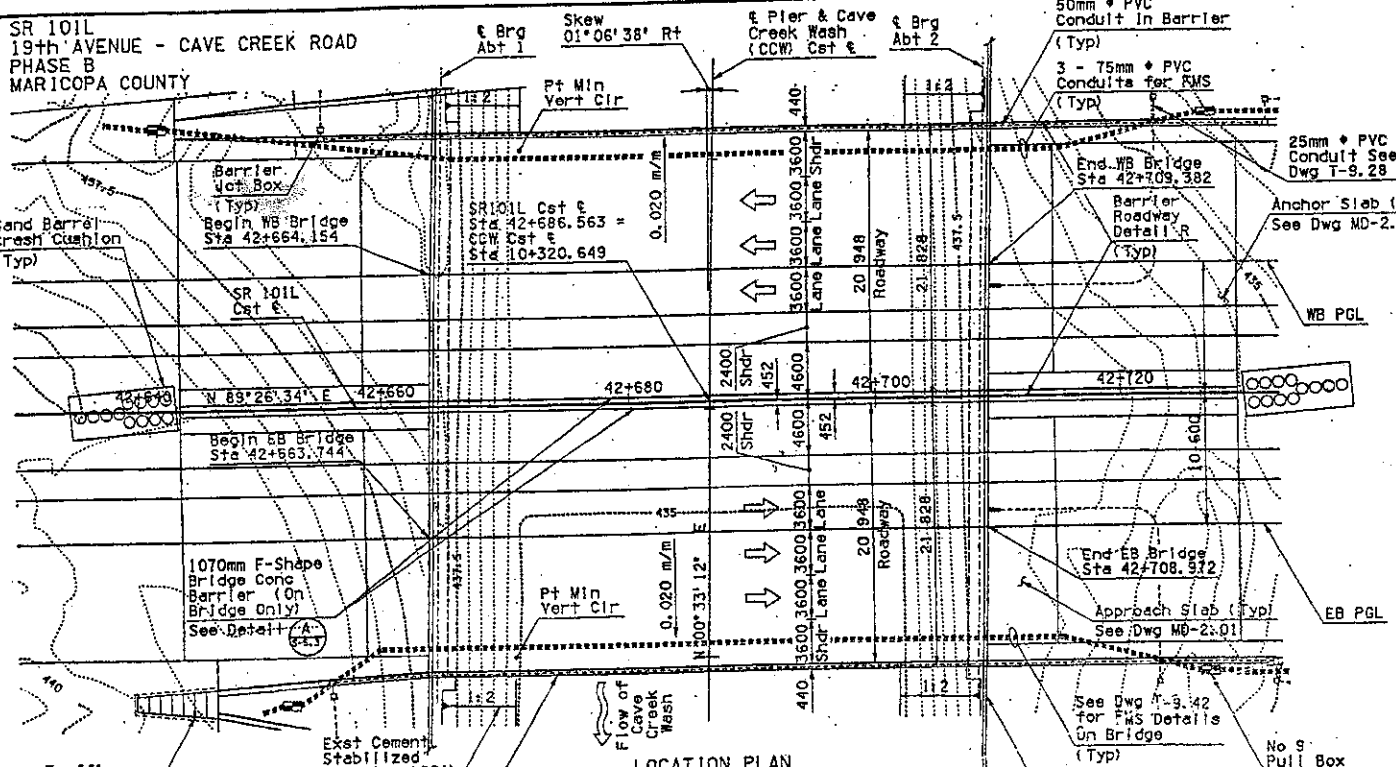
DATE	LOCATION	REVISIONS	PROJECT ENGR.	SURVEY NO.

DESIGN FILE: PCCWBR01.DGN
09/01/96

PLOT DATE: 03/19/99 12:07:49

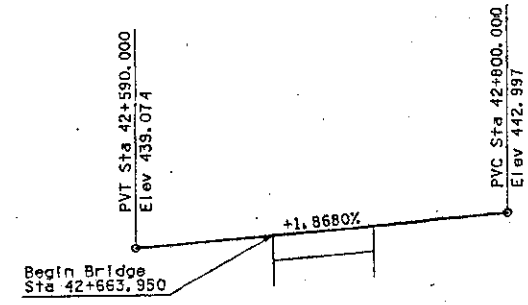
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	539	716	
		101 MA.024			

SR 101L
19th AVENUE - CAVE CREEK ROAD
PHASE B
MARICOPA COUNTY



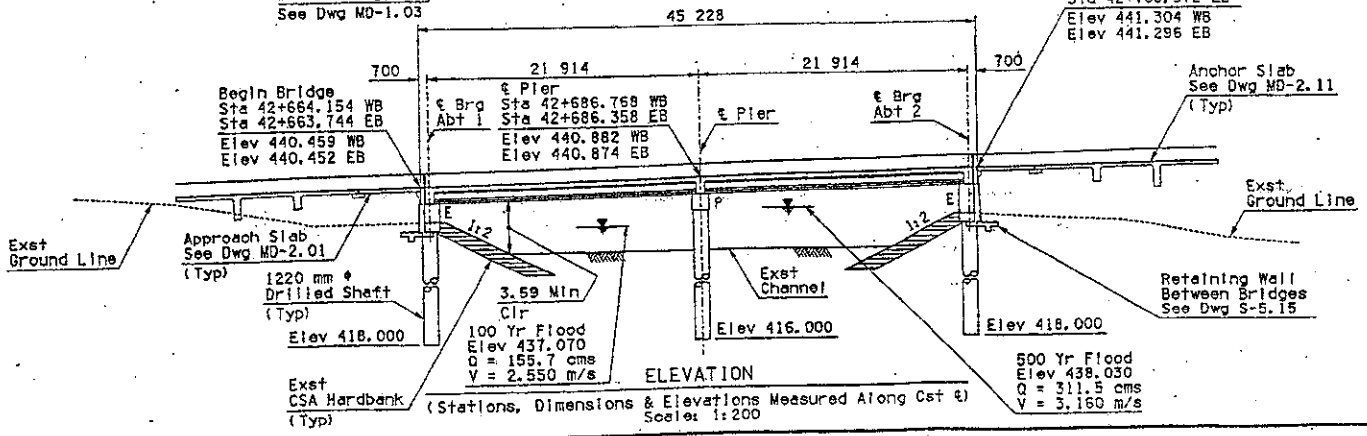
LOCATION PLAN

New 2- Span Continuous
AASHTO Type III Precast/Prestressed
Concrete Girder Bridge
Contour Interval = 0.5 m
Skew = 01°06'38" Rt
Scale: 1:200



MAINLINE PROFILE GRADE LINE

NTS



ELEVATION

(Stations, Dimensions & Elevations Measured Along Cst ℄)
Scale: 1:200

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TST, MRS	3/99
CHECKED	KTD	3/99

ENTRANCE

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
GENERAL PLAN

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

DWG S-5.2

TRACS NO. H 4830 01 C

600-1(13)

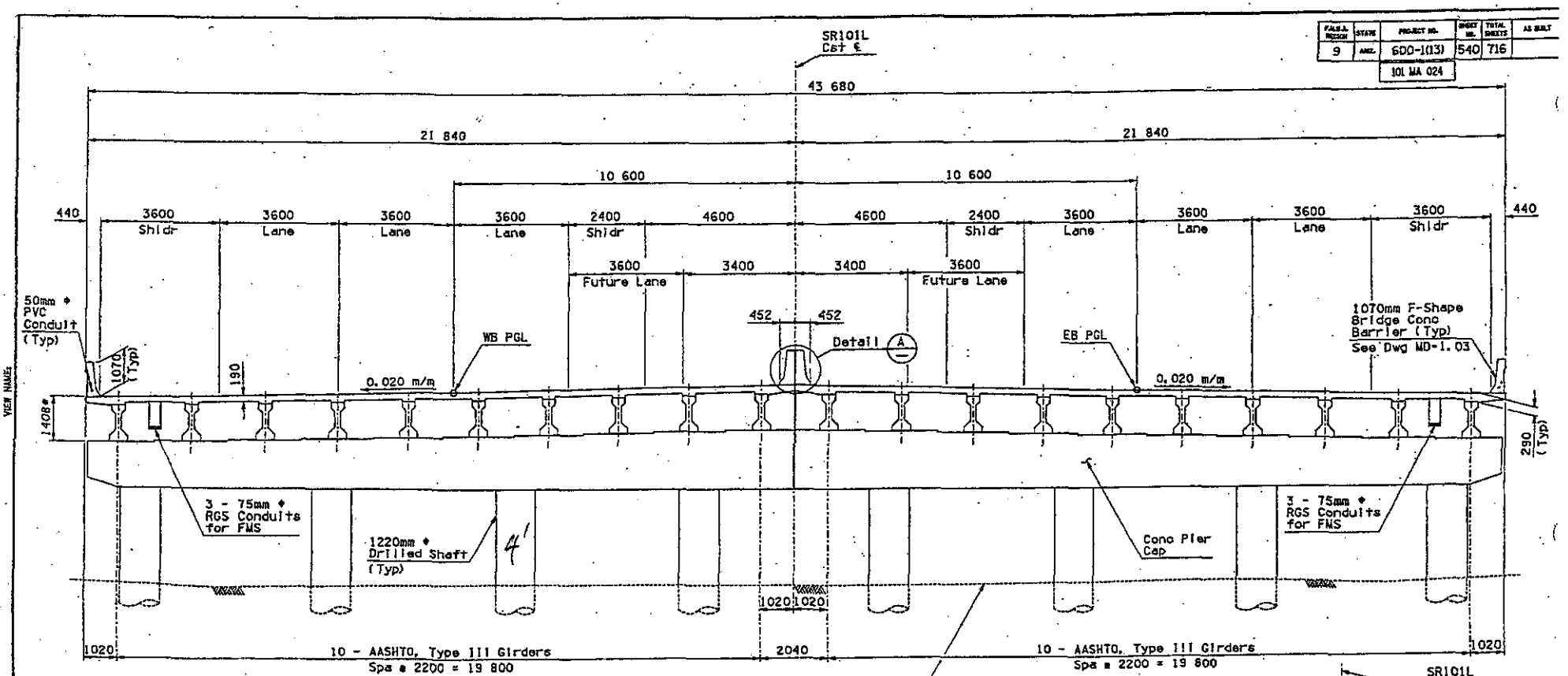
___ OF ___

DESIGN FILE: PCCWBR02.DGN

PLOT DATE: 03/19/99 12:08:19

VIEW NAMES

FAI.N.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	540	716	
		101 MA 024			



* Measured from top of deck to bottom of girder @ ℄ of girder and ℄ brg.

NORTH BRIDGE
Structure No. 1491

SOUTH BRIDGE
Structure No. 1490

Bearing Pads: Expansion 40 Ea, Fixed 40 Ea

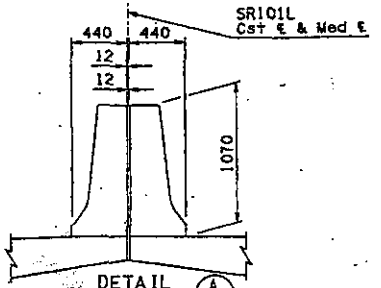
Approach Slab: 378 m^2

Restrainers: Expansion 36 Ea, Fixed 18 Ea

Bridge Conc Barrier: 178.5 m

Anchor Slab: 1095 m^2

TYPICAL SECTION
Shown Looking Ahead On Station
Scale: 1:60



DETAIL A
Scale: NTS

APPROXIMATE QUANTITIES

ITEM	STR EX m^3	STR BACKFILL m^3	CLASS 'S' CONCRETE f'c=20 MPa m^3	f'c=25 MPa m^3	f'c=31 MPa m^3	REINFORCING STEEL Kg	AASHTO TYPE III GIRDERS m	COMPRESSION SEAL JOINT m	1220 ϕ DRILLED SHAFTS m	Retaining Wall m^2
Abt 1	130	260	180	-	-	8,000	-	-	151.8	28
Abt 2	140	720	240	-	-	8,000	-	-	151.8	62
Pier	-	-	-	140	-	16,100	-	-	147.3	-
Superstructure	-	-	-	-	520	81,200	874.6	87.5	-	-
Total	270	980	420	140	520	113,300	874.6	87.5	450.9	90
As-Built Total	-		-	-	-	-	-	-		

	NAME	DATE
DESIGN	DCD	5/99
DRAWN	TST, MCG	5/99
CHECKED	KJD	5/99

INTRANET

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
SECTION & QUANTITIES

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

TRACS NO. H 4330 01 C

600-1(13)

DWG S-5.3

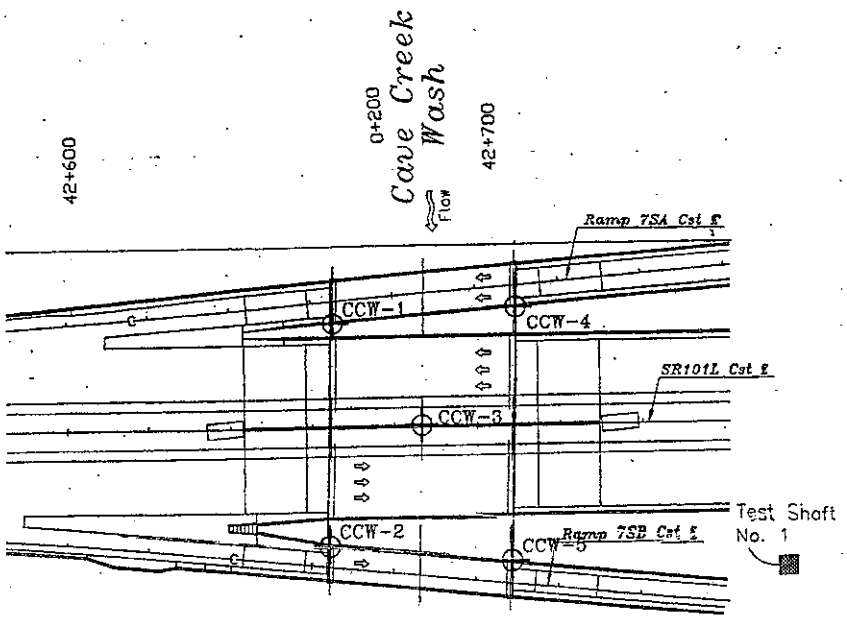
OF

REDUCED SIZE - DO NOT SCALE

DESIGN FILE: PCCWBR03.DGN

PLOT DATE: 05/19/99 12:09:28

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13B)	541	716	
		101 MA 024			



BORING CCW-1

Station and Offset: 42+665 , 24.3m L Elevation (m): 438.2m
Groundwater (m): No Free Groundwater Encountered
Drilling Company: Layne Equipment: Drill Sys. AP1000
Hole Diameter (mm): 254.00 Drilling Method: Percussion Hammer
Hammer Type: Down Hole Date Completed: 9/5/96

Depth (meters)	Sample Interval	Blow Count	Sample Type	Graphical Log	USCS Classification	DESCRIPTION
1–3		50/2"	SPT		GW	Sandy Gravel with cobbles trace silt, well graded (angular to subangular), light brown, slightly moist, very dense, non-plastic. Note: cobbles up to 250mm
4–6		50/5"	SPT			
7–9		50/2"	SPT		GW	
10			BULK			Note: Boulder (305mm in diameter) at 9.4m
12		50/4"	SPT		SM	Silty Sand trace clay, predominantly fine grained subangular, brown, moist, hard, low plasticity
13–14		17–50/5"	SPT			
15		40–50/5"	SPT		ML	Silt with sand trace clay, brown, moist, hard, low plasticity

Boring CCW-1 Continued...

Depth (meters)	Sample Interval	Blow Count	Sample Type	Graphical Log	USCS Classification	DESCRIPTION
16–17		20–27–29	SPT			
18		25–50/5"	SPT		SW	Gravelly Sand trace silt, well graded (subangular), brownish grey, very dense, low to no plasticity
21		31–41–37	SPT		SM	Silty Sand some gravel, predominantly fine grained (subangular), brown-grey, moist, very dense, non-plastic
22–23		28–37–50/3"	SPT		SM	
24–25		50/5"	SPT			
26		36m 50/5"	SPT		SW	Gravelly Sand trace silt, well graded (subangular), brown-grey, moist, very dense, non-plastic. Boring terminated at 25.91m bgs. Sampling stopped at 26.10m bgs. Caving to 17.07m

NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION MAP

No Scale

N

GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report – Foundations, Pima Freeway (101l) – 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter)
- NO SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

	NAME	DATE
DESIGN	JOW	12/98
DRAWN	SKO	12/98
CHECKED	GER	12/98

KLEINFELDER

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MATERIALS GROUP
STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (1 of 5)

ROUTE	M POST	STRUCTURE NO.
SR 101L	25.90	WB 1491
		EB 1490

PIMA FWY – 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-5.4

TRACS NO. H 4830 01 C 600-1(13B) 541 OF 716

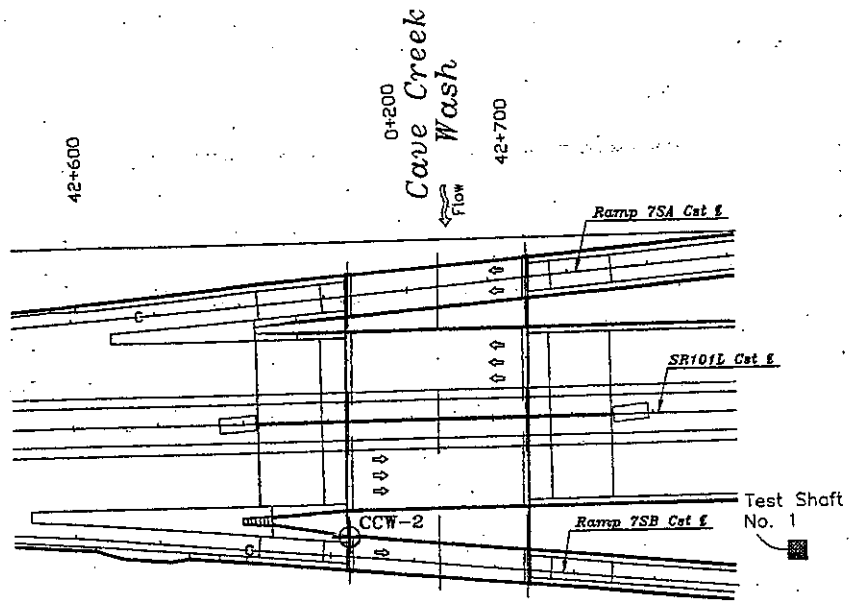
REDUCED SIZE - DO NOT SCALE

Metric

VIEW NAME:

DESIGN FILE: GRAPHICS \PROJECTS\5037\FOUNDATION_DATA\CAVE CREEK WASH\CCW-BRIDGE.DWG PLOT DATE: 12/30/98

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13B)	542	716	
		101 MA 024			



NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

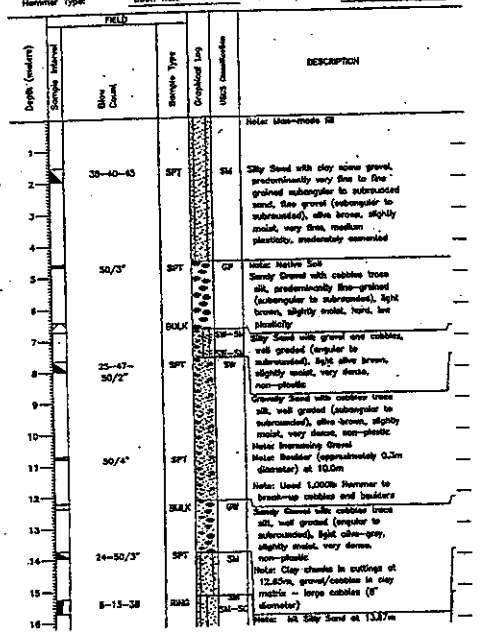
BORING LOCATION MAP

No Scale

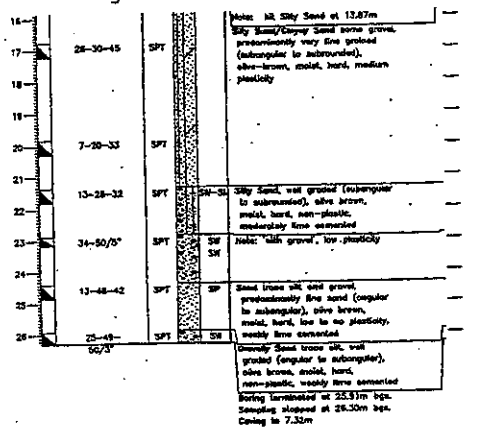
N

BORING CCW-2

Station and Offset: 42+665 , 28.5M RT
Elevation (m): 436.6m
Groundwater (m): No Free Groundwater Encountered
Drilling Company: WOC
Equipment: Drill Tech T40K
Hole Diameter (mm): 229mm
Drilling Method: Percussion Hammer
Hammer Type: Down Hole
Date Completed: 7/29/96



Boring CCW-2 Continued...



GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report - Foundations, Pima Freeway (101l) - 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter).
- NQ SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

	NAME	DATE
DESIGN	JOW	12/98
DRAWN	SKC	12/98
CHECKED	CGR	12/98

KLEINFELDER
2240 East Harbor Blvd
Phoenix, Arizona 85034-7237
PHONE 602-437-3437 • FAXIMILE 602-437-0000

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MATERIALS GROUP

STA. 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (2 of 5)

ROUTE	MILEPOST	EXPENDITURE NO.
SR 101L	25.90	WB 1491 EB 1490

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-5.5

TRACS NO. H 4830 01 C

600-1(13B)

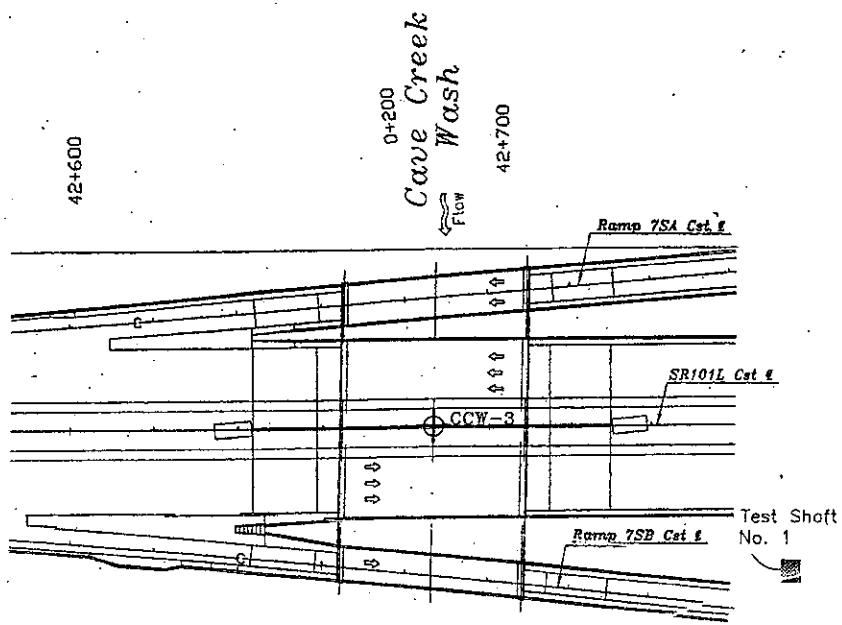
542 OF 716

VIEW NAME:

DESIGN FILE: GRAPHICS\PROJECTS\5037\FOUNDATION, PIMA CAVE CREEK WASH SOIL-BORING.DWG

PLOT DATE: 12/30/98

FAHWA REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13B)	543	716	
		101 MA 024			



NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION MAP

No Scale

N

BORING CCW-3

Station and Offset: 42+687 , 8M LEFT
Elevation (m): 435.5m
Groundwater (m): No Free Groundwater Encountered
Drilling Company: WDC
Equipment: Drill Tech T40K
Hole Diameter (mm): 229mm
Drilling Method: Percussion Hammer
Hammer Type: Down Hole
Date Completed: 7/28/98

Depth (meters)	Sample Interval	Blow Count	Sample Type	Graphical Log	USCS Classification	DESCRIPTION
1–10					GP	Sandy Gravel some cobbles trace silt, predominantly fine grained (angular to subangular), light olive-grey, slightly moist, very dense, non-plastic. Note: Down the Hole hammer not available to sample.
6–7					GW-GM	Note: Strongly cemented, cobbles in cuttings, (fine grained matrix, silt, clay)
7–8					GW-GM	Silty Gravel with cobbles trace clay, well graded (angular to subrounded), light brown, slightly moist, hard, low plasticity
10–11					SC	Clayey Sand with gravel and cobbles, predominantly fine grained (subangular to subrounded), olive-brown, moist, hard, medium dense
11–12			BULK		SM/SC	Silty Sand/Clayey Sand, predominantly very fine grained (subangular to subrounded), olive-brown, moist, hard, medium plasticity
13–14			BULK		SW	Gravelly Sand trace silt and clay, well graded (subangular to subrounded), olive-brown, moist, hard, medium plasticity
15–16			BULK		SW	

Boring CCW-3 Continued...

Depth (meters)	Sample Type	USCS Classification	DESCRIPTION
17–18	BULK	SM	Silty Sand some gravel, predominantly very fine grained (subangular to subrounded), olive-grey, moist, very dense, non-plastic. Grades to 'trace clay', low plasticity
18–19	BULK		
20–21	BULK		
23–24	BULK	SM	
24–25	BULK	SP	Poorly Graded Sand trace gravel, silt and clay, predominantly fine grained (subangular to subrounded), olive-brown, moist, hard, low plasticity, moderately cemented
25	BULK	SC/SM	Silty Sand trace gravel and clay, predominantly fine grained (subangular to subrounded), olive-brown, moist, hard, low plasticity, moderately lime cemented

Boring terminated at 25.30m bgs.
Sampling stopped at 25.60m bgs.

GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report – Foundations, Pima Freeway (101l) – 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter)
- NO SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

	NAME	DATE
DESIGN	JOW	12/98
DRAWN	SKC	12/98
CHECKED	CDR	12/98

KLEINFELDER

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MATERIALS GROUP
STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (3 of 5)

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	WB 1491 EB 1490

PIMA FWY. – 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-5.6

TRACS NO. H 4830 01 C

600-1(13B)

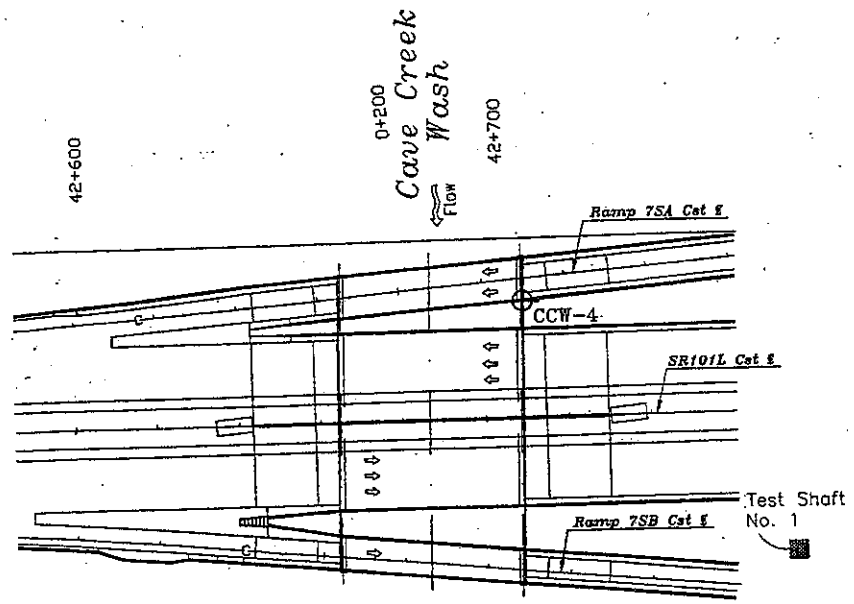
543 OF 716

DESIGN FILE: GRAPHICS\PROJECTS\5037\ PLOT DATE: 12/30/98

Metric

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13B)	544	716	

101 MA 024



NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

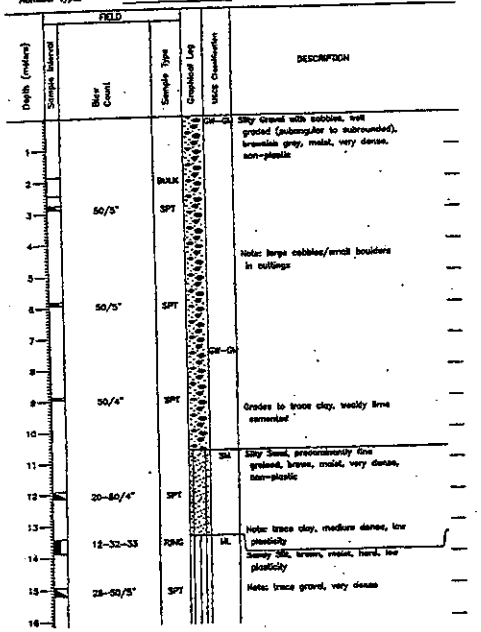
BORING LOCATION MAP

No Scale

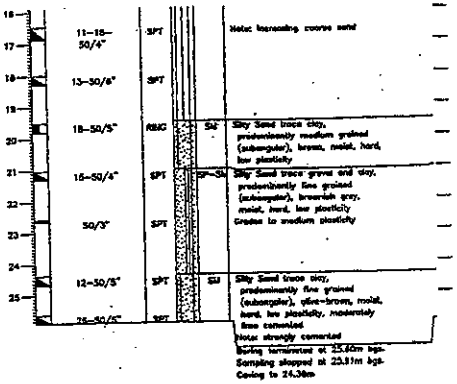
N

BORING CCW-4

Station and Offset: 42+715 - 30.5M LT
Elevation (m): 436.8m
Groundwater (m): No Free Groundwater Encountered
Drilling Company: Layne
Equipment: D16 Sys. AP1000
Hole Diameter (mm): 254.00
Drilling Method: Percussion Hammer
Hammer Type: Down Hole
Date Completed: 6/3/98



Boring CCW-4 Continued...



GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report - Foundations, Pima Freeway (101l) - 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

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LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter)
- NQ SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

	NAME	DATE
DESIGN	JDW	12/98
DRAWN	SKC	12/98
CHECKED	DEB	12/98

KLEINFELDER

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MATERIALS GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (4 of 5)

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	WB 1491 EB T490

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-S.7

TRACS NO. H 4830 01 C | 600-1(13B) | 544 OF 716

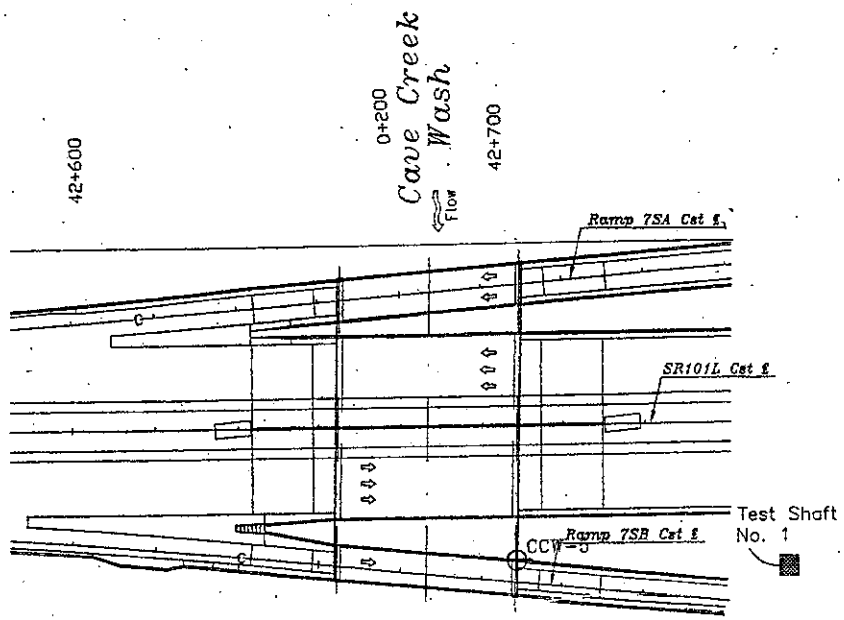
DESIGN FILE: GRAPHICS\PROJECTS\5037\FOUNDATION_DATA\CAVE CREEK WASH\CCW-BRIDGE.DWG

PLOT DATE: 12/30/98

VIEW NAME:

DO NOT SCALE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(138)	545	716	
		101 MA 024			



NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION MAP

No Scale

N

BORING CCW-5

Station and Offset:	42+715 , 23M RT	Elevation (m):	435.5m
Groundwater (m):	No Free Groundwater Encountered		
Drilling Company:	WDC	Equipment:	Drill Tech 740K
Hole Diameter (mm):	229mm	Drilling Method:	Percussion Hammer
Hammer Type:	Down Hole	Date Completed:	7/30/98

FIELD

Depth (meters)	Sample Interval	Blow Count	Sample Type	Graphical Log	USCS Classification	DESCRIPTION
1					GW-GM	Silty Gravel with cobbles, well graded (subangular to subrounded), olive-gray, slightly moist, dense, non-plastic
2		17-32-25	SPT			Note: Increase in amount of cobbles
3						
4						Note: Boulder (0.30m diameter) at 3.5m
5		50/4"	SPT			
			BULK			Grades to 'trace silt and clay', medium plasticity
6						
7					SP	Gravelly Sand, predominantly coarse grained sand (angular to subangular), olive-brown, slightly moist, very dense, non-plastic
8		18-13-15	SPT		SP	
9						Note: Some cobbles below 9.14m
10						
11					SM	Silty Sand trace clay and gravel, predominantly fine grained (subangular), olive brown, moist, hard, low plasticity
12						
13		14-32-50/5"	RING		ML	Sandy Silt, brown, moist, hard, low plasticity
14		8-20-23	SPT			
15						
16		8-16-24	SPT		ML	

Boring CCW-5 Continued...

16			
17	4-27-23	SPT	SM — Silty Sand some gravel, predominantly fine grained (subangular), olive-brown, moist, very firm, non-plastic, weakly fines cemented
18	5-11-22	SPT	
19			
20	13-27-20	SPT	
21			
22	11-20-23	SPT	
23	9-30-33	SPT	SM
24			
25	6-16-27	SPT	
26	3-20-30	SPT	

Boring terminated at 25.91m bgs.
Sampling stopped at 28.35m bgs.
Caving to 13.72m

NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report – Foundations, Pima Freeway (101l) – 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter)
- NQ SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

	NAME	DATE
DESIGN	JMW	12/98
DRAWN	SKC	12/98
CHECKED	CDR	12/98

KLEINFELDER

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MATERIALS GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (5 of 5)

ROUTE	MP	POST	STRUCTURE NO.
SR 101L	25.90	WB	1491
		EB	1490

PIMA FWY – 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-5.8

TRACS NO. H 4830 01 C | 600-1(138) | 545 OF 716

REDUCED SIZE - DO NOT SCALE

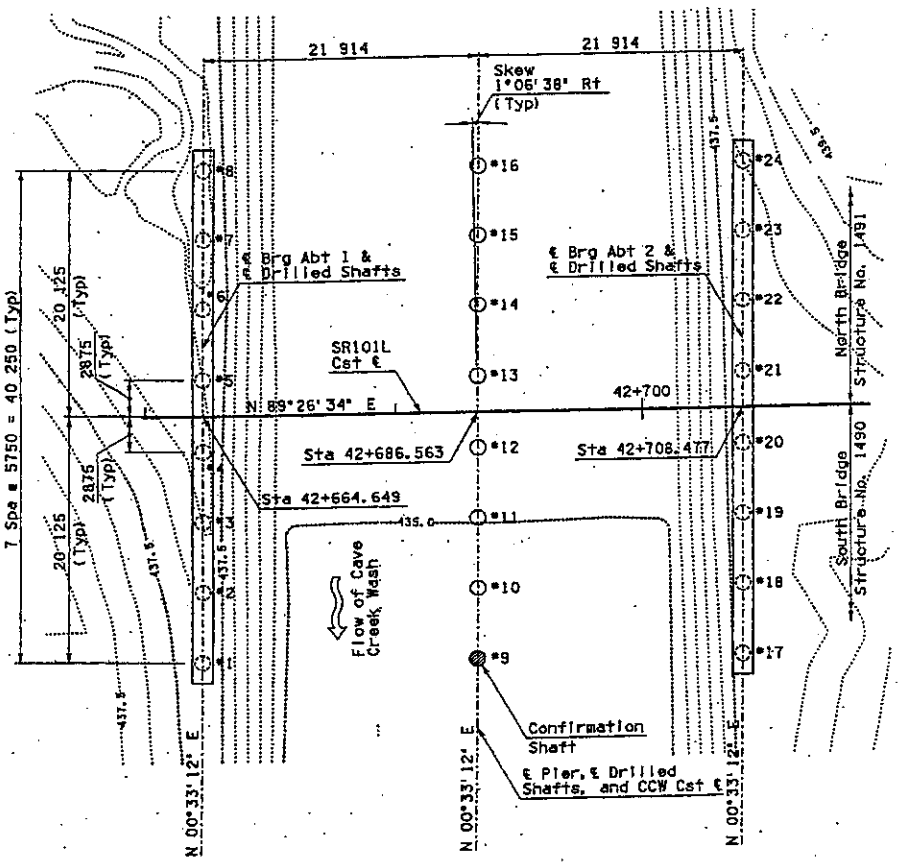
Metric

VIEW NAME:

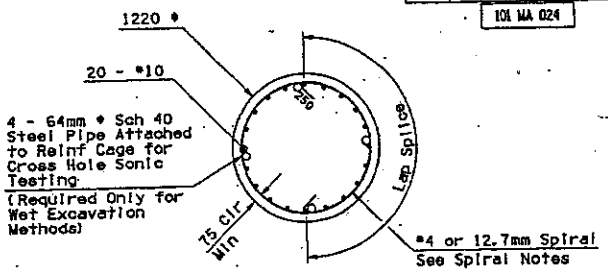
DESIGN FILE: GRAPHICS\PROJECTS\5037\FOUNDATION_DATA\CAVE CREEK WASH\CCW-BORING.DWG

PLOT DATE: 12/30/98

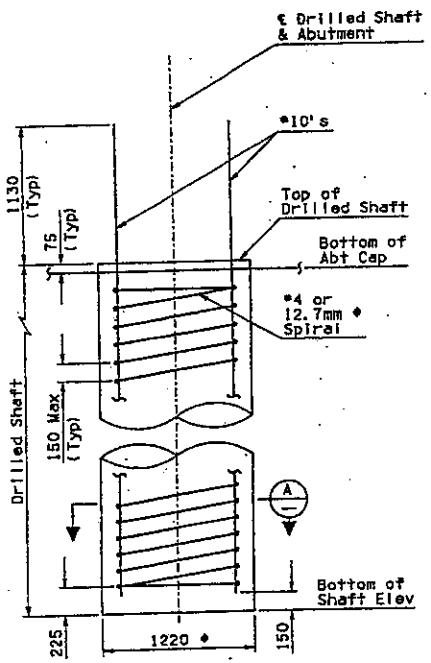
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	546	716	
		101 MA 024			



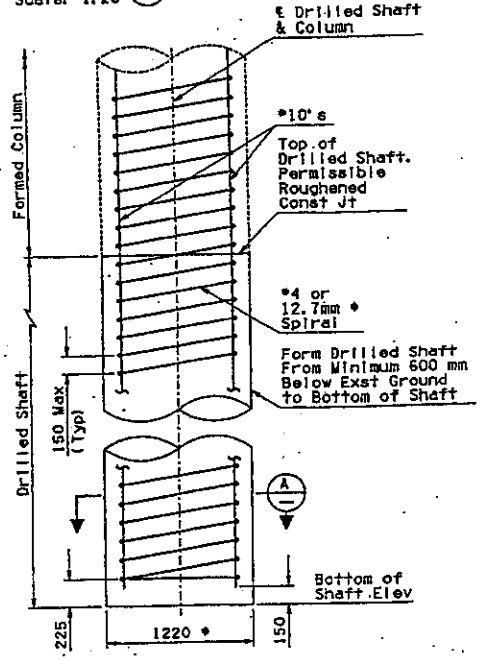
FOUNDATION PLAN
Scale: 1:200



SECTION A
Scale: 1:20



DRILLED SHAFT ELEVATION AT ABUTMENT
Scale: 1:20



DRILLED SHAFT ELEVATION AT PIER
Scale: 1:20

FOUNDATION NOTES:

Abutment drilled shaft vertical design load = 2425 kN.
Pier drilled shaft vertical design load = 2720 kN.

For further information regarding drilled shaft construction see Section 609 of the Special Provisions.

SPIRAL NOTES:

12.7mm diameter cold drawn steel wire shall conform to minimum AASHTO M32 tensile strength = 420 MPa.

Anchorage of spiral reinforcement shall be provided by 1½ extra turns of the spiral at the end of a spiral unit.

Splices in spiral reinforcement shall be lap splices of 48 bar diameters but not less than 300mm or shall be welded.

CONTOUR NOTES:

Contours shown are approximate and shall not be used for estimating purposes.

DRILLED SHAFT ELEVATIONS		
Location	Bottom	Top
Abt 1	418.000	436.975
Pier	416.000	434.410
Abt 2	418.000	436.975

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TYN, MEG	3/99
CHECKED	DEW	3/99

WYTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
FOUNDATION LAYOUT

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	EXPLANATION NO.
SR 101L	25.90	EB 1490 WB 1491

KEVIN TRACY CUNNINGHAM 26752

DWG S-5.5

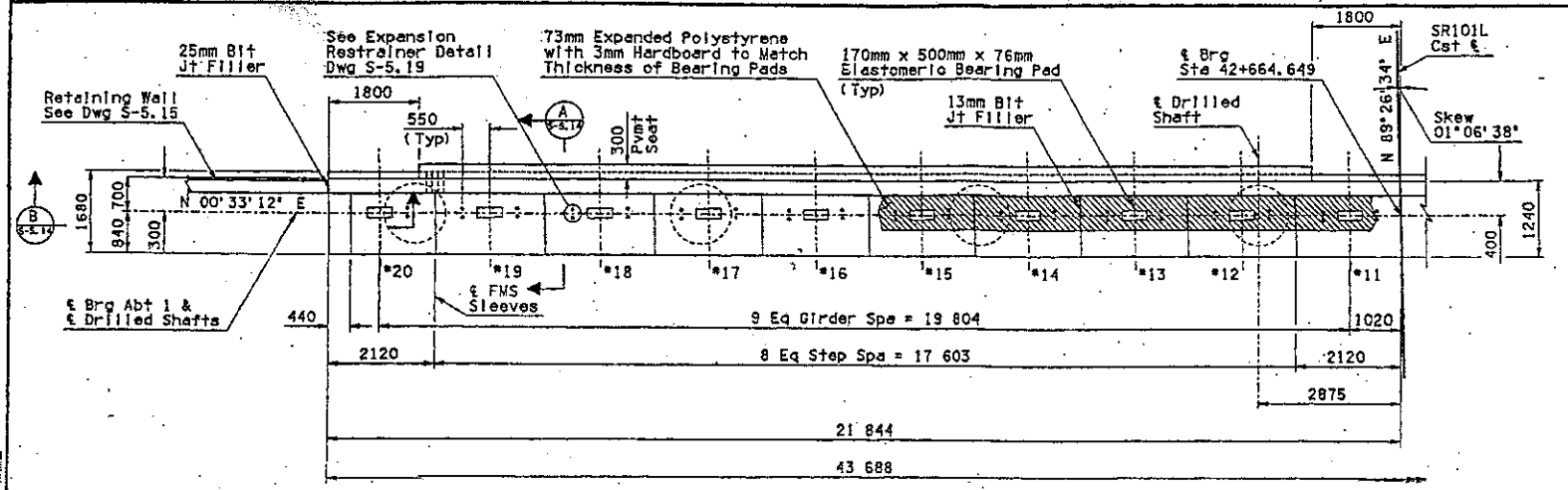
TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

REDUCED SIZE - DO NOT SCALE

DESIGN FILE: PCCWSRC-1.DGN

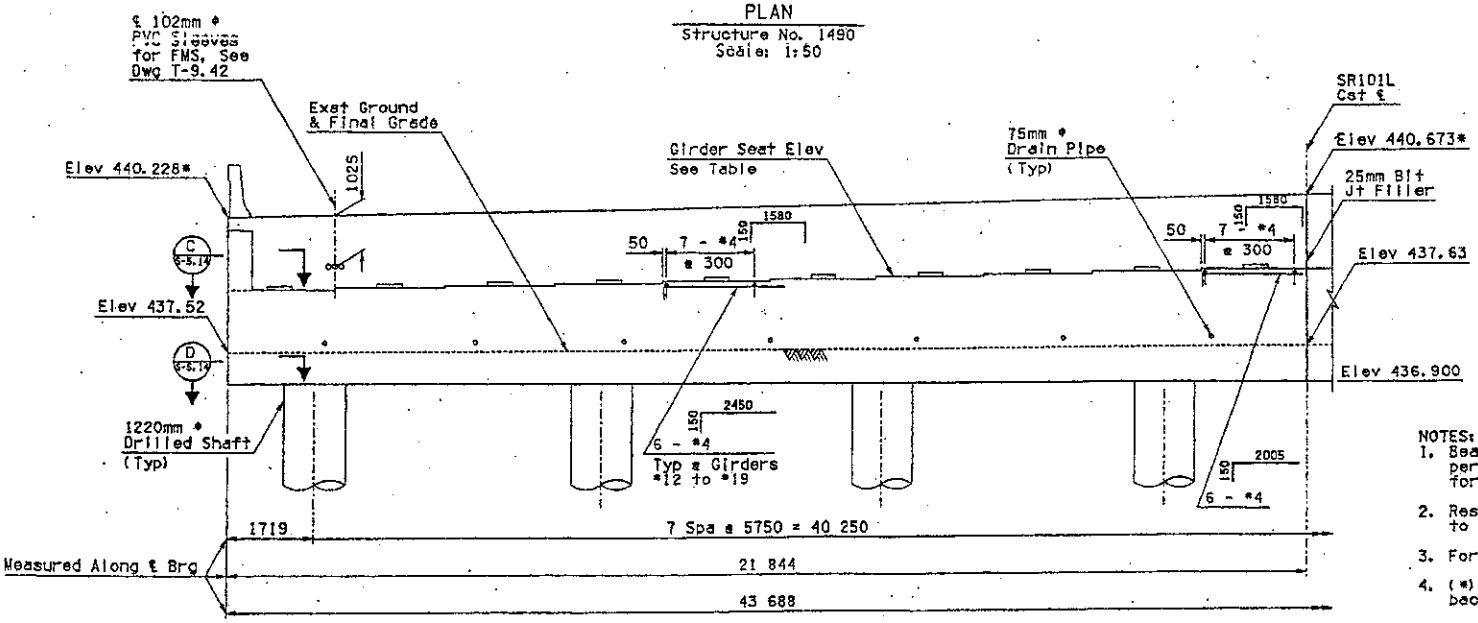
PLOT DATE: 03/19/99 12:09:51

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	547	716	
		101 MA 024			



PLAN
Structure No. 1490
Scale: 1:50

GIRDER SEAT ELEVATIONS	
Girder #	Elevation
*11	439.176
*12	439.131
*13	439.086
*14	439.041
*15	438.996
*16	438.952
*17	438.907
*18	438.862
*19	438.817
*20	438.773



ELEVATION
Structure No. 1490
Scale: 1:50

NOTES:
1. Bearing pads shall be placed perpendicular to ℄ girder. See Dwg S-5.28 for elastomeric bearing pad detail.
2. Restrainers shall be aligned parallel to ℄ girders. See Dwg S-5.19.
3. For Abutment Details, see Dwg S-5.14.
4. (*) Denotes elevations at front face of back wall.

	NAME	DATE
DESIGN	DCO	3/99
DRAWN	TST, MEG	3/99
CHECKED	KJD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP
STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH ABUTMENT 1 PLAN & ELEV (1 of 2)
PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

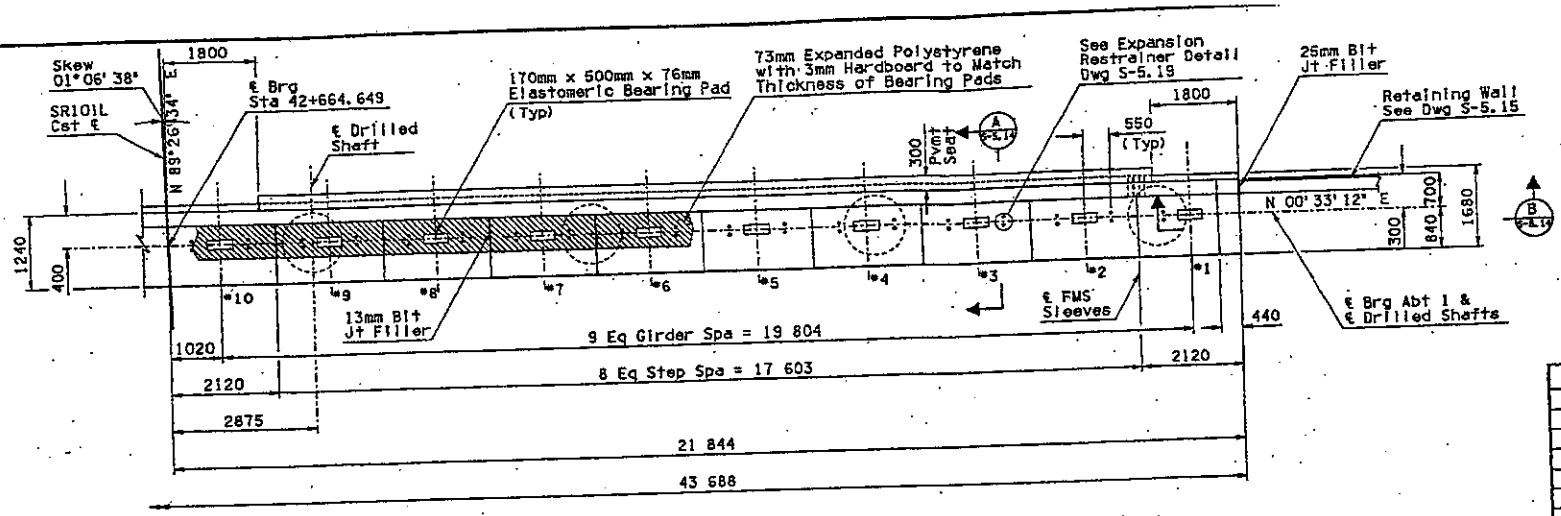
ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 - WB 1491

DWG S-5.10
TRACS NO. H 4830 01 C
600-1(13)
___ OF ___

REDUCED SIZE - DO NOT SCALE

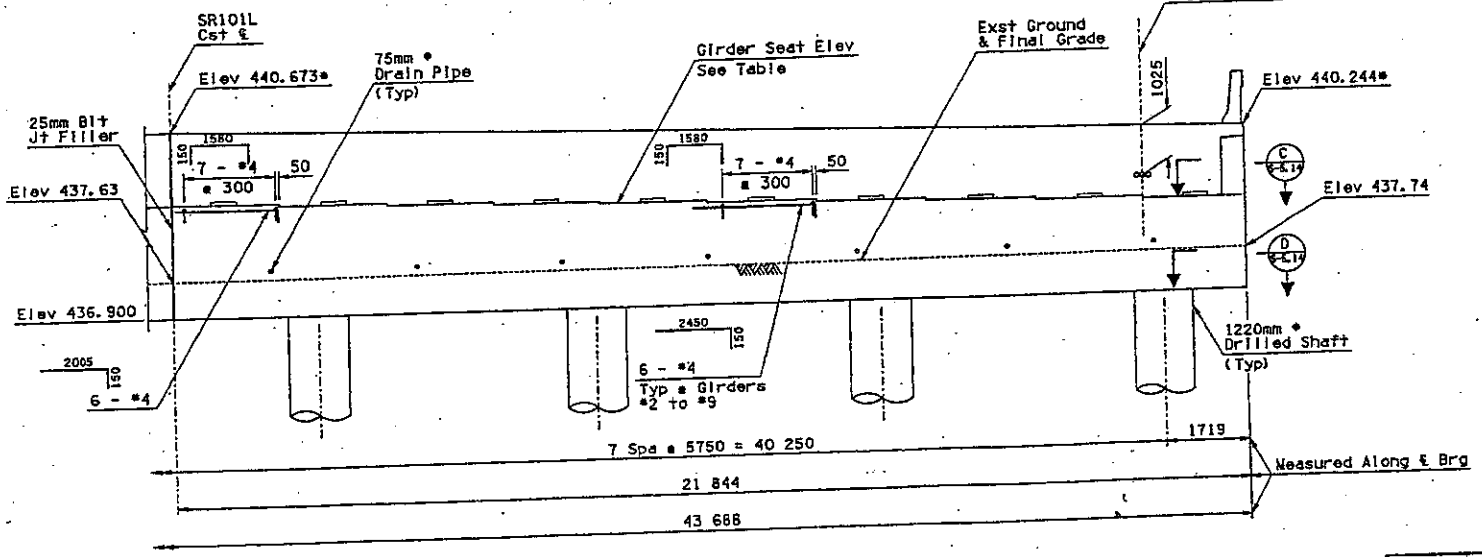
DESIGN FILE: PCCWBRCS.DGN
PLOT DATE: 03/19/99 12:09:06

F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	548	716	
		101 MA 024			



PLAN
Structure No. 1491
Scale: 1:50

GIRDER SEAT ELEVATIONS	
Girder #	Elevation
#1	438.788
#2	438.831
#3	438.874
#4	438.917
#5	438.960
#6	439.004
#7	439.047
#8	439.090
#9	439.133
#10	439.176



ELEVATION
Structure No. 1491
Scale: 1:50

NOTES:
1. Bearing pads shall be placed perpendicular to ℄ girder. See Dwg S-5.28 for elastomeric bearing pad detail.
2. Restrainers shall be aligned parallel to ℄ girders. See Dwg S-5.19.
3. For Abutment Details, see Dwg S-5.14.
4. (*) Denotes elevations at front face of back wall.

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TST, MCE	3/99
CHECKED	KTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH. ABUTMENT 1 PLAN & ELEV (2 of 2)

ROUTE	LR PROJ	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-5.11

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

VIEW NAME:

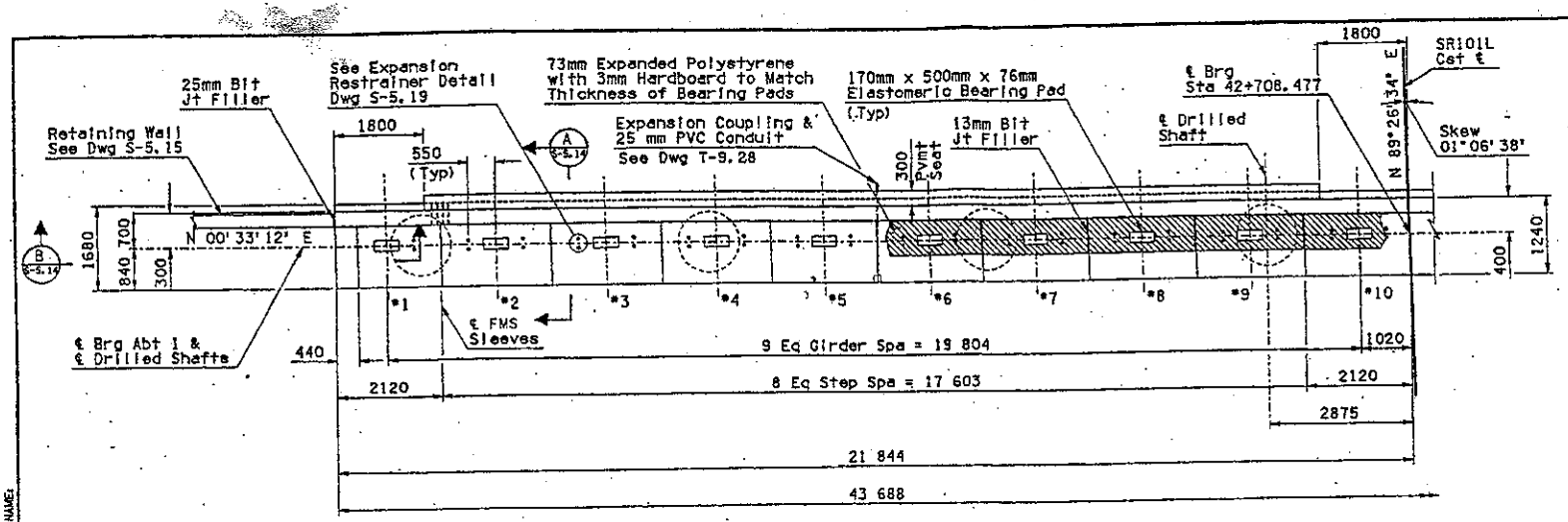
REDUCED SIZE - DO NOT SCALE

MARK	REVISIONS	DATE	LOCATION	DATE

DESIGN FILE: PCCW9021.DGN

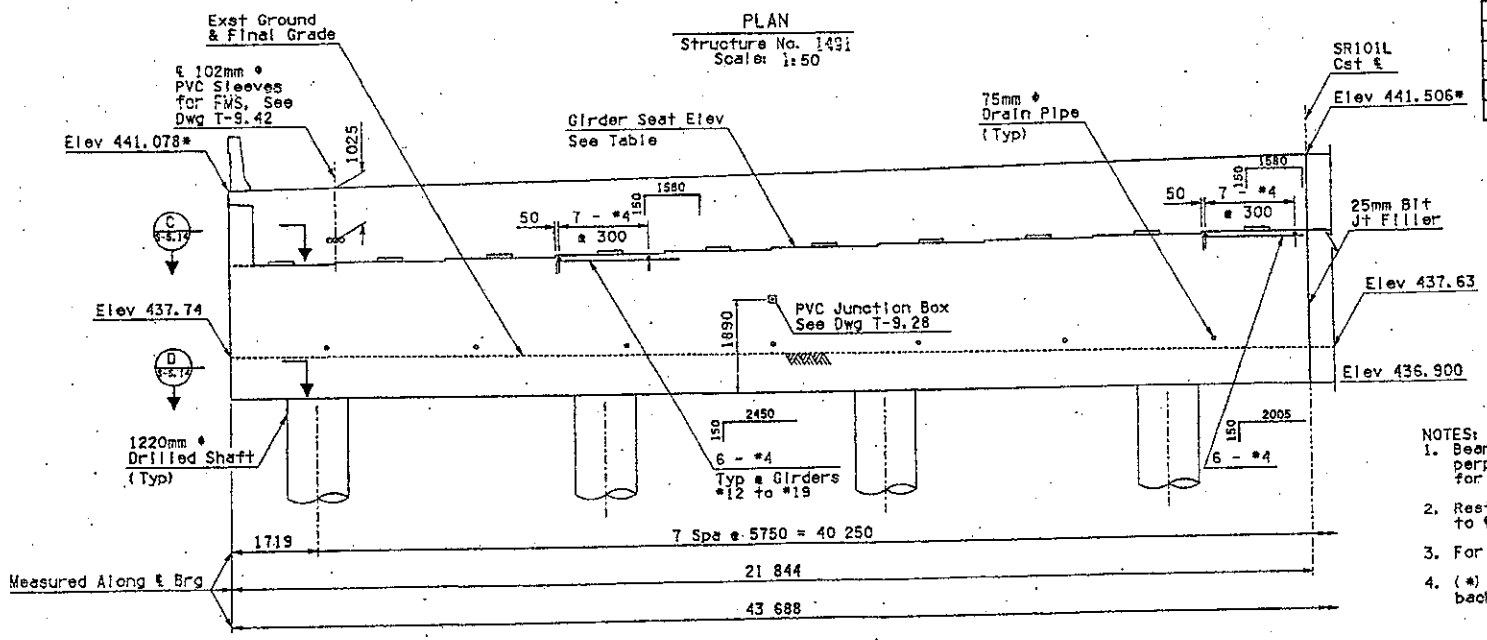
PLOT DATE: 03/19/99 12:29:36

FUNCTIONAL DESIGN	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	549	716	
		101 MA 024			



PLAN
Structure No. 1491
Scale: 1:50

GIRDER SEAT ELEVATIONS	
Girder #	Elevation
*1	439.606
*2	439.649
*3	439.693
*4	439.736
*5	439.779
*6	439.882
*7	439.866
*8	439.909
*9	439.952
*10	439.995



ELEVATION
Structure No. 1491
Scale: 1:50

NOTES:
1. Bearing pads shall be placed perpendicular to ℄ girder. See Dwg S-5.28 for elastomeric bearing pad detail.
2. Restrainers shall be aligned parallel to ℄ girders. See Dwg S-5.19.
3. For Abutment Details, see Dwg S-5.14.
4. (*) Denotes elevations at front face of back wall.

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TSI, MEC	3/99
CHECKED	KTG	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
ABUTMENT 2 PLAN & ELEV (1 of 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

DWG S-5.12

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

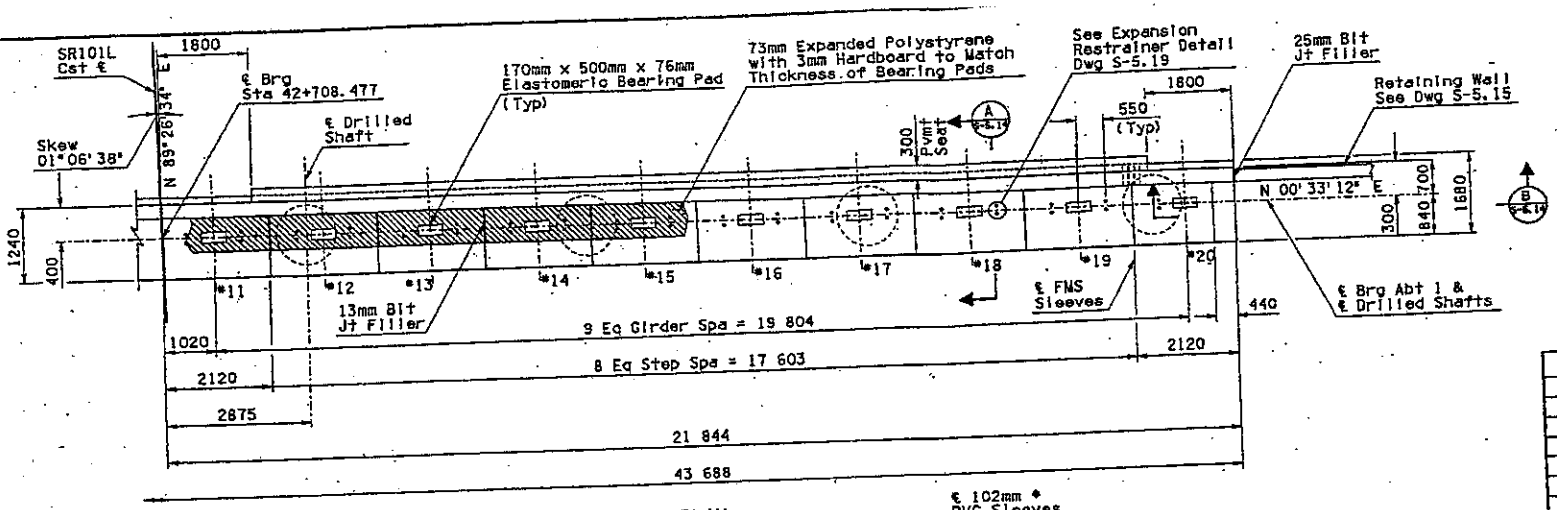
REDUCED SIZE - DO NOT SCALE

VIEW NAME:

DESIGN FILE: PDCWBR06.DGN

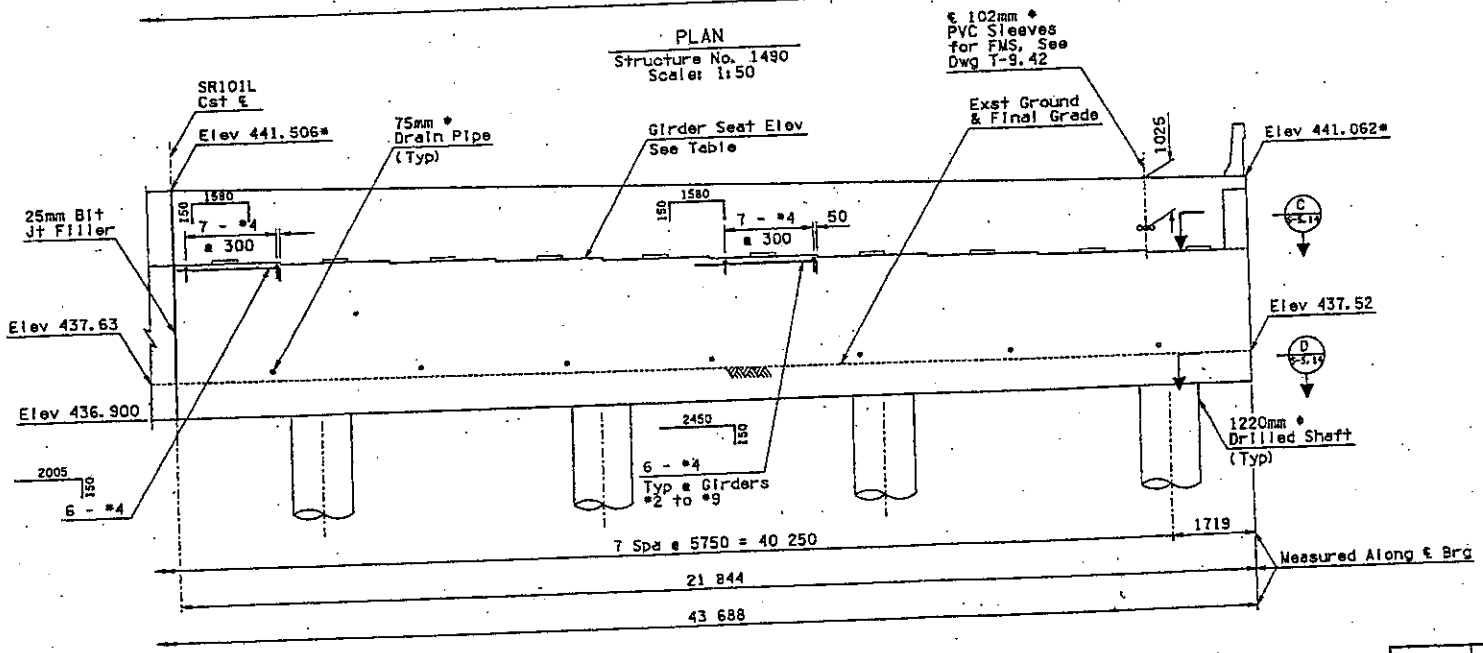
PLOT DATE: 03/19/99 12:09:21

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	
9	ARIZ.	600-1(13)	550	716	
		101 MA 024			



PLAN
Structure No. 1490
Scale: 1:50

GIRDER SEAT ELEVATIONS	
Girder #	Elevation
*11	439.994
*12	439.950
*13	439.905
*14	439.860
*15	439.815
*16	439.770
*17	439.726
*18	439.681
*19	439.636
*20	439.591



ELEVATION
Structure No. 1490
Scale: 1:50

NOTES:
1. Bearing pads shall be placed perpendicular to ℄ girder. See Dwg S-5.28 for elastomeric bearing pad detail.
2. Restrainers shall be aligned parallel to ℄ girders. See Dwg S-5.19.
3. For Abutment Details, see Dwg S-5.14.
4. (*) Denotes elevations at front face of back wall.

	NAME	DATE
DESIGN	DCO	3/99
DRAWN	TBT, MGB	3/99
CHECKED	KTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
ABUTMENT 2 PLAN & ELEV (2 of 2)

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

TRACS NO. H 4830 01 C | 600-1(13)

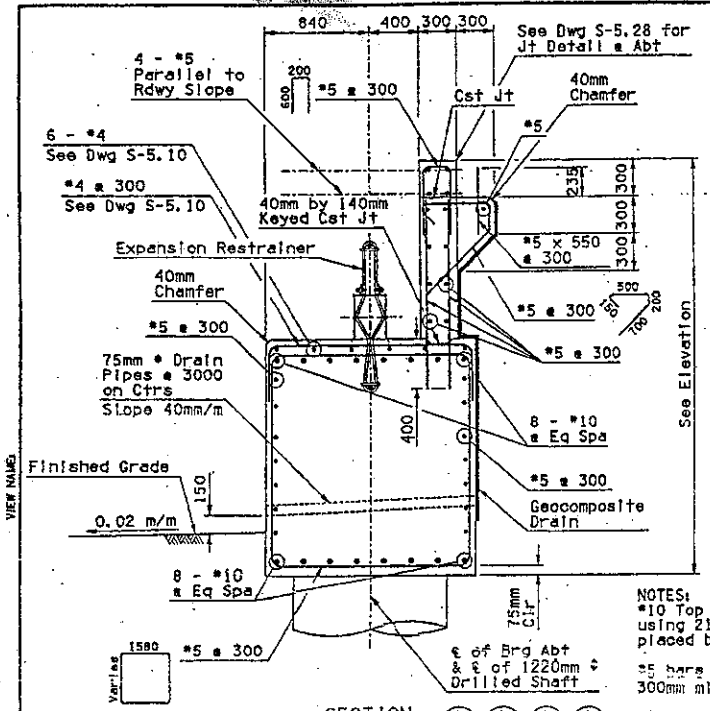
DWG S-5.13
___ OF ___

1-800-782-5348

DESIGN FILE: PCC\SR22.DGN
PLOT DATE: 03/19/99 12:09:52

REDUCED SIZE - DO NOT SCALE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	551	716	
		101 MA 024			



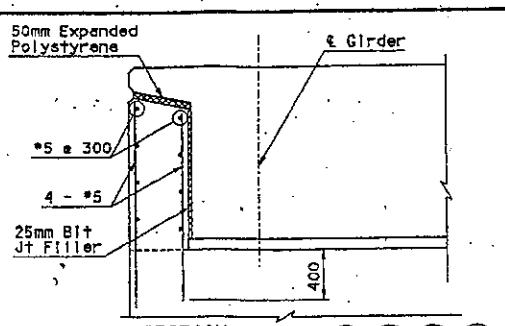
SECTION
Scale: 1:20
A A A A
S-5.19 S-5.11 S-5.12 S-5.13

NOTES:
#10 Top bars may be spliced using 2100mm min lap splice placed between drilled shafts.

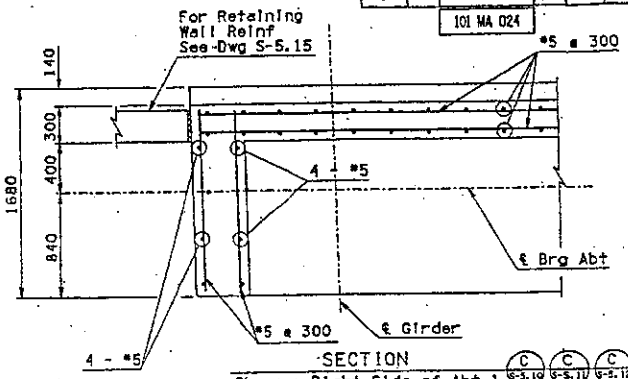
#5 bars may be spliced using 300mm min lap.

#10 bar bars may be spliced using 1470mm min lap splice placed above drilled shafts.

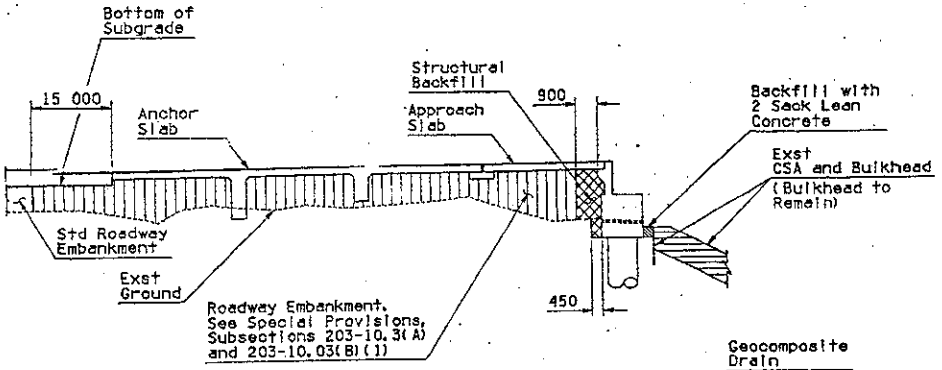
Alternate splice locations.



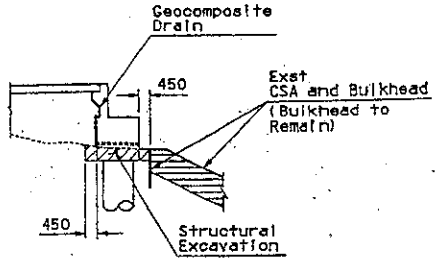
SECTION
Shown @ Right Side of Abt 1
Similar @ Other Locations
Scale: 1:20
B B B B
S-5.19 S-5.11 S-5.12 S-5.13



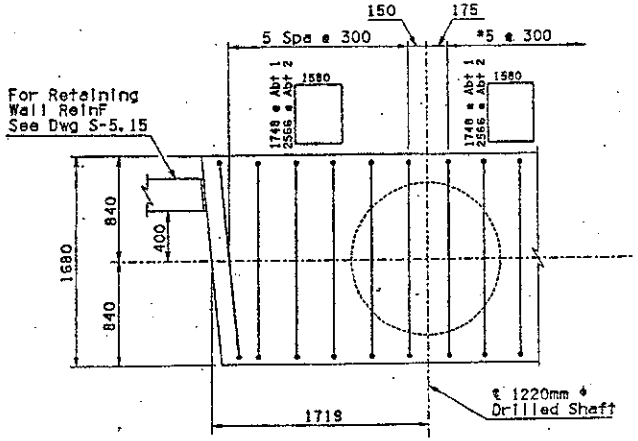
SECTION
Shown @ Right Side of Abt 1
Similar @ Other Locations
Scale: 1:20
C C C C
S-5.19 S-5.11 S-5.12 S-5.13



LIMITS OF STRUCTURE BACKFILL AT ABUTMENTS
NTS



LIMITS OF STRUCTURAL EXCAVATION AT ABUTMENTS
NTS



SECTION
Shown @ Right Side of Abt 1
Similar @ Other Locations
Scale: 1:20
D D D D
S-5.19 S-5.11 S-5.19 S-5.13

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TST, MEG	3/99
CHECKED	KJD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH ABUTMENT DETAILS

ROUTE	MP PROJ	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

KEVIN TRACY GUSENBERY 26752 REGISTERED PROFESSIONAL ENGINEER (STRUCTURAL) ARIZONA

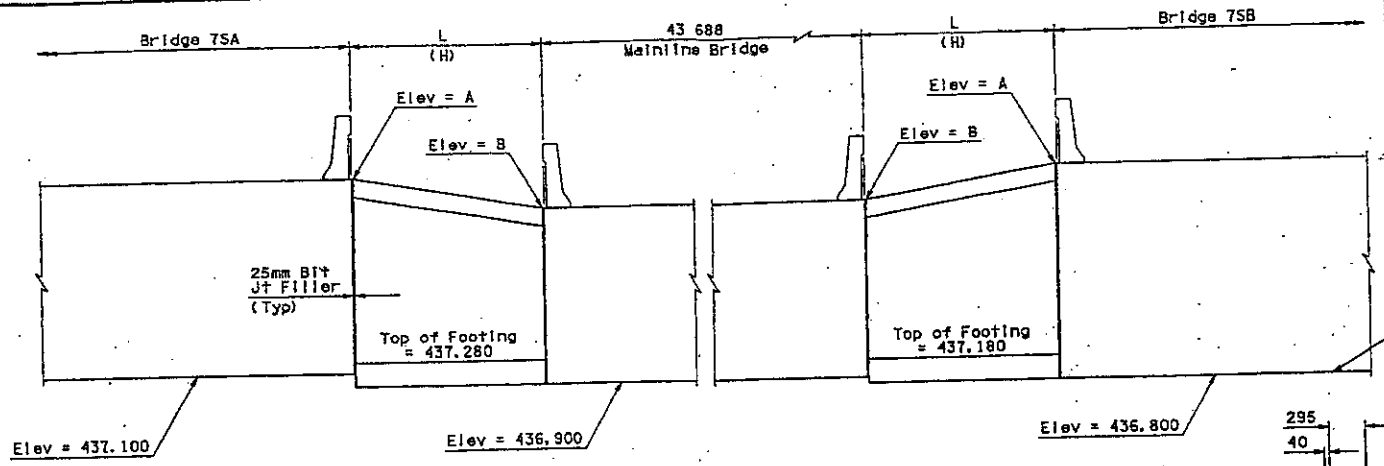
DWG S-5.14

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

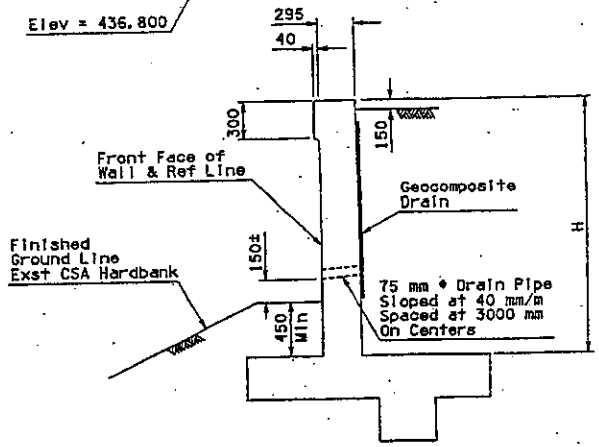
REDUCED SIZE - DO NOT SCALE

DESIGN FILE: FCCWBROT.DGN
PLOT DATE: 03/19/99 12:13:07

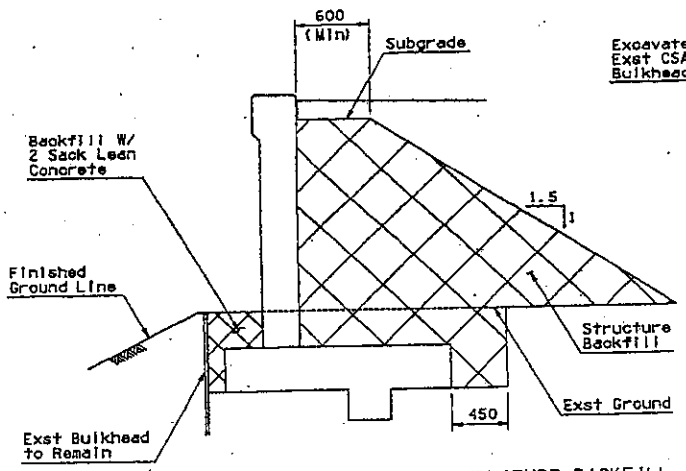
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	552	716	
		101 MA 024			



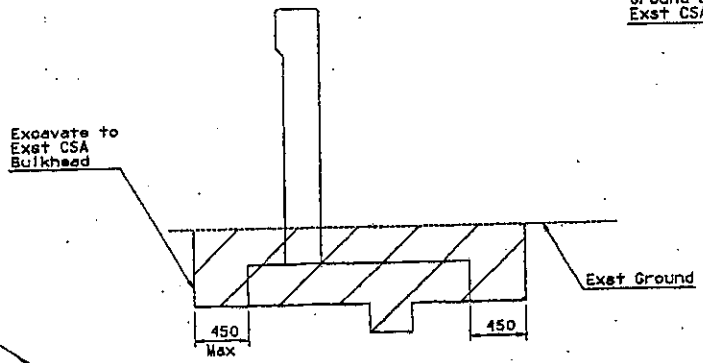
ELEVATION
Shown @ Abt 2
Similar @ Abt 1
Scale: 1:40



TYPICAL SECTION
Scale: 1:20



LIMITS OF WINGWALL STRUCTURE BACKFILL
Scale: 1:20



LIMITS OF WINGWALL STRUCTURAL EXCAVATION
Scale: 1:20

RETAINING WALL DIMENSIONS & ELEVATIONS				
Location *	L**	H	Elev A	Elev B
Abt 1 (Lt Side)	3.077	2.999 (10 Ft)	440.279	440.244
Abt 1 (Rt Side)	5.655	2.952 (10 Ft)	439.737	440.228
Abt 2 (Lt Side)	6.471	3.894 (13 Ft)	440.805	441.078
Abt 2 (Rt Side)	10.131	3.886 (13 Ft)	439.789	441.062

NOTES:

1. Dimensions & elevations shown at front face of retaining wall.
2. See ADOT Standard Dwg B-18.10 & B-18.20, Case II for wall dimensions & reinforcing.
3. (*) Looking ahead on stationing.
4. (**) Measured along front face of wall.

	NAME	DATE
DESIGN	WCY	3/99
DRAWN	TST, MEC	3/99
CHECKED	KTO	3/99

ENTRANCE

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
RETAINING WALL DETAILS

ROUTE	M. POST	STRUCTURE NO.
SR 101L	25.90	EB 1490
		WB 1491

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

KEVIN TRAN
DESIGNER
DATE

DWG S-5.15

TRACS NO. H 4830 01 C

600-1(13)

___ OF ___

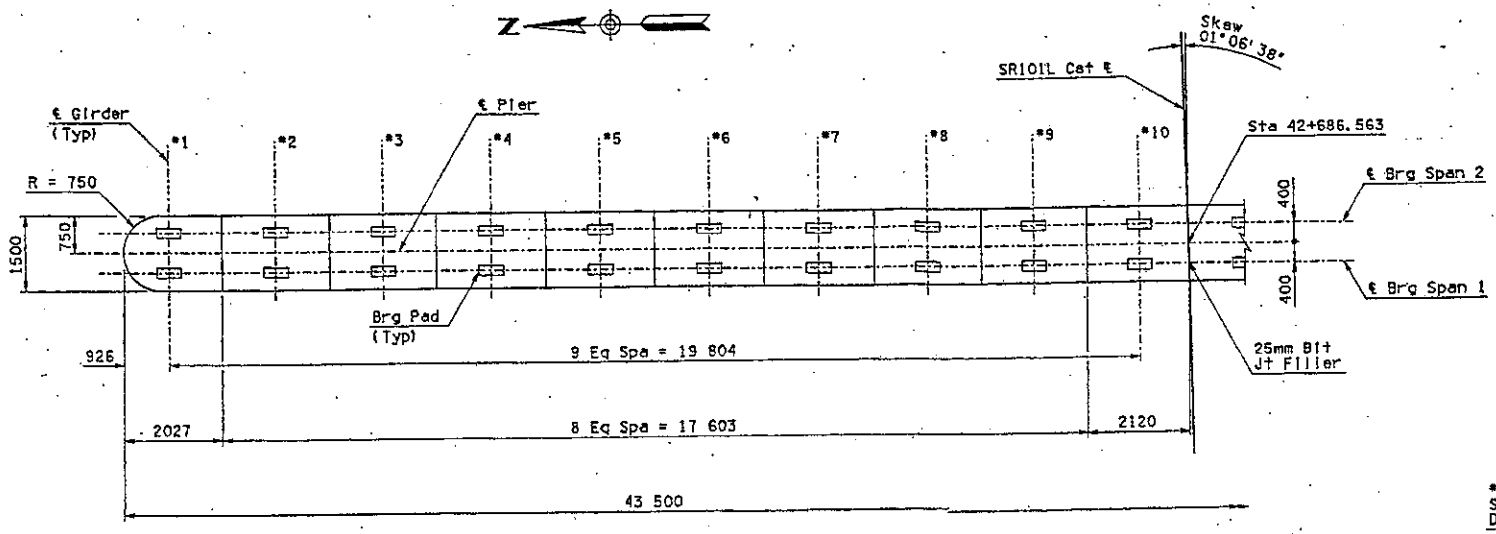
REDUCED SIZE - DO NOT SCALE

VIEW NAME:

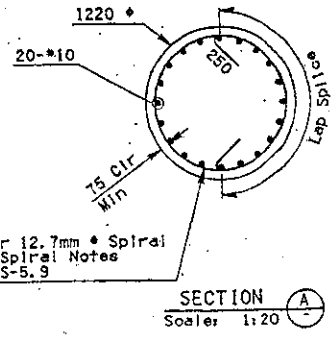
DESIGN FILE: PCCWBR08.DGN

PLOT DATE: 03/19/99 12:18:12

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	553	716	
		101 MA 024			

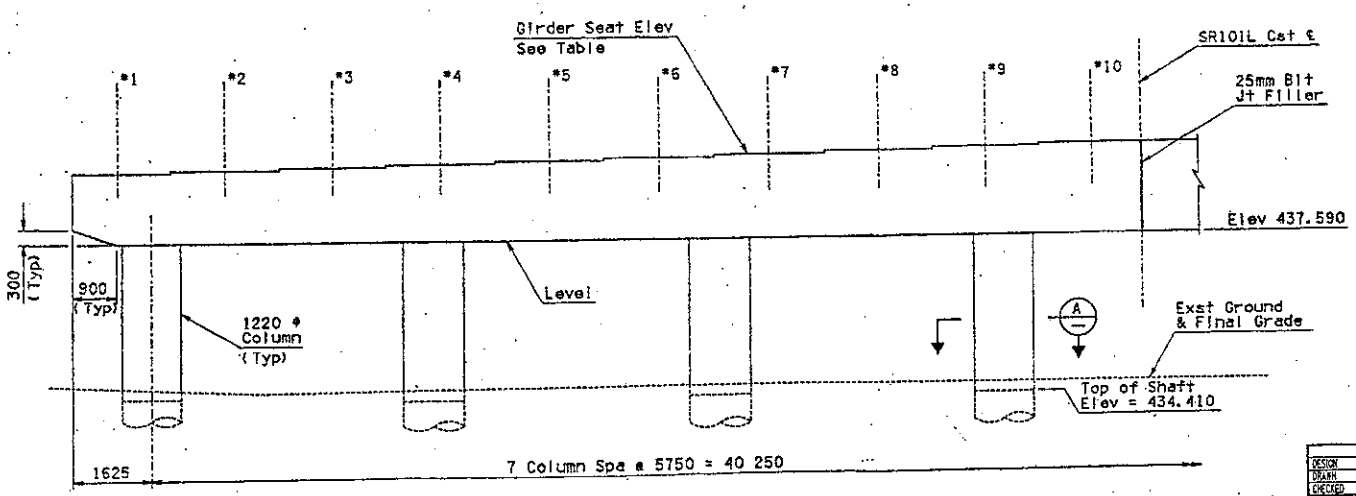


PLAN
Structure No. 1491
Scale: 1:50



SECTION A
Scale: 1:20

NOTE:
* Span 2 girder seat elevations may be lowered to match Span 1 elevations with the addition of galvanized steel plates 15 x 250 x 550 placed under the Span 2 bearing pads.



PIER ELEVATION
Structure No. 1491
Scale: 1:50

GIRDER SEAT ELEVATIONS		
Girder *	Span 1 Elev	Span 2 Elev
*1	439.189	439.204
*2	439.233	439.248
*3	439.276	439.291
*4	439.319	439.334
*5	439.362	439.377
*6	439.405	439.420
*7	439.449	439.464
*8	439.492	439.507
*9	439.535	439.550
*10	439.578	439.593

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TST, MRS	3/99
CHECKED	RTD	3/99

ENTRANCO
CONSULTING ENGINEERS
CHANDLER, ARIZONA

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
PIER PLAN & ELEVATION (1 OF 2)

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

DWG S-5.16

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

REDUCED SIZE - DO NOT SCALE

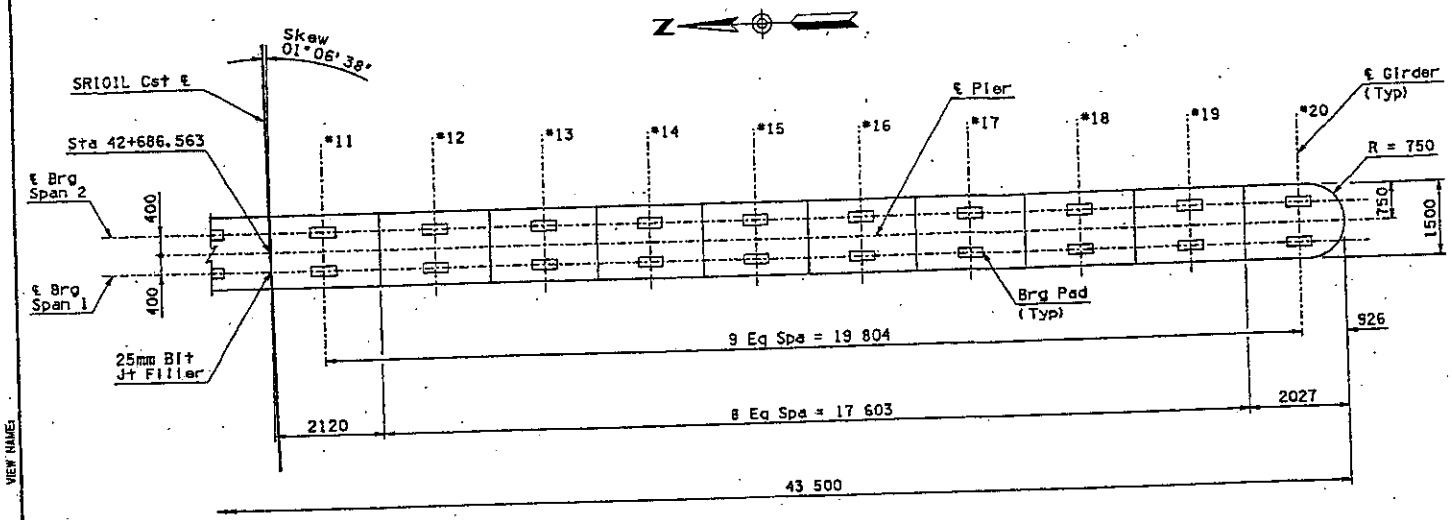
Metric

VIEW NAMES

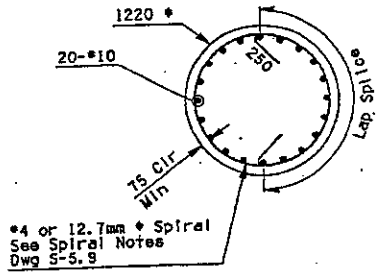
DESIGN FILE: PCCWBR09.DGN

PLOT DATE: 03/19/99 12:50:27

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	554	716	
		101 MA 024			

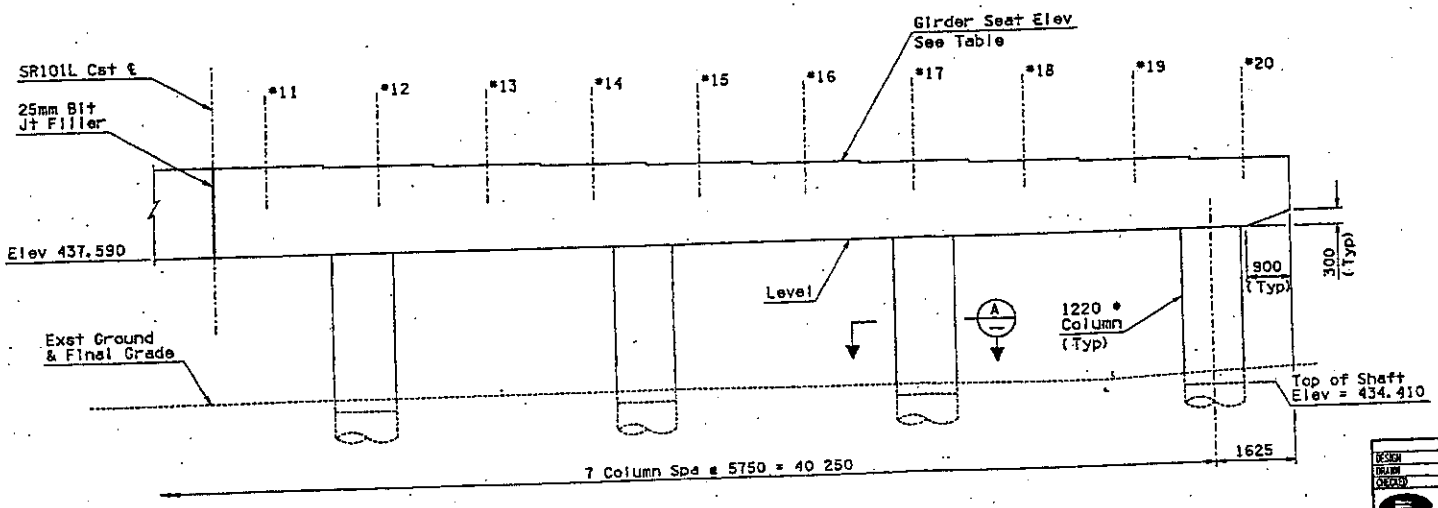


PLAN
Structure No. 1490
Scale: 1:50



SECTION A
Scale: 1:20

NOTE:
* Span 2 girder seat elevations may be lowered to match Span 1 elevations with the addition of galvanized steel plates 15 x 250 x 550 placed under the Span 2 bearing pads.



ELEVATION
Structure No. 1490
Scale: 1:50

GIRDER SEAT ELEVATIONS		
Girder #	Span 1 Elev	Span 2 Elev
#11	439.578	439.593
#12	439.533	439.548
#13	439.488	439.503
#14	439.443	439.458
#15	439.398	439.413
#16	439.354	439.369
#17	439.309	439.324
#18	439.264	439.279
#19	439.219	439.234
#20	439.174	439.189

	NAME	DATE
DESIGN	KRD	3/99
DRAWN	TSS, MGS	3/99
CHECKED	KRD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
PIER PLAN & ELEVATION (2 OF 2)

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POINT	STATIONING NO.
SR 101L	25.90	EB 1490 WB 1491

TRACS NO. H 4830 01 C

600-1(13)

DWG S-5.17

___ OF ___

REDUCED SIZE - DO NOT SCALE

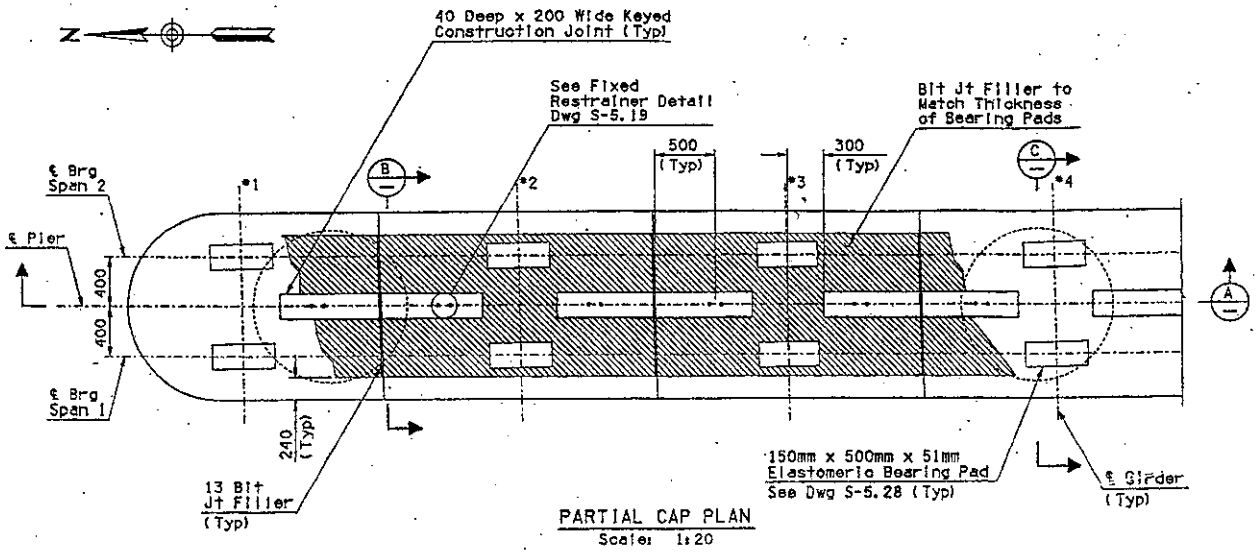
VIEW NAME:

DESIGN FILE: PCCWBR23.DGN

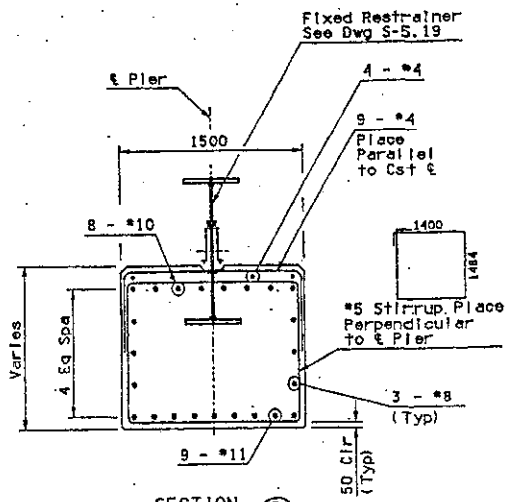
PLOT DATE: 03/19/99 12:10:48

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	555	716	

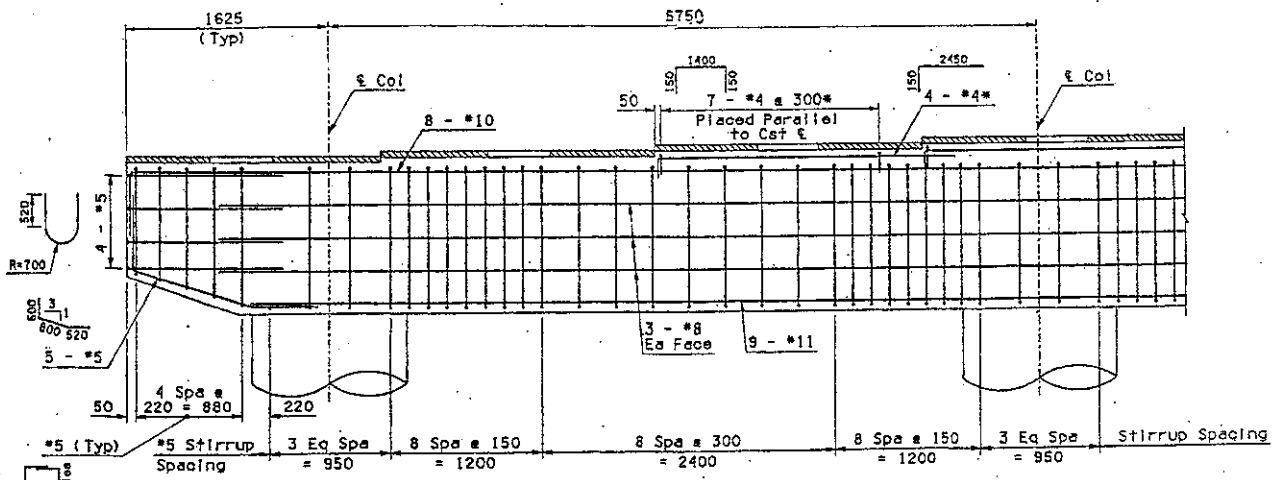
101 MA 024



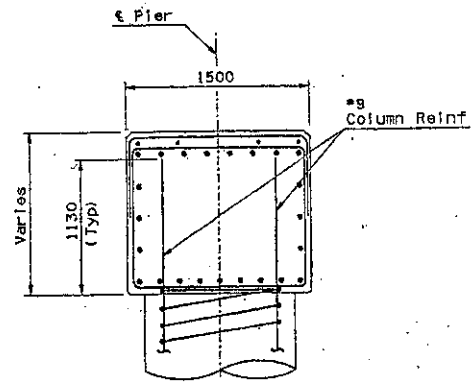
PARTIAL CAP PLAN
Scale: 1:20



SECTION B
Scale: 1:20



SECTION A
Scale: 1:20



SECTION C
Scale: 1:20

NOTES:
* Typical at steps for girders *3 to *17.

*10 bars may be spliced using 1900mm min lap splice placed between drilled shafts.

*8 bars may be spliced using 850mm min lap splice.

*11 bars may be spliced using 1700mm min lap splice above drilled shafts.

Alternate splice locations.

	NAME	DATE
DESIGN	BDG	3/99
DRAWN	TST, MEG	3/99
CHECKED	BTD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP
STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH
PIER DETAILS

ROUTE	MILEPOST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

TRACS NO. H 4830 01 C

600-1(13)

DWG S-5.18

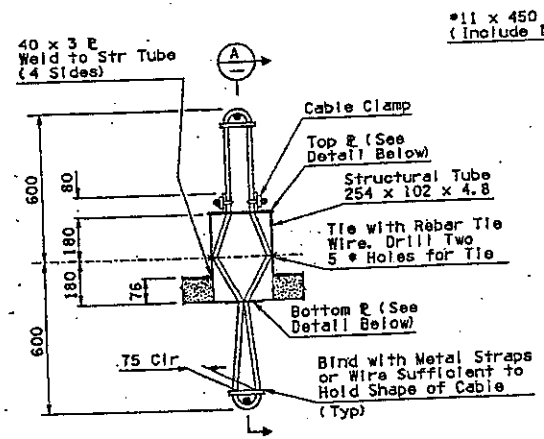
___ OF ___

DESIGN FILE: PCCWBRIC.DGN

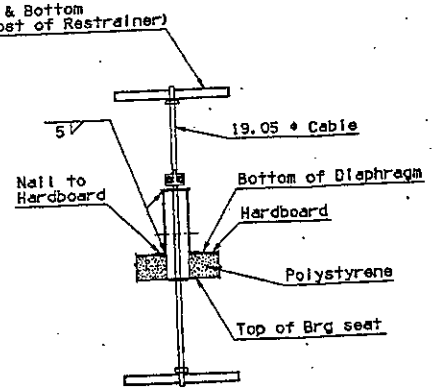
PLOT DATE: 03/19/99 12:10:58

REDUCED SIZE - DO NOT SCALE

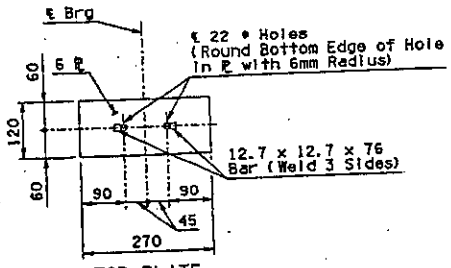
FINAL DESIGN	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	556	716	
		101 MA 024			



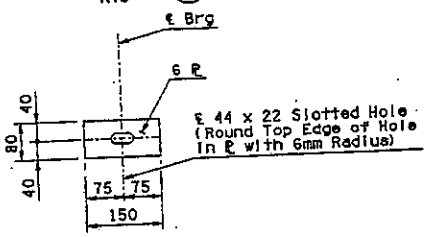
ELEVATION
NTS



SECTION A
NTS



TOP PLATE
NTS

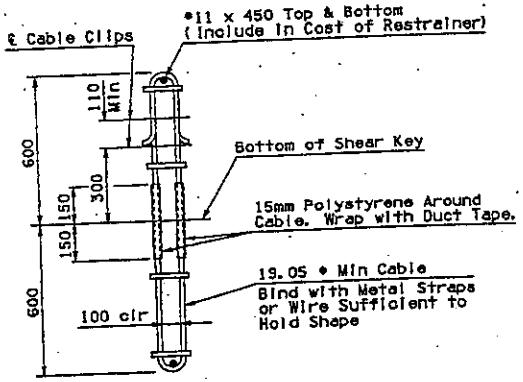


BOTTOM PLATE
NTS

EXPANSION RESTRAINER DETAIL

NOTES:
Seal all openings in structural tube to prohibit concrete intrusion.

Restrainer Cables shall be 19.05 ϕ min preformed 6x19 galvanized with a minimum breaking strength of 187 kN. One sample of cable 1 meter in length shall be furnished to the Engineer for testing



FIXED RESTRAINER DETAIL

Restrainer Cables shall be 19.05 ϕ min preformed 6x19 galvanized with a minimum breaking strength of 187 kN. One sample of cable 1 meter in length shall be furnished to the Engineer for testing

	NAME	DATE
DESIGN	RCO	3/99
DRAWN	TST, MCO	3/99
CHECKED	RTO	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
RESTRAINER DETAILS

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	AT POST	STATIONING	
SR 101L	25.90	EB 1490	WB 1491

TRACS NO. H 4830 01 C

600-1(13)

DWG S-5.19

___OF___

REVISIONS | DATE | APPROVED | DESIGNED FILES | DRAWN | CHECKED

VIEW NAMES

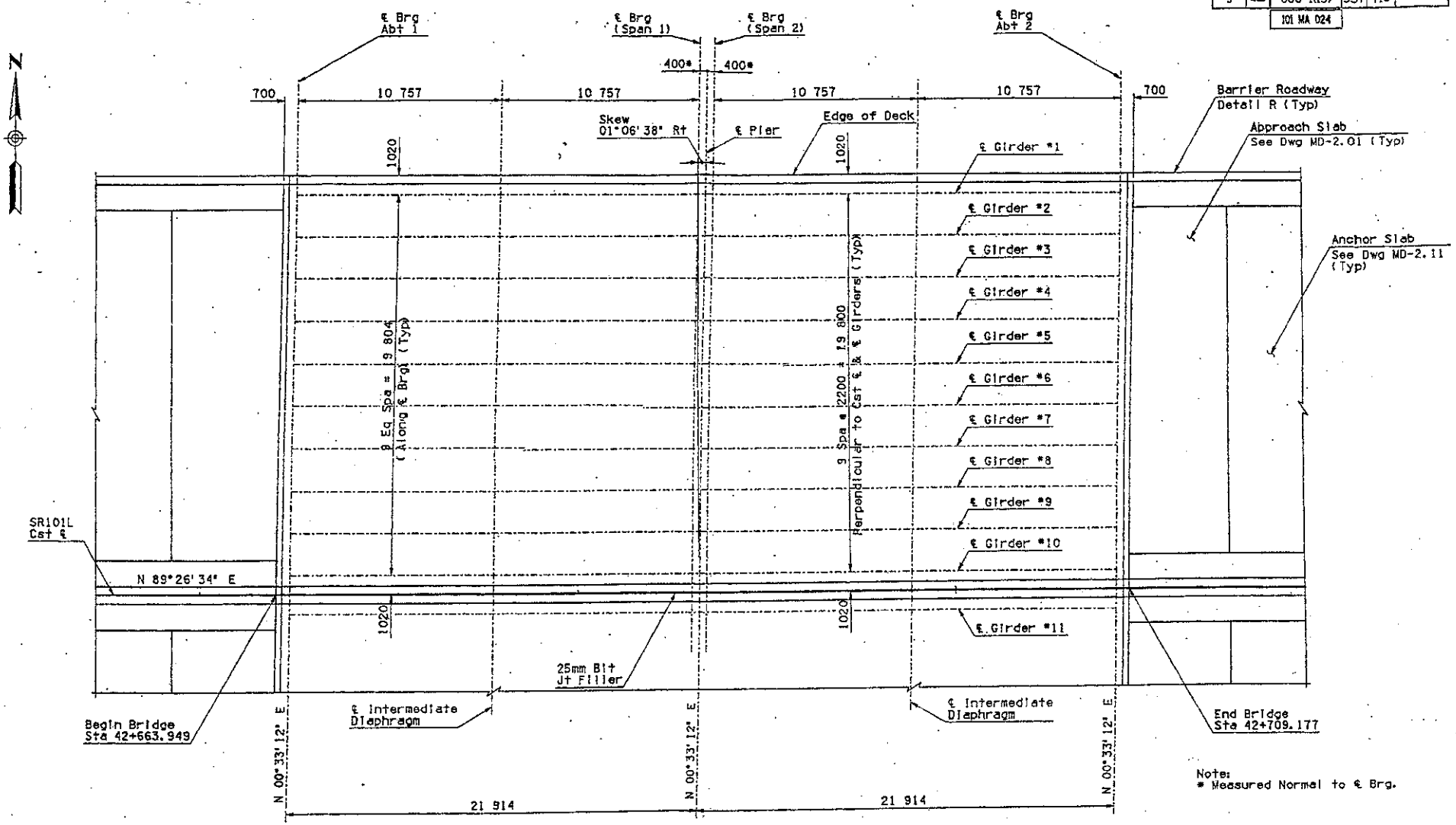
REDUCED SIZE - DO NOT SCALE

DESIGN FILE: PCCWBRIL.DGN

PLOT DATE: 03/19/99 12:11:03

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	557	716	

101 MA 024



Note:
* Measured Normal to ℄ Brg.

FRAMING PLAN
Structure No. 1491
Scale: 1:100

	NAME	DATE
DESIGN	DCG	3/99
DRAWN	TSL, MCG	3/99
CHECKED	KTB	3/99

ENTRANCE

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH GIRDER LAYOUT (1 OF 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

REVIN TRACY 26162

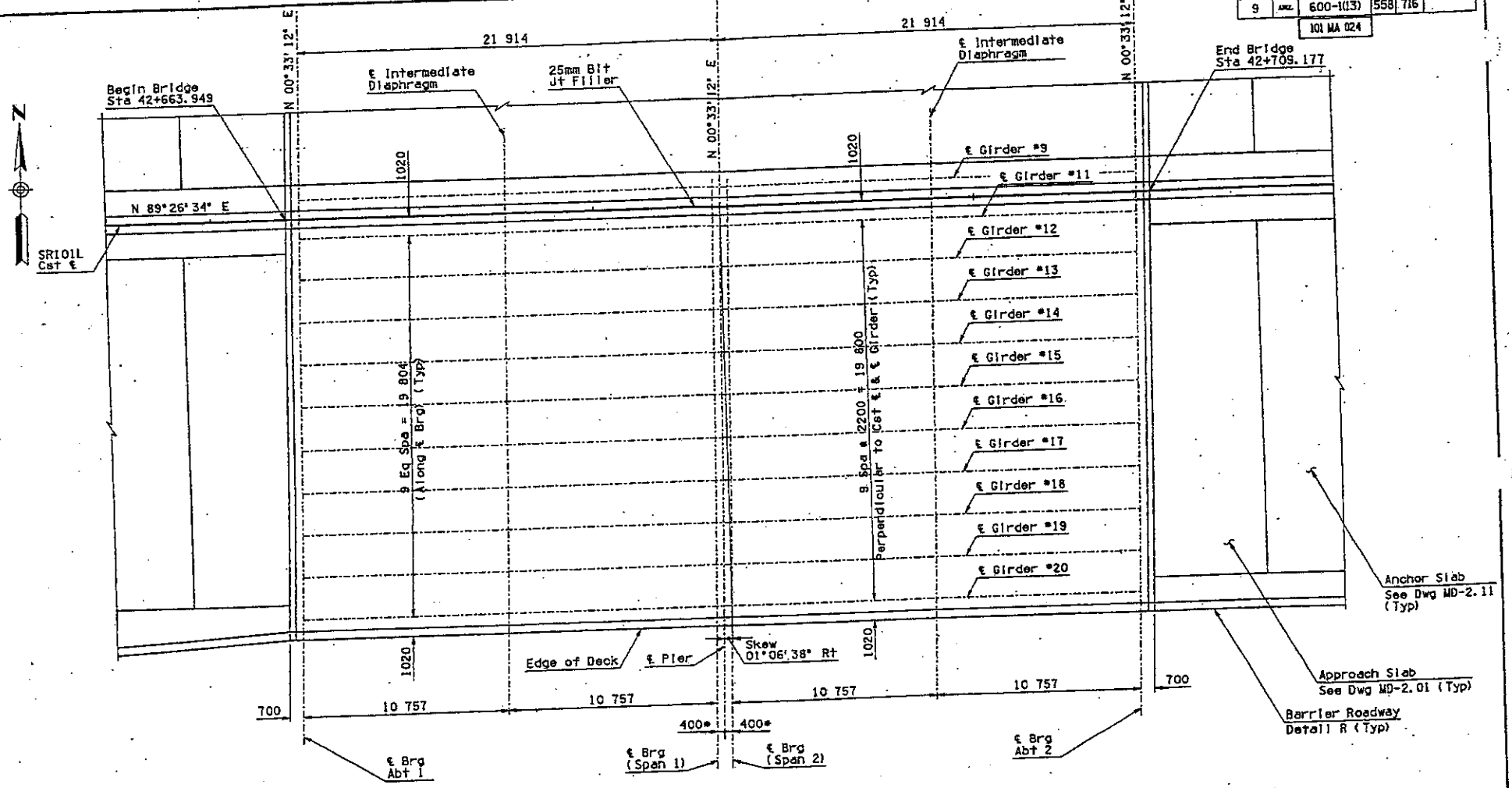
DWG S-5.20

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

DESIGN FILE: PCCWBRI2.DGN

PLOT DATE: 03/19/99 12:01:21

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	558	716	
		101 MA 024			



FRAMING PLAN
Structure No. 1490
Scale: 1:100

NOTES
1. Girders shall be placed parallel to SR101L Cst ℄.
2. For compression seal joint details see Dwg S-5.28 and MD-3.01.
3. Provide through joint in barriers with 6mm bit joint filler at ℄ pier.

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TSI, MEE	3/99
CHECKED	RTP	3/99

W H T R A N S C O

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
GIRDER LAYOUT (2 OF 2)

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	SR POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

TRACS NO. H 4830 01 C

600-1(13)

DWG S-5.21

OF

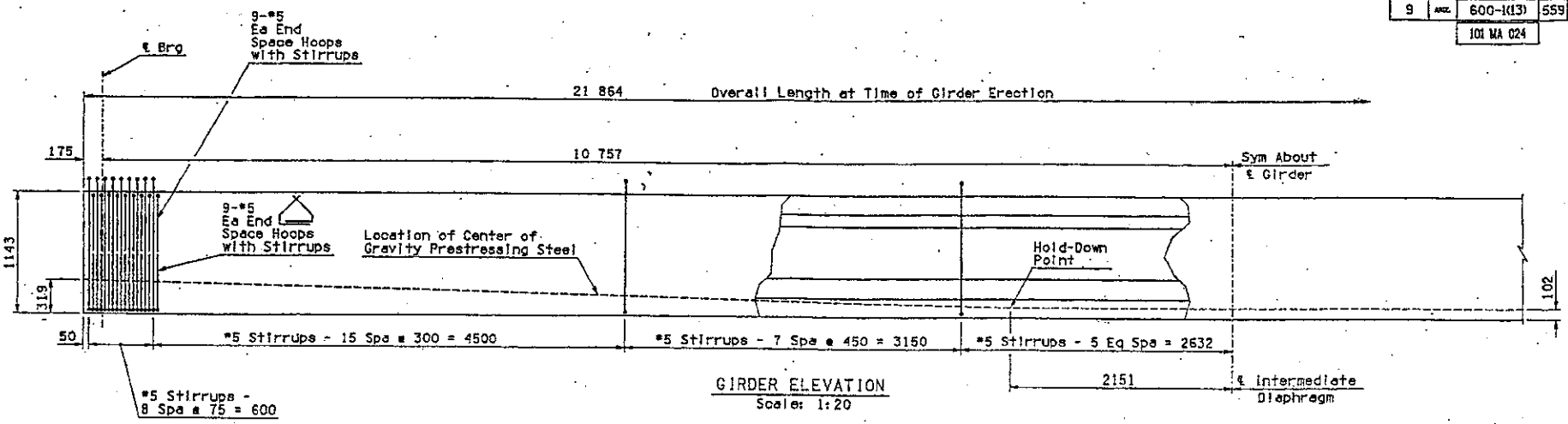
DESIGN FILE: PCCWBR24.DGN

PLOT DATE: 03/12/99 12:11:31

VIEW NAME:

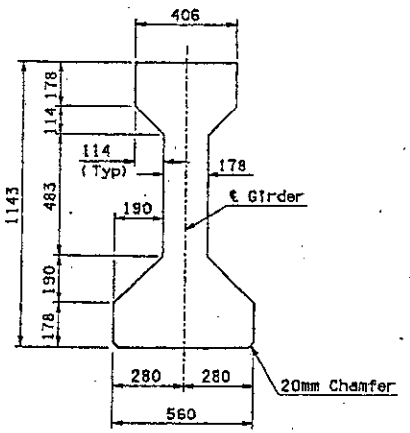
DO NOT SCALE

F.A.P.N. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	559	716	
		101 MA 024			

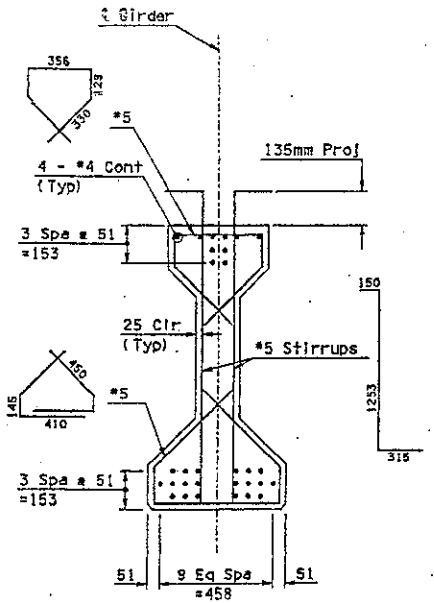


GIRDER ELEVATION
Scale: 1:20

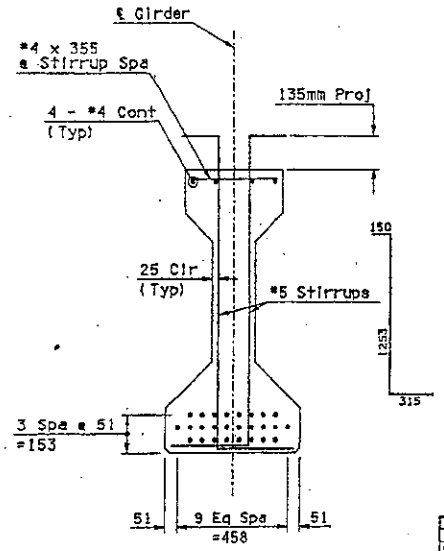
NOTE:
See pipe and insert detail on Dwg S-5.23 for insert and pipe locations.



TYPICAL SECTION
Scale: 1:10



SECTION THRU END
Scale: 1:10



SECTION THRU MIDSPAN
Scale: 1:10

AASHTO TYPE III GIRDER

PRESTRESSING NOTES:

26 (6 harped and 20 straight) and 12.54 millimeter dia 7 wire low relaxation strands.

PI = 3583 kN. Initial tension before losses.

Pw = 2681 kN. Working force remaining after all losses.

f'ci = 30.0 MPa. Minimum strength at transfer.

f'c = 41.0 MPa. Minimum strength at 28 days.

All low relaxation strands shall be stressed to 0.75f's. Girders shall be prestressed by the pretensioning method only. Use of masked strands will not be allowed.

Tops of girders shall be roughened transversely with a roughness amplitude of 6 mm.

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TSL, MGE	3/99
CHECKED	KTB	3/99

W N T R A N S O
DESIGNER CONTROL CHECK SIZE

ROUTE	MP POST	STATION	AHEAD / BACK
SR 101L	25.90	EB 1490	WB 1491

ARIZONA DEPARTMENT OF TRANSPORTATION
ADMINISTRATIVE DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
GIRDER DETAILS (1 of 2)

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

KEVIN TRACY SUBENDERSLER
26752

DWG S-5.22

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

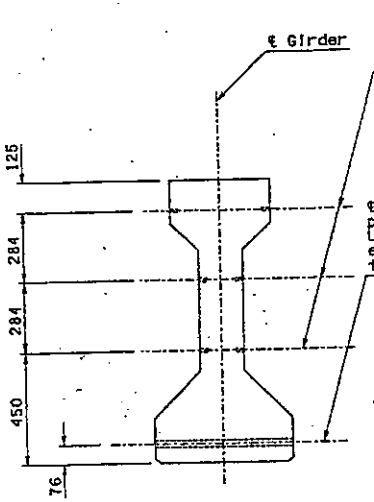
VIEW NAMES

REDUCED SIZE - DO NOT SCALE

DESIGN FILE: PCCWBRI3.DGN

PLOT DATE: 03/19/99 12:11:45

FINAL DESIGN	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-I(13)	560	716	
		101 MA 024			



℄ Threaded Inserts - Inserts are standard threaded with enclosed threads for 19mm ϕ (#6) threaded rods (Typ)

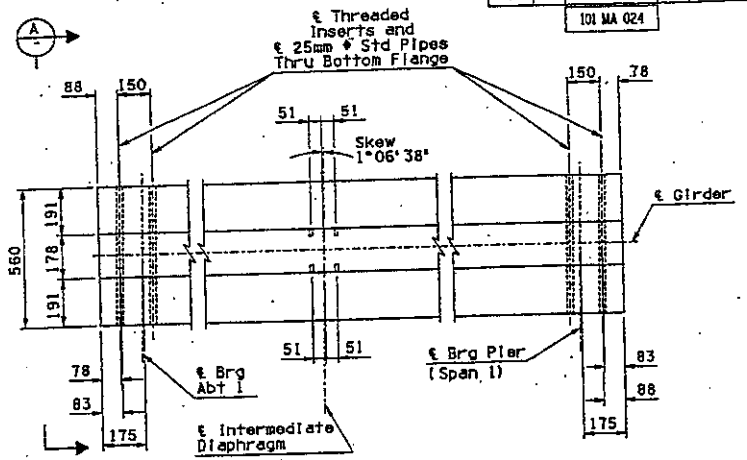
May use 25mm ϕ standard pipe sleeves @ ends of girders, except for exterior girders @ pier.

℄ 25mm ϕ standard pipe. Space pipe to clear strands and stirrups. Use inserts only on inside face of exterior girders @ pier. to connect to 19mm ϕ (#6) x 640mm threaded rods

VIEW A
Scale: 1:10

INSERT NOTES:

Inserts are Ferrule Loop Inserts for 19mm ϕ (#6) rods, threaded one end. Inserts shall have a working pullout strength of 16 kN. Inserts may be placed normal to ℄ girder, or on skew. If placed normal to ℄ girder, rods may be fabricated bent or field bent. If rods are field bent, method of field bending inserted rods 25mm beyond face of girder to maintain 54mm minimum clearance from edge of diaphragm without damaging insert, shall be submitted for approval with shop drawings. Rods shall conform to ASTM A615/A615M-96a Grade 420.

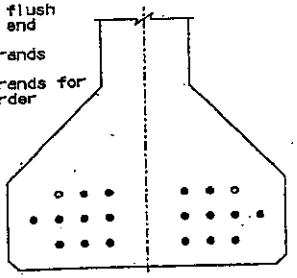


PIPE AND INSERT DETAIL
Scale: 1:10

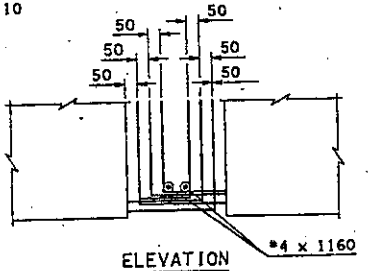
NOTE:
Span 1 shown.
Span 2 Similar.

NOTE:
Extend strands at Pier only.
Cut strands flush at Abutments.

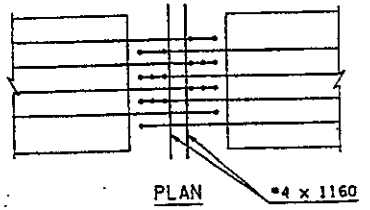
- o Strands cut flush with girder end
- • Extended strands
- • Extended strands for adjacent girder



TYPICAL SECTION



ELEVATION



PLAN

STRAND EXTENSION DETAIL
NTS

	NAME	DATE
DESIGN	DCB	3/99
DRAWN	HST, MRC	3/99
CHECKED	DCB	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH GIRDER DETAILS (2 of 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

TRACS NO. H 4830 01 C

: 600-I(13)

DWG S-5.23

___ OF ___

VIEW NAME:

REDUCED SIZE - DO NOT SCALE

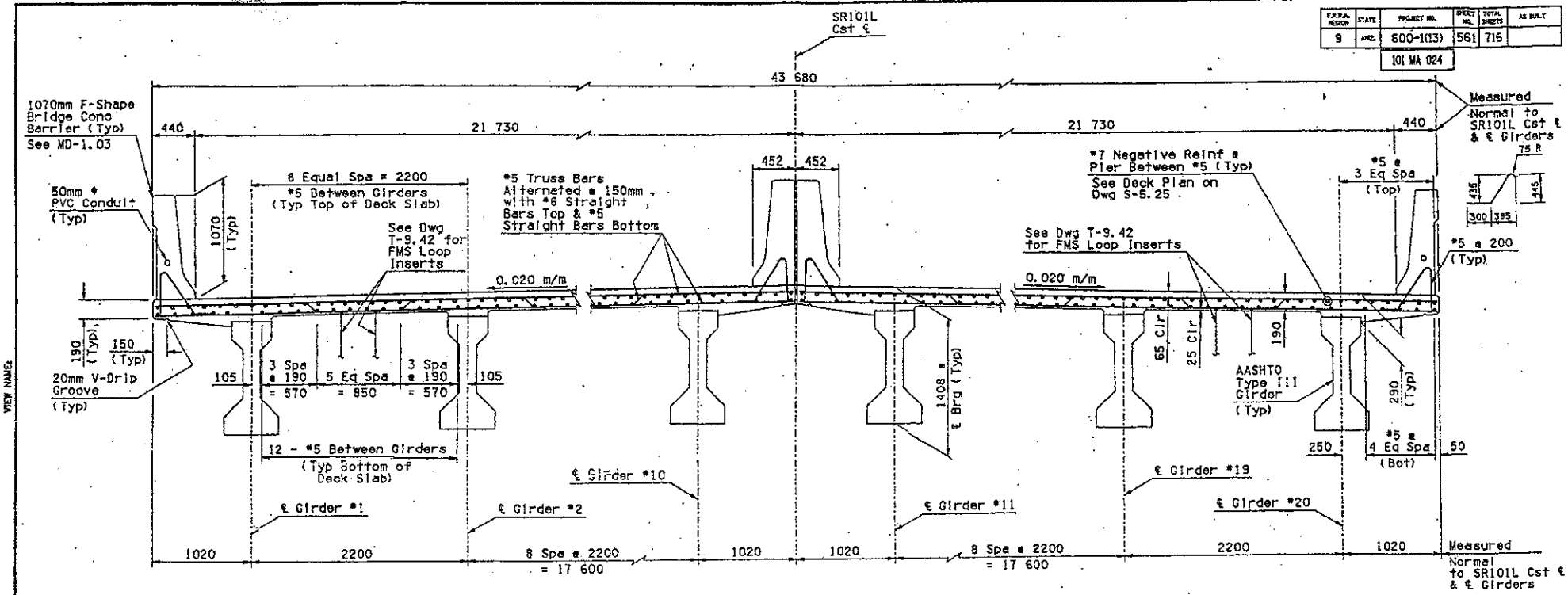
SHEET NO.	PROCESS PLANS	REVISIONS	LOCATION	DATE

DESIGN FILE: PCCWBR14.DGN

PLOT DATE: 03/19/99 12:11:57

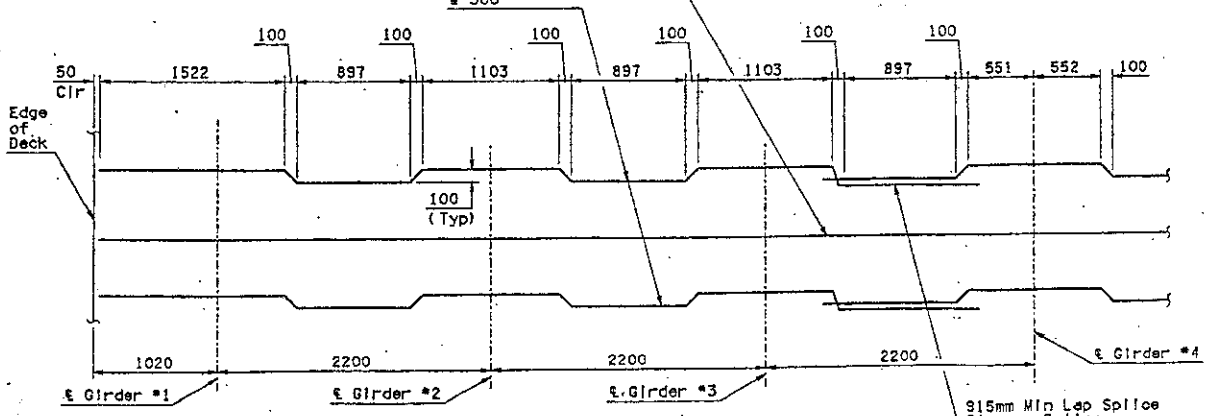
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	561	716	

101 MA 024



TYPICAL SECTION THRU DECK

Scale: 1:20



TRANSVERSE DECK REINFORCING PLACING DIAGRAM

NTS

DECK REINFORCEMENT NOTES:

1. All transverse deck bars shall be placed parallel to ℄ bearing. All longitudinal deck bars shall be placed parallel to SR101L Cst ℄.
2. All continuous horizontal bars in deck, diaphragms and barriers excluding transverse bars in top slab may be spliced where required with minimum lap length as specified:

   *5 bars 520 millimeter

3. Top slab transverse reinforcing splices where required shall be:

   Top bars: 915 millimeter minimum lap at centerline cell.

   Bottom bars: 915 millimeter minimum lap at centerline girder.

   Truss bars: 915 millimeter minimum lap at centerline cell or girder.

4. Bars shall not be spliced within the required lap length of the adjacent bars.

	NAME	DATE
DESIGN	DCO	3/99
DRAWN	TST, SCG	3/99
CHECKED	KTO	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH DECK DETAILS (1 of 2)

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

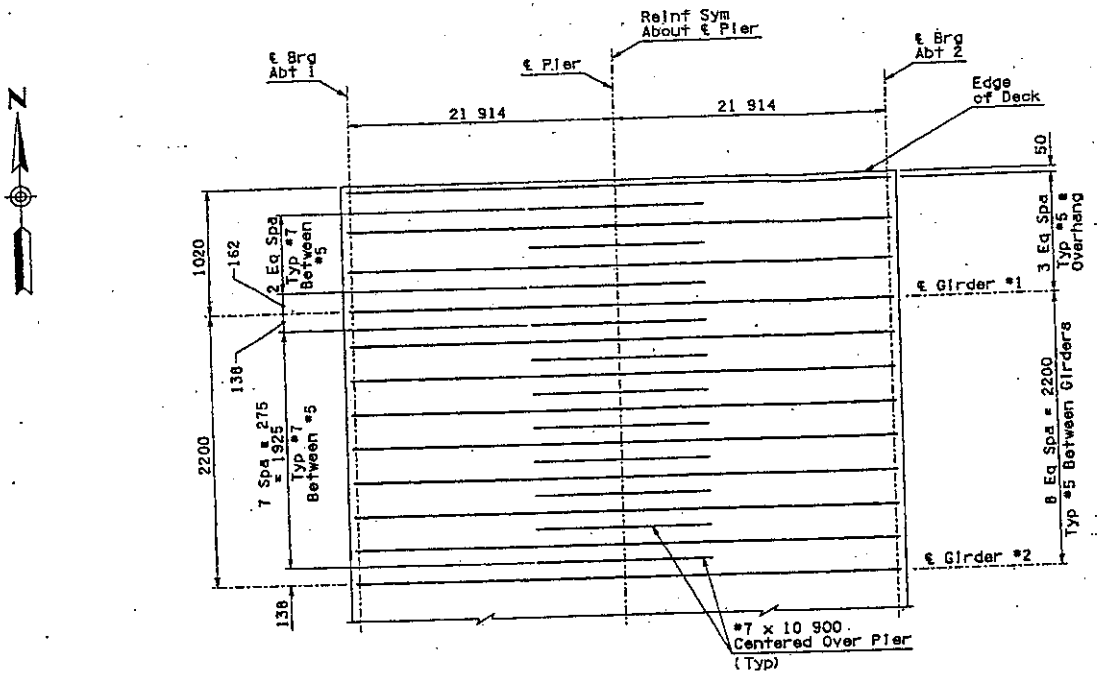
DWG S-5.24

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

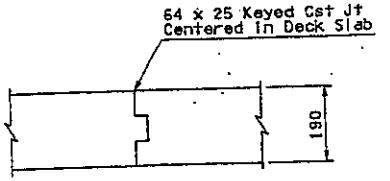
DESIGN FILE: FCCWBRIS.DGN

PLOT DATE: 03/19/99 12:12:26

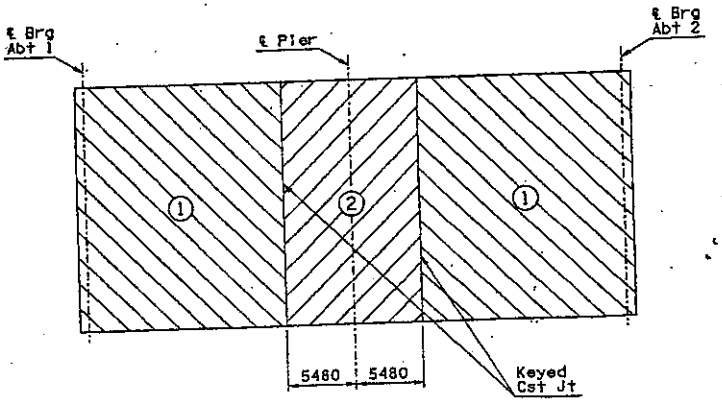
F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	562	716	
		101 MA 024			



PARTIAL DECK PLAN - TOP OF SLAB REINFORCEMENT AT PIER
Skew Not Shown For Clarity
NTS



TYPICAL KEYED CST JT
NTS



DECK POUR SCHEDULE
Skew Not Shown For Clarity
NTS

POUR NOTES:

1. Numbers ① & ② indicate placing sequence of deck concrete. Pour ② section a minimum of 12 hours after adjacent ① sections have been poured.
2. Intermediate diaphragms and expansion abutment diaphragms may be poured prior to or concurrent with the deck pour.
3. Pier diaphragms shall be poured concurrent with the deck pour.
4. The Contractor shall submit a Deck Pour Schedule to the Engineer for approval prior to placing concrete.

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TST, MGS	3/99
CHECKED	BJW	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP
STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH DECK DETAILS (2 OF 2)
PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP PROJ	STATION	ID NO.
SR 101L	25.90	EB 1490 WB 1491	

DWG S-6.25

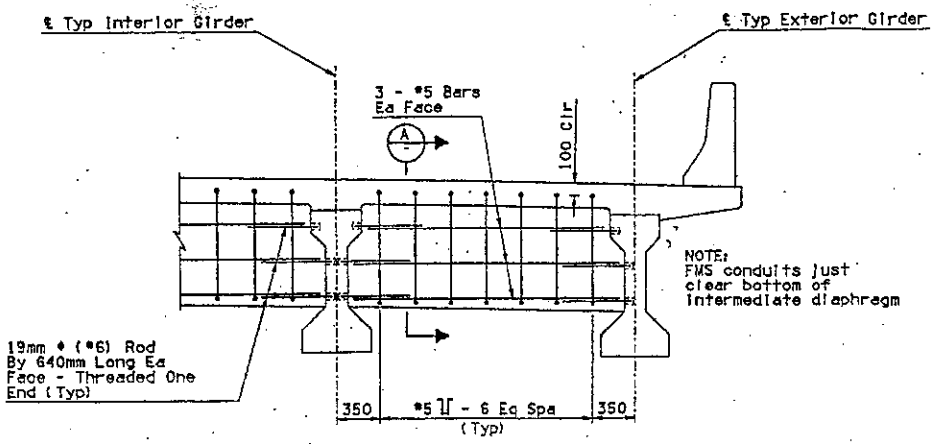
TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

VIEW NAME:

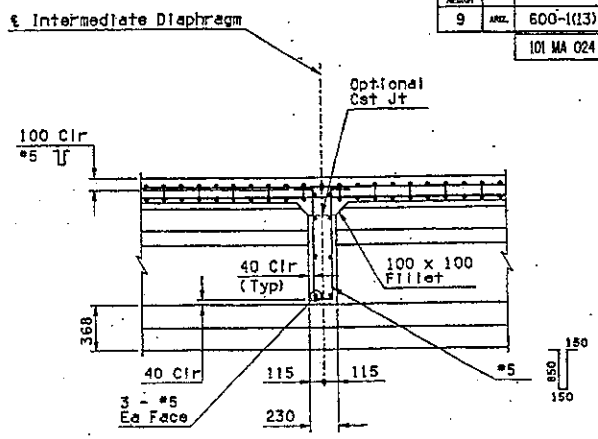
DESIGN FILE: FCCPBR16.DGN

PLOT DATE: 03/19/99 12:12:16

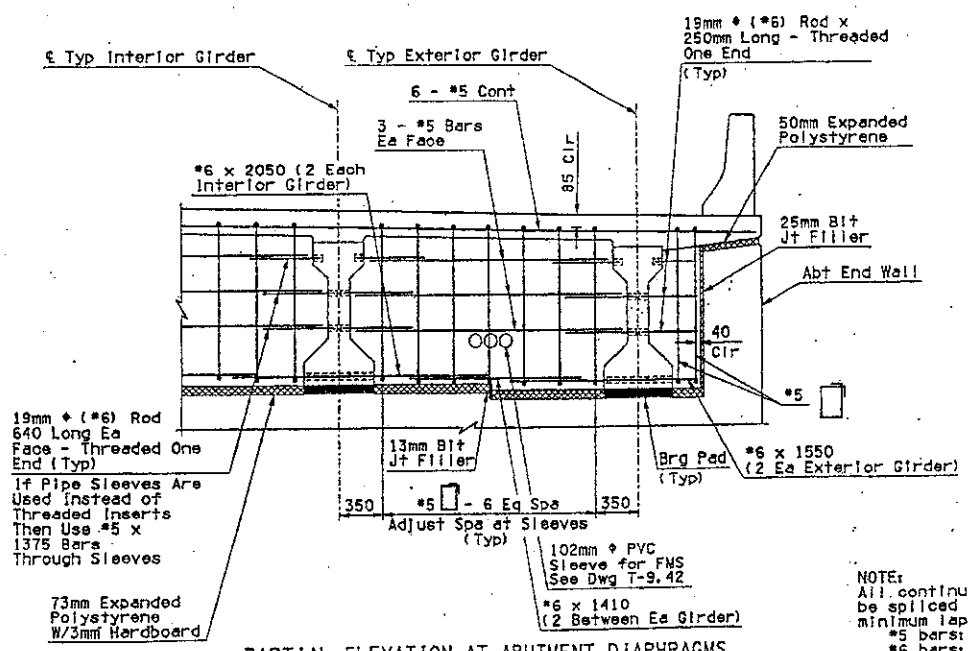
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	563	716	
		101 MA 024			



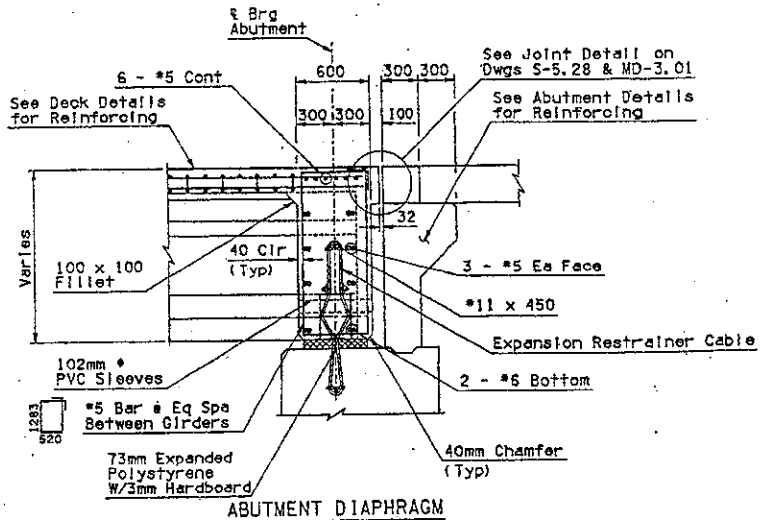
PARTIAL ELEVATION AT INTERMEDIATE DIAPHRAGM
Scale: 1:20



SECTION A
Scale: 1:20



PARTIAL ELEVATION AT ABUTMENT DIAPHRAGMS
Scale: 1:20



ABUTMENT DIAPHRAGM
Scale: 1:20

NOTE:
All continuous reinforcement may be spliced where required with minimum lap length as specified:
*5 bars: 520 millimeter
*6 bars: 640 millimeter

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TSL, MEG	3/99
CHECKED	KTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH DIAPHRAGM DETAILS (1 of 2)

ROUTE	MP ABT	STRUCTURE NO.	PS
SR 101L	25.90	EB 1490 WB 1491	

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-5.26

TRACS NO. H 4830 01 C

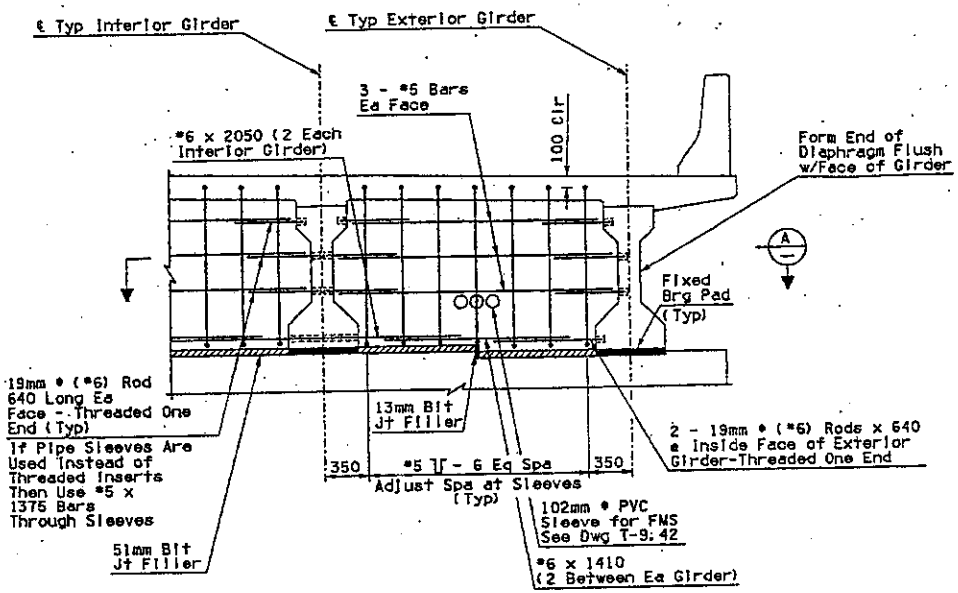
600-1(13)

___ OF ___

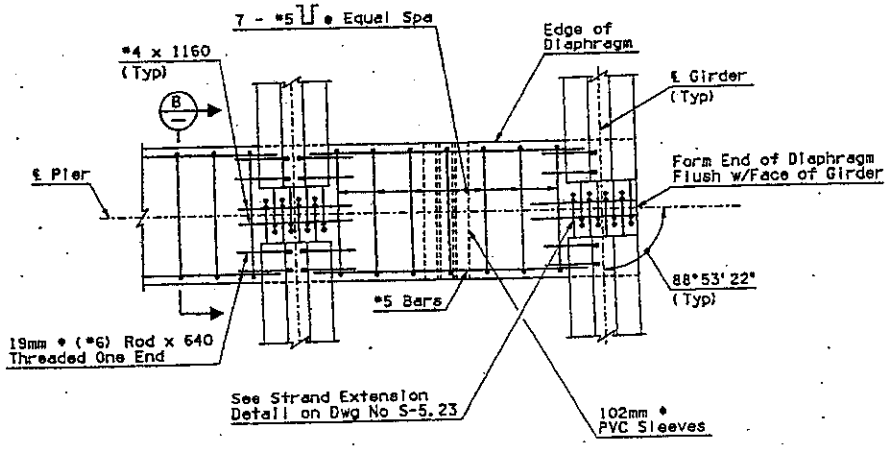
DESIGN FILE: PCCWBRIT.DGN

PLOT DATE: 03/19/99 12:12:25

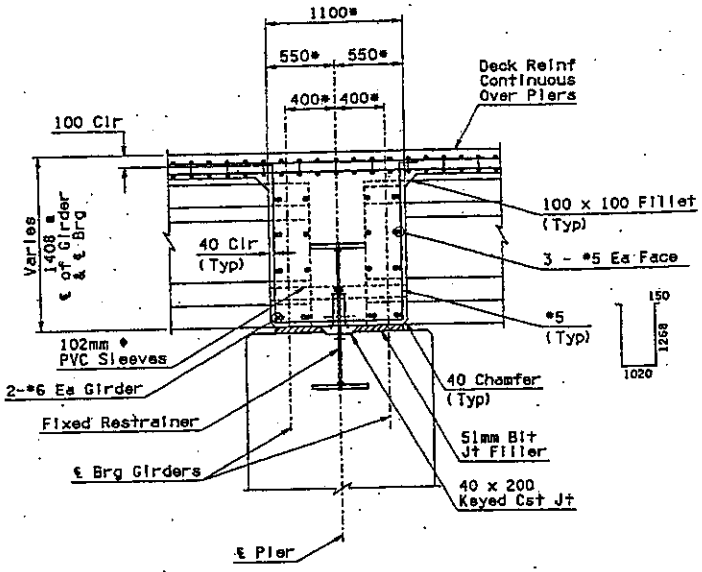
F.A.P.N. REVISION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	564	716	
		101 MA 024			



PARTIAL ELEVATION AT PIER DIAPHRAGM
Scale: 1:20



SECTION A
Scale: 1:20



SECTION B
Scale: 1:20

Note:
* Measured Normal to ℄ Brg.

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TST, MCC	3/99
CHECKED	TJD	3/99

W T R A N G O

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH DIAPHRAGM DETAILS (2 of 2)

ROUTE	MP POST	STA/ALIGNMENT NO.
SR 101L	25.90	EB 1490 WB 1491

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-5.27

TRACS NO. H 4830 01 C

600-1(13)

___ OF ___

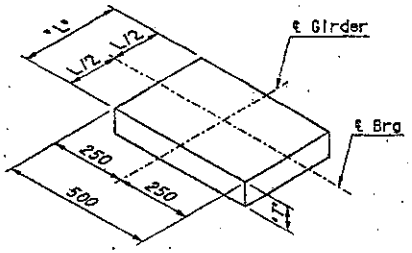
REDUCED SIZE - DO NOT SCALE

VIEW NAME:

DESIGN FILE: PCCPBR15.DGN

PLOT DATE: 03/19/99 12:12:39

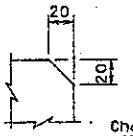
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	565	716	
		101 MA 024			



REINFORCED ELASTOMERIC
BEARING PAD
NTS

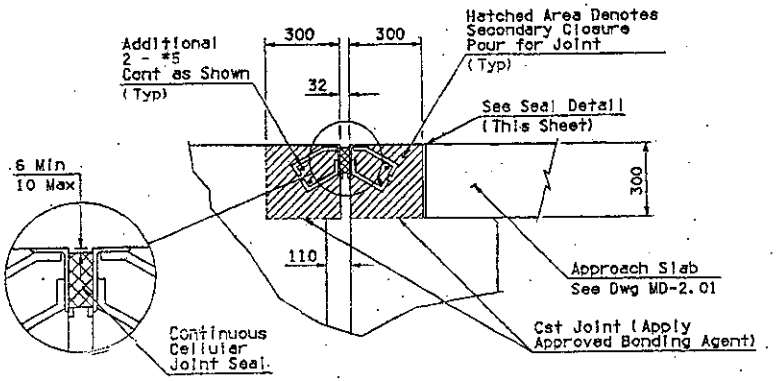
REINFORCED ELASTOMERIC
BEARING PAD DESIGN CRITERIA
Design Method A
Elastomer Grade 0

	T	L	Design Load
Abutment	76mm	170mm	479 kN
Pier	51mm	150mm	303 kN



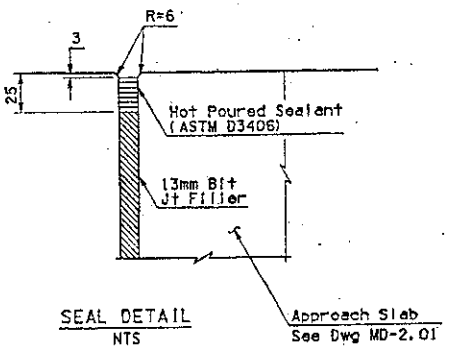
Chamfer all exposed corners unless otherwise noted. This note applicable to all sheets pertaining to the structures & walls.

CHAMFER DETAIL
NTS



JOINT DETAIL @ ABUTMENT
Dimensions shown are perpendicular to ℄ Brg
Scale: 1:10

Note:
1. 51 x 51 compression seal
f = 80
Joint opening = 32 @ 16°C
Temp corr = 2.4 per 10°C
See Joint Detail & MD 3.01



SEAL DETAIL
NTS

	NAME	DATE
DESIGN	DCD	3/99
DRAWN	TST, MEC	3/99
CHECKED	RTB	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
MISCELLANEOUS DETAILS

ROUTE	M. POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-5.28

TRACS NO. H 4830 01 C

600-1(13)

___ OF ___

VIEW NAME:

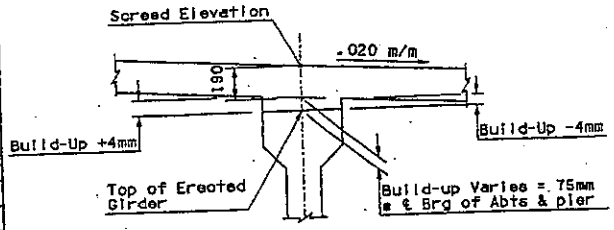
DESIGN FILE: FCCWBR19.DGN

PLOT DATE: 03/19/99 12:12:48

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	566	716	
		101 MA 024			

BRIDGE SCREED ELEVATIONS

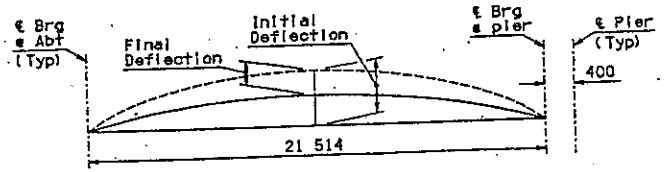
SPAN 1	℄ Brg Abt 1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	℄ Brg S1 Pier	℄ Pier
Lt Edge Deck	440.251	440.301	440.348	440.393	440.436	440.477	440.516	440.554	440.589	440.622	440.653	440.661
Girder #1	440.271	440.321	440.368	440.413	440.456	440.497	440.537	440.574	440.629	440.642	440.673	440.681
Girder #2	440.315	440.364	440.411	440.456	440.499	440.541	440.580	440.617	440.652	440.685	440.716	440.724
Girder #3	440.358	440.407	440.454	440.499	440.543	440.584	440.623	440.660	440.695	440.729	440.760	440.767
Girder #4	440.401	440.450	440.497	440.543	440.586	440.627	440.666	440.703	440.739	440.772	440.803	440.810
Girder #5	440.444	440.493	440.541	440.586	440.629	440.670	440.709	440.747	440.782	440.815	440.846	440.854
WB PGL	440.472	440.512	440.552	440.593	440.663	440.673	440.713	440.753	440.794	440.834	440.874	440.881
Girder #6	440.487	440.537	440.584	440.629	440.672	440.713	440.753	440.790	440.825	440.858	440.889	440.897
Girder #7	440.531	440.580	440.627	440.672	440.715	440.757	440.796	440.833	440.868	440.901	440.933	440.940
Girder #8	440.574	440.623	440.670	440.715	440.759	440.800	440.839	440.876	440.911	440.945	440.976	440.983
Girder #9	440.617	440.666	440.713	440.759	440.802	440.843	440.882	440.919	440.955	440.988	441.019	441.026
Girder #10	440.660	440.709	440.757	440.802	440.845	440.886	440.925	440.963	440.998	441.031	441.062	441.070
Cst ℄	440680	440.729	440.777	440.822	440.865	440.906	440.945	440.983	441.018	441.051	441.082	441.090
Girder #11	440.660	440.709	440.756	440.801	440.844	440.885	440.925	440.962	440.997	441.030	441.061	441.069
Girder #12	440.615	440.664	440.711	440.756	440.799	440.841	440.880	440.917	440.952	440.985	441.017	441.024
Girder #13	440.570	440.619	440.666	440.711	440.755	440.796	440.835	440.872	440.907	440.941	440.972	440.979
Girder #14	440.525	440.574	440.621	440.667	440.710	440.751	440.790	440.827	440.863	440.896	440.927	440.934
Girder #15	440.480	440.530	440.577	440.622	440.665	440.706	440.745	440.783	440.818	440.851	440.982	440.890
EB PGL	440.464	440.505	440.545	440.585	440.625	440.665	440.706	440.746	440.786	440.826	440.866	440.874
Girder #16	440.436	440.485	440.532	440.577	440.620	440.661	440.701	440.738	440.773	440.806	440.837	440.845
Girder #17	440.391	440.440	440.487	440.532	440.575	440.617	440.656	440.693	440.728	440.761	440.793	440.800
Girder #18	440.346	440.395	440.442	440.487	440.531	440.572	440.611	440.648	440.683	440.717	440.748	440.755
Girder #19	440.301	440.350	440.398	440.443	440.486	440.527	440.566	440.603	440.639	440.672	440.703	440.710
Girder #20	440.256	440.306	440.353	440.398	440.441	440.482	440.521	440.559	440.594	440.627	440.658	440.666
Rt Edge Deck	440.236	440.285	440.332	440.377	440.420	440.462	440.501	440.538	440.573	440.606	440.637	440.645



TYPICAL SECTION
NTS

SCREED ELEVATION NOTES:

1. The top of Erected Girder Elevation shall be surveyed in the field at the 1/10 points along the span, by the Contractor, prior to placing deck forming. The Survey information shall be provided to the Engineer a minimum of 15 working days prior to the deck pour, for review and approval. If the top of erected girder encroaches into the deck slab, adjustments to the structure may be necessary.
2. The Screed Elevation includes an allowance for the deflection due to the dead load of the concrete deck slab, diaphragm, barriers, and the effects of long term creep.
3. Screed Elevations shall be used in setting screed regardless of the measured top of erected girder elevations. (DO NOT USE FINISHED GRADE ELEVATIONS FOR SETTING SCREEDS.) Adjustments to the Screed Elevations, if necessary, shall be determined by the Engineer. Top of erected girder elevations taken @ ℄ of girders @ the 1/10 points, prior to placing steel reinforcing shall be supplied to the Engineer for review.
4. The Build-up shall be calculated based on measured top of erected girder Elevations. The Build-up equals the (Screed Elevation) minus (measured Erected Girder Elevation) minus (the deck slab thickness). The Build-up dimensions at the edge of girder will be plus or minus 4mm as shown in the TYPICAL SECTION above.



CAMBER DIAGRAM
NTS

DEFLECTION NOTES:

1. Initial Deflection equals the deflection the prestressed girder undergoes at the time of erection prior to the diaphragm and deck pours. The Initial Deflection includes the deflection due to the dead load of the girder, the initial prestressing and the effects of creep up to the time of erection.
2. Final Deflection equals the deflection due to the dead load of the deck slab, diaphragms, barriers and the effects of long term creep on the composite continuous girders.

CAMBER DEFLECTIONS									
	Deflections (m)								
Deflection	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Initial	0.018	0.032	0.042	0.048	0.050	0.048	0.042	0.032	0.018
Final	0.012	0.022	0.029	0.033	0.034	0.033	0.029	0.022	0.012

	NAME	DATE
DESIGN	KCD	3/99
DRAWN	YSL, MCG	3/99
CHECKED	KTD	3/99

ENTRAMCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
SPAN 1 SCREED ELEVATIONS

ROUTE	MP POST	STRUCTURE NO.	
SR 101L	25.90	EB 1490 WB 1491	PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

TRACS NO. H 4830 01 C | 600-1(13) | DWG S-5.29 | ___ OF ___

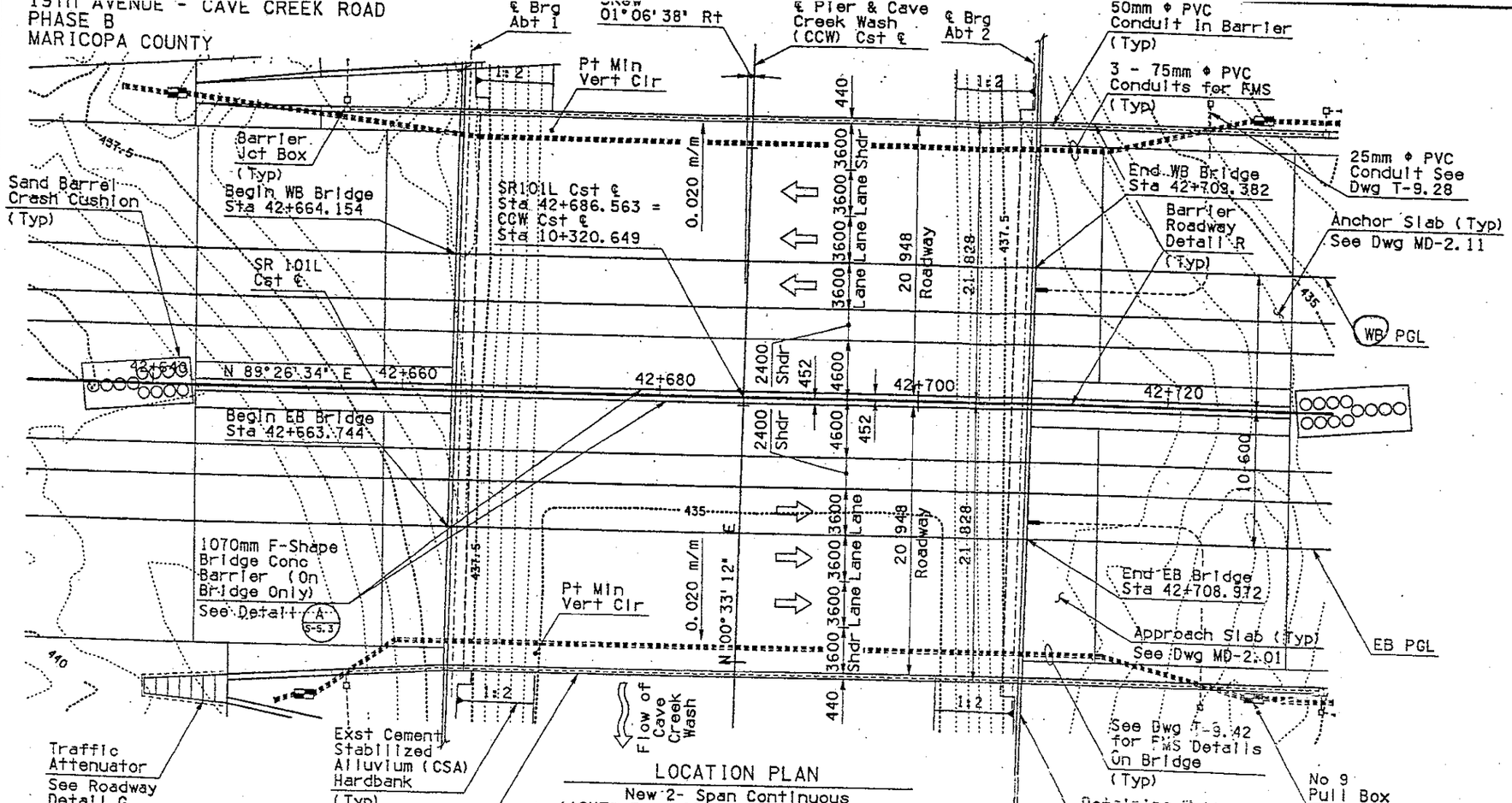
DESIGN FILE: PCCWBP20.DGN

PLOT DATE: 03/19/99 12:13:07

VIEW NAME:

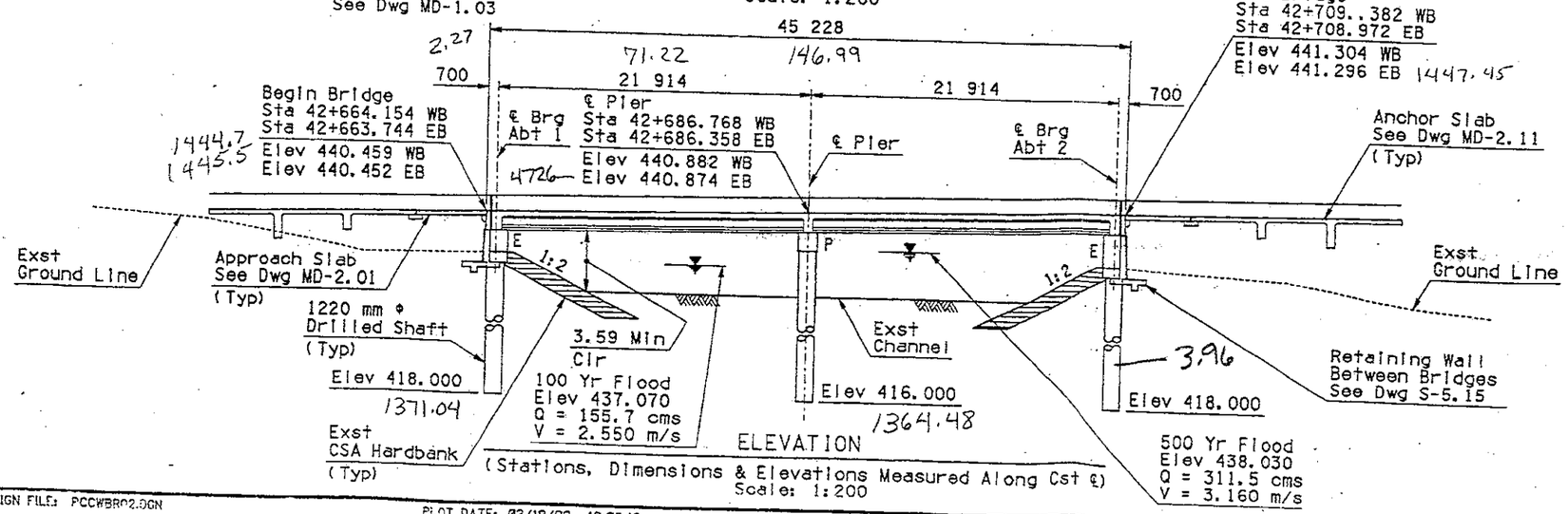
19TH AVENUE - CAVE CREEK ROAD
PHASE B
MARICOPA COUNTY

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	539	716	
		101 MA 024			



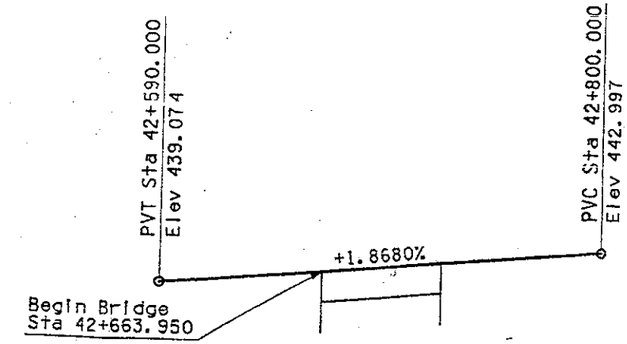
LOCATION PLAN

New 2- Span Continuous
AASHTO Type III Precast/Prestressed
Concrete Girder Bridge
Contour Interval = 0.5 m
Skew = 01°06'38" Rt
Scale: 1:200



ELEVATION

(Stations, Dimensions & Elevations Measured Along Cst ℄)
Scale: 1:200



MAINLINE PROFILE GRADE LINE

NTS

	NAME	DATE
DESIGN	DCO	3/99
DRAWN	TST, MEG	3/99
CHECKED	KTD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE
OVER CAVE CREEK WASH
GENERAL PLAN

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

KEVIN TRACY DUSENBERRY 26752

ROUTE	MI POST	STRUCTURE NO.	DWG S-5.2
SR 101L	25.98	SB 1490 / WB 1491	

TRACS NO. H 4830 01 C | 600-1(13) | OF

REDUCED SIZE - DO NOT SCALE

VIEW NAME:

SURVEY NO.	FINISHED PLANS	REVISIONS	LOCATION	DATE

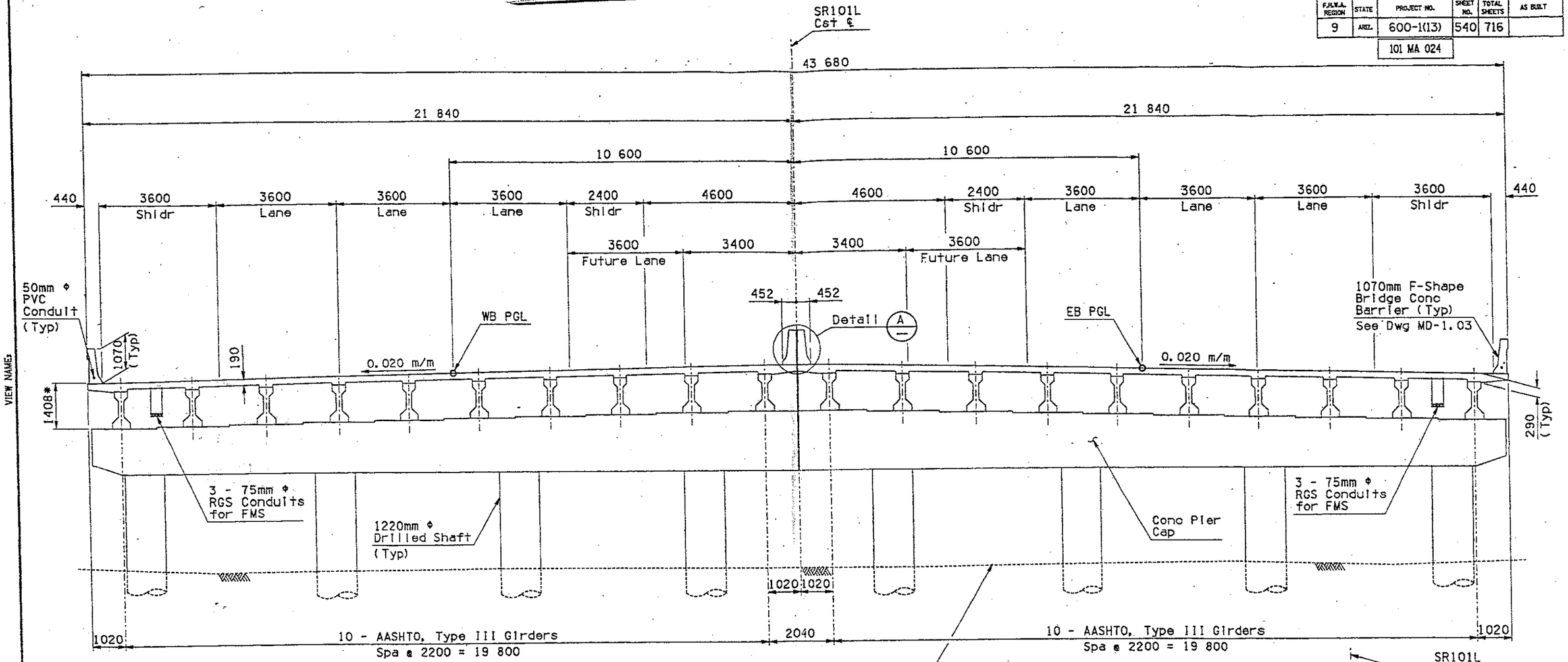
DESIGN FILE: PCCWBR02.DGN

PLOT DATE: 03/19/99 12:08:19

Metric

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	540	716	

101 MA 024



* Measured from top of deck to bottom of girder @ ℄ of girder and ℄ brg.

NORTH BRIDGE
Structure No. 1491

SOUTH BRIDGE
Structure No. 1490

TYPICAL SECTION
Shown Looking Ahead On Station
Scale: 1:60

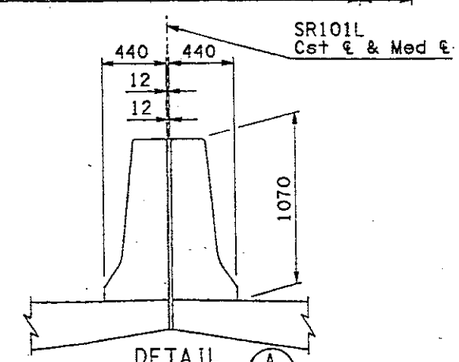
Bearing Pads: Expansion 40 Ea, Fixed 40 Ea

Approach Slab: 378 m^2

Restrainers: Expansion 36 Ea, Fixed 18 Ea

Bridge Conc Barrier: 178.5 m

Anchor Slab: 1095 m^2



DETAIL A
Scale: NTS

APPROXIMATE QUANTITIES

ITEM	STR EX m^3	STR BACKFILL m^3	CLASS 'S' CONCRETE f' c=20 MPa m^3	CLASS 'S' CONCRETE f' c=25 MPa m^3	CLASS 'S' CONCRETE f' c=31 MPa m^3	REINFORCING STEEL Kg	AASHTO TYPE III GIRDERS m	COMPRESSION SEAL JOINT m	1220 ϕ DRILLED SHAFTS m	Retaining Wall m^2
Abt 1	130	260	180	-	-	8,000	-	-	151.8	28
Abt 2	140	720	240	-	-	8,000	-	-	151.8	62
Pier	-	-	-	140	-	16,100	-	-	147.3	-
Superstructure	-	-	-	-	520	81,200	874.6	87.5	-	-
Total	270	980	420	140	520	113,300	874.6	87.5	450.9	90
As-Built Total	-		-	-	-	-	-	-		

	NAME	DATE
DESIGN	DCO	3/99
DRAWN	TST, MEG	3/99
CHECKED	KTD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ MAINLINE BRIDGE OVER CAVE CREEK WASH SECTION & QUANTITIES

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	EB 1490 WB 1491

TRACS NO. H 4830 01 C

600-1(13)

26752 KEVIN TRACY DUSENBERRY

DWG S-5.3

___ OF ___

Metric

REDUCED SIZE - DO NOT SCALE

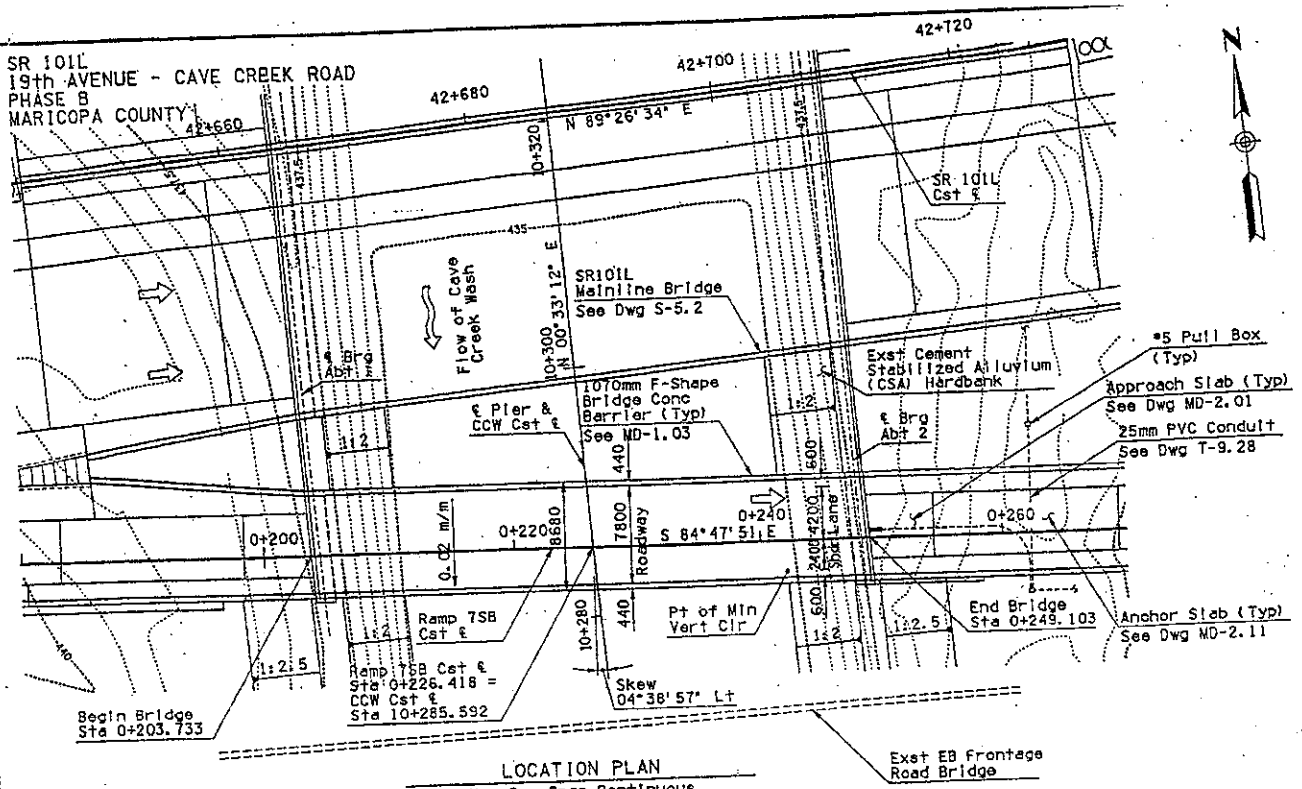
REDUCED SIZE - DO NOT SCALE

DESIGN FILE: PCCWBR03.DGN

PLOT DATE: 03/19/99 12:08:29

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	569	716	
		101 MA 024			

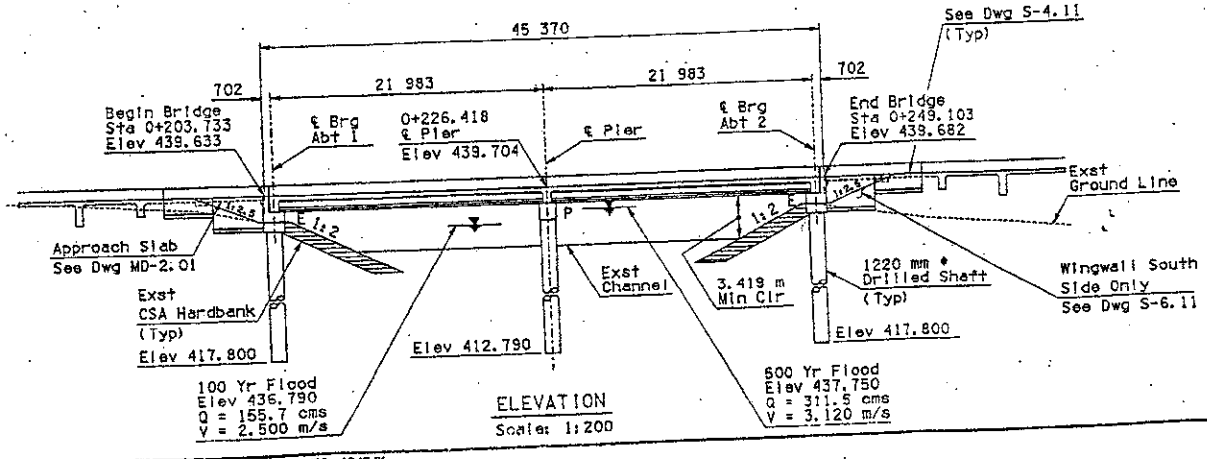
SR 101L
19th AVENUE - CAVE CREEK ROAD
PHASE B
MARICOPA COUNTY



LOCATION PLAN

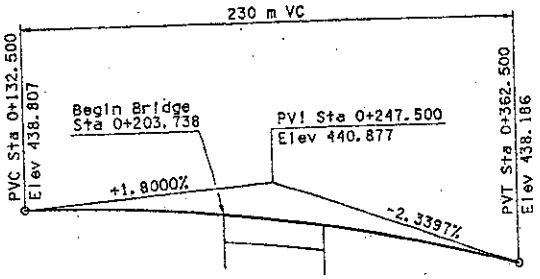
New 2 - Span Continuous
AASHTO Type III Precast/Prestressed
Concrete Girder Bridge
Contour Interval = 0.5 m
Skew = 04°38'57"Lt
Scale: 1:200

NOTE:
For Walls between bridges,
See Dwg S-5.15.



ELEVATION

Scale: 1:200



RAMP 7SB PROFILE GRADE LINE

NTS

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TSL, MSG	3/99
CHECKED	KTD	3/99

ENTRANCE RAMP/SIDEWALK ROADWAY ROW

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB BRIDGE
OVER CAVE CREEK WASH
GENERAL PLAN

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MILE POST	STRUCTURE NO.
SR 101L	25.80	1486

TRACS NO. H 4030 01 C

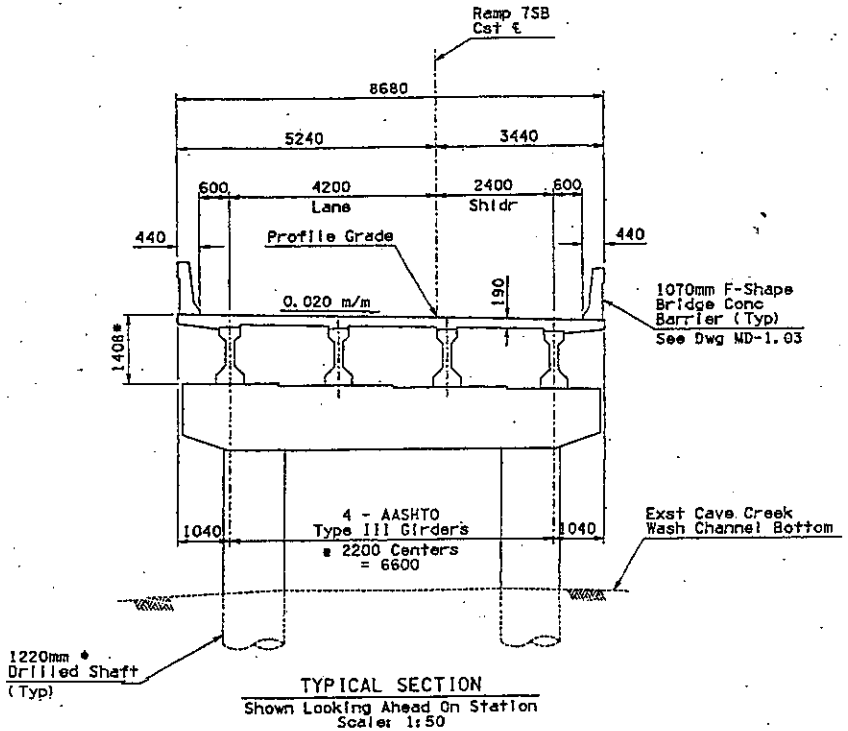
600-1(13)

DWG S-6.2

___ OF ___

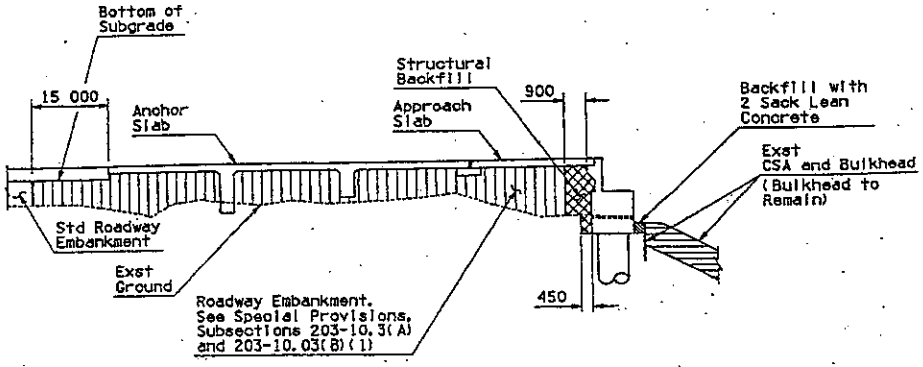
DESIGN FILE: P7S89R02.DGN PLOT DATE: 03/19/99 12:15:31

F.A.H.S. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	570	716	
		101 MA 024			

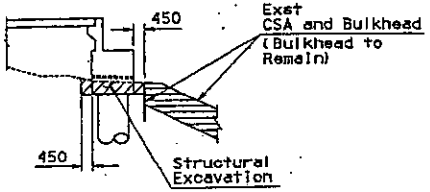


TYPICAL SECTION
Shown Looking Ahead On Station
Scale: 1:50

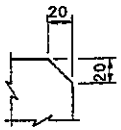
NOTE:
* Measured from top of deck to bottom of girder @ ℄ girder & ℄ brg.



LIMITS OF STRUCTURE
EXCAVATION AND STRUCTURAL
BACKFILL AT ABUTMENTS
NTS



LIMITS OF STRUCTURAL
EXCAVATION AT ABUTMENTS
NTS



NOTE:
Chamfer all exposed corners unless otherwise noted. This note applicable to all sheets pertaining to the structures & walls.

CHAMFER DETAIL
NTS

Bearing Pads: Expansion 8 Ea, Fixed 8 Ea

Approach Slab: 53 m^2

Anchor Slab: 153 m^2

Restrainers: Expansion 12 Ea, Fixed 6 Ea

Bridge Conc Barrier: 89.6 m

APPROXIMATE QUANTITIES

ITEM	STR EX m^3	STR BACKFILL m^3	CLASS 'S' CONCRETE f'c=20 MPa m^3	f'c=25 MPa m^3	f'c=30 MPa m^3	REINFORCING STEEL Kg	AASHTO TYPE III GIRDERS m	COMPRESSION SEAL JOINT m	1220 ϕ DRILLED SHAFTS m	Retaining Wall m^2
Abt # 1	30	30	28	-	-	1510	-	7.9	38.2	17
Pier	-	-	-	26	-	2550	-	-	40.8	-
Abt # 2	30	30	29	-	-	1560	-	7.9	38.2	16
Superstructure	-	-	-	-	98	15,000	175.5	-	-	-
Total	60	60	57	26	98	20,620	175.5	15.8	117.2	33
As-Built Total	-	-	-	-	-		-	-	-	-

	NAME	DATE
DESIGN	G.C.	3/99
DRAWN	TST, MEG	3/99
CHECKED	ATD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP TSB BRIDGE
OVER CAVE CREEK WASH
SECTION & QUANTITIES

ROUTE	M POST	STRUCTURE NO.
SR 101L	25.90	1486

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

DWG S-6.3

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

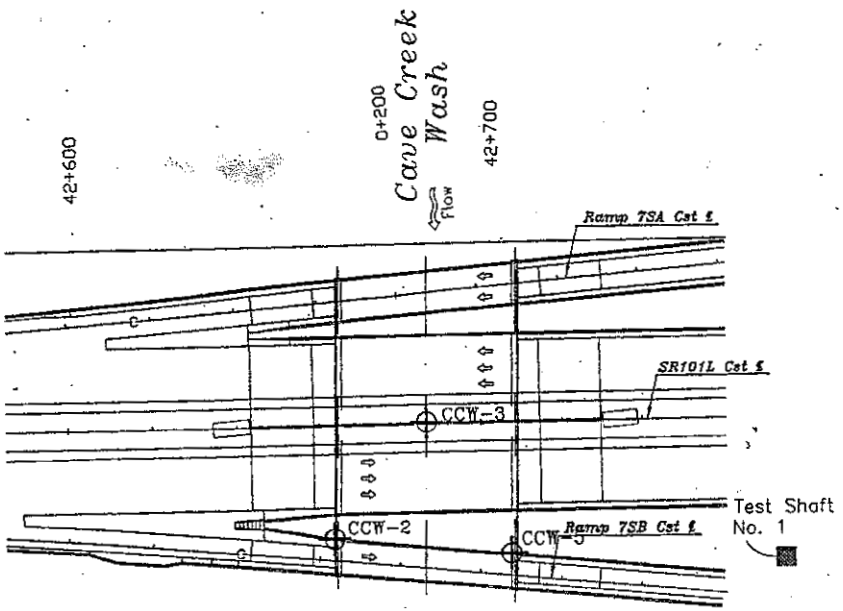
DESIGN FILE: P7SBBR03.DGN PLOT DATE: 03/19/99 12:15:44

VIEW NAME:

REDUCED SIZE - DO NOT SCALE

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13B)	571	716	

101 MA 024



NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION MAP

No Scale

N

BORING CCW-2

Station and Offset:	42+665 , 28.54 RT	Elevation (m):	436.8m
Groundwater (m):	No Free Groundwater Encountered		
Drilling Company:	WDC	Equipment:	Drill Tech T40K
Hole Diameter (mm):	229mm	Drilling Method:	Percussion Hammer
Hammer Type:	Down Hole	Date Completed:	7/29/98

Depth (meters)	Sample Interval	Blow Count	Sample Type	Graphical Log	USCS Classification	DESCRIPTION
1						Note: Man-made fill
2		35-40-45	SPT		SM	Silty Sand with clay some gravel, predominantly very fine to fine grained subangular to subrounded sand, fine gravel (subangular to subrounded), olive brown, slightly moist, very firm, medium plasticity, moderately cemented
3						
4						
5		50/3"	SPT		GP	Note: Native Soil Sandy Gravel with cobbles trace silt, predominantly fine-grained (subangular to subrounded), light brown, slightly moist, hard, low plasticity
6						
7			BULK		SW-SM	Silty Sand with gravel and cobbles, well graded (angular to subrounded), light olive brown, slightly moist, very dense, non-plastic
8		25-47-50/2"	SPT		SW-SM SW	
9						Gravelly Sand with cobbles trace silt, well graded (subangular to subrounded), olive brown, slightly moist, very dense, non-plastic
10						Note: Increasing Gravel Note: Boulder (approximately 0.3m diameter) at 10.0m
11		50/4"	SPT			Note: Used 1,000lb Hammer to break-up cobbles and boulders
12						
13			BULK		GW	Sandy Gravel with cobbles trace silt, well graded (angular to subrounded), light olive-grey, slightly moist, very dense, non-plastic
14		24-50/3"	SPT		SM	Note: Clay chunks in cuttings at 12.65m, gravel/cobbles in clay matrix - large cobbles (8" diameter)
15		5-15-38	RING		SW-SM	Note: Nt Silty Sand at 13.87m
16						

Boring CCW-2 Continued...

16				Note: Nt Silty Sand at 13.87m
17	25-30-45	SPT		Silty Sand/Clayey Sand some gravel, predominantly very fine grained (subangular to subrounded), olive-brown, moist, hard, medium plasticity
18				
19				
20	7-20-33	SPT		
21				
22	13-29-32	SPT	SW-SM	Silty Sand, well graded (subangular to subrounded), olive brown, moist, hard, non-plastic, moderately lime cemented
23	34-50/5"	SPT	SW SW	Note: With gravel, low plasticity
24				
25	13-46-42	SPT	SP	Sand trace silt and gravel, predominantly fine sand (angular to subangular), olive brown, moist, hard, low to no plasticity, weakly lime cemented
26	25-49-50/3"	SPT	SW	Gravelly Sand trace silt, well graded (angular to subangular), olive brown, moist, hard, non-plastic, weakly lime cemented Boring terminated at 25.91m bgs.

GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report -- Foundations, Pima Freeway (101I) - 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter)
- NQ SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

	NAME	DATE
DESIGN	JJW	12/98
DRAWN	SMC	12/98
CHECKED	CHR	12/98

KLEINFELDER
3249 East Watkins Drive
Phoenix, Arizona 85034-7227
PHONE: 602-437-8400 -- FACSIMILE: 437-8440

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MATERIALS GROUP

STA 42+ RAMP 7SB BRIDGE
OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (1 of 3)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	M. POST	STRUCTURE NO.
SR 101L	25.90	1486

DWG S-6.4

TRACS NO. H 4830 01 C | 600-1(13B) | SHT. OF 716

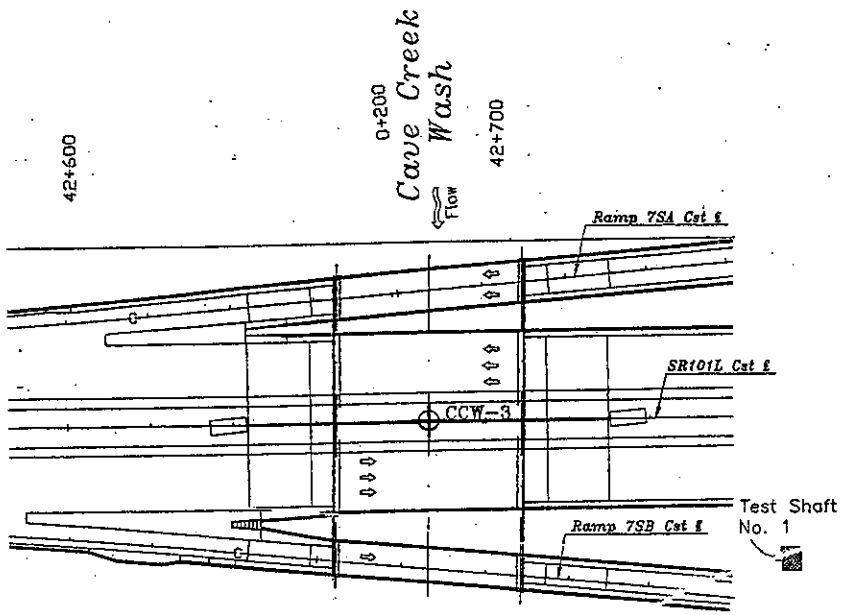
REDUCED SIZE - DO NOT SCALE

Metric

DESIGN FILE: GRAPHICS\PROJECTS\5037\[illegible]\CAVE CREEK WASH_7SB [illegible].DWG

PLOT DATE: 12/30/98

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13B)	572	716	
		101 MA 024			



NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

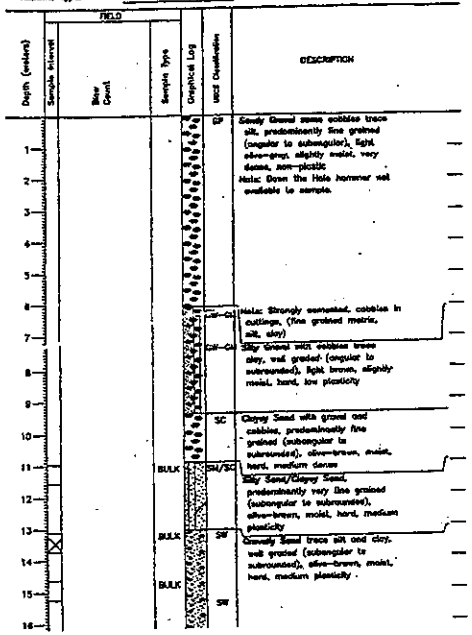
BORING LOCATION MAP

No Scale

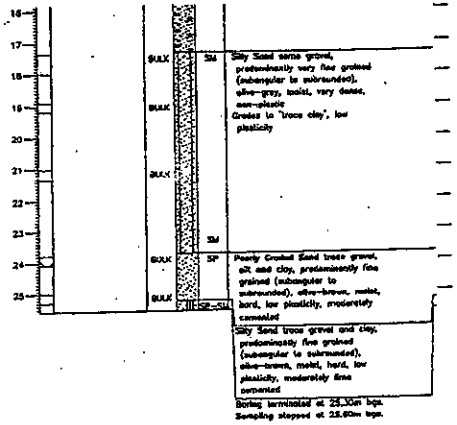
N

BORING CCW-3

Station and Offset: 42+687 , 54 LEFT. Elevation (m): 435.5m
Groundwater (m): No Free Groundwater Encountered
Drilling Company: WOC Equipment: Drill Tech T40K
Hole Diameter (mm): 225mm Drilling Method: Percussion Hammer
Hammer Type: Down Hole Date Completed: 7/28/98



Boring CCW-3 Continued...



GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report - Foundations, Pima Freeway (101L) - 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter)
- NQ SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

	NAME	DATE
DESIGN	JDW	12/98
DRAWN	SKC	12/98
CHECKED	CBR	12/98

KLEINFELDER

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MATERIALS GROUP

STA 42+ RAMP 7SB BRIDGE
OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (2 of 3)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POINT	STRUCTURE NO.
SR 101L	25.90	1486

DWG S-6.5

TRACS NO. H 4830 01 C

600-1(13B)

572 OF 716

REDUCED SIZE - DO NOT SCALE

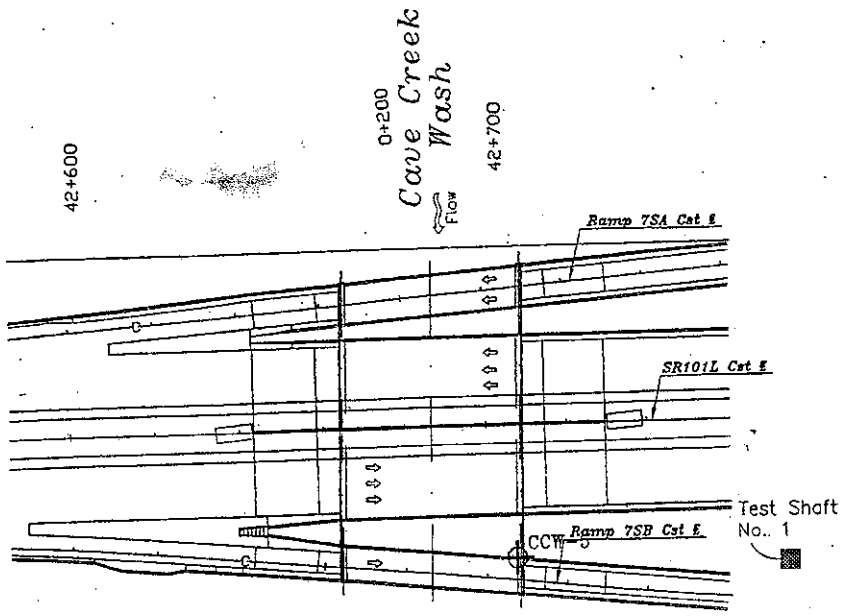
VIEW NAME:

DESIGN FILE: C:\TRACS\PROJECTS\5037\FOUNDATION, DATA\CAVE CREEK WASH\SB-6.DGN.DWG

PLOT DATE: 12/22/98

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13B)	573	715	

101 MA 024



NOTE:

Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION MAP

No Scale

N

BORING CCW-5

Station and Offset:	42+719 ; 23M RT	Elevation (m):	435.8m
Groundwater (m):	No Free Groundwater Encountered		
Drilling Company:	WDC	Equipment:	Drill Tech 740K
Hole Diameter (mm):	229mm	Drilling Method:	Percussion Hammer
Hammer Type:	Down Hole	Date Completed:	7/30/98

FIELD

Depth (meters)	Sample Interval	Blow Count	Sample Type	Graphical Log	USCS Classification	DESCRIPTION
1					GW-GM	Silty Gravel with cobbles, well graded (subangular to subrounded), olive-grey, slightly moist, dense, non-plastic
2		17-32-25	SPT			Note: Increase in amount of cobbles
3						Note: Boulder (0.30m diameter) at 3.5m
4						
5		50/4"	SPT BULK			Grades to 'trace silt and clay', medium plasticity
6						
7					SP SP	Gravelly Sand, predominantly coarse grained sand (angular to subangular), olive-brown, slightly moist, very dense, non-plastic
8		16-13-15	SPT			Note: Some cobbles below 9.14m
9						
10						
11					SM	Silty Sand trace clay and gravel, predominantly fine grained (subangular), olive brown, moist, hard, low plasticity
12		14-32-50/5"	RING		ML	Sandy Silt, brown, moist, hard, low plasticity
13						
14		6-20-23	SPT			
15						
16		8-16-24	SPT		ML	

Boring CCW-5 Continued...

Depth (meters)	Sample Interval	Blow Count	Sample Type	Graphical Log	USCS Classification	DESCRIPTION
16						
17		4-27-23	SPT		SM	Silty Sand some gravel, predominantly fine grained (subangular), olive-brown, moist, very firm, non-plastic, weakly lime cemented
18						
19		5-11-22	SPT			
20		13-27-20	SPT			
21						
22		11-20-23	SPT			
23		8-30-33	SPT		SM	
24						
25		8-16-27	SPT			
26		3-20-30	SPT			

Boring terminated at 25.91m bgs.
Sampling stopped at 26.38m bgs.
Caving to 13.72m

GENERAL LOG NOTES

Material encountered in the borings was classified in general accordance with ASTM D 2488-93 unless otherwise indicated. Additional information is provided in the Final Geotechnical Investigation Report - Foundations, Pima Freeway (101l) - 19th Avenue to Cave Creek Road, Phase B, Maricopa County, Arizona ADOT Project No. STP-600-1-(13), Tracs No. H4830 01D, Contract No. 98-42.

Groundwater and soil moisture conditions are as encountered during the field investigation. Groundwater levels and soil moisture conditions may vary greatly over time.

Information presented on the boring logs is intended to assist in estimating, bidding and design. Geotechnical conditions encountered in the borings may vary from that encountered between borings and samples.

LOG SYMBOLS

- BULK / GRAB SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 inch inside diameter)
- RING (PORTER) SAMPLER (2-1/2 inch inside diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (1.4 inch inside diameter)
- SHELBY TUBE (3 inch outside diameter)
- NQ SIZE CORE BARREL (1-7/8 inch inside diameter)
- WATER LEVEL (level after completion)
- WATER LEVEL (level where first encountered)

	NAME	DATE
DESIGN	JOW	12/98
DRAWN	SKC	12/98
CHECKED	CBR	12/98

KLEINFELDER
3140 Lark Harbour Drive
Phoenix, Arizona 85024-7227
PHONE 623-582-8822 - FAX(602) 437-0855

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
MATERIALS GROUP

STA 42+ RAMP 7SB BRIDGE
OVER CAVE CREEK WASH
FOUNDATION DATA SHEET (3 of 3)

ROUTE	MP	FORT STRUCTURE NO.
SR 101L	25.90	1486

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-6.5

TRACS NO. H 4830 01 C | 600-1(13B) | 573 OF 715

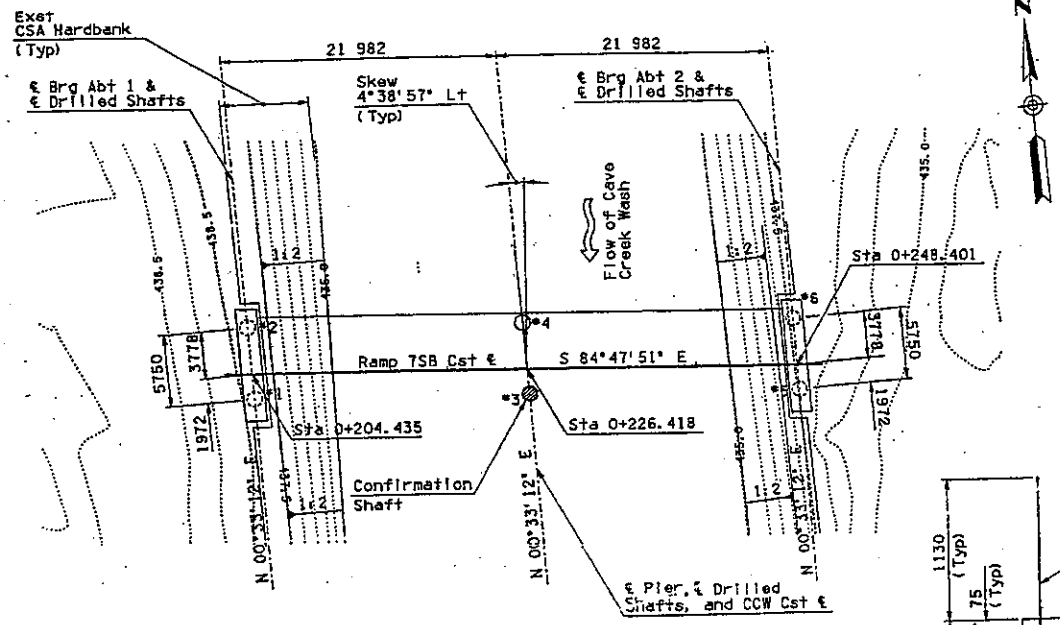
REDUCED SIZE - DO NOT SCALE

Metric

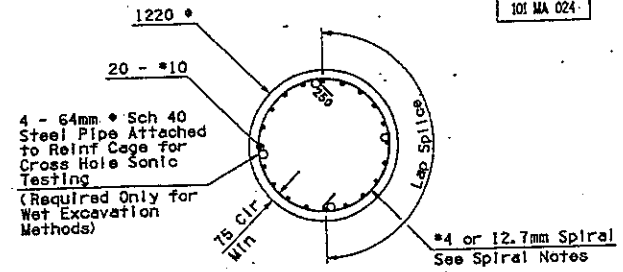
DESIGN FILE: GRAPHICS\PROJECTS\5037\FOUNDATION_DATA\CAVE CREEK WASH 7SB-RAMP.DWG

PLOT DATE: 12/30/98

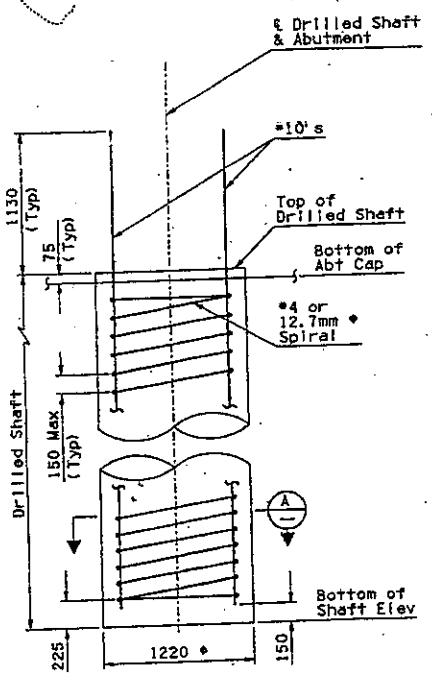
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	574	716	
		101 MA 024			



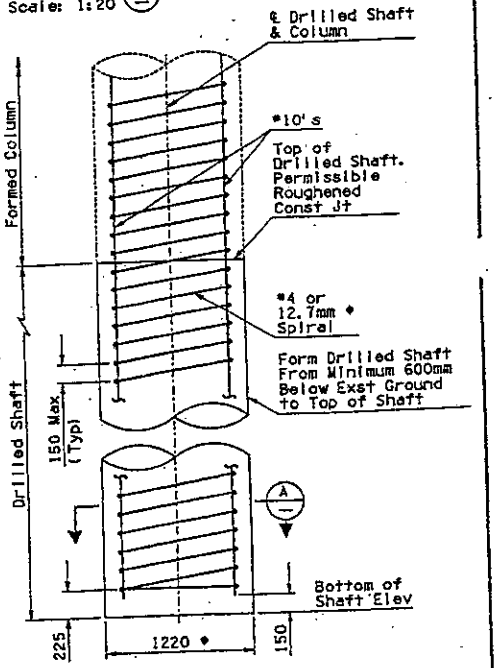
FOUNDATION PLAN
Scale: 1:200



SECTION A
Scale: 1:20



DRILLED SHAFT ELEVATION AT ABUTMENT
Scale: 1:20



DRILLED SHAFT ELEVATION AT PIER
Scale: 1:20

FOUNDATION NOTES:

Abutment drilled shaft vertical design load = 2425 kN.
Pier drilled shaft vertical design load = 2720 kN.

For further information regarding drilled shaft construction see Section 609 of the Special Provisions.

SPIRAL NOTES:

12.7mm diameter cold drawn steel wire shall conform to AASHTO M32 minimum tensile strength = 420 MPa.

Anchorage of spiral reinforcement shall be provided by 1½ extra turns of the spiral at the end of a spiral unit.

Splices in spiral reinforcement shall be lap splices of 48 bar diameters but not less than 300mm or shall be welded.

CONTOUR NOTES:

Contours shown are approximate and shall not be used for estimating purposes.

DRILLED SHAFT ELEVATIONS		
Location	Bottom	Top
Abt 1	417.800	436.875
Pier	412.790	433.184
Abt 2	417.800	436.875

	NAME	DATE
DESIGN	G.C.	3/99
DRAWN	TST, MEG	3/99
CHECKED	STD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
MIDDLE DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB BRIDGE OVER CAVE CREEK WASH FOUNDATION LAYOUT

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

TRACS NO. H 4830 01 C

600-1(13)

DWG S-6.7

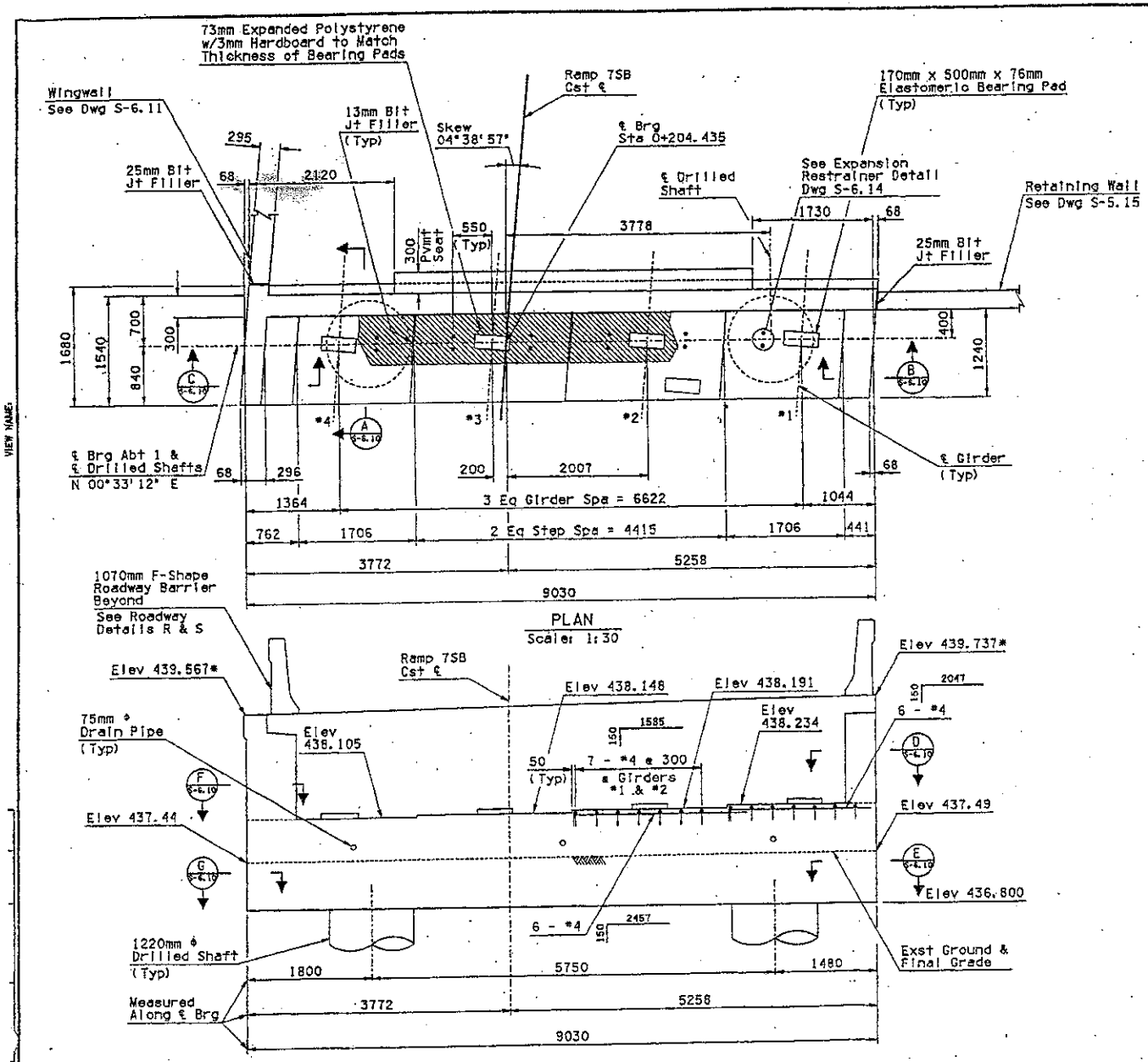
___ OF ___

REDUCED SIZE - DO NOT SCALE

VIEW NAME

DESIGN FILE: P7S9BR04.DGN PLOT DATE: 03/19/99 12:18:15

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	575	716	
		101 MA 024			



NOTES:

1. Bearing pads shall be placed perpendicular to ℄ girder. See Dwg S-6.22 for elastomeric bearing pad detail.
2. Restrainers shall be aligned parallel to ℄ girders. See Dwg S-6.14.
3. For Abutment Details, see Dwg S-6.10.
4. (*) Denotes elevations at front face of back wall.

	NAME	DATE	ARIZONA DEPARTMENT OF TRANSPORTATION STATEWIDE DIVISION BRIDGE GROUP
DESIGN	CLC	3/99	
DRAWN	TST, MEG	3/99	
CHECKED	RTO	3/99	

STA 42+ RAMP 7SB OVER CAVE CREEK WASH ABUTMENT 1 PLAN & ELEVATION

ROUTE	MP POST	STRUCTURE NO.	PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B
SR 101L	25.90	1486	

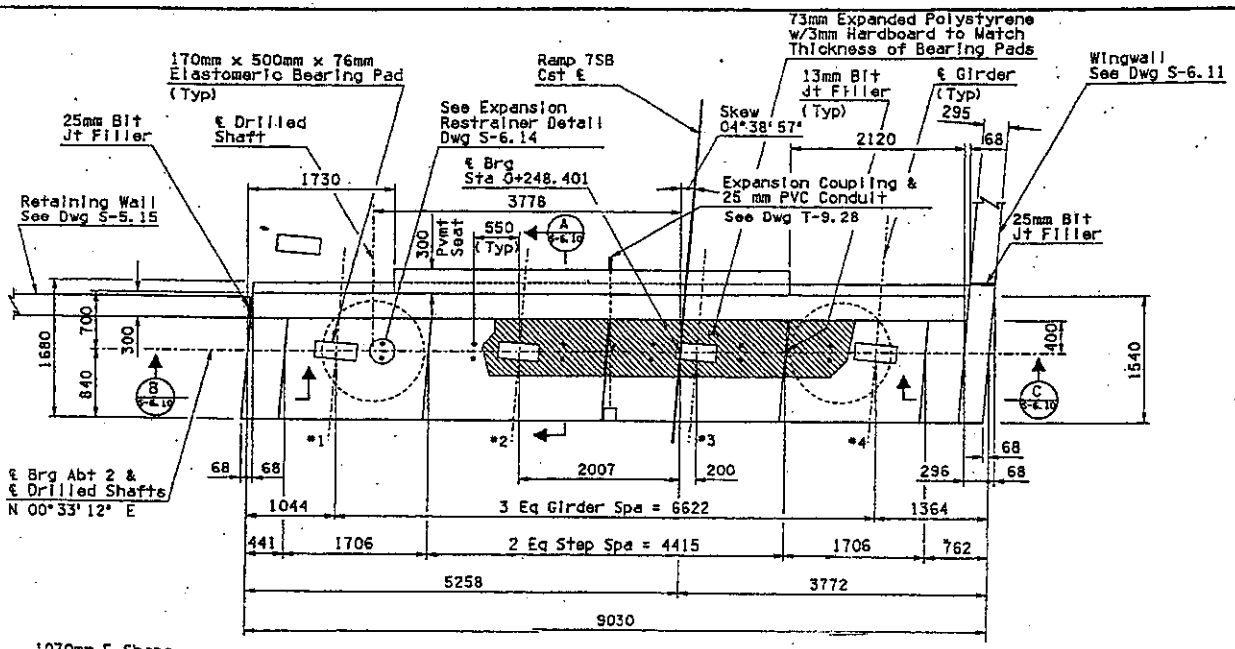
TRACS NO. H 4830 01 C | 600-1(13) | DWG S-6.6 | ___ OF ___

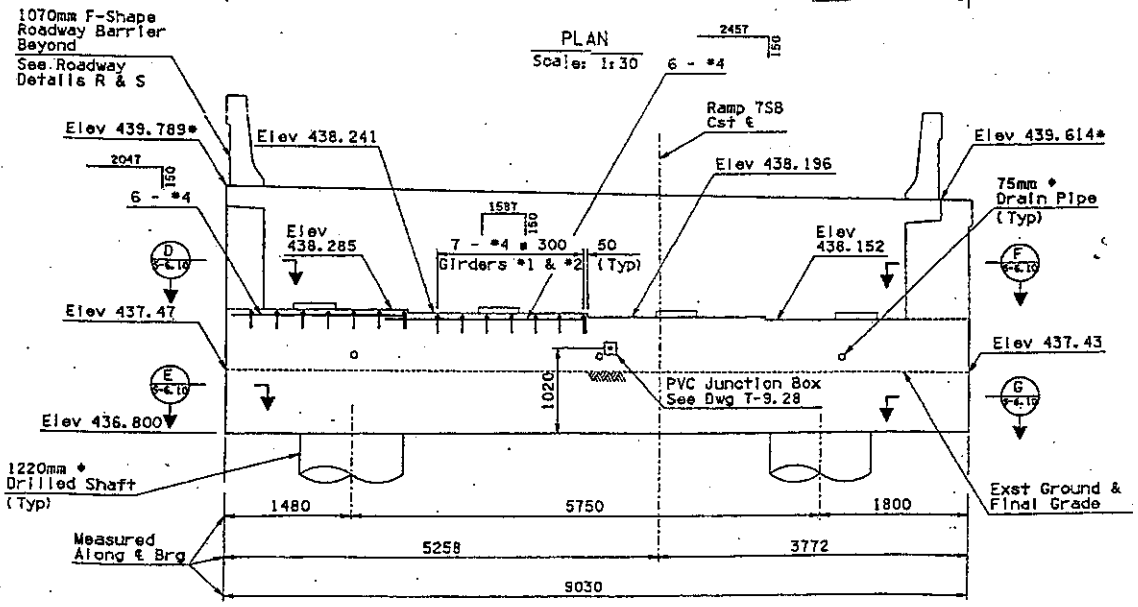
REDUCED SIZE - DO NOT SCALE

VIEW NAME:

DESIGN FILE: 7SBB205.DGN 09/01/98 PLOT DATE: 03/19/99 12:19:22

FAILA. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	576	716	
		101 MA 024			





NOTES:
1. Bearing pads shall be placed perpendicular to ℄ girder. See Dwg S-6.22 for elastomeric bearing pad detail.
2. Restrainers shall be aligned parallel to ℄ girders. See Dwg S-6.14.
3. For Abutment Details, see Dwg S-6.10.
4. (*) Denotes elevations at front face of back wall.

	NAME	DATE
DESIGN	CLC	5/99
DRAWN	TST, MCS	5/99
CHECKED	KTD	5/99

ARIZONA DEPARTMENT OF TRANSPORTATION
MIDWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB
OVER CAVE CREEK WASH
ABUTMENT #2 PLAN & ELEVATION

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

TRACS NO. H 4630 01 C

600-1(13)

DWG S-6.9

___ OF ___

DESIGN FILE: P7S8BR06.DGN 08/24/98

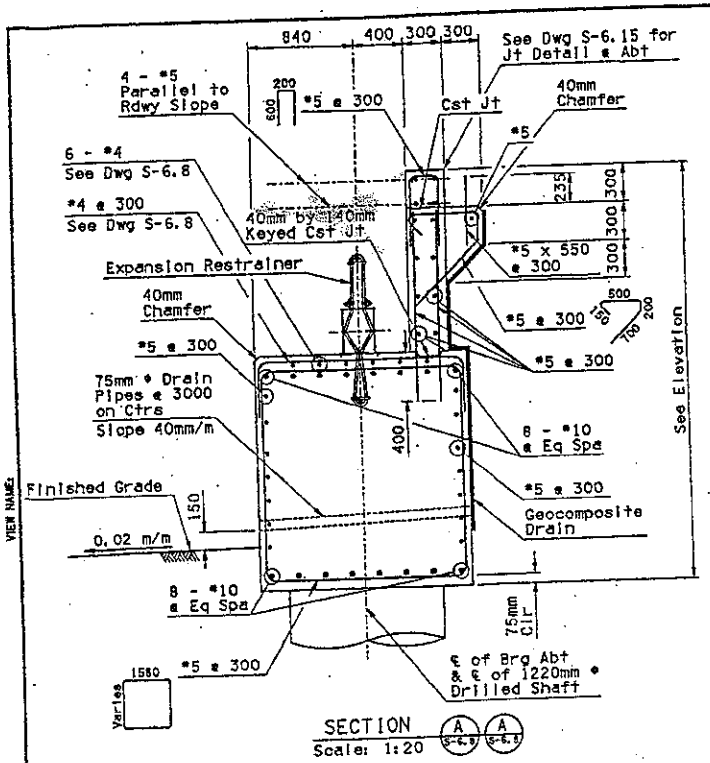
PLOT DATE: 03/15/11 12:15:42

REDUCED SIZE - DO NOT SCALE

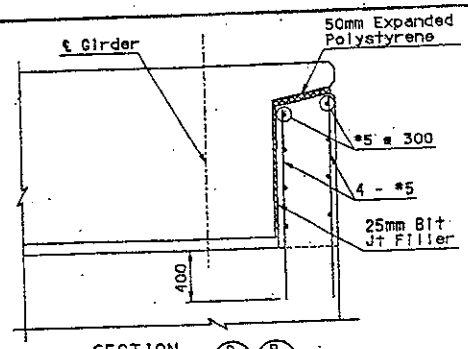
VIEW NAME

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	577	716	

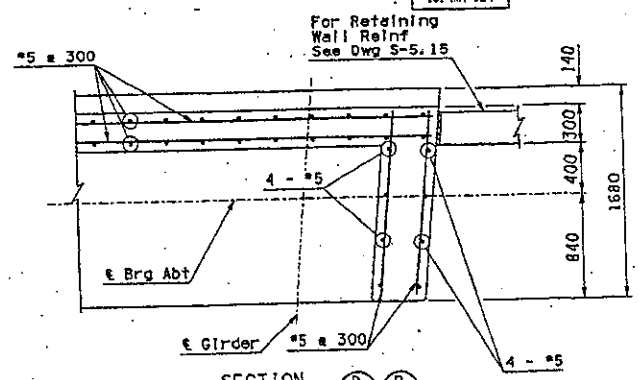
101 MA 024



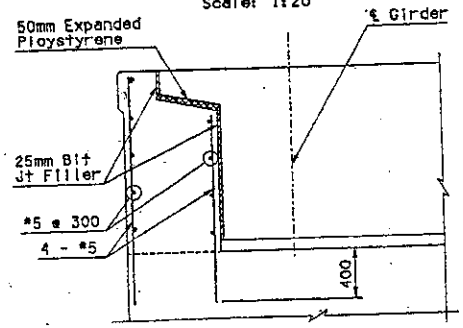
SECTION A S-6.8 A S-6.9
Scale: 1:20



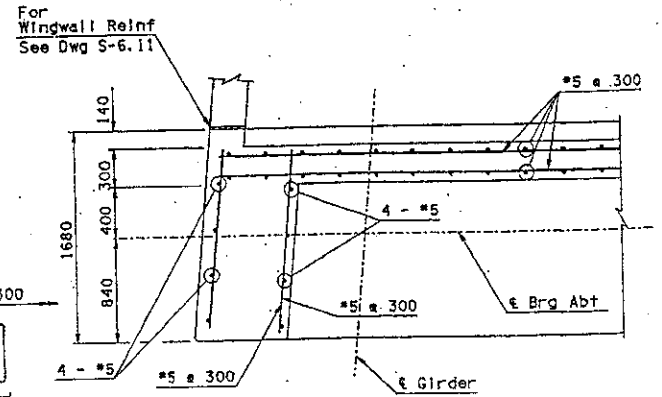
SECTION B S-6.8 B S-6.9
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20



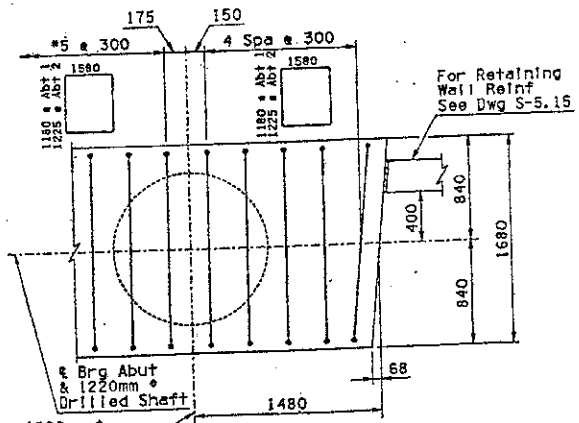
SECTION D S-6.8 D S-6.9
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20



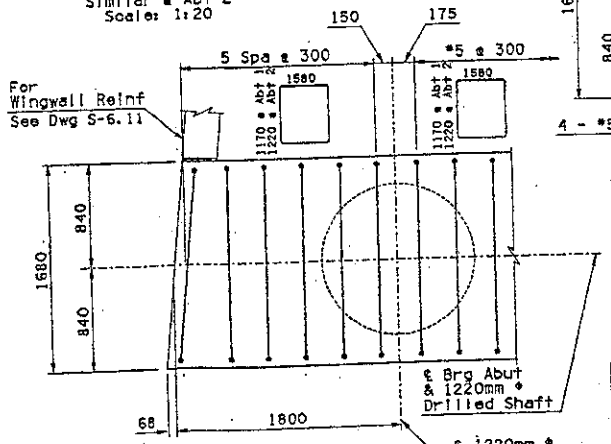
SECTION C S-6.8 C S-6.9
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20



SECTION F S-6.8 F S-6.9
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20



SECTION E S-6.8 E S-6.9
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20



SECTION G S-6.8 G S-6.9
Shown @ Abt 1
Similar @ Abt 2
Scale: 1:20

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TST, MES	3/99
CHECKED	KTD	3/99

W T R A N S B

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 75B BRIDGE
OVER CAVE CREEK WASH
ABUTMENT DETAILS

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

DWG S-6.10

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

REVIN TRACY BUSENBERG 26752

Metric

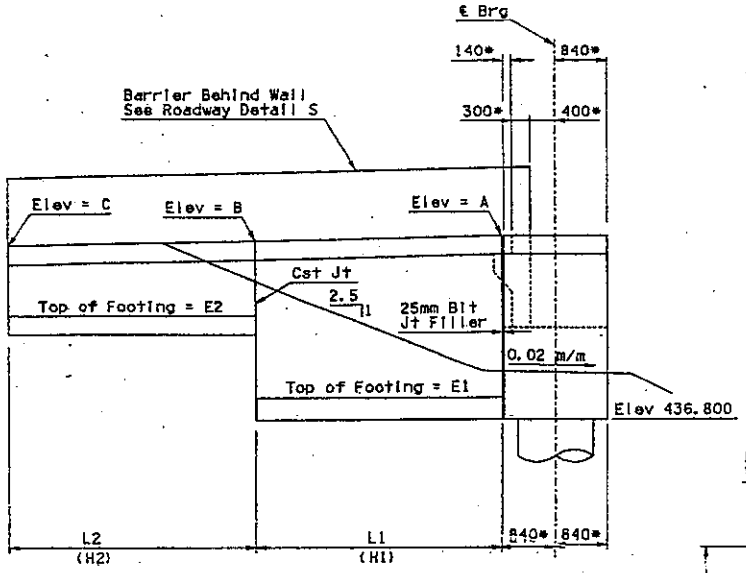
REDUCED SIZE - DO NOT SCALE

VIEW NAME:

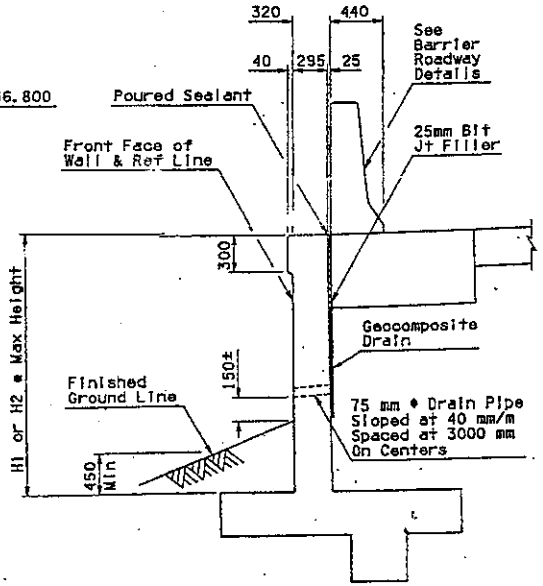
DESIGN FILE: P75BBRDT.DGN

PLOT DATE: 03/17/99 12:46:53

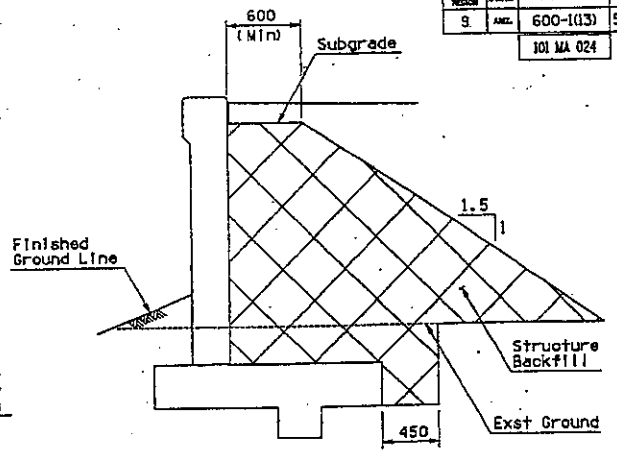
F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	578	716	
		101 MA 024			



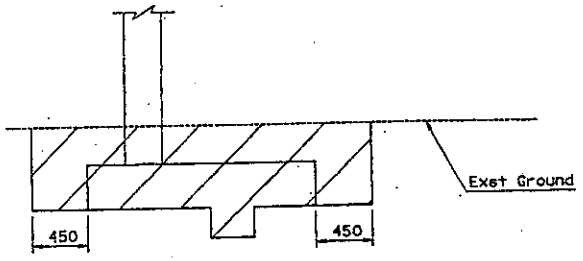
FRONT OF WINGWALL ELEVATION
Shown at Abut 1.
Similar at Abut 2
Scale: 1:40



TYPICAL WINGWALL SECTION
Scale: 1:20



LIMITS OF WINGWALL STRUCTURE BACKFILL
Scale: 1:20



LIMITS OF WINGWALL STRUCTURAL EXCAVATION
Scale: 1:20

NOTES:
1. See ADOT Standard Dwg B-18.10 & B-18.20 Case II for wall dimensions and reinforcing. (English June 1992).
2. (*) Dimensions measured perpendicular to ℄ bearing.
3. (**) Looking ahead on stationing.

BRIDGE 7SB WINGWALL DIMENSIONS (m) & ELEVATIONS

Location **	L1	H1	L2	H2	L	A	B	C	E1	E2
Abt 1 (Right Side)	4.000	2.356(8 Ft)	4.000	1.832(6 Ft)	8.000	439.599	439.537	439.512	437.156	437.705
Abt 2 (Right Side)	4.000	2.451(8 Ft)	5.000	1.188(4 Ft)	9.000	439.607	439.593	439.572	437.156	438.405

	NAME	DATE
DESIGN	GLC	3/99
DRAWN	TST, MEG	3/99
CHECKED	KTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB
OVER CAVE CREEK WASH
WINGWALL DETAILS

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

TRACS NO. H 4830 01 C

600-1(13)

DWG S-6.11

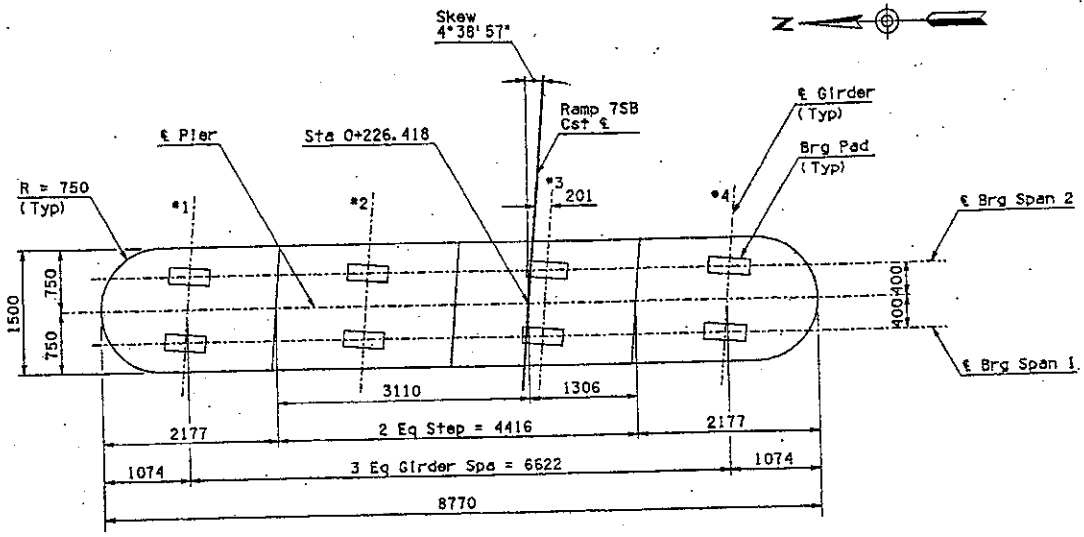
___ OF ___

DESIGN FILE: PTSBBRD9.DGN PLOT DATE: 03/19/99 12:17:27

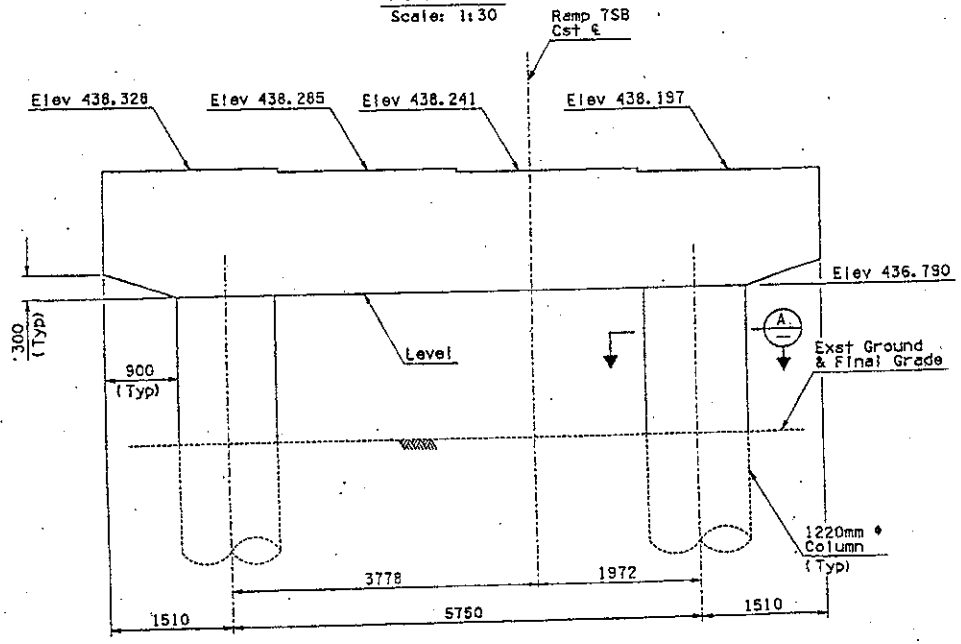
VIEW NAME:

REDUCED SIZE - DO NOT SCALE

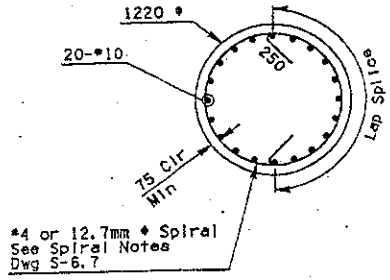
F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	579	716	
		101 MA 024			



PIER PLAN
Scale: 1:30



PIER ELEVATION
Scale: 1:30



SECTION A
Scale: 1:20

	NAME	DATE
DESIGN	DLC	3/99
DRAWN	TST, MEG	3/99
CHECKED	GTP	3/99

ADOT LANDSCAPE ARCHITECT | ADOT STRUCTURE DESIGN | ADOT CIVIL DESIGN

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB BRIDGE
OVER CAVE CREEK WASH
PIER PLAN & ELEVATION

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

TRACS NO. H 4830 01 C

600-1(13)

DWG S-6.12

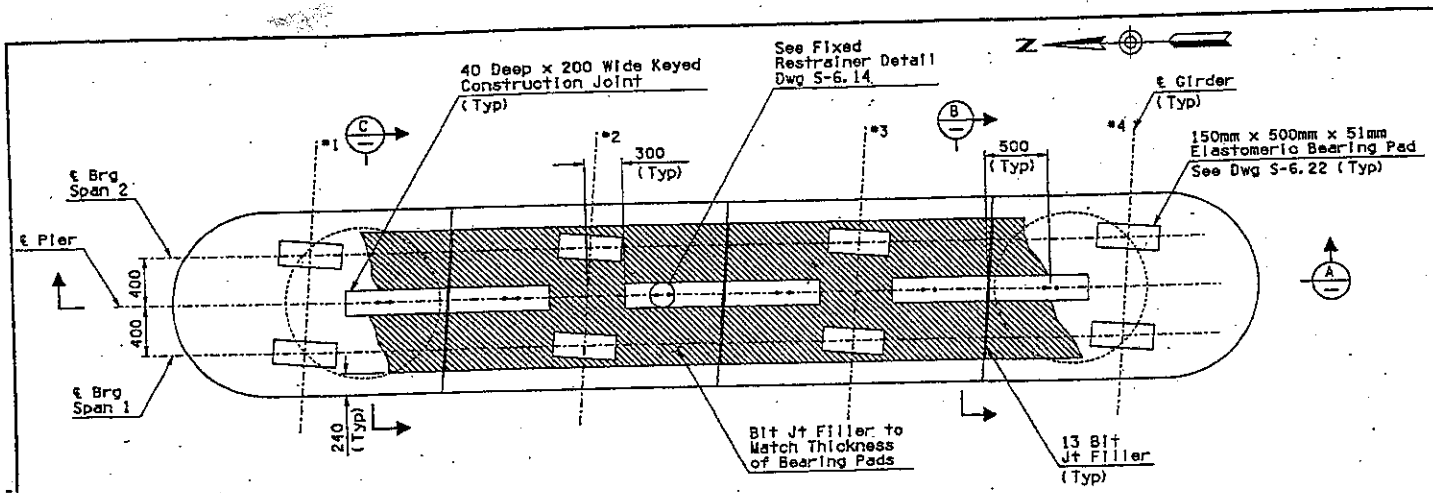
___ OF ___

REDUCED SIZE - DO NOT SCALE

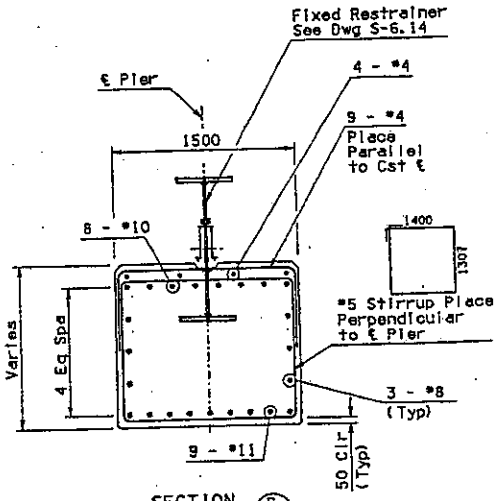
VIEW NAME:

DESIGN FILE: I7SBBR04.DGN PLOT DATE: 03/19/99 12:17:12

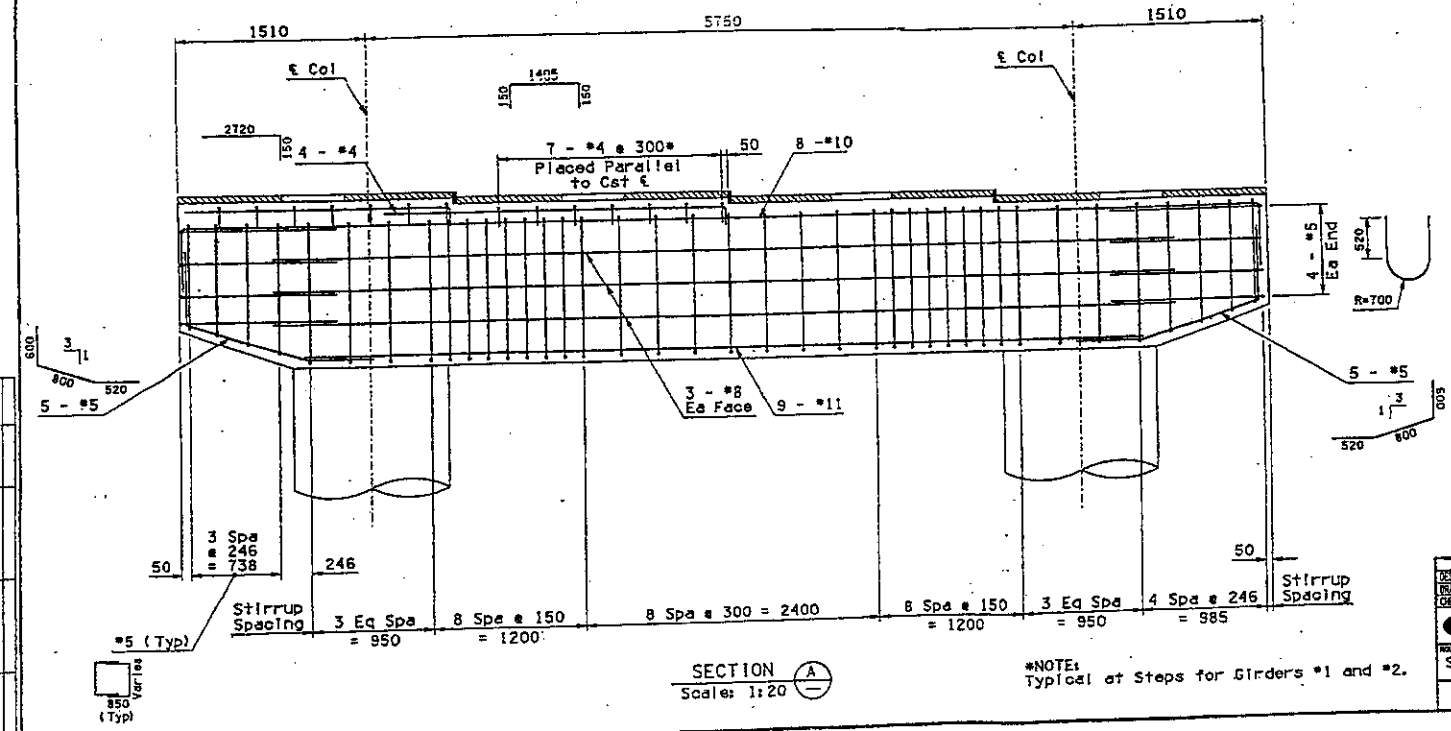
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	580	716	
		101 MA 024			



CAP PLAN
Scale: 1:20

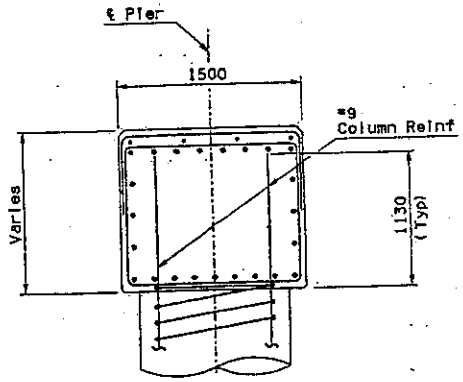


SECTION B
Scale: 1:20



SECTION A
Scale: 1:20

*NOTE:
Typical at Steps for Girders *1 and *2.



SECTION C
Scale: 1:20

	NAME	DATE
DESIGN	FLC	3/99
DRAWN	TST, MES	3/99
CHECKED	RTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP TSB BRIDGE
OVER CAVE CREEK WASH
PIER DETAILS

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

TRACS NO. H 4830 01 C

600-1(13)

DWG S-6.13

___ OF ___

REVISE TRACY CLESSENBERG

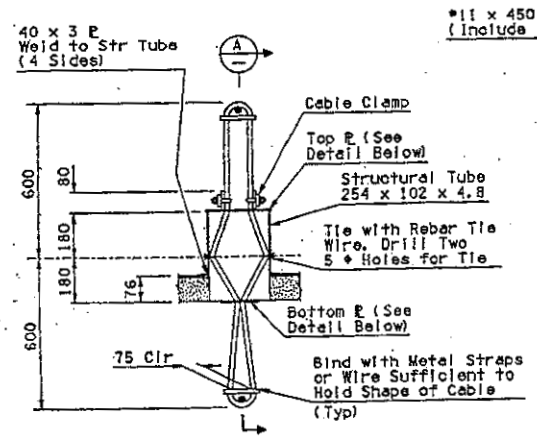
DESIGN FILE: PTSEBR10.DGN

PLOT DATE: 03/22/99 12:17:27

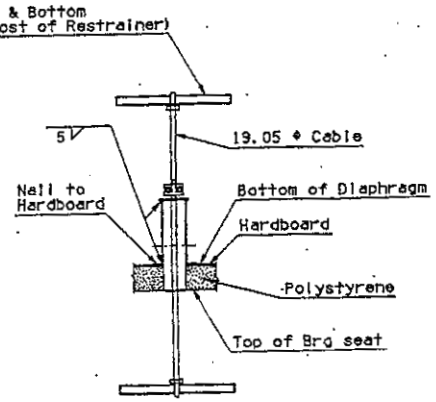
VIEW NAME:

PLOTTED SIZE - DO NOT SCALE

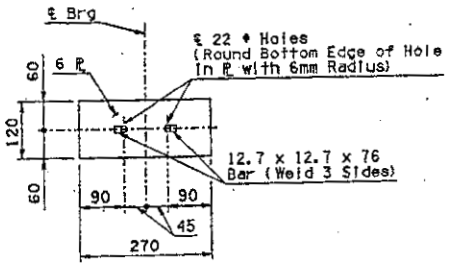
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	581	716	
		101 MA 024			



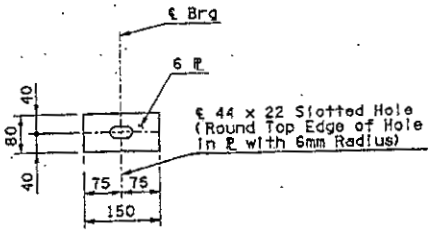
ELEVATION
NTS



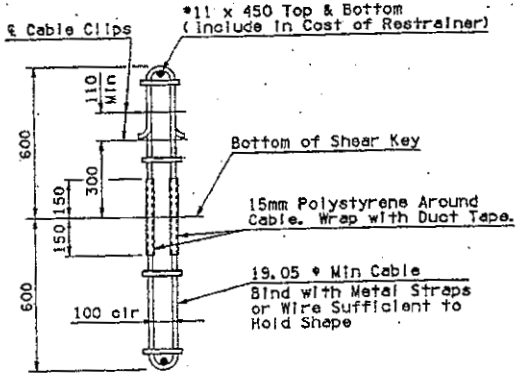
SECTION A
NTS



TOP PLATE
NTS



BOTTOM PLATE
NTS



FIXED RESTRAINER DETAIL

Restrainer Cables shall be 19.05 ϕ min preformed 6x19 galvanized with a minimum breaking strength of 187 kN. One sample of cable 1 meter in length shall be furnished to the Engineer for testing

EXPANSION RESTRAINER DETAIL

NOTES:

Seal all openings in structural tube to prohibit concrete intrusion.

Restrainer Cables shall be 19.05 ϕ min preformed 6x19 galvanized with a minimum breaking strength of 187 kN. One sample of cable 1 meter in length shall be furnished to the Engineer for testing

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TSL, WCB	3/99
CHECKED	KTD	3/99

ENTRANCE

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP TSB BRIDGE
OVER CAVE CREEK WASH
RESTRAINER DETAILS

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

TRACS NO. H 4830 01 C

600-1(13)

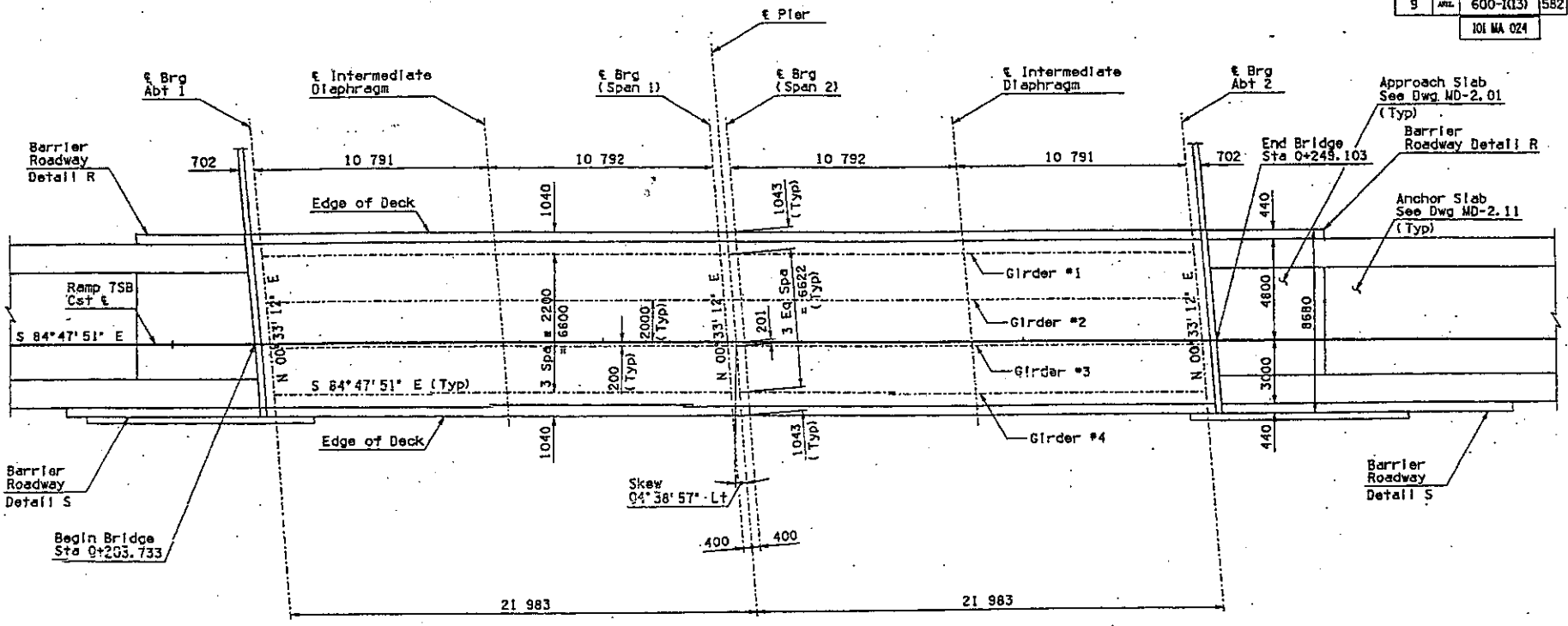
DWG S-6.14

OF

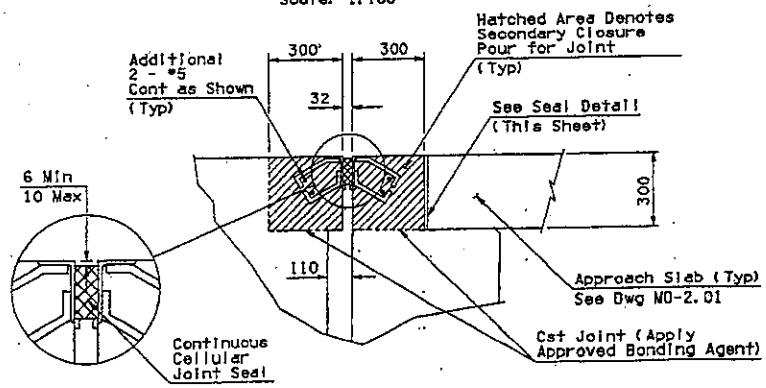
DESIGN FILE: PTSBBRIDGN

PLOT DATE: [illegible]

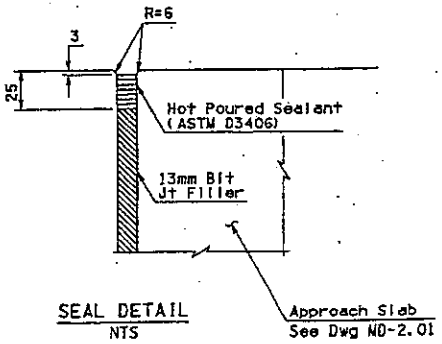
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	582	716	
		101 MA 024			



FRAMING PLAN
Scale: 1:100



JOINT DETAIL @ ABUTMENT
Dimensions shown are perpendicular to ℄ Brg
Scale: 1:10



SEAL DETAIL
NTS

NOTES:
1. Girders shall be placed parallel to Ramp TSB Cst ℄.
2. 51 x 51 compression seal, f = 80
   Joint opening = 32 @ 16°C
   Temp correction = 2.4 per - 10°C
3. For compression seal joint details not shown, See Dwg MD-3.01.
4. Provide through joint in barriers with 6mm bit joint filler at ℄ pier.

	NAME	DATE
DESIGN	KLC	3/99
DRAWN	TST, MEG	3/99
CHECKED	RTO	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP TSB BRIDGE
OVER CAVE CREEK WASH
GIRDER LAYOUT

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	LG POST	STRUCTURE NO.
SR 101L	25.90	1486

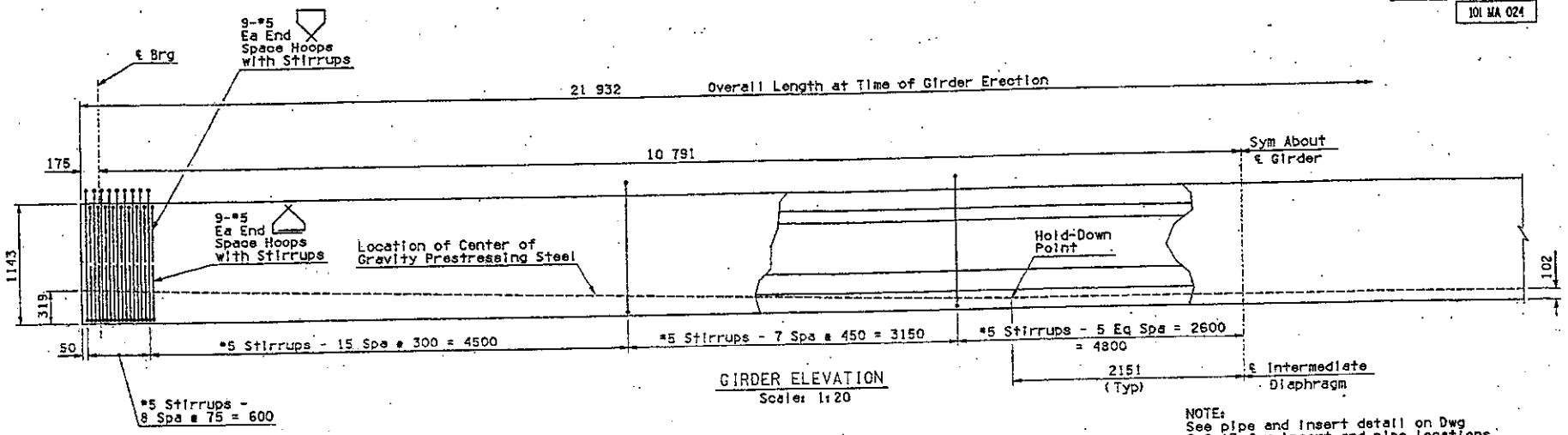
DWG S-6.15

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

DESIGN FILE: PTSBBRI2.DGN PLOT DATE: 03/13/99 12:37:49

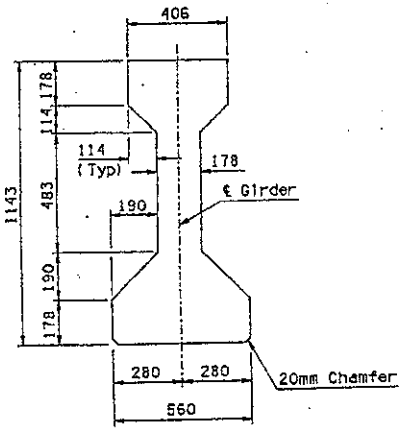
REDUCED SIZE - DO NOT SCALE

F.A.P.N.H. DESIGN	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	583	716	
		101 MA 024			

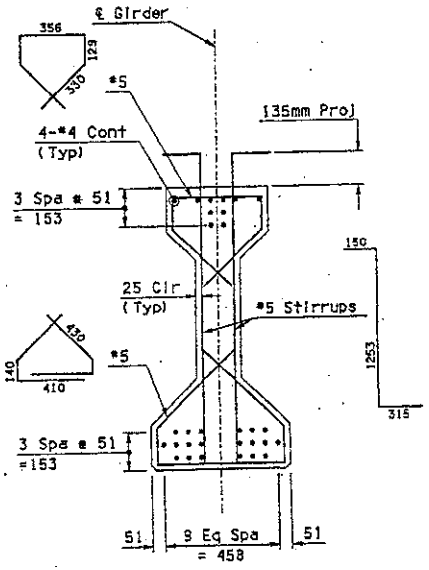


GIRDER ELEVATION
Scale: 1:20

NOTE:
See pipe and insert detail on Dwg S-6.17 for insert and pipe locations.

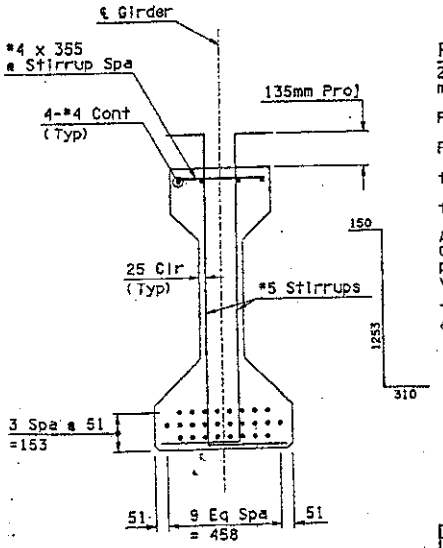


TYPICAL SECTION
Scale: 1:10



SECTION THRU END
Scale: 1:10

AASHTO TYPE III GIRDER



SECTION THRU MIDSPAN
Scale: 1:10

PRESTRESSING NOTES:

26 (6 harped and 20 straight) 12.54 millimeter dia 7 wire low relaxation strands.

Pi = 3583 kN. Initial tension before losses.

Pw = 2681 kN. Working force remaining after all losses.

f'ci = 31.0 MPa. Minimum strength at transfer.

f'c = 41.0 MPa. Minimum strength at 28 days.

All low relaxation strands shall be stressed to 0.75f's. Girders shall be prestressed by the pretensioning method only. Use of masked strands will not be allowed.

Tops of girders shall be roughened transversely with a roughness amplitude of 6 mm.

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TST, MEC	3/99
CHECKED	KTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB BRIDGE
OVER CAVE CREEK WASH
GIRDER DETAILS (1 of 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

DWG S-6.16

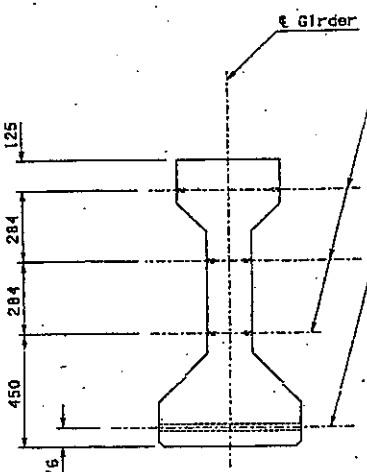
TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

DESIGN FILE: P7SBBRI3.DGN PLOT DATE: 03/12/99 12:17:59

VIEW NAMES

DENOTES SIZE - DO NOT SCALE

F.A.H.S.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	584	716	
		101 MA 024			



VIEW (A)
Scale: 1:10

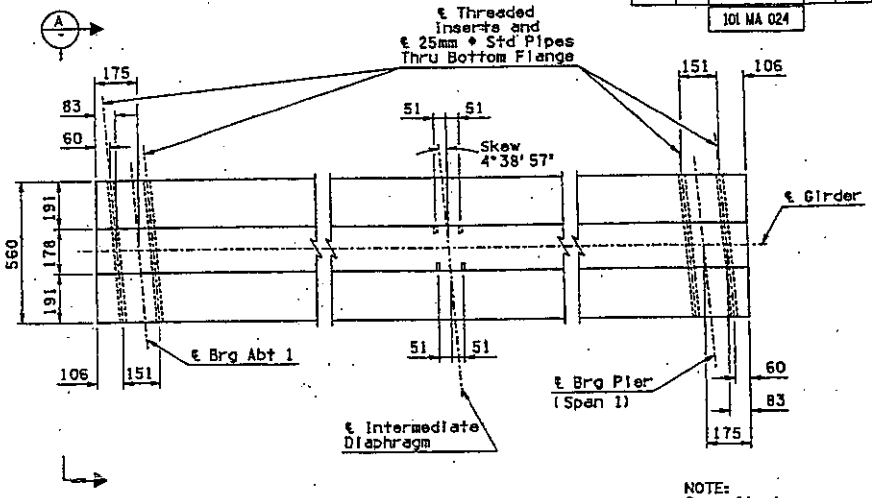
℄ Threaded Inserts - Inserts are standard threaded with enclosed threads for 19mm ϕ (#6) threaded rods (Typ)

May use 25mm ϕ standard pipe sleeves ⅊ ends of girders, except for exterior girders ⅊ pier.

℄ 25mm ϕ standard pipe. Space pipe to clear strands and stirrups. Use inserts only on inside face of exterior girders ⅊ pier, to connect to 19mm ϕ (#6) x 640mm threaded rods

INSERT NOTES:

Inserts are Ferrule Loop Inserts for 19mm ϕ (#6) rods, threaded one end. Inserts shall have a working pullout strength of 16 kN. Inserts may be placed normal to ℄ girder, or on skew. If placed normal to ℄ girder, rods may be fabricated bent or field bent. If rods are field bent, method of field bending inserted rods 25mm beyond face of girder to maintain 54mm minimum clearance from edge of diaphragm without damaging insert, shall be submitted for approval with shop drawings. Rods shall conform to ASTM A615/A615M-96a Grade 420.

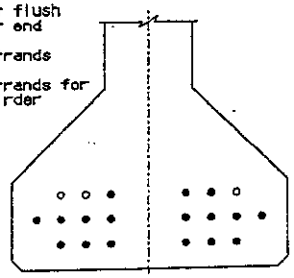


PIPE AND INSERT DETAIL
Scale: 1:10

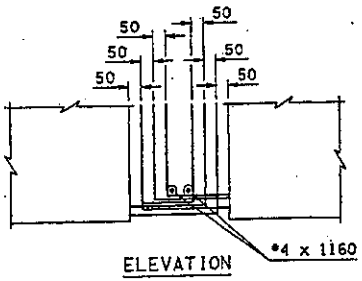
NOTE:
Span #1 shown.
Span #2 similar

NOTE:
Extend strands at Pier only.
Cut strands flush at Abutments.

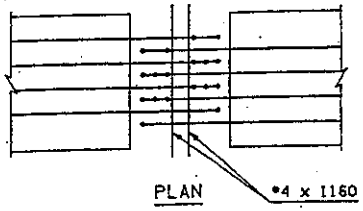
- ○ Strands cut flush with girder end
- ● Extended strands
- ● Extended strands for adjacent girder



TYPICAL SECTION



ELEVATION



PLAN

STRAND EXTENSION DETAIL
NTS

	NAME	DATE
DESIGN	CLC	1/99
DRAWN	TSI, MEG	1/99
CHECKED	KTD	1/99

ENTRANCO

ROUTE	MP FROM	STRUCTURE NO.
SR 101L	25.90	1486

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP TSB BRIDGE OVER CAVE CREEK WASH
GIRDER DETAILS (2 of 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

KEVIN TRAN CHUNGHSIEN
26752
ARIZONA

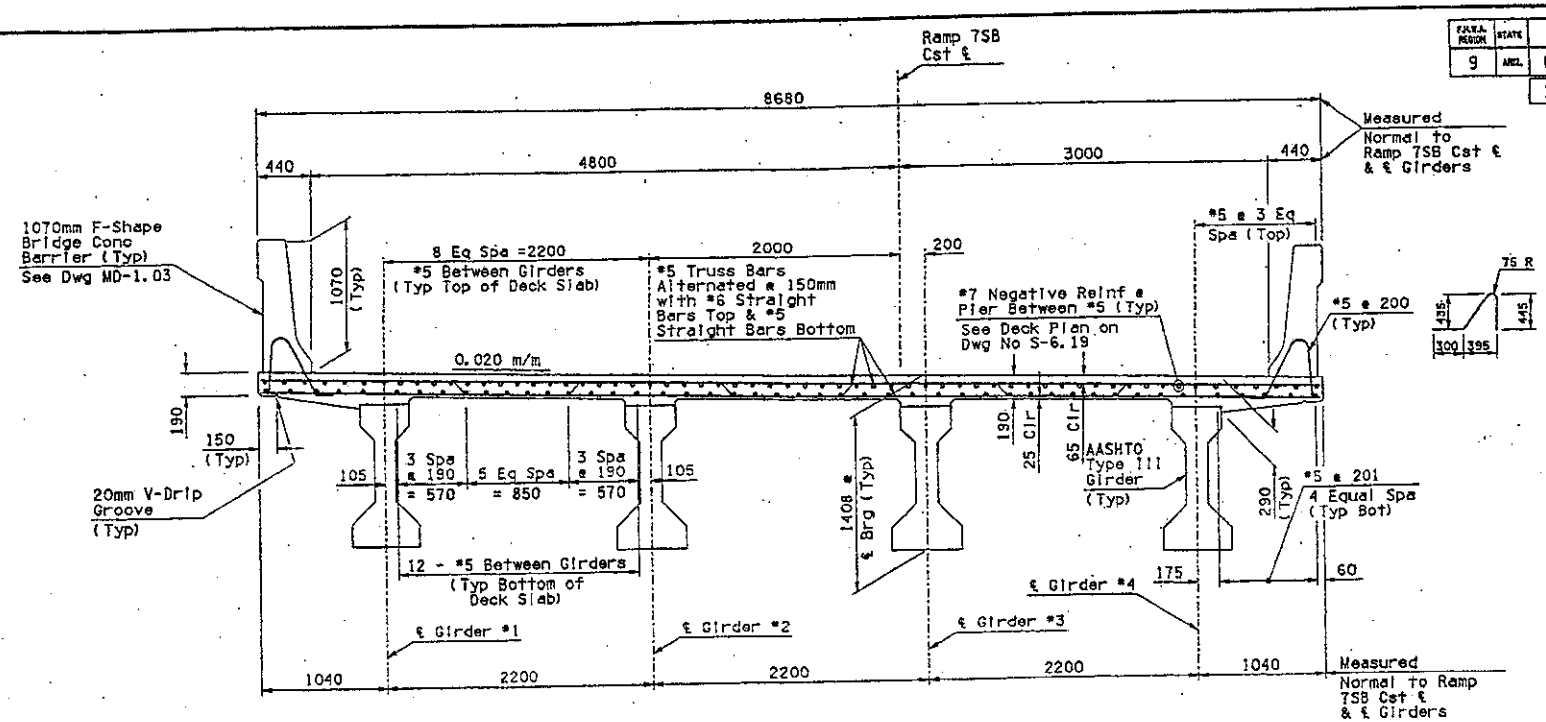
DWG 5-6.17

TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

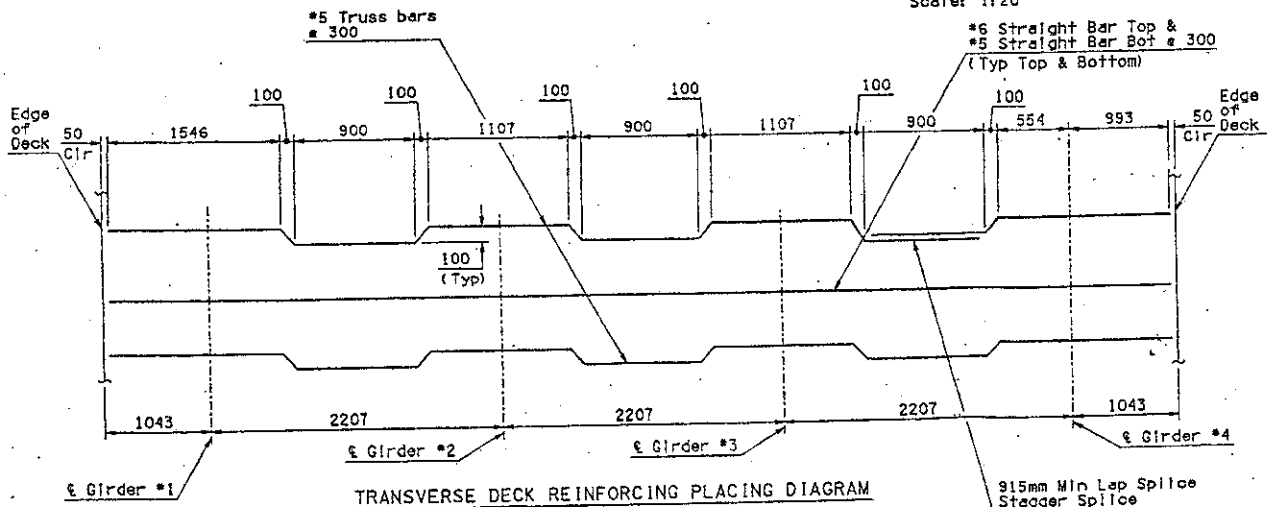
DESIGN FILE: P7S8BR14.DGN PLOT DATE: 03/19/99 12:19:18

PRINTED SIZE - DO NOT SCALE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	585	716	
		10L MA 024			



TYPICAL SECTION THRU DECK
Scale: 1:20



TRANSVERSE DECK REINFORCING PLACING DIAGRAM
Dimensions shown are parallel to ℄ brg in this diagram
NTS

DECK REINFORCEMENT NOTES:

1. All transverse deck bars shall be placed parallel to ℄ bearing. All longitudinal deck bars shall be placed parallel to 7SB Cst ℄.
2. All continuous horizontal bars in deck, diaphragms and barriers excluding transverse bars in top slab may be spliced where required with minimum lap length as specified:

   *5 bars 520 millimeter

3. Top slab transverse reinforcing splices where required shall be:

   Top bars: 915 millimeter minimum lap at centerline cell.

   Bottom bars: 915 millimeter minimum lap at centerline girder.

   Truss bars: 915 millimeter minimum lap at centerline cell or girder.

4. Bars shall not be spliced within the required lap length of the adjacent bars.

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TSI, MEG	3/99
CHECKED	ATO	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB BRIDGE OVER CAVE CREEK WASH DECK DETAILS (1 of 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	M POST	STRUCTURE NO.
SR 101L	25.90	1486

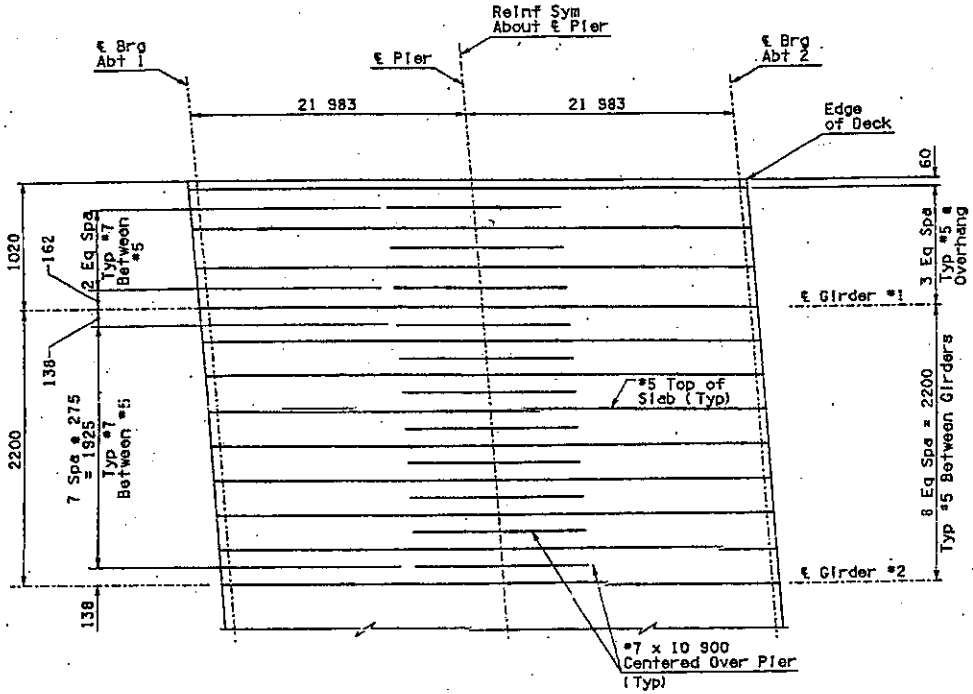
TRACS NO. H 4830 01 C | 600-1(13) | DWG S-6.18 | ___ OF ___

KEVIN TRACY DUENSING 26752

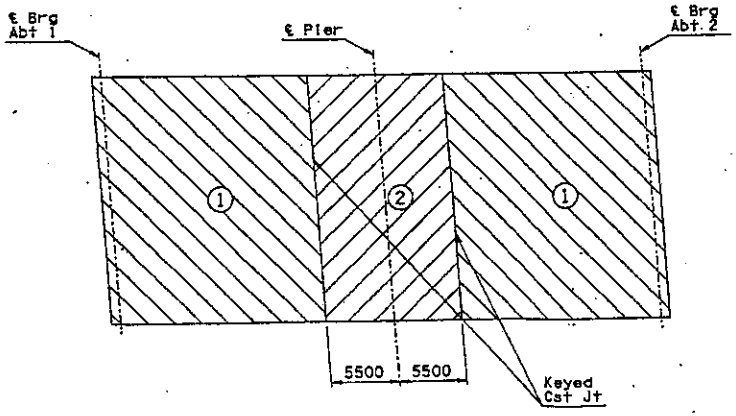
VIEW NAME:

DESIGN FILE: P7SBBRIS.DGN PLOT DATE: 03/19/99 12:09:25

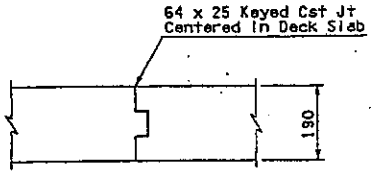
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	586	716	
		101 MA 024			



PARTIAL DECK PLAN - TOP OF SLAB REINFORCEMENT AT PIER
NTS



DECK POUR SCHEDULE
NTS



TYPICAL KEYED CST JT
NTS

POUR NOTES:

1. Numbers ① & ② indicate placing sequence of deck concrete. Pour ② section a minimum of 12 hours after adjacent ① sections have been poured.
2. Intermediate diaphragms and expansion abutment diaphragms may be poured prior to or concurrent with the deck pour.
3. Pier diaphragms shall be poured concurrent with the deck pour.
4. The Contractor shall submit a Deck Pour Schedule to the Engineer for approval prior to placing concrete.

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TST, MEC	3/99
CHECKED	RTD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP TSB BRIDGE OVER CAVE CREEK WASH DECK DETAILS (2 of 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP	PROJ/STRUCTURE NO.
SR 101L	25.90	1486

TRACS NO. H 4830 01 C

600-1(13)

DWG S-6J9

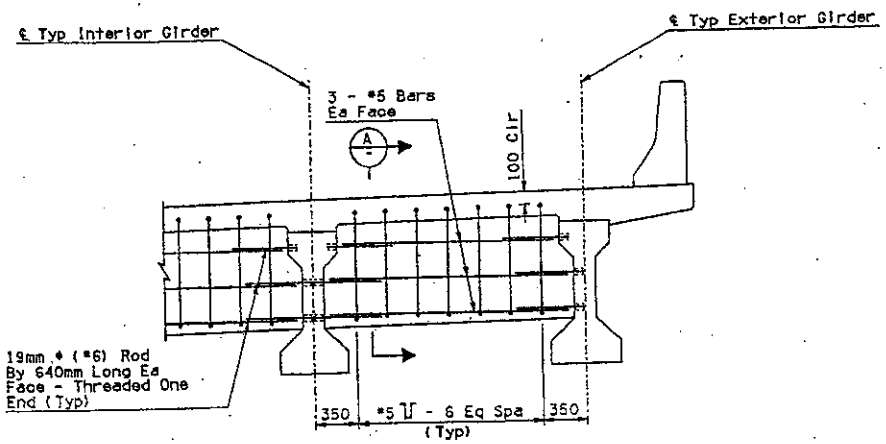
___ OF ___

REDUCED SIZE - DO NOT SCALE

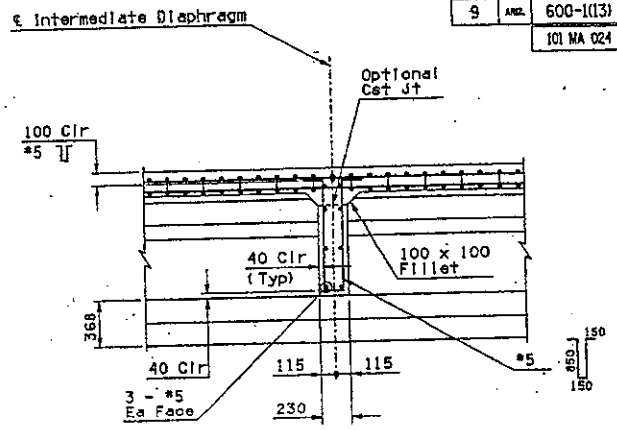
VIEW NAME:

DESIGN FILE: P7SBBRU6.DGN PLOT DATE: 03/19/99 12:18:35

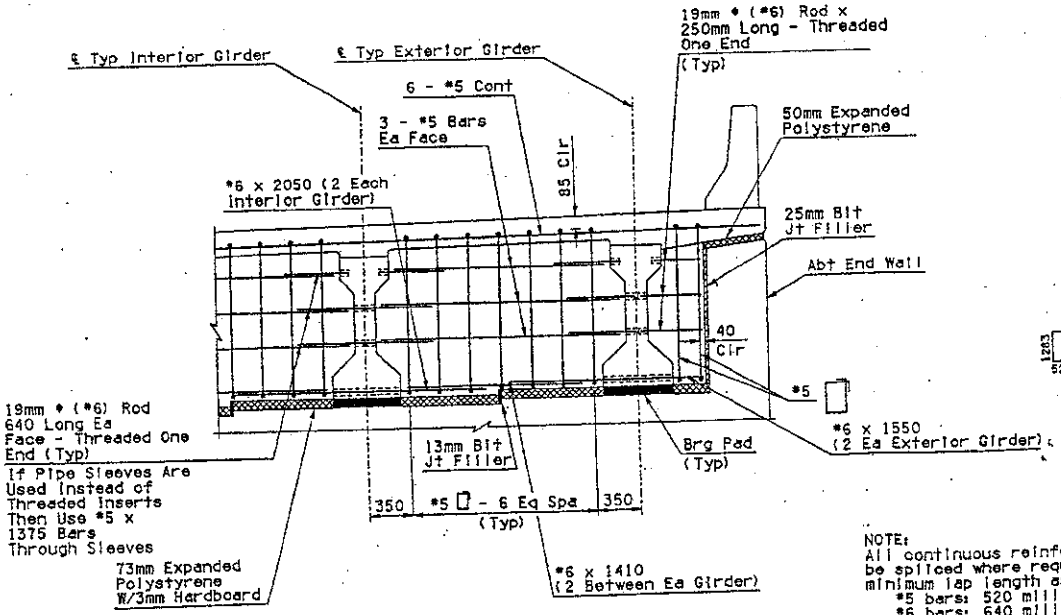
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	587	715	
		101 MA 024			



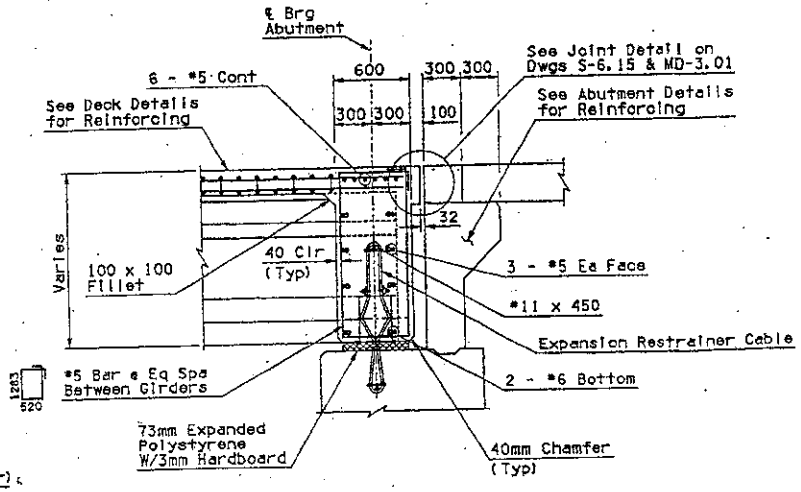
PARTIAL ELEVATION AT INTERMEDIATE DIAPHRAGM
Scale: 1:20



SECTION A
Scale: 1:20



PARTIAL ELEVATION AT ABUTMENT DIAPHRAGMS
Scale: 1:20



ABUTMENT DIAPHRAGM
Scale: 1:20

NOTE:
All continuous reinforcement may be spliced where required with minimum lap length as specified:
*5 bars: 520 millimeter
*6 bars: 640 millimeter

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TSL, WEO	3/99
CHECKED	KTG	3/99

HYDRANOO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ 758 BRIDGE
OVER CAVE CREEK WASH
DIAPHRAGM DETAILS (1 of 2)

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

DWG S-6.20

TRACS NO. H 4830 01 C

600-1(13)

___ OF ___

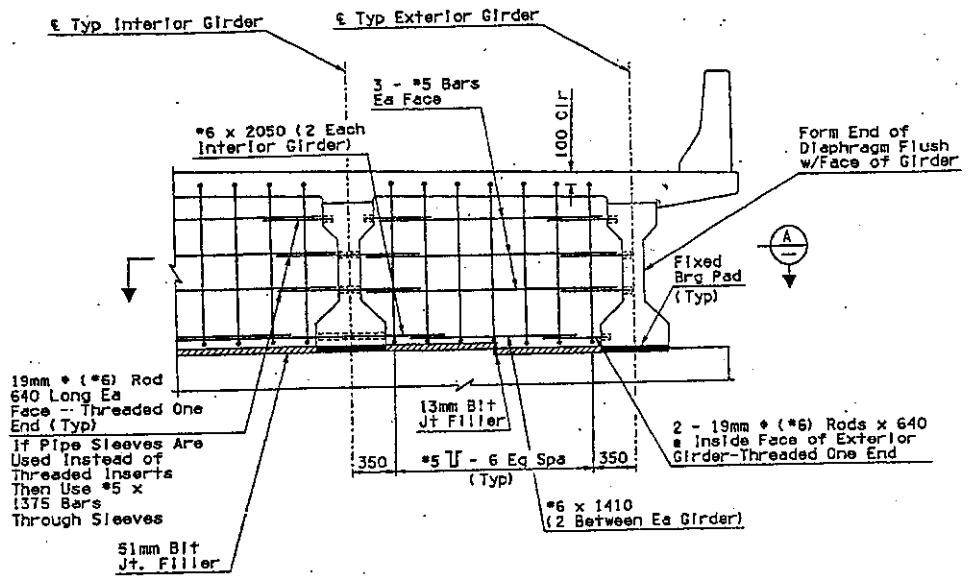
DESIGN FILE: P7SBRRIT.DGN

PLOT DATE: 03/19/99 12:18:45

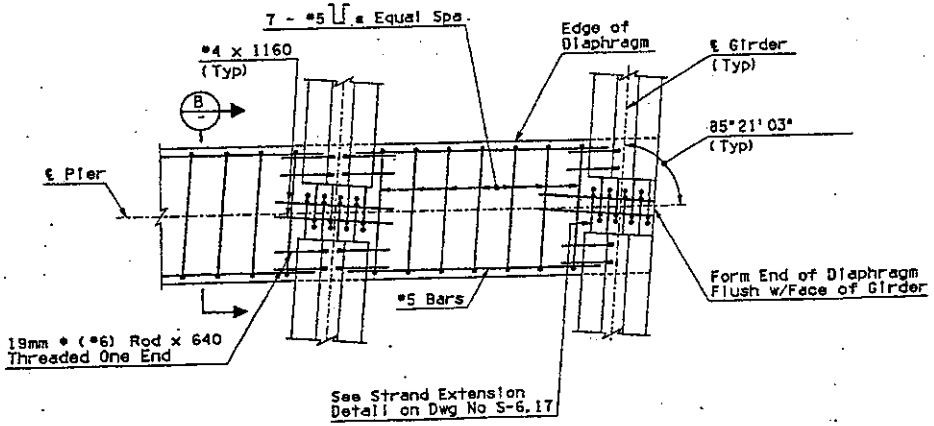
VIEW NAME:

DESIGNED SIZE - DO NOT SCALE

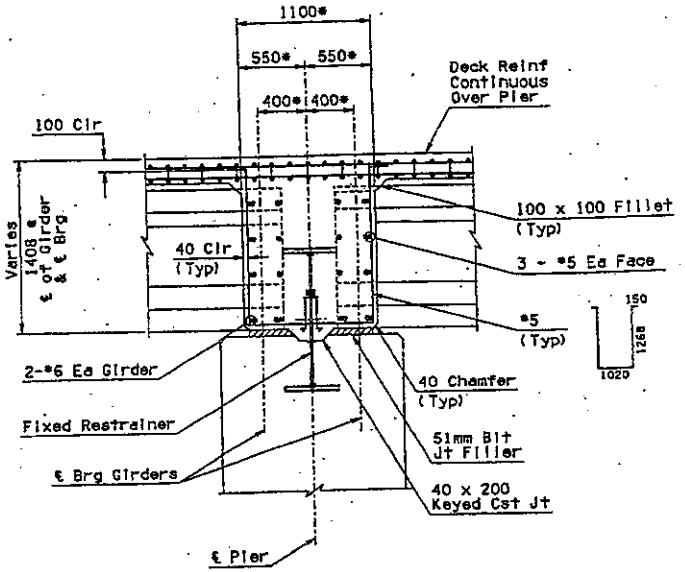
F.A.H.A. DIVISION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	588	716	
		101 MA 024			



PARTIAL ELEVATION AT PIER DIAPHRAGM
Scale: 1:20



SECTION A
Scale: 1:20



SECTION B
Scale: 1:20

NOTE:
Measured Normal to ℄ Brg

	NAME	DATE
DESIGN	KLC	3/99
DRAWN	FST, MEG	3/99
CHECKED	KYO	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ TSB BRIDGE
OVER CAVE CREEK WASH
DIAPHRAGM DETAILS (2 of 2)

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

TRACS NO. H 4830 01 C

600-1(13)

DWG S-6.21

___ OF ___

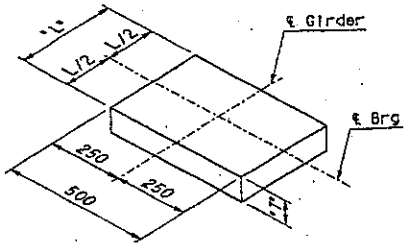
REVIEW TRACT SUPERVISOR

VIEW NAME:

REDUCED SIZE - DO NOT SCALE

DESIGN FILE: P:\S9B818.DGN PLOT DATE: 03/19/99 12:18:55

F.A.P.N.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	589	716	
		101 MA 024			



REINFORCED ELASTOMERIC
BEARING PAD
NTS

REINFORCED ELASTOMERIC
BEARING PAD DESIGN CRITERIA
Design Method A
Elastomer Grade 0

	T	L	Design Load
Abutment	76mm	170mm	479 KN
Pier	51mm	150mm	303 KN

VIEW NAME:

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TSI, WEG	3/99
CHECKED	RTO	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP TSB BRIDGE
OVER CAVE CREEK WASH
MISCELLANEOUS DETAILS

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

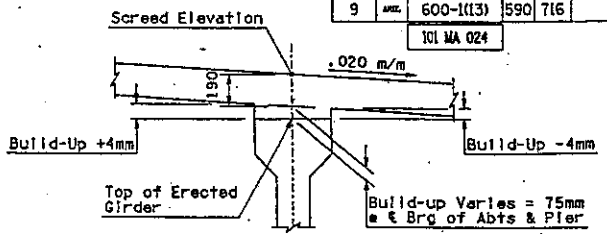
DWG S-6.22

TRACS NO. H 4830 01 C — 600-1(13) — OF

DESIGN FILE: PTSI8819.DGN PLOT DATE: 03/19/99 12:19:09

SCALE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	590	716	
		101 MA 024			



TYPICAL SECTION
NTS

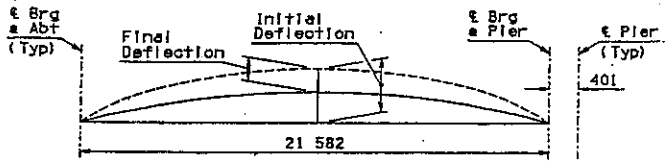
BRIDGE SCREED ELEVATIONS

SPAN 1	℄ Brg Abt #1	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	℄ Brg S1 Pier	℄ Pier
Lt Edge Deck	439.739	439.758	439.775	439.789	439.800	439.809	439.814	439.817	439.817	439.813	439.808	439.808
Girder #1	439.718	439.738	439.755	439.769	439.780	439.788	439.794	439.796	439.796	439.793	439.787	439.787
Girder #2	439.675	439.695	439.712	439.725	439.737	439.745	739.750	439.753	439.752	439.749	439.743	439.744
Girder #3	439.632	439.652	439.668	439.682	439.693	439.701	439.707	439.709	439.709	439.705	439.699	439.700
Girder #4	439.589	439.609	439.625	439.639	439.650	439.658	439.663	439.665	439.665	439.662	439.655	439.656
Rt Edge Deck	439.569	439.588	439.605	439.618	439.629	439.637	439.642	439.645	439.644	439.641	439.635	439.635

SPAN 2	℄ Brg S2 Pier	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	℄ Brg Abt #2
Lt Edge Deck	439.808	439.819	439.828	439.833	439.835	439.835	439.832	439.826	439.817	439.805	439.790
Girder #1	439.788	739.799	439.807	439.812	439.814	439.814	439.811	439.805	439.796	439.784	439.769
Girder #2	439.744	439.755	439.763	439.768	439.770	439.770	439.766	439.760	439.751	439.739	439.725
Girder #3	439.700	439.711	739.719	439.724	4439.726	439.726	439.722	439.716	439.707	439.695	439.680
Girder #4	439.656	439.667	439.675	439.680	439.682	439.682	439.678	439.672	436.663	439.651	439.636
Rt Edge Deck	439.636	439.646	439.654	439.659	439.661	439.661	439.657	439.651	439.642	439.630	439.615

SCREED ELEVATION NOTES:

1. The top of Erected Girder Elevation shall be surveyed in the field at the 1/10 points along the span, by the Contractor, prior to placing deck forming. The Survey information shall be provided to the Engineer a minimum of 15 working days prior to the deck pour, for review and approval. If the top of erected girder encroaches into the deck slab, adjustments to the structure may be necessary.
2. The Screed Elevation includes an allowance for the deflection due to the dead load of the concrete deck slab, diaphragm, barriers, and the effects of long term creep.
3. Screed Elevations shall be used in setting screed regardless of the measured top of erected girder elevations. (DO NOT USE FINISHED GRADE ELEVATIONS FOR SETTING SCREEDS.) Adjustments to the Screed Elevations, if necessary, shall be determined by the Engineer. Top of erected girder elevations taken @ ℄ of girders @ the 1/10 points, prior to placing steel reinforcing shall be supplied to the Engineer for review.
4. The Build-up shall be calculated based on measured top of erected Girder Elevations. The Build-up equals the (Screed Elevation) minus (measured Erected Girder Elevation) minus (the deck slab thickness). The Build-up dimensions at the edge of girder will be plus or minus 4mm as shown in the TYPICAL SECTION above.



CAMBER DIAGRAM
NTS

DEFLECTION NOTES:

1. Initial Deflection equals the deflection the prestressed girder undergoes at the time of erection prior to the diaphragm and deck pours. The Initial Deflection includes the deflection due to the dead load of the girder, the initial prestressing and the effects of creep up to the time of erection.
2. Final Deflection equals the deflection due to the dead load of the deck slab, diaphragms, barriers and the effects of long term creep on the composite continuous girders.

CAMBER DEFLECTIONS									
	Deflections (m)								
Deflection	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Initial	.020	.035	.046	.053	.055	.053	.046	.035	.020
Final	.009	.016	.021	.024	.025	.024	.021	.016	.009

	NAME	DATE
DESIGN	DLC	3/99
DRAWN	TST, MCG	3/99
CHECKED	BTD	3/99

ARIZONA DEPARTMENT OF TRANSPORTATION
MOHAVE DIVISION
BRIDGE GROUP

STA 42+ RAMP TSB BRIDGE OVER CAVE CREEK WASH
SCREED ELEVATIONS

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

PIMA FWY - 19th AVENUE TO CAVE CREEK ROAD, PHASE B

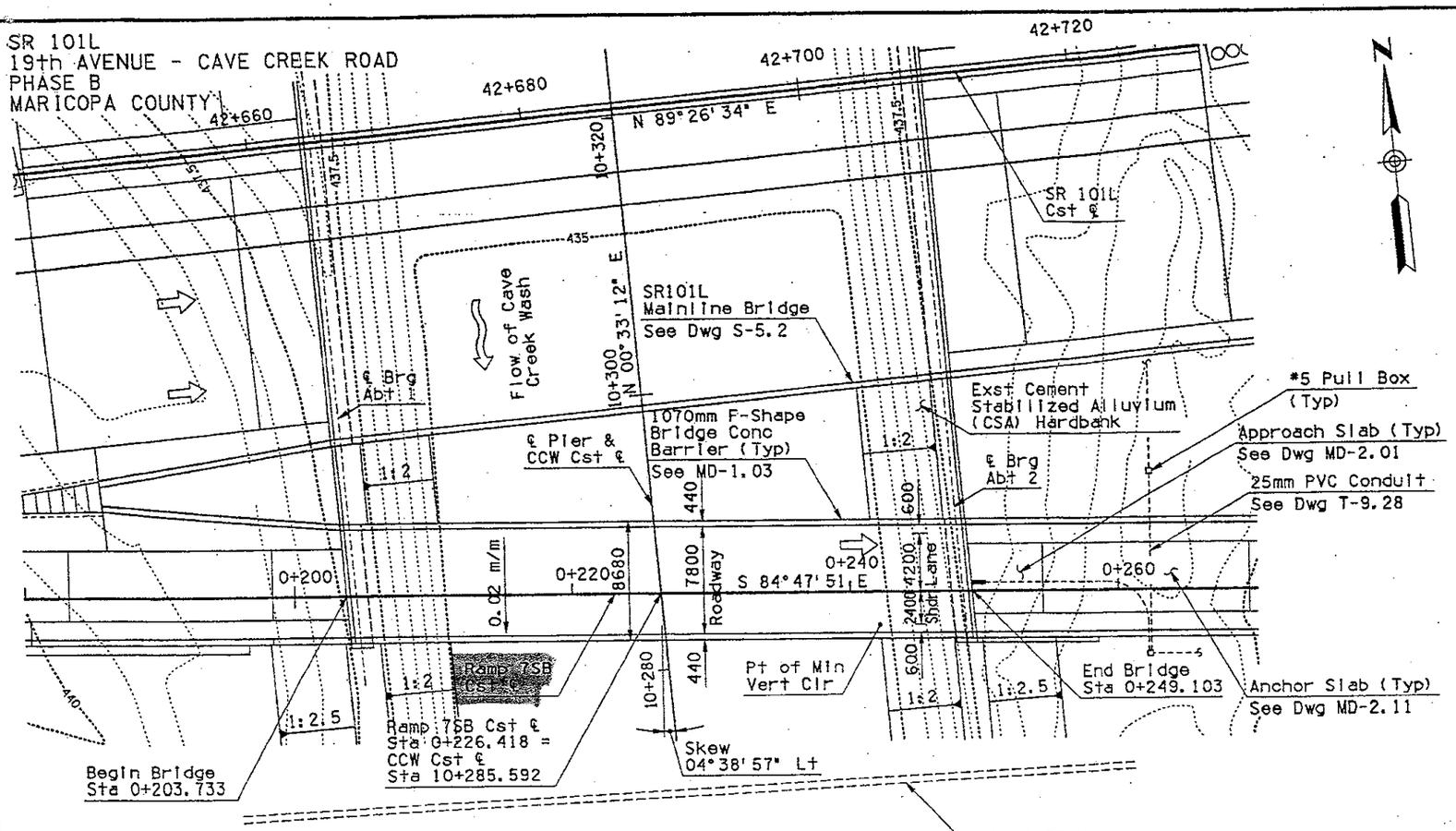
DWG S-6.23

TRACS NO. H 4930 01 C | 600-1(13) | ___ OF ___

DESIGN FILE: PTSBBRZO.DGN PLOT DATE: 03/19/99 12:19:24

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	569	716	
		101 MA 024			

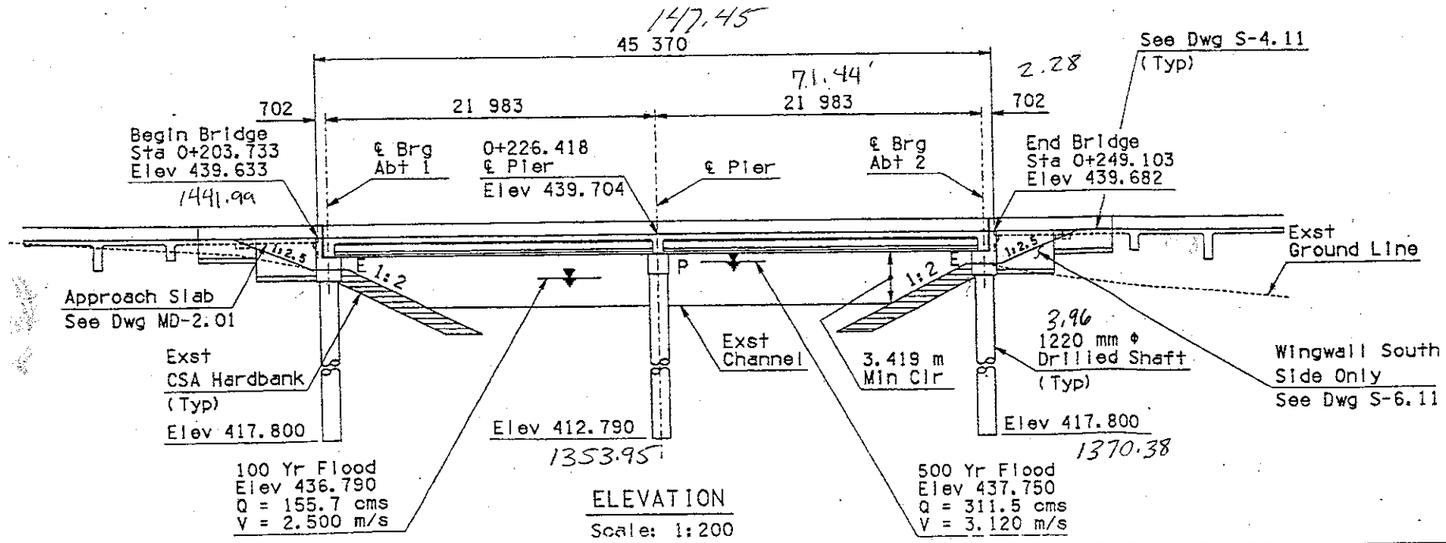
SR 101L
19th AVENUE - CAVE CREEK ROAD
PHASE B
MARICOPA COUNTY



NOTE:
For Walls between bridges,
See Dwg S-5.15.

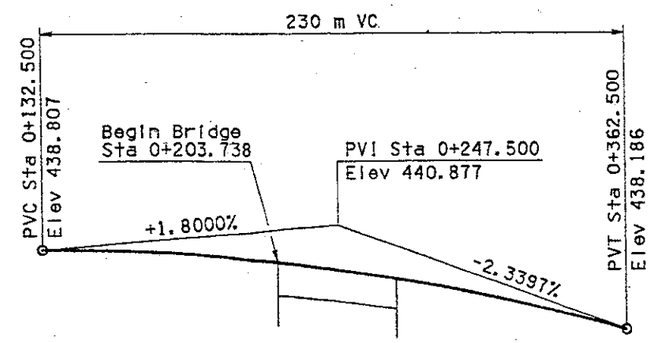
LOCATION PLAN

New 2 - Span Continuous
AASHTO Type III Precast/Prestressed
Concrete Girder Bridge
Contour Interval = 0.5 m
Skew = 04°38'57" Lt
Scale: 1:200



ELEVATION

Scale: 1:200



RAMP 7SB PROFILE GRADE LINE

NTS

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TST, WEG	3/99
CHECKED	KTD	3/99

ENTRANCO

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB BRIDGE
OVER CAVE CREEK WASH
GENERAL PLAN

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

ROUTE	MP POST	STRUCTURE NO.
SR 101L	25.90	1486

DWG S-6.2

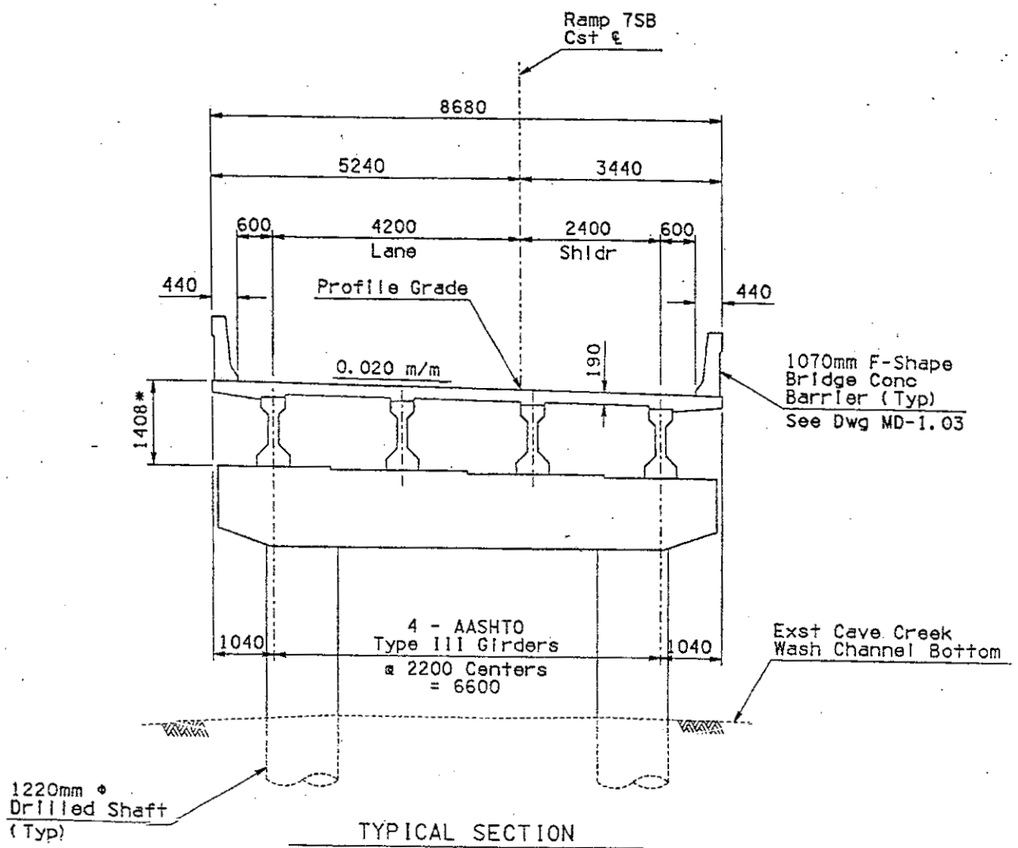
TRACS NO. H 4830 01 C | 600-1(13) | ___ OF ___

REDUCED SIZE - DO NOT SCALE

Metric

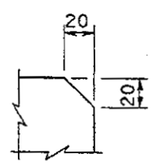
DESIGN FILE: PTSBBR02.DGN PLOT DATE: 03/19/99 12:15:31

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(13)	570	716	
		101 MA 024			



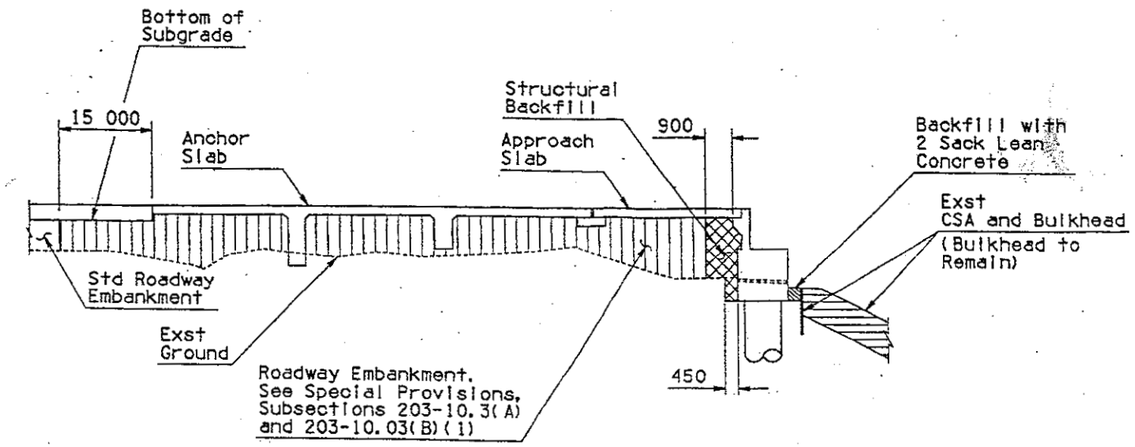
TYPICAL SECTION
Shown Looking Ahead On Station
Scale: 1:50

NOTE:
* Measured from top of deck to bottom of girder @ ℄ girder & ℄ brg.

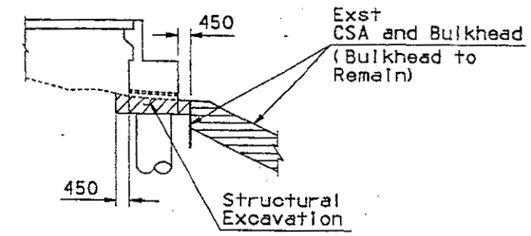


NOTE:
Chamfer all exposed corners unless otherwise noted. This note applicable to all sheets pertaining to the structures & walls.

CHAMFER DETAIL
NTS



LIMITS OF STRUCTURE
EXCAVATION AND STRUCTURAL
BACKFILL AT ABUTMENTS
NTS



LIMITS OF STRUCTURAL
EXCAVATION AT ABUTMENTS
NTS

Bearing Pads: Expansion 8 Ea, Fixed 8 Ea

Approach Slab: 53 m^2

Anchor Slab: 153 m^2

Restrainers: Expansion 12 Ea, Fixed 6 Ea

Bridge Conc Barrier: 89.6 m

APPROXIMATE QUANTITIES

ITEM	STR EX m^3	STR BACKFILL m^3	CLASS 'S' CONCRETE f'c=20 MPa m^3	f'c=25 MPa m^3	f'c=30 MPa m^3	REINFORCING STEEL Kg	AASHTO TYPE III GIRDERS m	COMPRESSION SEAL JOINT m	1220 ϕ DRILLED SHAFTS m	Retaining Wall m^2
Abt # 1	30	30	28	-	-	1510	-	7.9	38.2	17
Pier	-	-	-	26	-	2550	-	-	40.8	-
Abt # 2	30	30	29	-	-	1560	-	7.9	38.2	16
Superstructure	-	-	-	-	98	15,000	175.5	-	-	-
Total	60	60	57	26	98	20,620	175.5	15.8	117.2	33
As-Built Total	-	-	-	-	-		-	-	-	-

	NAME	DATE
DESIGN	CLC	3/99
DRAWN	TST, MEG	3/99
CHECKED	KTO	3/99

ENTRANCO
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
BRIDGE GROUP

STA 42+ RAMP 7SB BRIDGE
OVER CAVE CREEK WASH
SECTION & QUANTITIES

ROUTE	MI POST	STRUCTURE NO.
SR 101L	25.90	1486

PIMA FWY - 19th AVENUE TO
CAVE CREEK ROAD, PHASE B

DWG S-6.3

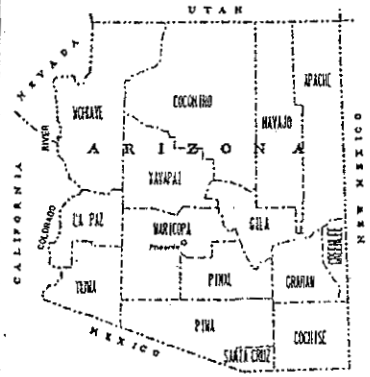
TRACS NO. H 4830 01 C | 600-1(13) | ___OF___

REDUCED SIZE - DO NOT SCALE

VIEW NAME:

DESIGN FILE: P7SBBR03.DGN PLOT DATE: 03/19/99 12:15:44

Bridge #5 (EBFR)



STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

PLAN AND PROFILE OF PROPOSED

STATE HIGHWAY
PIMA FREEWAY (101L)
ACSTP-600-1(6)P
101L MA 022
PHASE A
VOLUME 1 OF 3

ARIZONA DEPARTMENT OF TRANSPORTATION

EBFR 2281

PROPERTY OF
BRIDGE MANAGEMENT
STRUCTURE NO. 2281
RTE, MP 101L @ 25.87

CONSTRUCT FRONTAGE ROADS AND MAINLINE

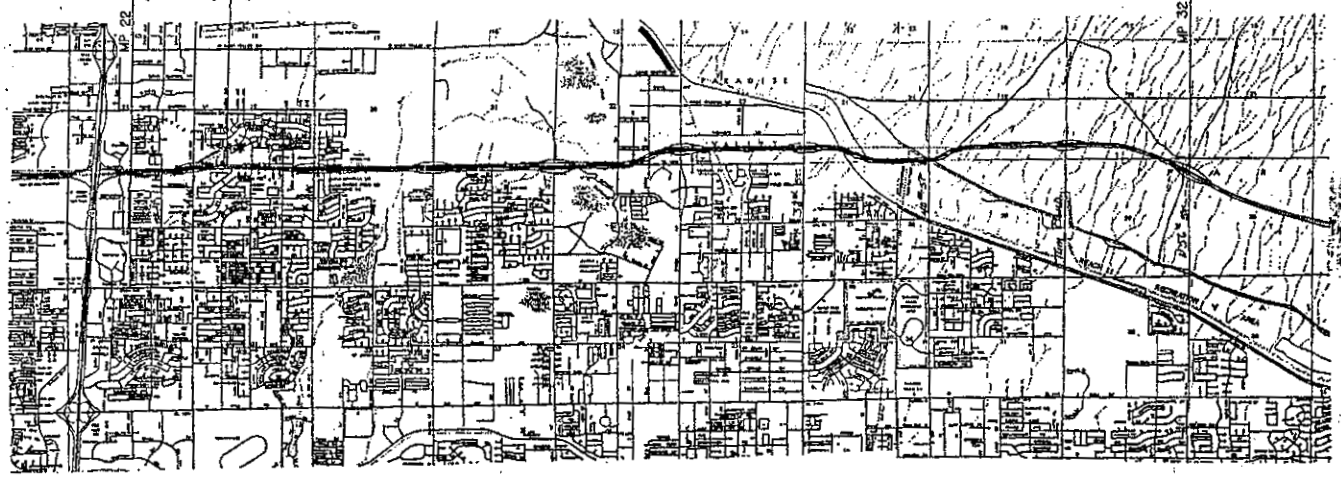
PROJECT

VOL. 1

VOL. 2 & 3

MP 22

MP 32



N

T4N R2,3,4E

PROPERTY OF
BRIDGE MANAGEMENT
STRUCTURE NO.
RTE, MP

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
APPROVED: THOMAS G. SCHMITT
STATE ENGINEER

APPROVED DATE

ASSISTANT STATE ENGINEER

JCT.I 17(23rd AVE.)-56th STREET

TRACS NO. H3565 01 C		ACSTP-600-1(6)P	A1 OF 170

Metric

REDUCED SIZE DO NOT SCALE

F.A.P.N. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	2	170	
		101 L MA 22			

REFERENCES

RAM-600-1-539

MID-POINT OF PROJECT

Central Zone
State Plane Coordinates
x = 133 200
y = 297 200

DESIGN DATA

1992 ADT = 6 645
2015 ADT = 11 035
Min Design Speed = 70 km/h

LENGTH OF PROJECT

N Frt Rd Sta 24+327.66 to 25+402.08 = 1 074.42 m
S Frt Rd Sta 27+164.77 to 28+380.63 = 1 215.86 m
Gross & Net Length = 2 290.28 m = 2.29 km
Kilometer Post
Mile Post

INDEX OF DRAWINGS

Sheet No.	Sheet Type
1	Face Sheet
2	Design Sheet
3 - 5	Standard Drawing Listing
6 - 8	Typical Sections
9	Barrier Summary Sheet
10-12	Curb, Gutter, Sidewalk Summary Sheets
13	New Pipe Sleeve Summary Sheet
14-20	New Pipe Summary Sheets
21-22	Special Details
23-24	19th Ave Joint Layout
25-28	Existing Conditions
29-30	Geometric Plan Sheets
31	Survey Control Points
32-33	Horizontal Control Data
34	Roadway Intersection Sheets
35-40	North Frontage Road Plan and Profiles
41-44	South Frontage Road Plan and Profiles
45-46	Slip Ramp Profiles
47-52	19th Avenue Roadway Plan and Profiles
53-55	Minor Intersection Roadway Plan and Profiles
56-58	Staking Plans
59-63	Gravity Drain Plans and Profiles
64-66	Drainage Plans
67-73	Drainage Profiles
74	Embankment Site
75-76	Channel Plan and Profiles
77-79	Erosion Control Plans
80	Topsoil Plating
81	Traffic Control General Notes
82-106	Traffic Control Plans
107-109	Temporary Signal Plans
110	Signing General Notes
111-115	Sign Summary
116-118	Signing Plan
119-121	Sign Structures
122-129	Pavement Marking Plans
130-137	Traffic Signals
138	Sanitary Sewer Cover Sheet
139	Sanitary Sewer Detail
140-150	Sanitary Sewer Plan and Profiles
151	Water Line Cover Sheet
152-154	Water Line Details
155-170	Water Line Plan and Profiles

EARTHWORK QUANTITIES

Roadway Excavation*	7 320 m3
Drainage Excavation	98 387 m3
Pipe Excess	6 202 m3
Shrink/Swell	6 089 m3
Embankment (Incl Grd Comp)	40 593 m3
Haul to Part B	65 227 m3

Shrinkage Factor = 15%

Ground Compaction = 0.100

GENERAL NOTES

All dimensions and elevations on Roadway Design plan sheets are shown in meters (m) unless noted otherwise.

The project roadway shall be striped by the contractor in accordance with the current edition of the Signing and Marking Standard Drawings (M&S-Series) and the pavement marking plans.

R/W Markers shall be furnished and placed by the contractor, as directed by the Engineer Std C-21.10.

For R/W information not shown, see Right-of-Way project No. BPM-600-1-705

Bench markers will be furnished by the State and shall be placed by the contractor. Std C-21.20.

The contractor shall verify the exact horizontal location and depth of each underground facility.

For superelevation information not shown, see Std C-02.50.

	NAME	DATE
DESIGN		3/97
DRAWN		3/97
CHECKED		3/97

Carter-Burgess

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

DESIGN SHEET

ROUTE 101L LOCATION PIMA FWY-JCT I-17 TO 17TH DRIVE

DWG NO. D-1.01
SHEET 1 OF 1

DESIGN FILE: R:/ADOT/96755 15/010/INDEX.10B PLOT DATE 09-10-97

TRACS NO. H3565 01C | 600-1(6)P | A2 OF 12

REDUCED SIZE DO NOT SCALE

ADOT STANDARD DRAWINGS

F.H.P.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	A4	170	
		101L MA 022			

ISSUE OR REVISION DATE	STANDARD NO.	SUBJECT
		STRUCTURES - 1992
		REINFORCED CONCRETE BOX CULVERTS
6-92	B-01.10	Miscellaneous Details for Standard Box Culverts
6-92	B-01.11	Box Culvert Extension Details
6-92	B-02.10	Single Barrel Box Culvert
	B-02.20	Double Barrel Box Culvert
6-92	B-02.25	Double Barrel Box Culvert
6-92	B-02.30	Triple Barrel Box Culvert
6-92	B-02.35	Triple Barrel Box Culvert
6-92	B-02.40	Four Barrel Box Culvert
6-92	B-02.45	Four Barrel Box Culvert
6-92	B-02.50	Five Barrel Box Culvert
6-92	B-02.55	Five Barrel Box Culvert
6-92	B-02.60	Six Barrel Box Culvert
8-92	B-02.65	Six Barrel Box Culvert
6-92	B-02.70	Culvert Quantities
6-92	B-03.10	4875 mm x 4265 mm Equipment Pass
6-92	B-04.10	Outlet Wings, Culvert Height 900 mm to 2100 mm, Skew 0° to 20°
6-92	B-04.20	Outlet Wings, Culvert Height 2400 mm to 3600 mm, Skew 0° to 20°
6-92	B-04.30	Inlet Wings, Culvert Height 900 mm to 2100 mm, Skew 0° to 20°
6-92	B-04.40	Inlet Wings, Culvert Height 2400 mm to 3600 mm, Skew 0° to 20°
6-92	B-04.50	Outlet Wings, Culvert Height 900 mm to 2100 mm, Skew 25° to 45°
6-92	B-04.60	Outlet Wings, Culvert Height 2400 mm to 3600 mm, Skew 25° to 45°
6-92	B-04.70	Inlet Wings, Culvert Height 900 mm to 2100 mm, Skew 25° to 45°
6-92	B-04.80	Inlet Wings, Culvert Height 2400 mm to 3600 mm, Skew 25° to 45°
6-92	B-05.10	Headwall Quantities, 1:2 Slope
6-92	B-05.20	Headwall Quantities, 1:4 Slope
6-92	B-05.30	Headwall Quantities, 1:6 Slope
6-92	B-06.10	Outlet Apron Details
6-92	B-06.20	Outlet Apron Dimensions & Quantities, 1:2 Slope
6-92	B-06.30	Outlet Apron Dimensions & Quantities, 1:4 Slope
6-92	B-06.40	Outlet Apron Dimensions & Quantities, 1:6 Slope
6-92	B-08.10	Inlet or Outlet Level Wings, Height 900 mm to 2100 mm
6-92	B-08.20	Inlet or Outlet Level Wings, Height 2400 mm to 3600 mm
		REINFORCED CONCRETE HEADWALLS FOR PIPE CULVERTS
6-92	B-11.10	Pipe Culvert Headwalls, Miscellaneous Details
6-92	B-11.11	Inlet and Outlet Headwalls, 460 mm to 1070 mm Pipes
6-92	B-11.12	Inlet and Outlet Headwalls, Right Angle Pipe Culverts, 1220 mm to 2130 mm Pipes
6-92	B-11.13	Inlet and Outlet Headwalls, Skewed Pipe Culverts, 1220 mm to 2130 mm Pipes
6-92	B-11.14	Multipipe Headwalls, 1220 mm to 2130 mm Pipes
6-92	B-12.10	Inlet Headwalls, Right Angle Pipe Culvert
6-92	B-12.20	Inlet Headwalls, Right Angle Pipe Culvert, 1:2 Slope
6-92	B-12.30	Inlet Headwalls, Right Angle Pipe Culvert, 1:4 Slope
6-92	B-12.40	Inlet Headwalls, Right Angle Pipe Culvert, 1:6 Slope
6-92	B-12.50	Outlet Headwalls, Right Angle Pipe Culvert
6-92	B-12.60	Outlet Headwalls, Right Angle Pipe Culvert, 1:2 Slope
6-92	B-12.70	Outlet Headwalls, Right Angle Pipe Culvert, 1:4 Slope
6-92	B-12.80	Outlet Headwalls, Right Angle Pipe Culvert, 1:6 Slope
6-92	B-13.10	Inlet Headwalls, 15° Skew Pipe Culvert
6-92	B-13.20	Inlet Headwalls, 15° Skew Pipe Culvert, 1:2 Slope
6-92	B-13.30	Inlet Headwalls, 15° Skew Pipe Culvert, 1:4 Slope
6-92	B-13.40	Inlet Headwalls, 15° Skew Pipe Culvert, 1:6 Slope
6-92	B-13.50	Outlet Headwalls, 15° Skew Pipe Culvert
6-92	B-13.60	Outlet Headwalls, 15° Skew Pipe Culvert, 1:2 Slope
6-92	B-13.70	Outlet Headwalls, 15° Skew Pipe Culvert, 1:4 Slope
6-92	B-13.80	Outlet Headwalls, 15° Skew Pipe Culvert, 1:6 Slope
6-92	B-14.10	Inlet Headwalls, 30° Skew Pipe Culvert
6-92	B-14.20	Inlet Headwalls, 30° Skew Pipe Culvert, 1:2 Slope
6-92	B-14.30	Inlet Headwalls, 30° Skew Pipe Culvert, 1:4 Slope
6-92	B-14.40	Inlet Headwalls, 30° Skew Pipe Culvert, 1:6 Slope
6-92	B-14.50	Outlet Headwalls, 30° Skew Pipe Culvert
6-92	B-14.60	Outlet Headwalls, 30° Skew Pipe Culvert, 1:2 Slope
6-92	B-14.70	Outlet Headwalls, 30° Skew Pipe Culvert, 1:4 Slope
6-92	B-14.80	Outlet Headwalls, 30° Skew Pipe Culvert, 1:6 Slope
6-92	B-15.10	Inlet Headwalls, 45° Skew Pipe Culvert
6-92	B-15.20	Inlet Headwalls, 45° Skew Pipe Culvert, 1:2 Slope
6-92	B-15.30	Inlet Headwalls, 45° Skew Pipe Culvert, 1:4 Slope
6-92	B-15.40	Inlet Headwalls, 45° Skew Pipe Culvert, 1:6 Slope
6-92	B-15.50	Outlet Headwalls, 45° Skew Pipe Culvert
6-92	B-15.60	Outlet Headwalls, 45° Skew Pipe Culvert, 1:2 Slope
6-92	B-15.70	Outlet Headwalls, 45° Skew Pipe Culvert, 1:4 Slope
6-92	B-15.80	Outlet Headwalls, 45° Skew Pipe Culvert, 1:6 Slope

ISSUE OR REVISION DATE	STANDARD NO.	SUBJECT
		STRUCTURES - 1992
6-92	B-16.10	Multipipe Headwalls without Apron
6-92	B-16.20	Multipipe Headwall with Outlet Apron
6-92	B-17.10	Outlet Aprons
6-92	B-17.20	Outlet Apron Steel List Right Angle
6-92	B-17.30	Outlet Apron Steel List 15° Skew
6-92	B-17.40	Outlet Apron Steel List 30° Skew
6-92	B-17.50	Outlet Apron Steel List 45° Skew
		RETAINING WALLS
6-92	B-18.10	Cantilever Retaining Wall Details
6-92	B-18.20	Cantilever Retaining Walls on Spread Footings
6-92	B-18.30	Cantilever Retaining Walls on Spread Footings
6-92	B-18.40	Cantilever Retaining Walls with Barrier
6-92	B-18.50	Masonry Retaining Walls
		MISCELLANEOUS STANDARDS
~~6-95~~	~~B-19.10~~	~~Miscellaneous Details for Bridges~~
~~6-95~~	~~B-19.11~~	~~Approach Slab Details~~
~~6-95~~	~~B-19.12~~	~~Anchor Slab Details (PCC Pavement Greater than 200 meters)~~
~~6-95~~	~~B-19.13~~	~~Anchor Slab Details (PCC Pavement 100 meters to 200 meters)~~
~~6-95~~	~~B-19.14~~	~~Anchor Slab Details (PCC Pavement less than 100 meters)~~
~~6-95~~	~~B-19.20~~	~~Slope Paving Details, Underpass~~
~~6-95~~	~~B-19.21~~	~~Slope Paving Details, Overpass~~
~~6-95~~	~~B-19.30~~	~~Structural Excavation - Payment Limits~~
~~6-95~~	~~B-19.40~~	~~Structural Backfill - Payment Limits~~
6-92	B-19.50	Structural Excavation & Structural Backfill for R.C.B. Culvert
~~6-95~~	~~B-21.10~~	~~Bridge Concrete Barrier Details~~
~~6-95~~	~~B-21.19~~	~~Bridge Concrete Barrier Transition with Curb~~
~~6-95~~	~~B-21.20~~	~~Bridge Concrete Barrier Transition~~
~~6-95~~	~~B-21.21~~	~~Stack and Terminal Connector Assembly Details~~
6-92	B-21.30	Barrier Junction Box
~~6-95~~	~~B-22.10~~	~~Bridge Pedestrian Rail~~
~~6-95~~	~~B-22.11~~	~~Bridge Pedestrian Rail~~
~~6-95~~	~~B-22.50~~	~~Pedestrian Fence Details with Curb~~
~~6-95~~	~~B-22.60~~	~~Pedestrian Fence Details with Parapet~~
~~6-95~~	~~B-22.70~~	~~1830 mm High Fence Details with Parapet or Barrier~~
~~6-95~~	~~B-23.10~~	~~Rail Bank Protection for Bridges~~
~~6-95~~	~~B-24.20~~	~~Compression Seal Joint, Sheet 01 thru 20~~
~~6-95~~	~~B-24.21~~	~~Compression Seal Joint, Sheet 21 thru 60~~
6-92	B-30.10	Concrete Sound Barrier Walls
6-92	B-30.20	Masonry Sound Barrier Walls
6-92	B-40.10	Tubular Sign Structures, Tubular Cantilever
6-92	B-40.20	Tubular Sign Structures, Tubular Overhead
6-92	B-40.30	Tubular Sign Structures, Foundation Details
6-92	B-40.40	Tubular Sign Structures, Frame Details
6-92	B-40.50	Tubular Sign Structures, Sign Connection Details
6-92	B-40.60	Tubular Sign Structures, Miscellaneous Details

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2287
RTE, MP

ADOT STANDARD DRAWINGS REVISION DATES and STANDARD NO.'s REVIEW.		
	NAME	DATE
STRUCTURES Standards		

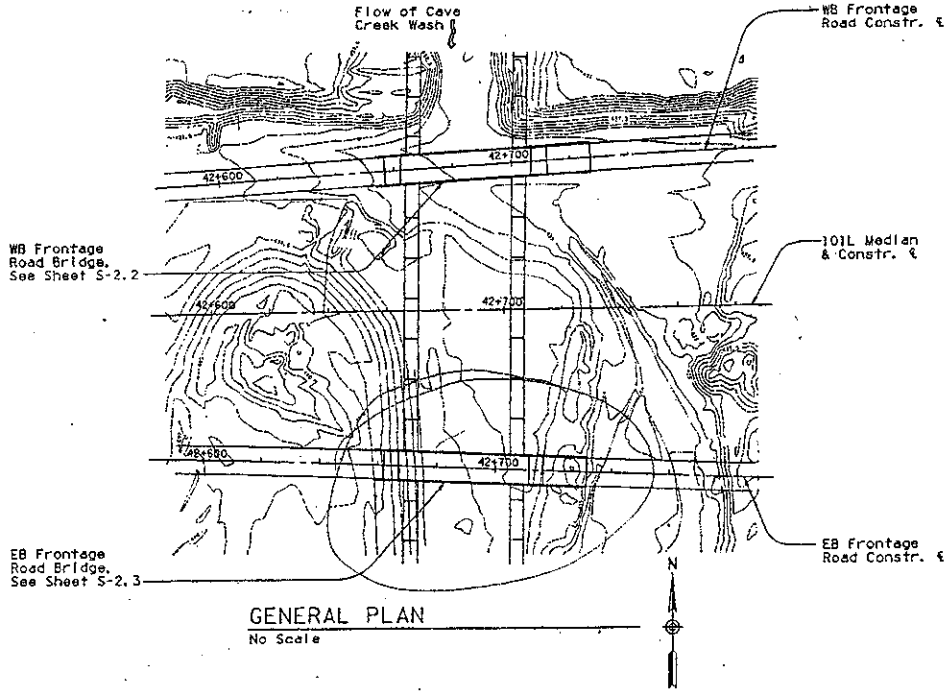
TRACS NO. H3565 01 C | 600-1(6)P | A4 OF 170

Metric

REV. DATE: 08-01-95

REDUCED SIZE DO NOT SCALE

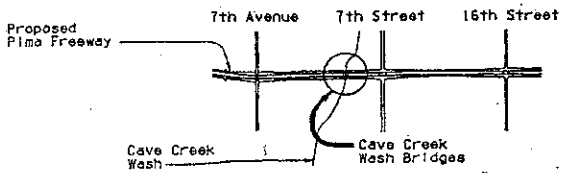
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-I(6)P	8857	1030	
		101L MA 22			



GENERAL PLAN
No Scale

SHEET LIST

Title	Sheet No.
General Plan & Quantities	S-2.1
WB Frontage Road Plan, Elev. & Sect.	S-2.2
EB Frontage Road Plan, Elev. & Sect.	S-2.3
General Notes & Details	S-2.4
Foundation Data	S-2.5 to S-2.8
Foundation Plan & Schedule	S-2.9
Foundation Details	S-2.10
WBFR Abutment Plan & Elev.	S-2.11
EBFR Abutment Plan & Elev.	S-2.12
Abutment Details	S-2.13 to S-2.16
WBFR Pier Plan, Elev. & Dtls.	S-2.17
EBFR Pier Plan, Elev. & Dtls.	S-2.18
Pier Details	S-2.19 to S-2.20
Deck Plan	S-2.21
Deck Section & Details	S-2.22
Deck Details	S-2.23 to S-2.24
Girder Details	S-2.25 to S-2.26
Miscellaneous Details	S-2.27
Screed Elevations	S-2.28



KEY MAP

APPROXIMATE QUANTITIES

	Item	Structural Excavation	Structure Backfill	Class 'S' Concrete 20 MPa	Class 'S' Concrete 25 MPa	Class 'S' Concrete 30 MPa	Bridge Barrier	Deck Joint Assembly	Approach Slab	Anchor Slab	Precast Girder Type III		Vertical Restrainers Expansion	Vertical Restrainers Fixed	Reinf. Steel	Drilled Shaft 1220mm Diam.	
		m^3	m^3	m^3	m^3	m^3	m	m	m^2	m^2	m	No.	Each	Each	Kg	m	No.
WBFR	Abutment 1	30	30	—	45	—	11.4	9.6	52	—	—	—	4	—	4,180	44.6	2
	Pier 1	—	—	—	26	—	—	—	—	—	—	—	—	4	3,030	37.6	2
	Abutment 2	30	30	—	52	—	11.4	9.6	52	154	—	—	4	—	4,290	44.6	2
	Superstructure	—	—	—	—	132	89.3	—	—	—	219.5	10	—	—	22,100	—	—
	Approach Slabs	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Anchor Slab	—	—	—	—	—	20.4	—	—	—	—	—	—	—	—	—	—
	Retaining Walls	80	30	26	—	—	17.6	—	—	—	—	—	—	—	1020	—	—
	Total	140	90	26	123	132	150.1	19.2	104	154	219.5	10	8	4	34,620	126.8	6
	As-Built Total																
EBFR	Abutment 1	30	30	—	45	—	10.9	9.6	55	—	—	—	4	—	4,190	42.8	2
	Pier 1	—	—	—	25	—	—	—	—	—	—	—	—	4	2,920	36.4	2
	Abutment 2	30	30	—	45	—	10.9	9.6	55	156	—	—	4	—	4,190	42.8	2
	Superstructure	—	—	—	—	132	89.1	—	—	—	219.0	10	—	—	22,100	—	—
	Approach Slabs	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Anchor Slab	—	—	—	—	—	23.4	—	—	—	—	—	—	—	—	—	—
	Retaining Walls	50	20	17	—	—	13.2	—	—	—	—	—	—	—	750	—	—
	Total	110	80	17	115	132	147.5	19.2	110	156	219.0	10	8	4	34,150	122.0	6
	As-Built Total																

Notes:

1. Drilled shaft quantities are based on linear meter of drilled shaft including concrete and reinforcing steel in place. See Special Provisions.
2. Wingwall quantities are included in abutment quantities.
3. For limits of Structural Excavation and Structure Backfill, see ADOT. Std. No. SD 5.11 and SD 5.21.

REDUCED SIZE DO NOT SCALE

PROPERTY OF: BRIDGE MANAGEMENT
STRUCTURE NO. 2281
RTE. MP.

	NAME	DATE
DESIGN	R. G.	9/26/97
DRAWN	R. G.	9/26/97
CHECKED	R. G.	9/26/97

Cannon & Associates, Inc.
Consulting Engineers CA/HC40-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
GENERAL PLAN & QUANTITIES

ROUTE 101L | AS FOR | STRUCTURE NO. 8857-2465 (2281)
LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.
DWG NO. S-2.1

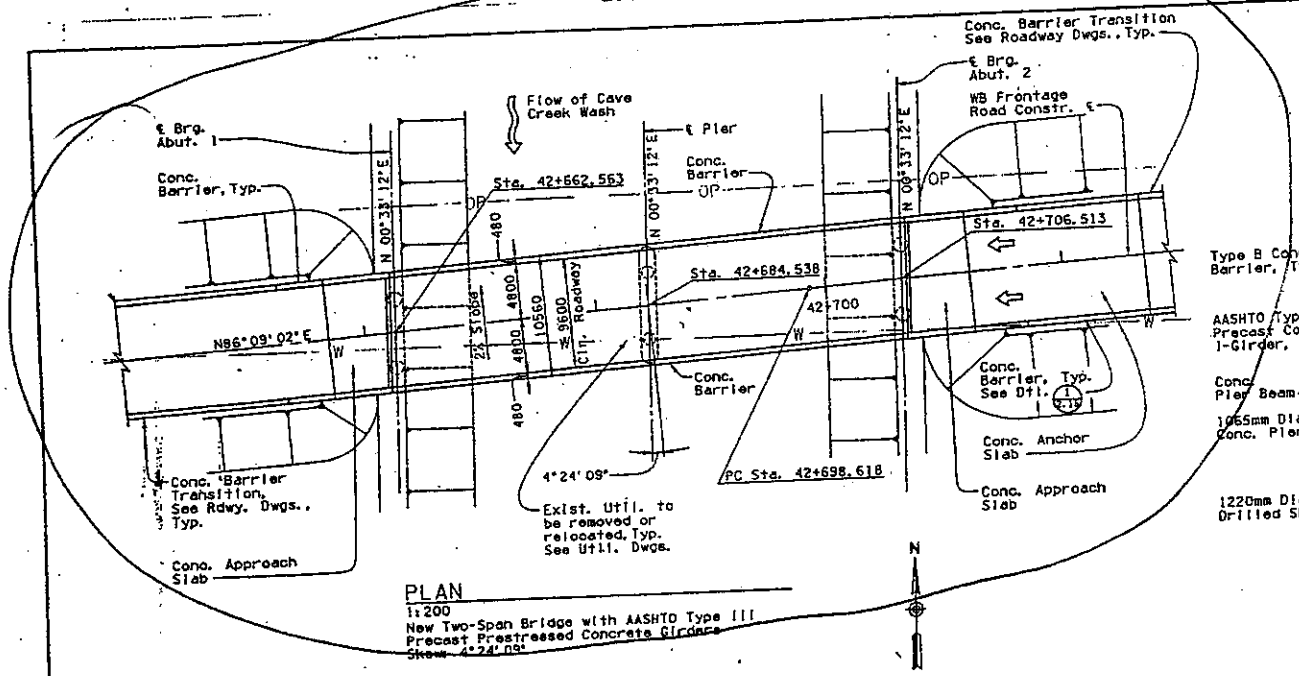
TRACS NO. H 3565 01C | 600-I(6)P | 8857 OF 1030

STRUCTURE NO.
RTE. MP.

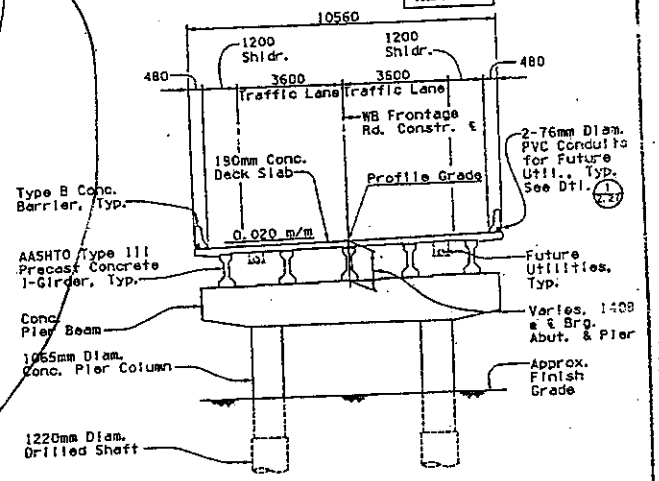
ccccccDGNcSPECIFICATIONcccccc VIEW NAME: CCSHT01.DGN
cccccSYSTIMEccccc

CAUTION! This is WBFR (Struc # 2466)

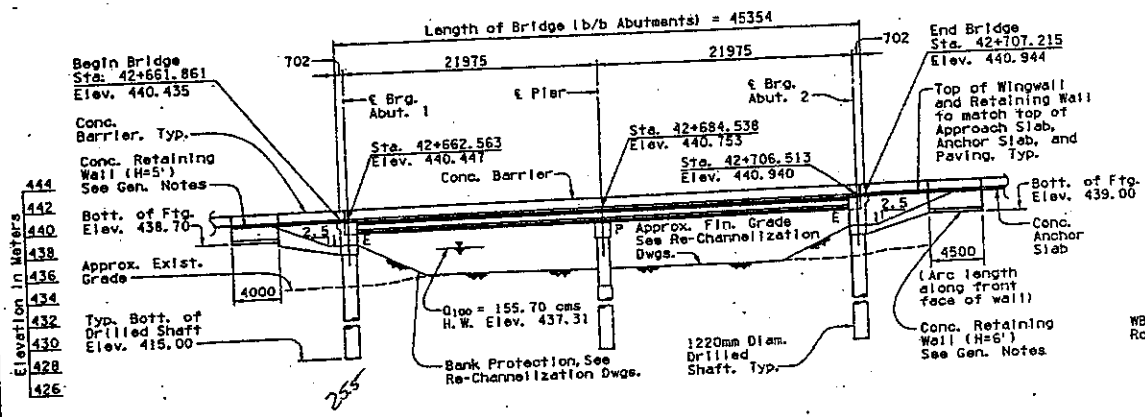
FAILED. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	B858	1030	
		10IL MA 22			



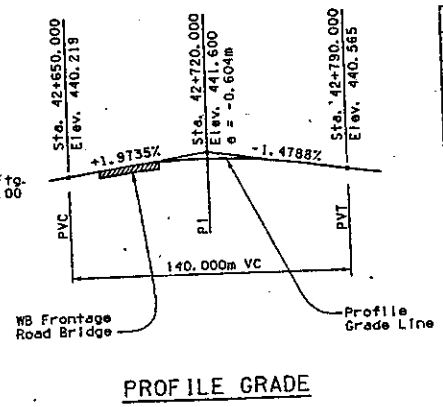
PLAN
1:200
New Two-Span Bridge with AASHTO Type III Precast Prestressed Concrete Girders
Skew 4°24' 09"



TYPICAL SECTION
1:80



ELEVATION
1:200
(Stations, Dimensions & Elevations at top of deck along Construction ℄, u.n.o.)



PROFILE GRADE

CURVE DATA

℄ WB Frontage Road	
PC Sta.	42+698.618
PI Sta.	42+795.058
PT Sta.	42+891.441
T	96.441m
L	192.823m
Δ	3°27' 09"
R	3200.000m

	NAME	DATE
DESIGN	KL CS	9/26/97
DRAWN	DL DV	9/26/97
CHECKED	RL RB	9/26/97

Cannon & Associates, Inc. Consulting Engineers CAINCO-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
WBFR PLAN, ELEV. & SECTION

ROUTE 10IL | NO. POST | STRUCTURE NO. WBFR 2466P EBFR 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.2

TRACS NO. H 3565 01C | 600-1(6)P | B858 OF 1030

REDUCED SIZE DO NOT SCALE

VIEW NAME: CCSHT02.DGN

F.A.P. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	8863	1030	
		101L MA 22			

LOG OF BORING NO. CCB5

LOCATION 101L Sta. 42+154, 50m Rt.
RIG TYPE AP-1000
BORING TYPE 248mm Dual Percussion Hammer
SURFACE ELEV. 571.5m
DATUM State of Arizona

REMARKS	VISUAL CLASSIFICATION
very moist	SILTY SAND & GRAVEL predominantly fine grained gravel, well graded sand, subrounded to subangular, low to medium plasticity, brown
moist to slightly moist hard	SAND, GRAVEL & COBBLES, occasional boulder, some clay, poorly graded sand & gravel, subrounded to subangular, nonplastic to low plasticity, brown
moist very firm to hard	CLAYEY SAND, predominantly medium to fine grained sand, subrounded to subangular, weakly cemented, low to medium plasticity, brown

Stopped Hammer at 21.1m
Stopped Sampler at 27.6m

Date: 11-10-95

Groundwater none

LOG OF BORING NO. CCB6

LOCATION 101L Sta. 42+178, 50m Rt.
RIG TYPE AP-1000
BORING TYPE 248mm Dual Wall Percussion Hammer
SURFACE ELEV. 575.0m
DATUM State of Arizona

REMARKS	VISUAL CLASSIFICATION
slightly moist to moist hard	SAND, GRAVEL & COBBLES, some clay, coarse to medium grained sand, well graded gravel, subrounded to rounded, lime cement, nonplastic, brown note: increase in clay content below 1.52m
moist to very moist hard	CLAYEY SAND, coarse to medium grained sand, some fine grained gravel, subangular to subrounded, weakly to moderately cemented, medium plasticity, dark brown

Stopped Drill at 27.1m
Sampler refused at 27.3m

Date: 11-1-95

Groundwater none

LOG OF BORING NO. CCB7

LOCATION 101L Sta. 42+660, 47m Lt.
RIG TYPE AP-1000
BORING TYPE 203mm Dual-Wall Percussion Hammer
SURFACE ELEV. 575.6m
DATUM State of Arizona

REMARKS	VISUAL CLASSIFICATION
slightly moist very dense	SAND, GRAVEL & COBBLES predominantly medium grained sand, poorly graded subrounded gravel, no lime to weakly lime cemented, nonplastic, brown note: some clay below 4.0m note: possible boulders from 6.4m to 8.0m
slightly moist to moist hard	SANDY SILT, some fine grained gravel, predominantly fine grained sand, low plasticity, brown
slightly moist hard to very firm	SILTY SAND, trace of clay, some to considerable fine grained subangular gravel, weakly to moderately lime cemented, low plasticity, brown

Stopped Hammer at 25.6m
Sampler refused at 21.5m

Date: 4-12-96

Groundwater none

Notes:
For Boring Location Plan and Notes, see Sheet S-2.5

	NAME	DATE
DESIGN	DB	3/26/97
DRAWN	TMP	3/26/97
CHECKED	MB	3/26/97

AGRA Earth & Environmental

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
FOUNDATION DATA

ROUTE 101L | MP POST | STRUCTURE NO. BSFR: 7466 ESFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.7

TRACS NO. H 3565 01C | 600-1(6)P | 8863 OF 1030

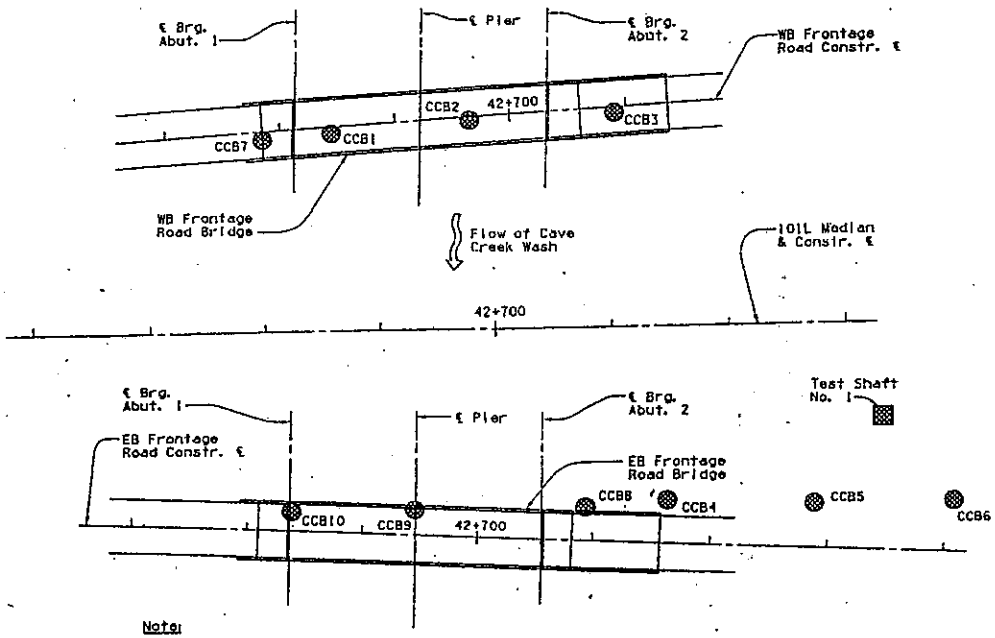
REDUCED SIZE - DO NOT SCALE

Metric

oooooDGN=SPECIFICATIONoooooo
oooooSYSTEMoooooo
VIEW NAME: CCSHT07.DGN

FAR.A. SIGN	STATE	JOB-UNIT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(16)P	8861	1030	

101L MA 22



Note:

● Indicates approximate boring location and identification number (CCB2, etc.). See Foundation Data Sheets S-2.5 through S-2.8 for boring logs.

▩ Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION PLAN

No Scale

N

LOG OF BORING NO. CCB1

LOCATION: 101L STA. 42+572, 49ft Lt.
AIR TYPE: Diamond Drill
BORING TYPE: 140mm Dual Percussion Hammer
SURFACE ELEV.: 436.58
DATUM: State of Arizona

Depth in Meters	Drill Data Water Level	Graphical Log	Sample Type	Blow Counts	Dry Density Kg/m³	Moisture Content %	Unconfined Comp. Strength Kpa	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0.00									slightly moist	SILTY SAND, GRAVEL & COBBLES, trace of boulders, angular to subangular, nonplastic to low plasticity, brown
1.22								GW-GM		
2.44			A					SC	moist to very moist moderately firm	CLAYEY SAND, some fine grained gravel, well graded sand, subrounded to subangular, low to medium plasticity, dark brown
3.66			S	17/ 45 blows						
4.88			A						moist hard	SAND, GRAVEL & COBBLES, trace of clay, occasional boulder, angular, nonplastic to low plasticity, brown
6.10			S	50/ 127 blows				GP-GC		
7.32			A							
8.54										
9.76										
10.98										
12.20			A						moist very firm to hard	CLAYEY SAND, predominantly fine to medium grained sand, subrounded to subangular, mostly to moderately cemented, low plasticity, brown notes some nodules of moderately cemented clay
			S	50/- 21						
13.42								SC		
14.64										
15.86			S	50/- 40						
17.08			A							
18.30			S	50/- 30						
19.52										
20.74										
21.96			S	50/- 50						
23.18			A							
24.40			S	50/- 31						
25.62										Stopped Hammer at 24.4m Stopped Sampler at 24.8m
26.84										
28.06										

Continued on next page

Date: 10-24-95

NOTES:

Information contained on the Foundation Data Sheets is made available to prospective bidders for information purposes only and is not to be considered a part of the contract papers.

Information is developed as accurately as possible by the methods utilized. However, the State accepts no responsibility for any conditions encountered which may be at variance from information contained herein.

The absence of a ground water indication does not constitute a representation that the ground water will not be present during construction. Ground water is indicated herein only when found during the foundation investigation and represents that condition only on the date of the investigation.

Classification of materials is in accordance with the Unified Soil Classification System (ASTM D2487), is based upon field inspection, and is not to be construed to imply mechanical analysis.

The boring logs were prepared by AGRA Earth & Environmental, Inc., the Geotechnical Engineer for the project. For further information, refer to Geotechnical Investigation Report dated January 4, 1996, Foundation Design Report dated January 8, 1996 with Addenda dated May 17, 1996 July 11, 1996, July 15, 1996, July 26, 1996 and October 10, 1996 by AGRA Earth & Enviromental, Inc.

SAMPLE TYPE LEGEND

A - Drill Cuttings
S - 51mm O.D. 35mm I.D. Tube Sample.
U - 51mm I.D. California Tube Sample.
NR - No Recovery

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. _____
RTE, MP _____

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 22
RTE, MP _____

REDUCED SIZE DO NOT SCALE

	NAME	DATE
DESIGN	RB	9/96/97
DRAWN	SJP	9/96/97
CHECKED	MH	9/96/97

AGRA Earth & Environmental

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
FOUNDATION DATA

ROUTE 101L | STRUCTURE NO. WBFTR: 2466 EBFTR: 2467 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.5

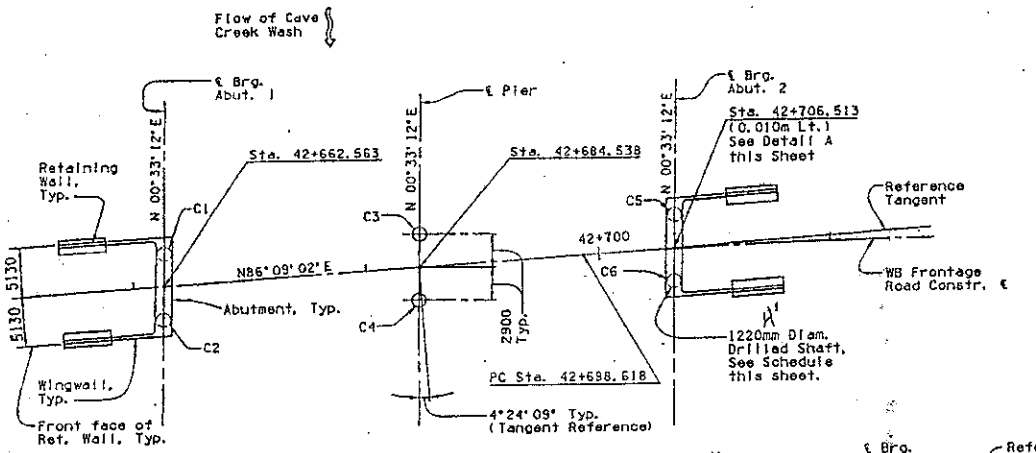
TRACS NO. H 3565 01C | 600-1(16)P | 8861 OF 1030

Metric

VIEW NAME: CCSHT05.DGN

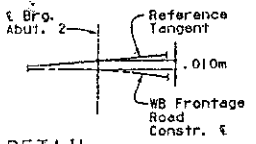
ooooDGNcSPECIFICATIONoooooo
ooooSYSTIMEoooooo

FAILA. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-116P	B865	1030	
		10IL MA 22			



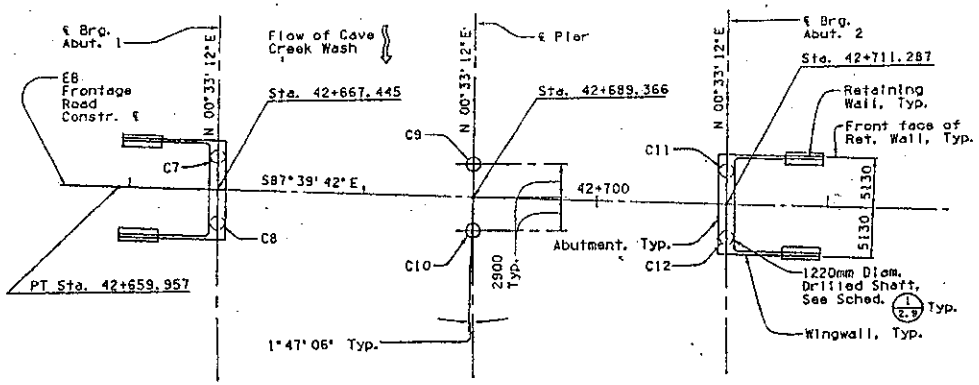
WBFR FOUNDATION PLAN

No Scale



DETAIL (A)

No Scale



EBFR FOUNDATION PLAN

No Scale

Foundation Plan Notes:

1. See General Notes, Sheet S-2.4
2. Abutment and piers are to be supported on 1220mm diameter cast-in-place concrete drilled shafts with a minimum allowable downward capacity of 2400 kN.

   Excavation of adjacent drilled shafts within 4 shaft diameters measured center to center will not be permitted until 48 hours after the adjacent drilled shaft has been concreted.

   Tops of drilled shafts shall be within 40mm of plan dimensions and shall not deviate more than 15mm in 1 meter from plumb.

   Construction joints not shown on the project plans will require approval of the Engineer prior to construction.

   Contractor shall be responsible for providing support of reinforcing cages during fabrication, erection and placement of concrete. Plans showing reinforcing cage support and methods of erection shall be submitted to the Engineer for review and approval prior to construction.

   Vertical reinforcement shall consist of as long a length bars as practical with lap splices located in lower portion of shafts.

   Contractor may select any one of the abutment shafts as the required Confirmation Shaft. See Special Provisions.
3. Retaining walls are to be supported on spread footings that bear on undisturbed native soil or engineered fill with a minimum allowable bearing capacity of 100 kPa.

	Mark	Top of Conc. Column Elev.	Drilled Shaft Cut-off Elev.	Bott. of Drilled Shaft Elev.	Detail	Location
WBFR	C1	—	437.275	415.000	1/2.10	Abut. 1
	C2	—	437.275	415.000	1/2.10	Abut. 1
	C3	437.814	433.800	415.000	2/2.10	Pier
	C4	437.814	433.800	415.000	2/2.10	Pier
	C5	—	437.275	415.000	1/2.10	Abut. 2
	C6	—	437.275	415.000	1/2.10	Abut. 2
EBFR	C7	—	436.375	415.000	1/2.10	Abut. 1
	C8	—	436.375	415.000	1/2.10	Abut. 1
	C9	436.733	433.200	415.000	2/2.10	Pier
	C10	436.733	433.200	415.000	2/2.10	Pier
	C11	—	436.375	415.000	1/2.10	Abut. 2
	C12	—	436.375	415.000	1/2.10	Abut. 2

DRILLED SHAFT SCHEDULE

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2281 (1)
RTE. MP

	NAME	DATE
DESIGN	R. C.	9/26/97
DRAWN	M. D.	9/26/97
CHECKED	M. M.	9/26/97

Cannon & Associates, Inc.
Consulting Engineers C-00000-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
FOUNDATION PLAN & SCHEDULE

ROUTE 10IL | ALL POST | STRUCTURE NO. WBFR: 2466 EBFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.9

600-116P

B865 OF 1030

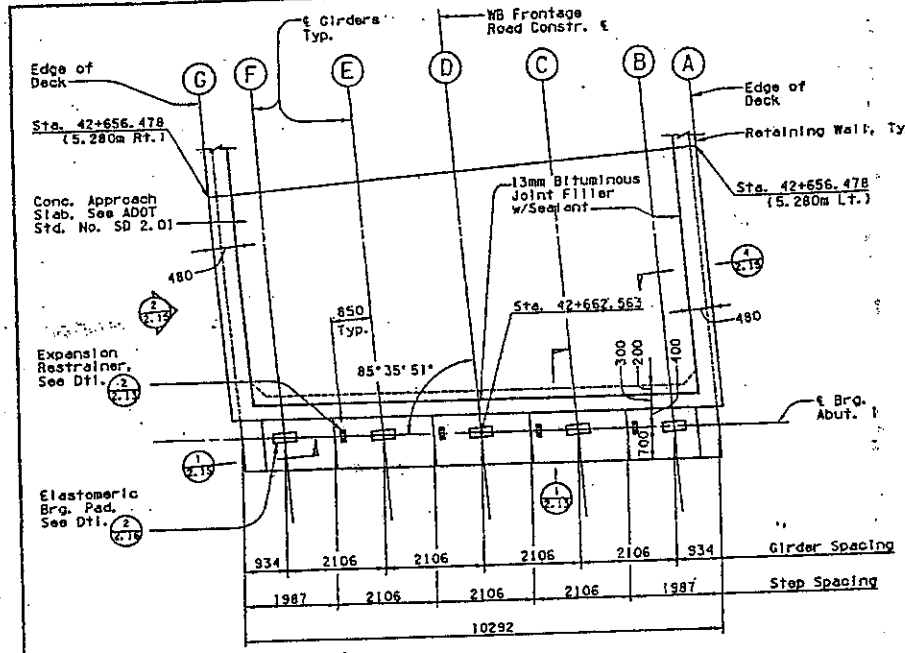
REDUCED SIZE - DO NOT SCALE

Metric

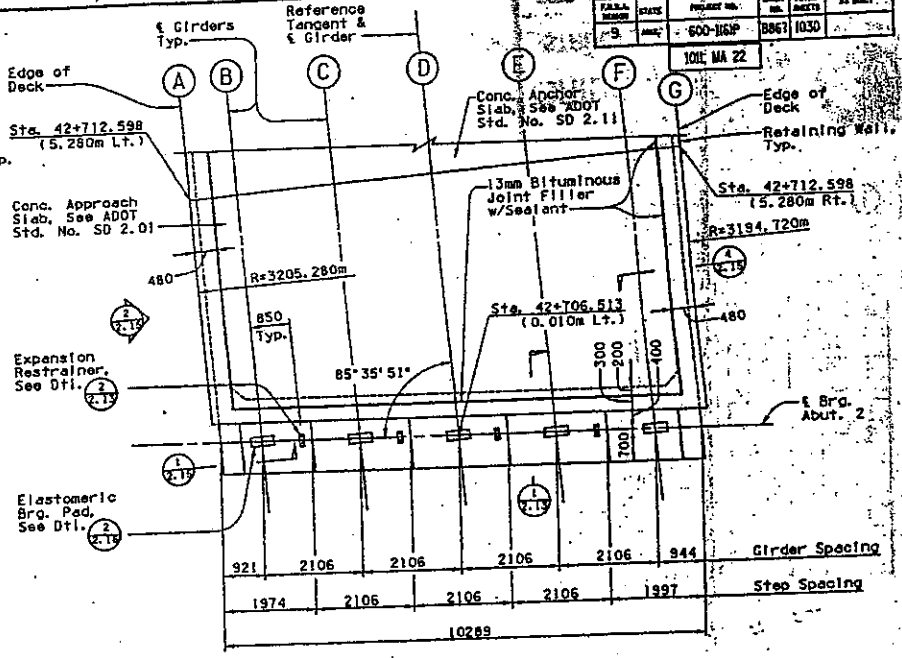
TRACS NO. H 356 OTB

VIEW NAME: CCSHT09.DGN

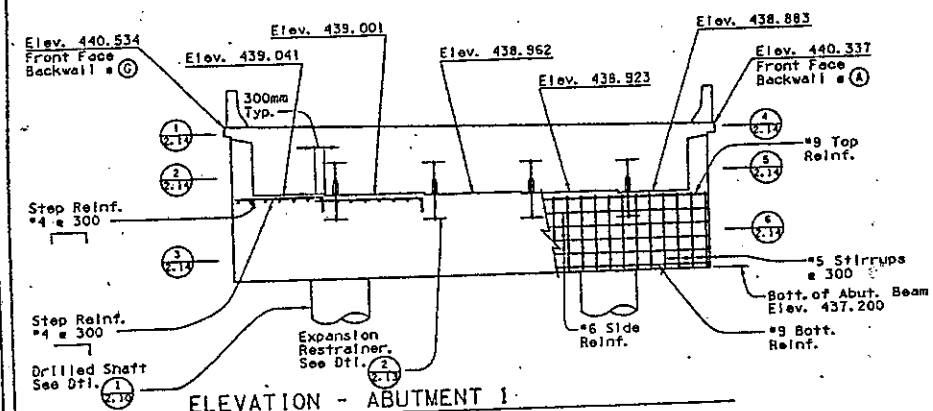
PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO.
RTE. MP



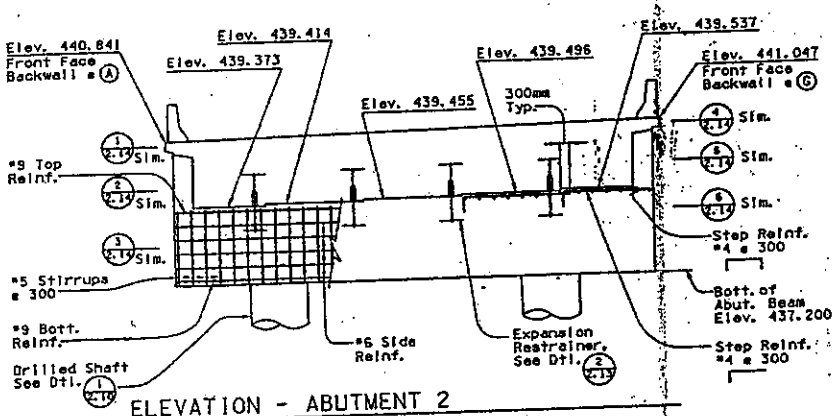
PLAN - ABUTMENT 1
1:50



PLAN - ABUTMENT 2
1:50



ELEVATION - ABUTMENT 1
1:50



ELEVATION - ABUTMENT 2
1:50

NOTES:

1. See General Notes, Sheet S-2.4.
2. Girder Bearing Elevations are to top of concrete.
3. Provide #4 Step Reinf. @ 300 each way where conc. coverage above #9 Top Reinf. exceeds 100mm.

F.A.P. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1161P	8867	1030	

101L MA 22

DESIGN	KK	9/26/97	
DRAWN	KL	9/26/97	
CHECKED	RL	9/26/97	

Carson & Associates, Inc. Consulting Engineers CA#0401

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
WBFR ABUTMENT PLAN & ELEV.

PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.11

101L | EXECUTIVE DIR. WBFR: 2466 EBFR: 2281

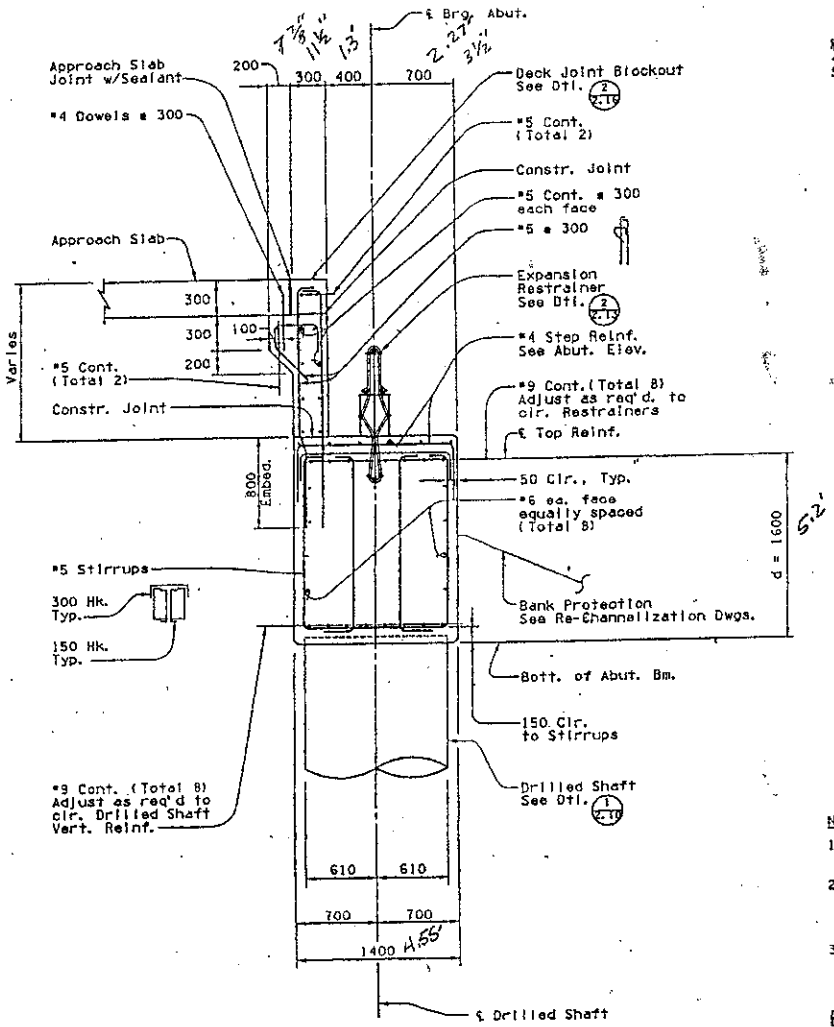
TRACS NO. H 3565 01C | 600-1161P | 8867 OF 1030

REDUCED SIZE - DO NOT SCALE

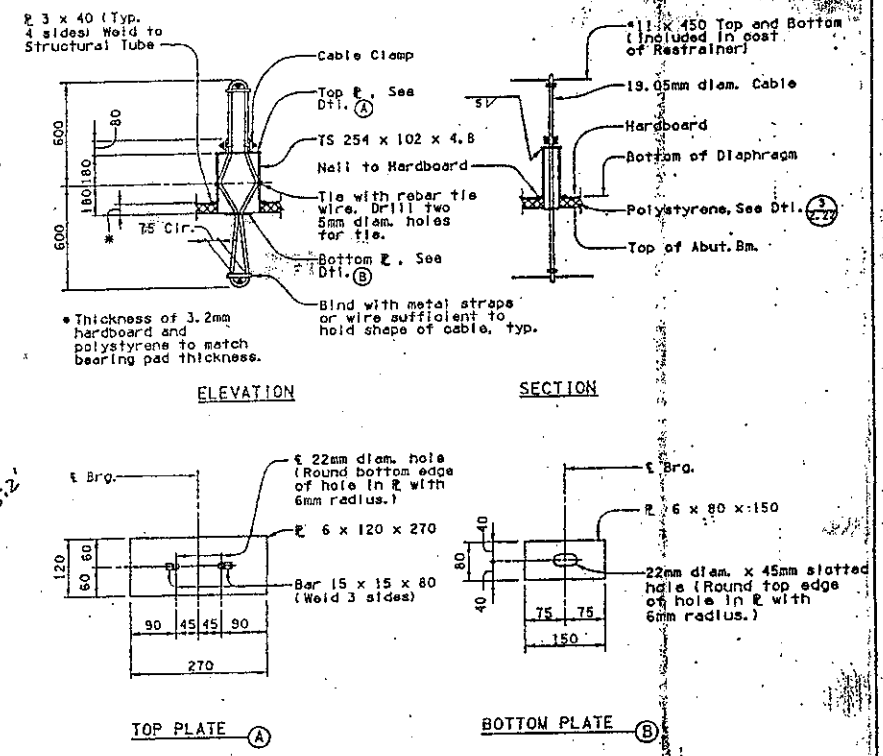
Metric

CCSSOCGNoSPECIFICATIONoooooo
oooooSYSTIMEoooooo VIEW NAME: CCSHT1.DGN

F.A.P.I. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-116IP	8869	1030	
		101L MA 22			



SECTION 1
1:20



Notes:

1. Seal all openings in structural tube to prohibit concrete intrusion.
2. Restrainer cables shall be 19.05mm diam. preformed 6 x 19 galvanized cable with minimum breaking strength of 187 kN. A one meter long sample of cable shall be furnished to the Engineer for testing.
3. For additional information not shown or noted, see Standard Specifications.

EXPANSION RESTRAINER DETAIL 2
No Scale

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2287
RTE. MP.

REDUCED SIZE - DO NOT SCALE

Metric

DESIGN	RK. G	3/26/91
DRAWN	RK. G	3/26/91
CHECKED	RK. W	3/26/91

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Consulting Engineers CA3400-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
ABUTMENT DETAILS

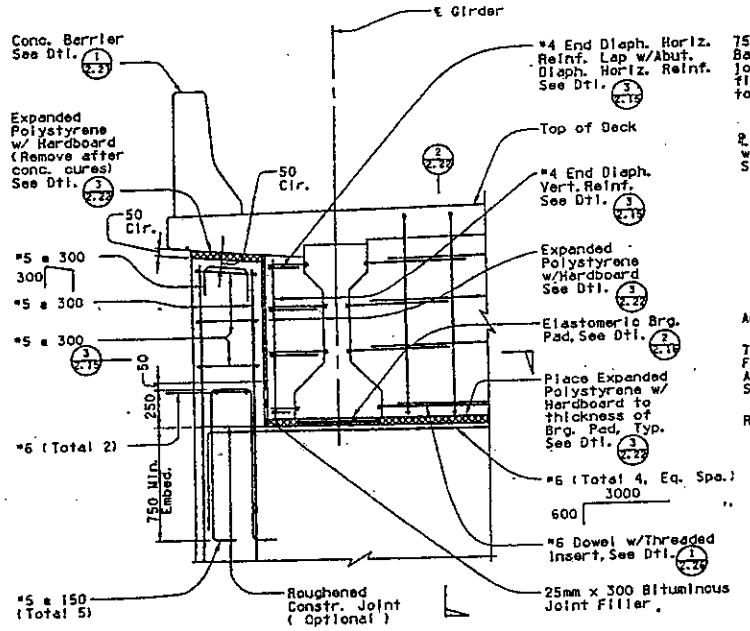
ROUTE 101L | NO. POLE | STRUCTURE NO. WBFTR: 2466 EBFTR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DSG NO. S-2.13

TRACS NO. H 3565 OIC | 600-116IP | 8869 OF 1030

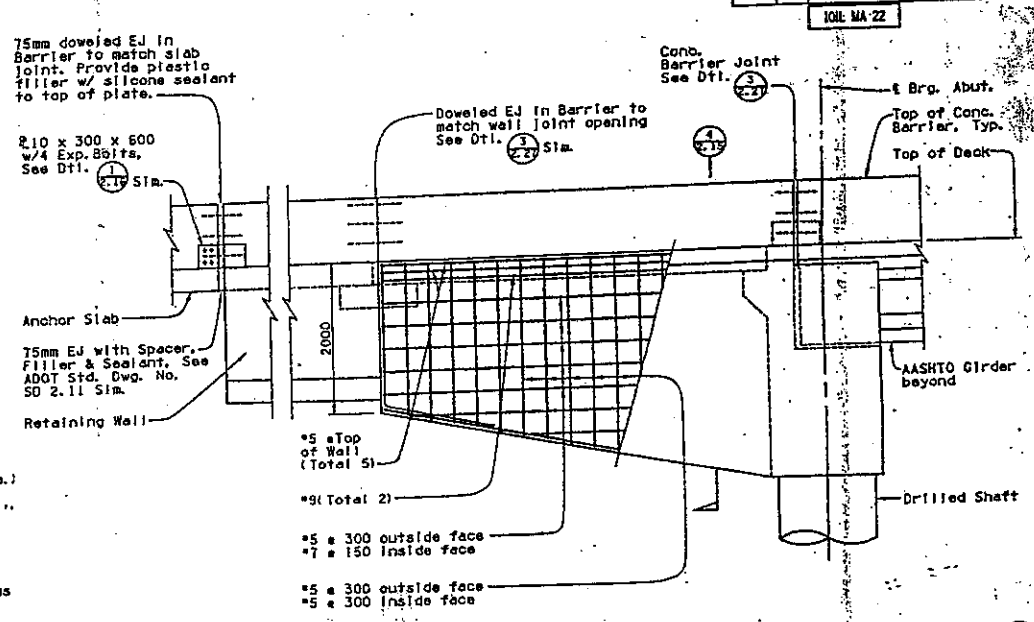
DGN=SPECIFICATION=====
=====SYSTEM=====
VIEW NAME: CCS11713.DGN

F.A.P. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	NO. SHT.
9	ARIZ.	600-I(6)P	B871	1030	
		10IL MA 22			



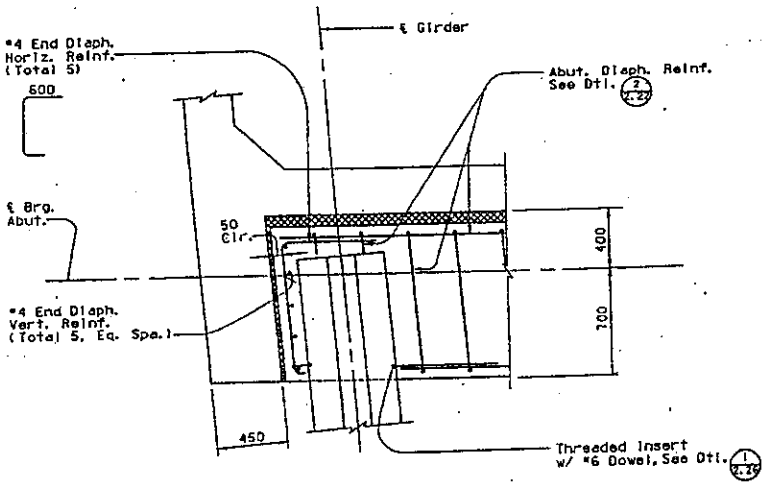
SECTION - KEY (1)

1:15



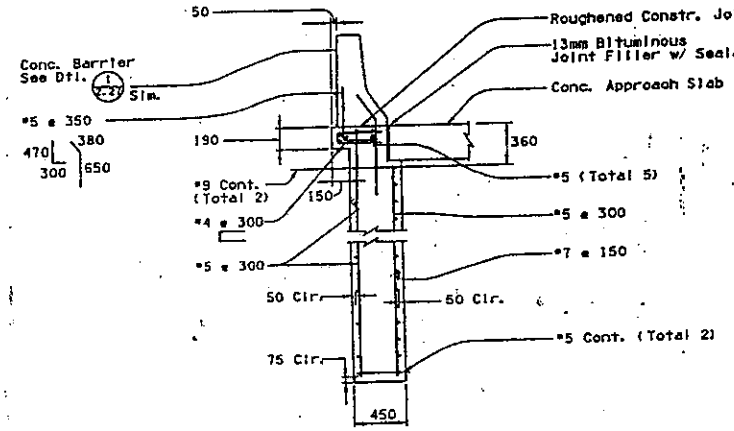
TYP. WINGWALL ELEVATION (2)

1:30



PLAN - ABUTMENT END DIAPHRAGM (3)

1:15



TYP. WINGWALL SECTION (4)

1:20

	NAME	DATE
DESIGN		
DRAWN		
CHECKED		

Cannon & Associates, Inc.
Consulting Engineers CAN-001-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
ABUTMENT DETAILS

STRUCTURE NO. BRIFRs 2466 EBFRs 2281

LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.15

10IL

TRACS NO. H 3565 01C

600-I(6)P

B871 OF 1030

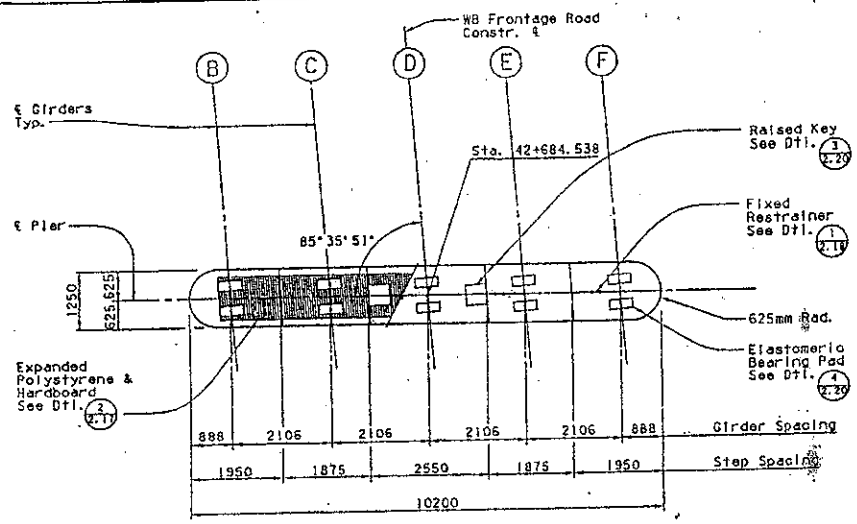
REDUCED SIZE. DO NOT SCALE

Metric

eeeeeDGNoSPECIFICATIONeeeee
eeeeeSYSTIHEeeeee

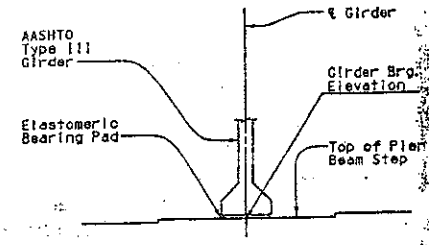
VIEW NAME: CCSHTIS.DGN

F.A.P.N. NUMBER	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	B873	1030	
		JOIL MA 22			



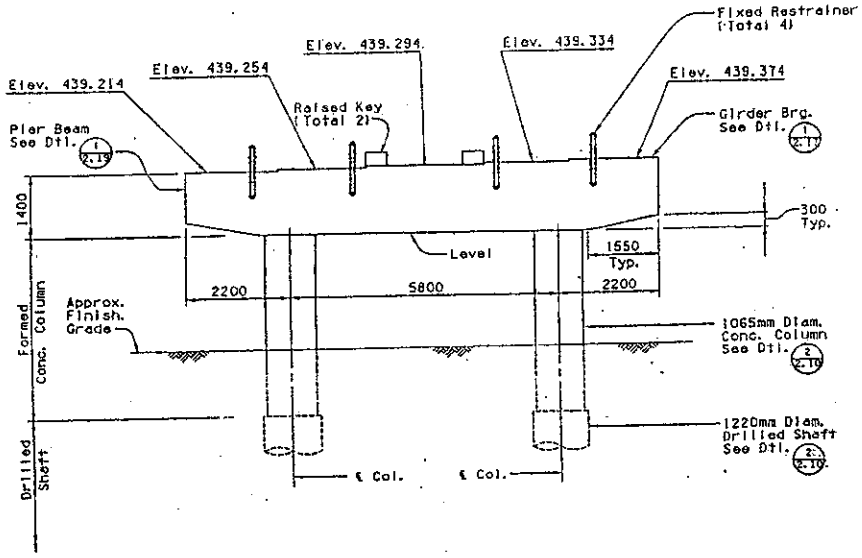
PLAN - WBFR PIER

1:50



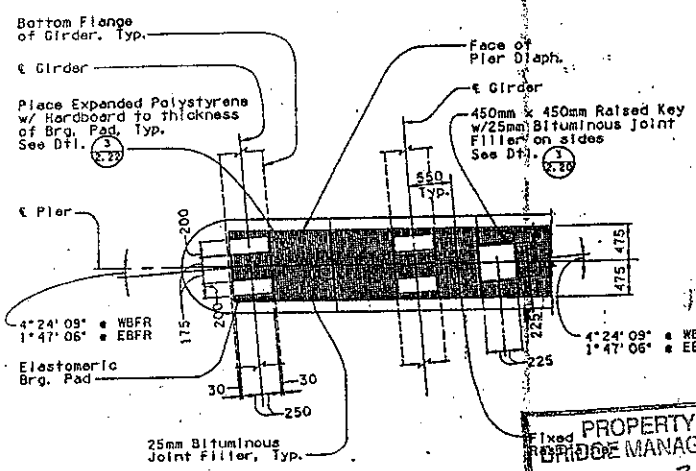
GIRDER BEARING DETAIL 1

No Scale



ELEVATION - WBFR PIER

1:50



PARTIAL PLAN - PIER 2

1:30

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 22 81
RTE. MP.

REDUCED SIZE - DO NOT SCALE

Metric

	NAME	DATE
DESIGN	R.S. CS	9/26/97
DRAWN	R.L. CF	9/26/97
CHECKED	R.T. RB	9/26/97

Cannon & Associates, Inc.
Consulting Engineers CANCINO

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
WBFR PIER PLAN, ELEV. & DTLS.

ROUTE: 10IL
NO. POST
STRUCTURE NO.: WBFR: 2466, EBFR: 2281
LOCATION: PIMA FWY-JCT. I-17 TO 56TH ST.
DWG NO. S-2.17

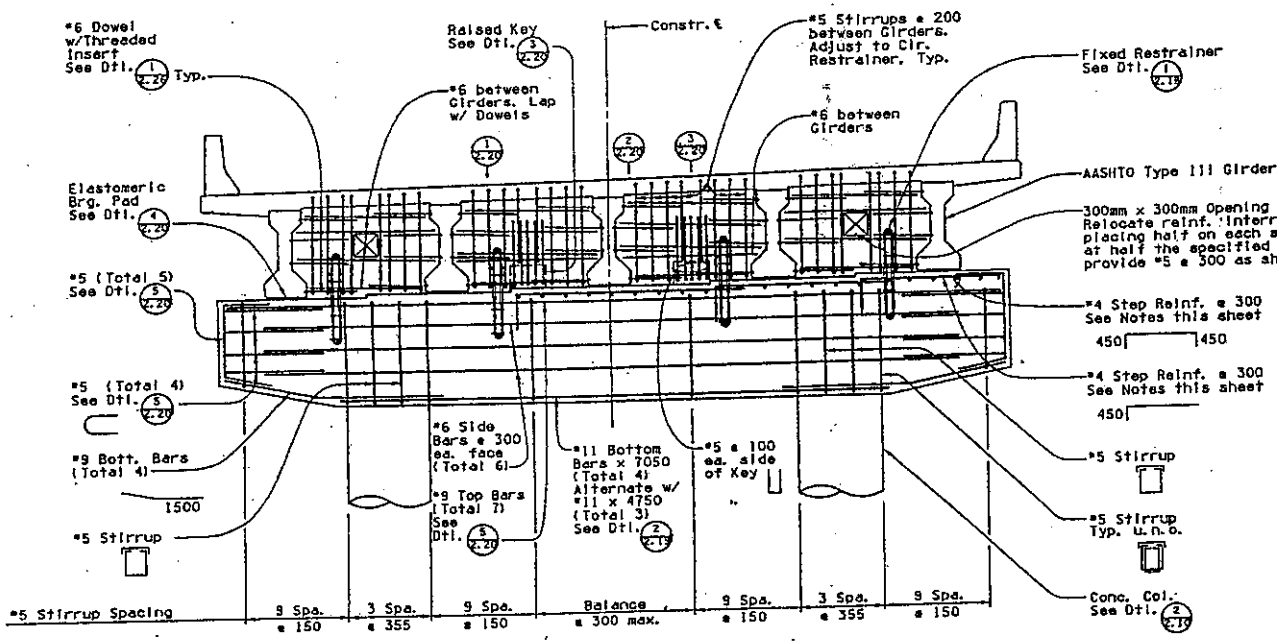
TRACS NO. H 3565 01C
600-1(6)P
B873 OF 1030

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO.
RTE. MP.

eeeeeDGNeSPECIFICATIONeeeeee
eeeeeSYSTIMEeeeee
VIEW NAME: CCSH717.DGN

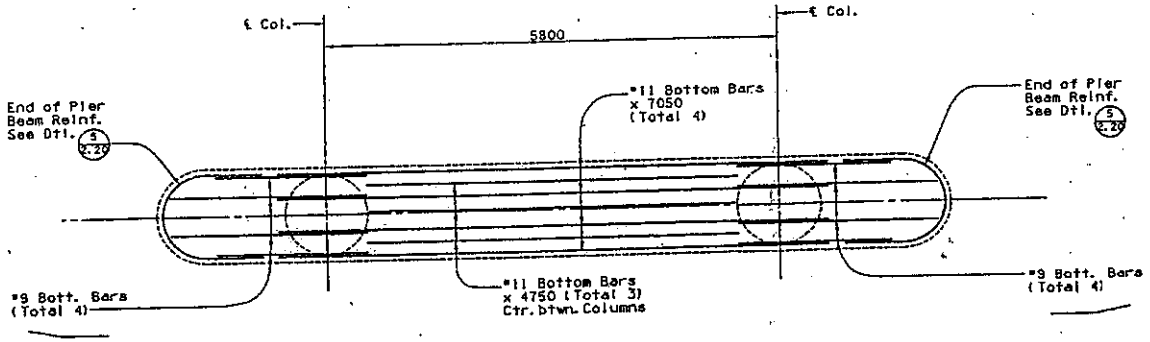
F.A.S.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-H6JP	8875	1030	

10IL MA 22



PIER REINFORCING - ELEVATION (1)

1:30

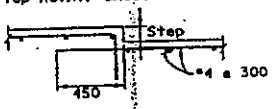


BAR PLACING DIAGRAM - BOTTOM OF PIER BEAM (2)

1:30

Notes:

1. See General Notes, Sheet S-2.4
2. Adjust pier beam reinf. to clear column vertical reinf. See Dtl. 2/2.19 All adjustments subject to approval of the Engineer.
3. Provide *4 Step Reinf. @ 300 each way where conc. coverage above *9 Top Reinf. exceeds 100mm



			DATE
DESIGN	R. G.		3/96
DRAWN	R. G.		3/96
CHECKED	R. G.		3/96

Cannon & Associates, Inc.
Consulting Engineers

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
PIER DETAILS

STATE 10IL | STRUCTURE NO. WBFR: 2466 EBFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.19

TRACS NO. H 3565 01C | 600-H6JP | 8875 OF 1030

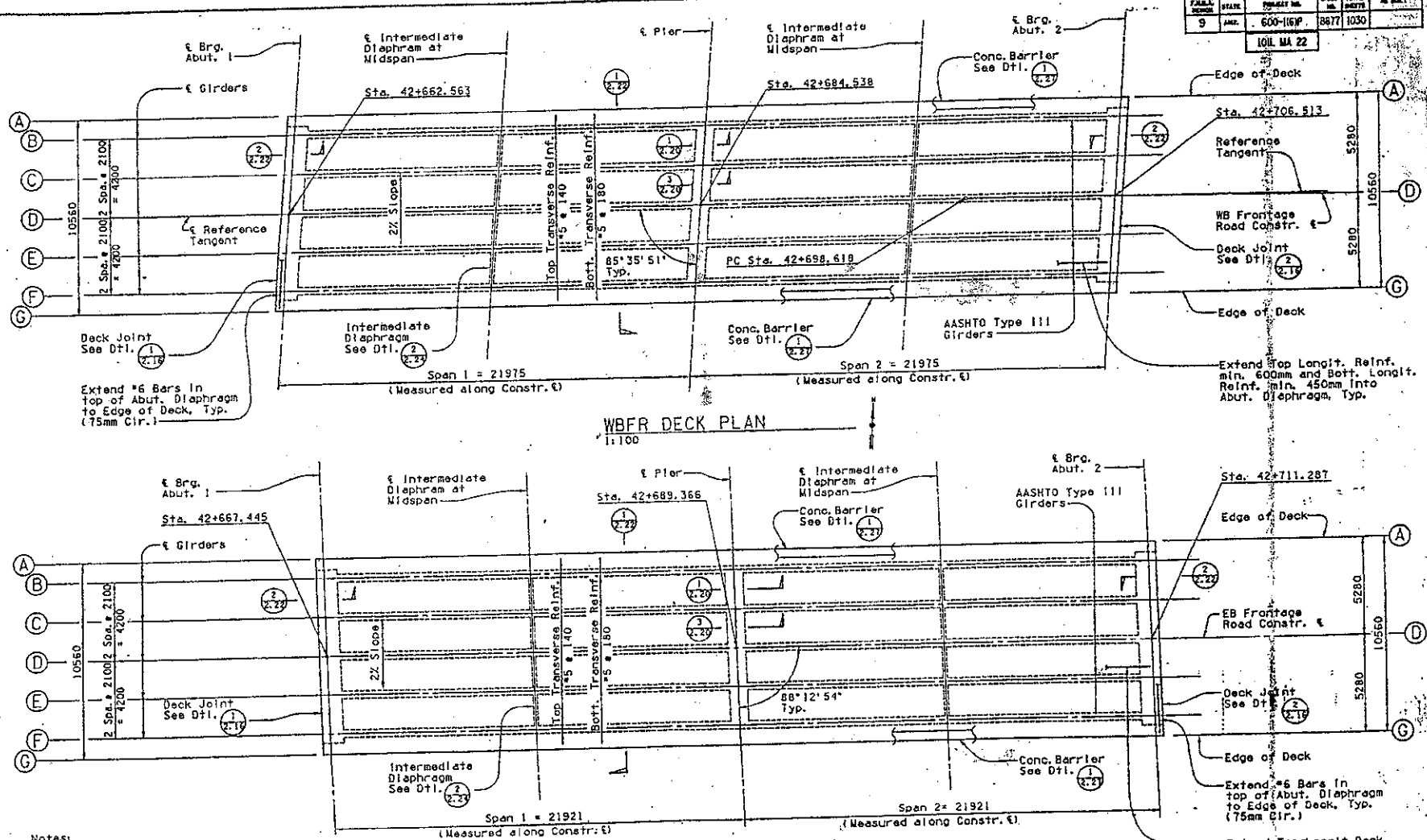
REDUCED SIZE - DO NOT SCALE

Metric

VIEW NAME: CCSH719.DGN

ooooOGNcSPECIFICATIONoooooo
oooooSYSTEMooooooo

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	8877	1030	
		10IL MA 22			



WBFR DECK PLAN
1:100

EBFR DECK PLAN
1:100

Notes:
1. See General Notes, Sheet S-2.4
2. WBFR Girders to be parallel to Reference Tangent while Edges of Deck to be parallel to Constr. ℄
3. Transverse top and bott. deck reinf. to be placed normal to Constr. ℄ and shall be full length (no splices).
4. For top longitudinal reinf., see Sheet S-2.23
5. For Deck placing sequence, see Dtl. 1/2.25
6. Concrete Barrier Joints:
   Provide open joints at Abutments. See Dtl. 3/2.27
   Provide joint at ℄ Pier with 10mm bituminous joint filler. See Dtl. 2/2.27

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2281
RTE. MP

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO.
RTE. MP

	SIGN	DATE
DESIGN	R. G.	3/8/01
DRAWN	R. G.	3/8/01
CHECKED	R. G.	3/8/01

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Consulting Engineers CA/HO-7

ARIZONA DEPARTMENT OF TRANSPORTATION
INTRAMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
DECK PLAN

ROUTE 10IL | SR FROM | STRUCTURE NO. WBFR: 2466 EBFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.21

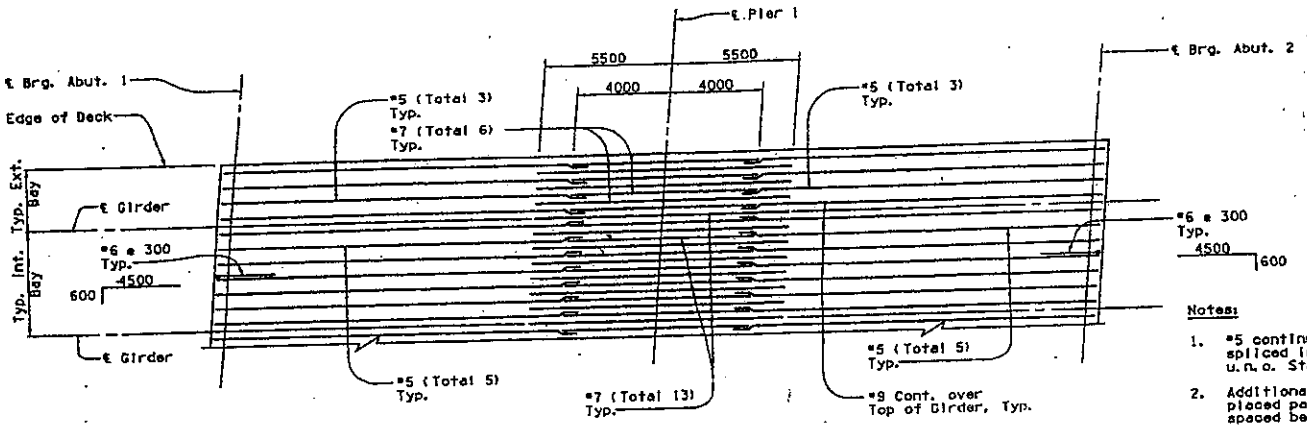
TRACS NO. H 3565 01C | 600-1(6)P | 8877 OF 1030

REDUCED SIZE DO NOT SCALE

Metric

VIEW NAME: CCSHT21.DGN

F.A.P.N. NUMBER	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-I(61)P	8879	1030	
		101L MA 22			

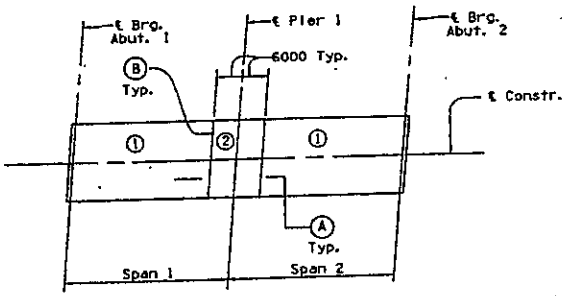


Notes:

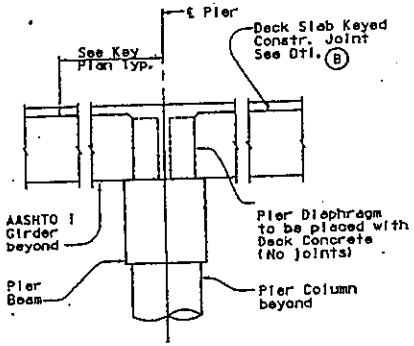
1. #5 continuous bars to be lap spliced in middle third of span only, u.n.o. Stagger all splices. See Dtl. 5/2-23
2. Additional top longitudinal reinf. to be placed parallel to girders and equally spaced between girders.
3. Deck bottom longitudinal reinf. stm.

TYP. DECK TOP LONGITUDINAL REINFORCING PLAN

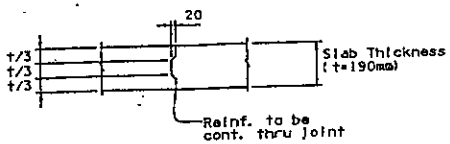
No Scale



KEY PLAN



SECTION-TYP. CONTINUOUS DECK SLAB OVER PIER — A



SECTION-TYP. DECK SLAB KEYED CONSTRUCTION JOINT — B

Notes for Deck Placing:

1. Longit. construction joints in deck shall not be allowed except as shown or approved by the Engineer. Transverse construction joints shall be located in accordance with deck placing sequence plan.
2. The numbers shown thus: 1 etc., indicate deck pouring sequence. The Contractor shall allow min. 12 hours between adjacent pours.
3. Abutment, pier and intermediate diaphragms are to be placed when deck is placed.
4. Reinf. to be continuous through construction joints.
5. Alternative pouring sequences will require a no cost supplemental agreement detailing joint locations and conditions, and shall be subject to approval of the Engineer.

DECK PLACING SEQUENCE DETAILS — 1

No Scale

	NAME	DATE
DESIGN	RL. D.	9/26/97
DRAWN	RL. D.	9/26/97
CHECKED	RT. W.	9/26/97

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Consulting Engineers CA3-040-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
DECK DETAILS

ROUTE 101L | SUB FUNC | STRUCTURE NO. WBFR: 2466 EBFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.23

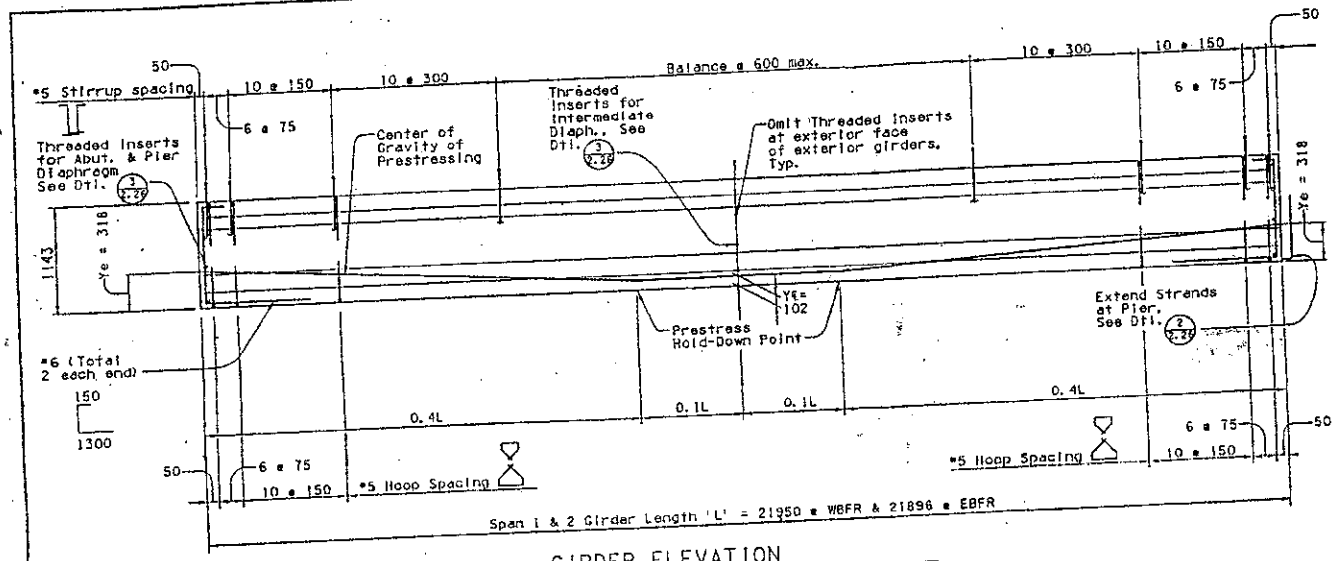
TRACS NO. H 3565 01C | 600-I(61)P | 8879 OF 1030

REDUCED SIZE DO NOT SCALE

Metric

ccccccDGNcSPECIFICATIONcccccc
cccccSYSTEMcccccc VIEW NAME: CCSHT23.DGN

FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-H(6)P	B881	1030	
		101L MA 22			



GIRDER ELEVATION

No Scale

PRESTRESSED GIRDER NOTES

Prestressed Concrete Girders

AASHTO Type III Girders

Concrete Strength

f'ci = 31 MPa ultimate compressive strength of concrete at time of initial prestressing.
f'c = 35 MPa min. ultimate concrete strength at 28 days.

Working Force

Pw = The force remaining per girder after losses. Total assumed losses 345 MPa
Pw = 2700 kN.

Strand

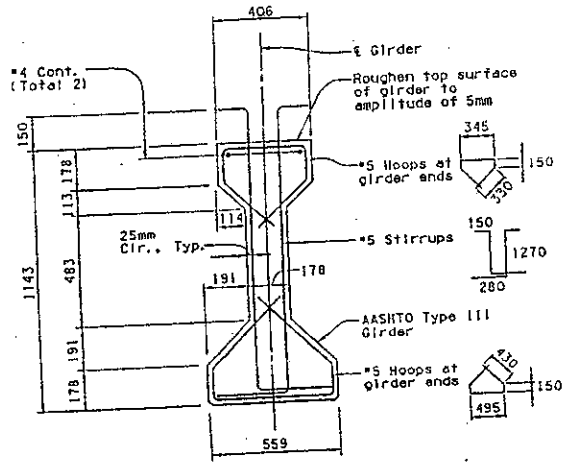
12.70mm diameter, ASTM A416M, Grade 1860 MPa 7-wire low relaxation prestressing strand with initial strand tension equal to 138 kN. Use of masked strands will not be allowed.

Prestressing

All girders shall be prestressed by the pretensioning method only. Two hold-down points (as shown) within the girder shall be used to position the tendons. The center of gravity of the prestressing steel shall be as shown at the ends (Ye) and at midspan of the girders (Y€). Ends of girders shall be constructed so they will be vertical when erected. Extend the prestressing strand beyond the ends of girders at pier ends only as shown. Cut all other strands flush and protect exposed steel at cut ends with asphalt coating.

Camber

Estimated midspan girder camber at release of prestress is 33mm upward. Contractor to provide measured midspan camber of girders to Engineer for evaluation. For additional information, see Girder Build-Up Profile this sheet and Screed Elevation Sheet S-2.28.

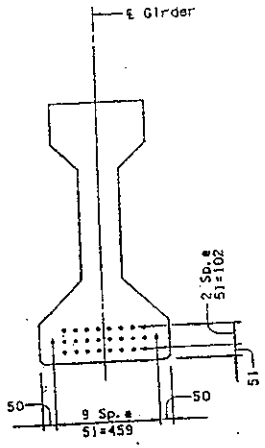


Note:

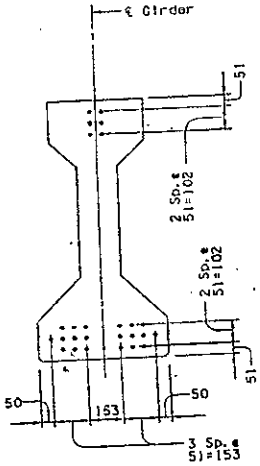
This section shows mild steel reinf. and dimensions only.

TYPICAL GIRDER SECTION

1:10



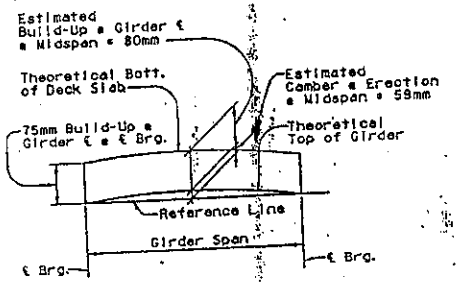
AT MIDSPAN



AT ENDS

STRAND PATTERN (26-12.70mm Diam. 7- Wire Strands)

1:10



GIRDER BUILD-UP PROFILE

No Scale

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2281
RTE. MP.

	NAME	DATE
DESIGN	R.C.	1/20/97
DRAWN	R.S.	1/20/97
CHECKED	R.E.	1/20/97

Cannon & Associates, Inc.
Consulting Engineers CA2400-7

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
GIRDER DETAILS

ROUTE	MP FROM	STRUCTURE NO.	LOCATION	DWG NO.
101L		B(FR) 2466 EB(FR) 2281	PIMA FWY-JCT. I-17 TO 56TH ST.	S-2.25

TRACS NO. H 3565 01C

600-H(6)P B881 OF 1030

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO.
RTE. MP.

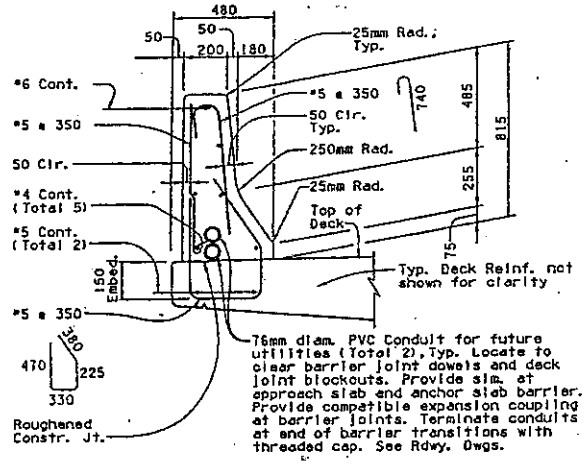
REDUCED SIZE DO NOT SCALE

Metric

VIEW NAME: bcsht25.dgn 1-22-97

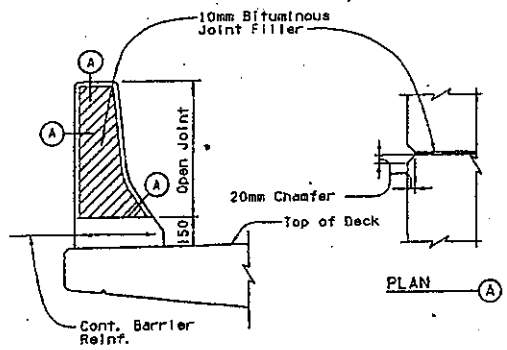
eeeeeDGNeSPECIFICATIONeeeee
eeeeeSYSTIMEeeeee

F.A.P. NUMBER	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(63)P	8883	1030	
		101L MA 22			



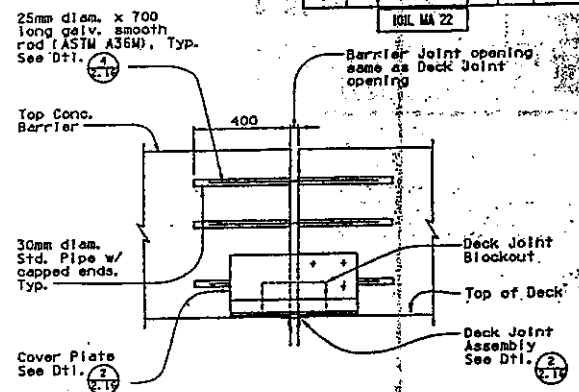
CONC. BARRIER DETAIL (1)

No Scale



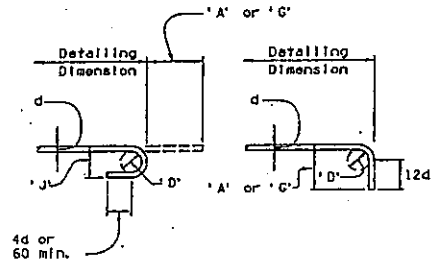
CONC. BARRIER JOINT DETAIL (2)

No Scale



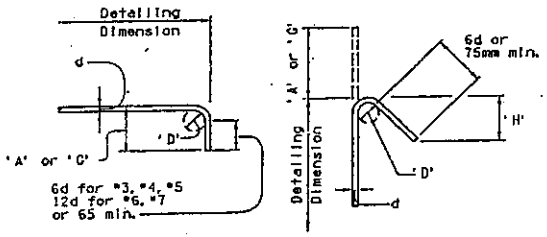
ELEV. CONC. BARRIER JOINT AT ABUT. (3)

No Scale



180° & 90° Standard Hooks

Hook(mm)	Bar Size 3	4	5	6	7	8	9	10	11
'D'	55	75	95	115	135	150	240	275	305
180° 'A' or 'G'	125	150	180	205	255	280	380	430	485
'J'	75	100	125	150	180	205	300	335	375
90° 'A' or 'G'	150	205	255	305	355	405	510	560	610



90° & 135° Standard Hooks (stirrups & ties)

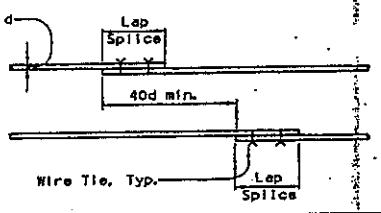
Hook(mm)	Bar Size 3	4	5	6	7
'D'	40	50	65	115	135
135° 'A' or 'G'	125	165	205	275	320
'H' (approx.)	90	115	140	165	200
90° 'A' or 'G'	100	115	150	305	355

Notes:

1. Typical for all drawings u.n.o.
2. All bar bends to be cold bent.
3. Dimensions are in millimeters.

STANDARD REINF. BAR HOOK DETAILS (4)

No Scale



Bar size	3	4	5	6	7	8	9	10	11
Lap Splice (mm)	305	405	510	660	890	1145	1450	1855	2260

Notes:

1. Laps provided in table are to be used as minimum for lapping horizontal reinforcing, typical unless noted otherwise.
2. The minimum lap requirements are based on Grade 420 reinforcement and 25 MPa concrete for a Class B splice. The lap requirements shall be modified by the following appropriate factors except bars smaller than *7 shall not be modified for concrete strength:

   Bar spacing greater than 150mm = 0.80
   Top bars = 1.40
   20 MPa concrete = 1.12
   30 MPa concrete = 0.91
3. Top bars have more than 300mm of concrete cast below them.
4. Lap splices shall not be less than 300mm.
5. Deviation requires approval of the Engineer.

HORIZ. REINF. LAP SPLICE DETAIL (5)

No Scale

	NAME	DATE
DESIGN	RL CS	9/26/97
DRAWN	RL CP	9/26/97
CHECKED	RL CS	9/26/97

Cannon & Associates, Inc.
Consulting Engineers CANNON

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
MISCELLANEOUS DETAILS

LOCATION: PIMA FWY-JCT. I-17 TO 56TH ST.

REGISTERED PROFESSIONAL ENGINEER (CIVIL) — CHRIS EDWIN T. SCHMANDT — 14 SEP 1997

REVISE	NO. PART	STRUCTURE NO.
101L		BBFR: 2466 EBFR: 2281

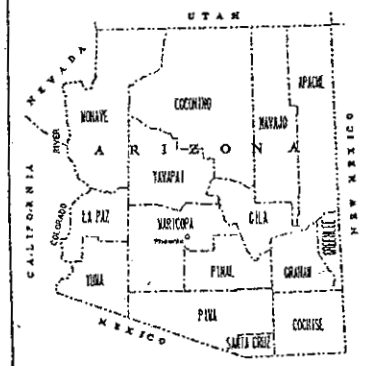
DWG NO. S-2.27

TRACS NO. H 3565 01C | 600-1(63)P | 8883OF1030

REDUCED SIZE - DO NOT SCALE

Metric

00ecc0DGN:SPECIFICATIONeeeee
eeeeeSYSTEMEeeeec
VIEW NAME: CCSHT20.DGN



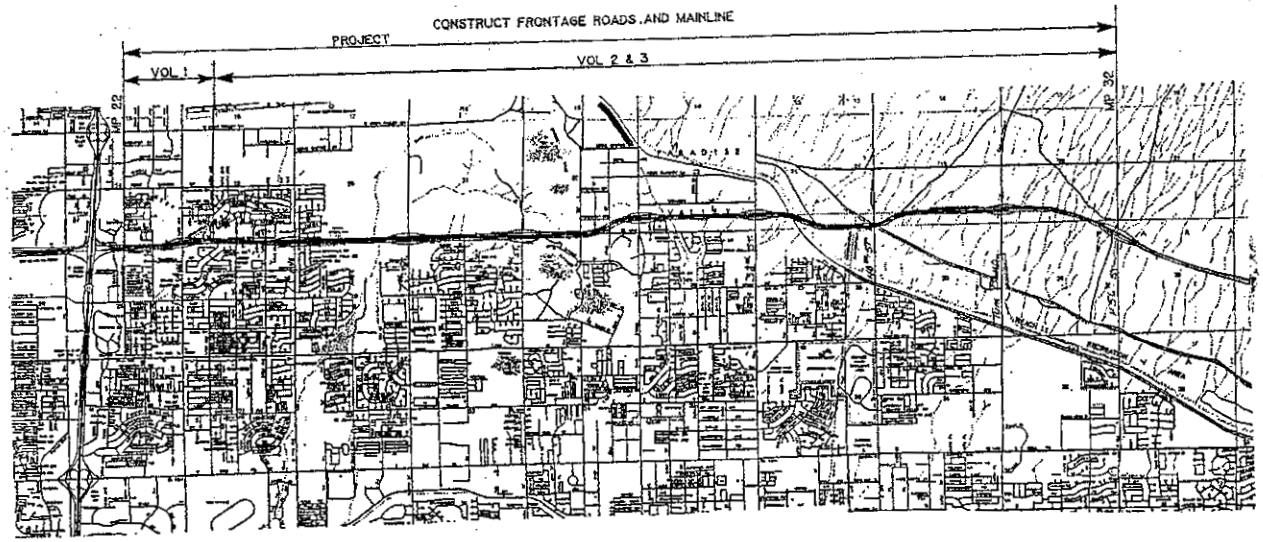
STATE OF ARIZONA
DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

PLAN AND PROFILE OF PROPOSED

STATE HIGHWAY
PIMA FREEWAY (101L)
ACSTP-600-1(6)P
101L MA 022
PHASE A
VOLUME 1 OF 3

ARIZONA DEPARTMENT OF TRANSPORTATION

PROPERTY OF
BRIDGE MANAGEMENT
STRUCTURE NO. 2466
RTE. MP. 101L-25.87



JCT.I 17(23rd AVE.)-56th STREET

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
APPROVED: THOMAS G. SCHMITT
STATE ENGINEER

APPROVED DATE

ASSISTANT STATE ENGINEER

TRACS NO. H3565 01 C	ACSTP-600-1(6)P	A1 OF 170

Metric

REDUCED SIZE DO NOT SCALE

F.A.R.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(61)P	2	170	

101 L MA 22

REFERENCES

RAM-600-1-539

MID-POINT OF PROJECT

Central Zone
State Plane Coordinates
x = 133 200
y = 297 200

DESIGN DATA

1992 ADT = 6 645
2015 ADT = 11 035
Min Design Speed = 70 km/h

LENGTH OF PROJECT

N Frt Rd Sta 24+327.66 to 25+402.08 = 1 074.42 m
S Frt Rd Sta 27+164.77 to 28+380.63 = 1 215.86 m
Gross & Net Length = 2 290.28 m = 2.29 km
Kilometer Post
Mile Post

INDEX OF DRAWINGS

Sheet No.	Sheet Type
1	Face Sheet
2	Design Sheet
3 - 5	Standard Drawing Listing
6 - 8	Typical Sections
9	Barrier Summary Sheet
10-12	Curb, Gutter, Sidewalk Summary Sheets
13	New Pipe Sleeve Summary Sheet
14-20	New Pipe Summary Sheets
21-22	Special Details
23-24	19th Ave Joint Layout
25-28	Existing Conditions
29-30	Geometric Plan Sheets
31	Survey Control Points
32-33	Horizontal Control Data
34	Roadway Intersection Sheets
35-40	North Frontage Road Plan and Profiles
41-44	South Frontage Road Plan and Profiles
45-46	Slip Ramp Profiles
47-52	19th Avenue Roadway Plan and Profiles
53-55	Minor Intersection Roadway Plan and Profiles
56-58	Staking Plans
59-63	Gravity Drain Plans and Profiles
64-66	Drainage Plans
67-73	Drainage Profiles
74	Embankment Site
75-76	Channel Plan and Profiles
77-79	Erosion Control Plans
80	Topsoil Plating
81	Traffic Control General Notes
82-106	Traffic Control Plans
107-109	Temporary Signal Plans
110	Signing General Notes
111-115	Sign Summary
116-118	Signing Plan
119-121	Sign Structures
122-129	Pavement Marking Plans
130-137	Traffic Signals
138	Sanitary Sewer Cover Sheet
139	Sanitary Sewer Detail
140-150	Sanitary Sewer Plan and Profiles
151	Water Line Cover Sheet
152-154	Water Line Details
155-170	Water Line Plan and Profiles

EARTHWORK QUANTITIES

Roadway Excavation*	7 320 m³
Drainage Excavation	98 387 m³
Pipe Excess	6 202 m³
Shrink/Swell	6 089 m³
Embankment (Incl Grd Comp)	40 593 m³
Haul to Part B	65 227 m³

Shrinkage Factor = 15%

Ground Compaction = 0.100

GENERAL NOTES

All dimensions and elevations on Roadway Design plan sheets are shown in meters (m) unless noted otherwise.

The project roadway shall be striped by the contractor in accordance with the current edition of the Signing and Marking Standard Drawings (M&S-Series) and the pavement marking plans.

R/W Markers shall be furnished and placed by the contractor, as directed by the Engineer Std C-21.10.

For R/W information not shown, see Right-of-Way project No. BPM-600-1-705

Bench markers will be furnished by the State and shall be placed by the contractor. Std C-21.20.

The contractor shall verify the exact horizontal location and depth of each underground facility.

For superelevation information not shown, see Std C-02.50.

	NAME	DATE
DESIGN	DK	7/97
DRAWN	PMP	7/97
CHECKED	JS	7/97

Carter-Burgess

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

DESIGN SHEET

ROUTE 101L | LOCATION PIMA FWY-JCT I-17 TO 17TH DRIVE | DWG NO. G-1.01 | SHEET 1 OF 1

DESIGN FILE: R:\ADOT\86756 15\010\INDEX.100 PLOT DATE 09-10-97

TRACS NO. H3565 01C | 600-1(61)P | A2 OF 170

REDUCED SIZE DO NOT SCALE

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-I(6)P	A4	170	
		10IL MA 022			

ADOT STANDARD DRAWINGS

ISSUE OR REVISION DATE	STANDARD NO.	SUBJECT
		STRUCTURES - 1992
		REINFORCED CONCRETE BOX CULVERTS
6-92	B-01.10	Miscellaneous Details for Standard Box Culverts
6-92	B-01.11	Box Culvert Extension Details
6-92	B-02.10	Single Barrel Box Culvert
	B-02.20	Double Barrel Box Culvert
6-92	B-02.25	Double Barrel Box Culvert
6-92	B-02.30	Triple Barrel Box Culvert
6-92	B-02.35	Triple Barrel Box Culvert
6-92	B-02.40	Four Barrel Box Culvert
6-92	B-02.45	Four Barrel Box Culvert
6-92	B-02.50	Five Barrel Box Culvert
6-92	B-02.55	Five Barrel Box Culvert
6-92	B-02.60	Six Barrel Box Culvert
6-92	B-02.65	Six Barrel Box Culvert
6-92	B-02.70	Culvert Quantities
6-92	B-03.10	4815 mm x 4265 mm Equipment Pass
6-92	B-04.10	Outlet Wings, Culvert Height 900 mm to 2100 mm, Skew 0° to 20°
6-92	B-04.20	Outlet Wings, Culvert Height 2400 mm to 3600 mm, Skew 0° to 20°
6-92	B-04.30	Inlet Wings, Culvert Height 900 mm to 2100 mm, Skew 0° to 20°
6-92	B-04.40	Inlet Wings, Culvert Height 2400 mm to 3600 mm, Skew 0° to 20°
6-92	B-04.50	Outlet Wings, Culvert Height 900 mm to 2100 mm, Skew 25° to 45°
6-92	B-04.60	Outlet Wings, Culvert Height 2400 mm to 3600 mm, Skew 25° to 45°
6-92	B-04.70	Inlet Wings, Culvert Height 900 mm to 2100 mm, Skew 25° to 45°
6-92	B-04.80	Inlet Wings, Culvert Height 2400 mm to 3600 mm, Skew 25° to 45°
6-92	B-05.10	Headwall Quantities, 1:2 Slope
6-92	B-05.20	Headwall Quantities, 1:4 Slope
6-92	B-05.30	Headwall Quantities, 1:6 Slope
6-92	B-06.10	Outlet Apron Details
6-92	B-06.20	Outlet Apron Dimensions & Quantities, 1:2 Slope
6-92	B-06.30	Outlet Apron Dimensions & Quantities, 1:4 Slope
6-92	B-06.40	Outlet Apron Dimensions & Quantities, 1:6 Slope
6-92	B-08.10	Inlet or Outlet Level Wings, Height 900 mm to 2100 mm
6-92	B-08.20	Inlet or Outlet Level Wings, Height 2400 mm to 3600 mm
		REINFORCED CONCRETE HEADWALLS FOR PIPE CULVERTS
6-92	B-11.10	Pipe Culvert Headwalls, Miscellaneous Details
6-92	B-11.11	Inlet and Outlet Headwalls, 460 mm to 1010 mm Pipes
6-92	B-11.12	Inlet and Outlet Headwalls, Right Angle Pipe Culverts, 1220 mm to 2130 mm Pipes
6-92	B-11.13	Inlet and Outlet Headwalls, Skewed Pipe Culverts, 1220 mm to 2130 mm Pipes
6-92	B-11.14	Multipipe Headwalls, 1220 mm to 2130 mm Pipes
6-92	B-12.10	Inlet Headwalls, Right Angle Pipe Culvert
6-92	B-12.20	Inlet Headwalls, Right Angle Pipe Culvert, 1:2 Slope
6-92	B-12.30	Inlet Headwalls, Right Angle Pipe Culvert, 1:4 Slope
6-92	B-12.40	Inlet Headwalls, Right Angle Pipe Culvert, 1:6 Slope
6-92	B-12.50	Outlet Headwalls, Right Angle Pipe Culvert
6-92	B-12.60	Outlet Headwalls, Right Angle Pipe Culvert, 1:2 Slope
6-92	B-12.70	Outlet Headwalls, Right Angle Pipe Culvert, 1:4 Slope
6-92	B-12.80	Outlet Headwalls, Right Angle Pipe Culvert, 1:6 Slope
6-92	B-13.10	Inlet Headwalls, 15° Skew Pipe Culvert
6-92	B-13.20	Inlet Headwalls, 15° Skew Pipe Culvert, 1:2 Slope
6-92	B-13.30	Inlet Headwalls, 15° Skew Pipe Culvert, 1:4 Slope
6-92	B-13.40	Inlet Headwalls, 15° Skew Pipe Culvert, 1:6 Slope
6-92	B-13.50	Outlet Headwalls, 15° Skew Pipe Culvert
6-92	B-13.60	Outlet Headwalls, 15° Skew Pipe Culvert, 1:2 Slope
6-92	B-13.70	Outlet Headwalls, 15° Skew Pipe Culvert, 1:4 Slope
6-92	B-13.80	Outlet Headwalls, 15° Skew Pipe Culvert, 1:6 Slope
6-92	B-14.10	Inlet Headwalls, 30° Skew Pipe Culvert
6-92	B-14.20	Inlet Headwalls, 30° Skew Pipe Culvert, 1:2 Slope
6-92	B-14.30	Inlet Headwalls, 30° Skew Pipe Culvert, 1:4 Slope
6-92	B-14.40	Inlet Headwalls, 30° Skew Pipe Culvert, 1:6 Slope
6-92	B-14.50	Outlet Headwalls, 30° Skew Pipe Culvert
6-92	B-14.60	Outlet Headwalls, 30° Skew Pipe Culvert, 1:2 Slope
6-92	B-14.70	Outlet Headwalls, 30° Skew Pipe Culvert, 1:4 Slope
6-92	B-14.80	Outlet Headwalls, 30° Skew Pipe Culvert, 1:6 Slope
6-92	B-15.10	Inlet Headwalls, 45° Skew Pipe Culvert
6-92	B-15.20	Inlet Headwalls, 45° Skew Pipe Culvert, 1:2 Slope
6-92	B-15.30	Inlet Headwalls, 45° Skew Pipe Culvert, 1:4 Slope
6-92	B-15.40	Inlet Headwalls, 45° Skew Pipe Culvert, 1:6 Slope
6-92	B-15.50	Outlet Headwalls, 45° Skew Pipe Culvert
6-92	B-15.60	Outlet Headwalls, 45° Skew Pipe Culvert, 1:2 Slope
6-92	B-15.70	Outlet Headwalls, 45° Skew Pipe Culvert, 1:4 Slope
6-92	B-15.80	Outlet Headwalls, 45° Skew Pipe Culvert, 1:6 Slope

ISSUE OR REVISION DATE	STANDARD NO.	SUBJECT
		STRUCTURES - 1992
6-92	B-16.10	Multipipe Headwalls without Apron
6-92	B-16.20	Multipipe Headwall with Outlet Apron
6-92	B-17.10	Outlet Aprons
6-92	B-17.20	Outlet Apron Steel List Right Angle
6-92	B-17.30	Outlet Apron Steel List 15° Skew
6-92	B-17.40	Outlet Apron Steel List 30° Skew
6-92	B-17.50	Outlet Apron Steel List 45° Skew
		RETAINING WALLS
6-92	B-18.10	Cantilever Retaining Wall Details
6-92	B-18.20	Cantilever Retaining Walls on Spread Footings
6-92	B-18.30	Cantilever Retaining Walls on Spread Footings
6-92	B-18.40	Cantilever Retaining Walls with Barrier
6-92	B-18.50	Masonry Retaining Walls
		MISCELLANEOUS STANDARDS
~~8-95~~	~~B-19.10~~	~~Miscellaneous Details for Bridges~~
~~8-95~~	~~B-19.11~~	~~Approach Slab Details~~
~~8-95~~	~~B-19.12~~	~~Anchor Slab Details (PCC Pavement Greater than 200 meters)~~
~~8-95~~	~~B-19.13~~	~~Anchor Slab Details (PCC Pavement 100 meters to 200 meters)~~
~~8-95~~	~~B-19.14~~	~~Anchor Slab Details (PCC Pavement less than 100 meters)~~
~~8-95~~	~~B-19.20~~	~~Slope Paving Details, Underpass~~
~~8-95~~	~~B-19.21~~	~~Slope Paving Details, Overpass~~
~~8-95~~	~~B-19.30~~	~~Structural Excavation - Payment Limits~~
~~8-95~~	~~B-19.40~~	~~Structural Backfill - Payment Limits~~
6-92	B-19.50	Structural Excavation & Structural Backfill for R.C.B. Culvert
~~8-95~~	~~B-21.10~~	~~Bridge Concrete Barrier Details~~
~~8-95~~	~~B-21.12~~	~~Bridge Concrete Barrier Transition with Curb~~
~~8-95~~	~~B-21.20~~	~~Bridge Concrete Barrier Transition~~
~~8-95~~	~~B-21.30~~	~~Stockyard Terminal Connector Assembly Details~~
6-92	B-21.30	Barrier Junction Box
~~8-95~~	~~B-22.40~~	~~Bridge Pedestrian Rail~~
~~8-95~~	~~B-22.41~~	~~Bridge Pedestrian Rail~~
~~8-95~~	~~B-22.50~~	~~Pedestrian Fence Details with Curb~~
~~8-95~~	~~B-22.60~~	~~Pedestrian Fence Details with Parapet~~
~~8-95~~	~~B-22.70~~	~~1870 mm High Fence Details with Parapet or Barrier~~
~~8-95~~	~~B-23.10~~	~~Rail Bank Protection for Bridges~~
~~8-95~~	~~B-24.20~~	~~Compression Seal Joint, Skews 0° thru 30°~~
~~8-95~~	~~B-24.21~~	~~Compression Seal Joint, Skews 31° thru 60°~~
6-92	B-30.10	Concrete Sound Barrier Walls
6-92	B-30.20	Masonry Sound Barrier Walls
6-92	B-40.10	Tubular Sign Structures, Tubular Cantilever
6-92	B-40.20	Tubular Sign Structures, Tubular Overhead
6-92	B-40.30	Tubular Sign Structures, Foundation Details
6-92	B-40.40	Tubular Sign Structures, Frame Details
6-92	B-40.50	Tubular Sign Structures, Sign Connection Details
6-92	B-40.60	Tubular Sign Structures, Miscellaneous Details

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2466
RTE. NO.

ADOT STANDARD DRAWINGS REVISION DATES and STANDARD NO.'s REVIEW		
	NAME	DATE
STRUCTURES Standards		

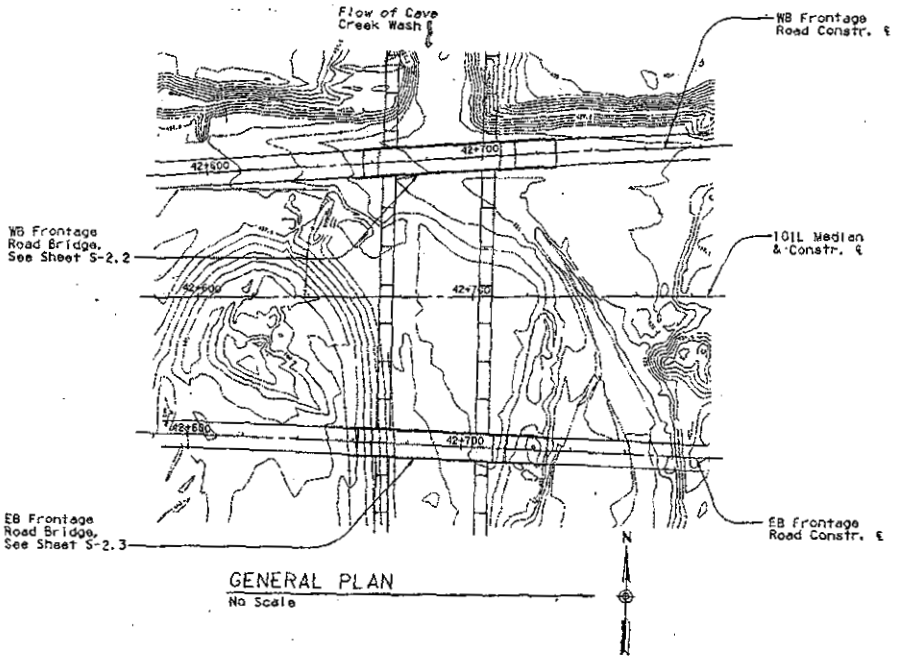
TRACS NO. H3565 01 C		600-I(6)P	A4 OF 170

Metric

REV. DATE: 08-01-95

REDUCED SIZE DO NOT SCALE

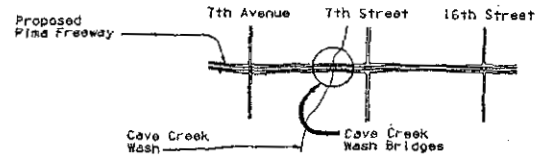
F.A.H.S. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-H6IP	8857	1030	
		10IL MA 22			



GENERAL PLAN
No Scale

SHEET LIST

Title	Sheet No.
General Plan & Quantities	S-2.1
WB Frontage Road Plan, Elev. & Sect.	S-2.2
EB Frontage Road Plan, Elev. & Sect.	S-2.3
General Notes & Details	S-2.4
Foundation Data	S-2.5 to S-2.8
Foundation Plan & Schedule	S-2.9
Foundation Details	S-2.10
WBFR Abutment Plan & Elev.	S-2.11
EBFR Abutment Plan & Elev.	S-2.12
Abutment Details	S-2.13 to S-2.16
WBFR Pier Plan, Elev. & Dtls.	S-2.17
EBFR Pier Plan, Elev. & Dtls.	S-2.18
Pier Details	S-2.19 to S-2.20
Deck Plan	S-2.21
Deck Section & Details	S-2.22
Deck Details	S-2.23 to S-2.24
Girder Details	S-2.25 to S-2.26
Miscellaneous Details	S-2.27
Screed Elevations	S-2.28



KEY MAP

APPROXIMATE QUANTITIES

	Item	Structural Excavation	Structure Backfill	Class 'S' Concrete 20 MPa	Class 'S' Concrete 25 MPa	Class 'S' Concrete 30 MPa	Bridge Barrier	Deck Joint Assembly	Approach Slab	Anchor Slab	Precast Girder Type III		Vertical Restrainers Expansion	Vertical Restrainers Fixed	Reinf. Steel	Drilled Shaft 1220mm Diam.	
		m^3	m^3	m^3	m^3	m^3	m	m	m^2	m^2	m	No.	Each	Each	Kg	m	No.
WBFR	Abutment 1	30	30	—	45	—	11.4	9.6	52	—	—	—	4	—	4,180	44.6	2
	Pier 1	—	—	—	26	—	—	—	—	—	—	—	—	4	3,030	37.6	2
	Abutment 2	30	30	—	52	—	11.4	9.6	52	154	—	—	4	—	4,290	44.6	2
	Superstructure	—	—	—	—	132	89.3	—	—	—	219.5	10	—	—	22,100	—	—
	Approach Slabs	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Anchor Slab	—	—	—	—	—	20.4	—	—	—	—	—	—	—	—	—	—
	Retaining Walls	80	30	26	—	—	17.6	—	—	—	—	—	—	—	1020	—	—
	Total	140	90	26	123	132	150.1	19.2	104	154	219.5	10	8	4	34,620	126.8	6
	As-Built Total																
EBFR	Abutment 1	30	30	—	45	—	10.9	9.6	55	—	—	—	4	—	4,190	42.8	2
	Pier 1	—	—	—	25	—	—	—	—	—	—	—	—	4	2,920	36.4	2
	Abutment 2	30	30	—	45	—	10.9	9.6	55	156	—	—	4	—	4,190	42.8	2
	Superstructure	—	—	—	—	132	89.1	—	—	—	219.0	10	—	—	22,100	—	—
	Approach Slabs	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Anchor Slab	—	—	—	—	—	23.4	—	—	—	—	—	—	—	—	—	—
	Retaining Walls	50	20	17	—	—	13.2	—	—	—	—	—	—	—	750	—	—
	Total	110	80	17	115	132	147.5	19.2	110	156	219.0	10	8	4	34,150	122.0	6
	As-Built Total																

Notes:

1. Drilled shaft quantities are based on linear meter of drilled shaft including concrete and reinforcing steel in place. See Special Provisions.
2. Wingwall quantities are included in abutment quantities.
3. For limits of Structural Excavation and Structure Backfill, see ADOT. Std. No. SD 5.11 and SD 5.21.

	NAME	DATE
DESIGN	KO, TS	9/26/97
DRAWN	EA, SE	9/26/97
CHECKED	KO, LB	9/26/97

Cannon & Associates, Inc.
Consulting Engineers CA-00001

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
GENERAL PLAN & QUANTITIES

ROUTE 10IL | SHEET | STRUCTURE NO. WBFR: 2466 EBFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.1

TRACS NO. H 356S OIC | 600-H6IP | 8857 OF 1030

REDUCED SIZE DO NOT SCALE

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2466
RTE. MP. 10 IL e

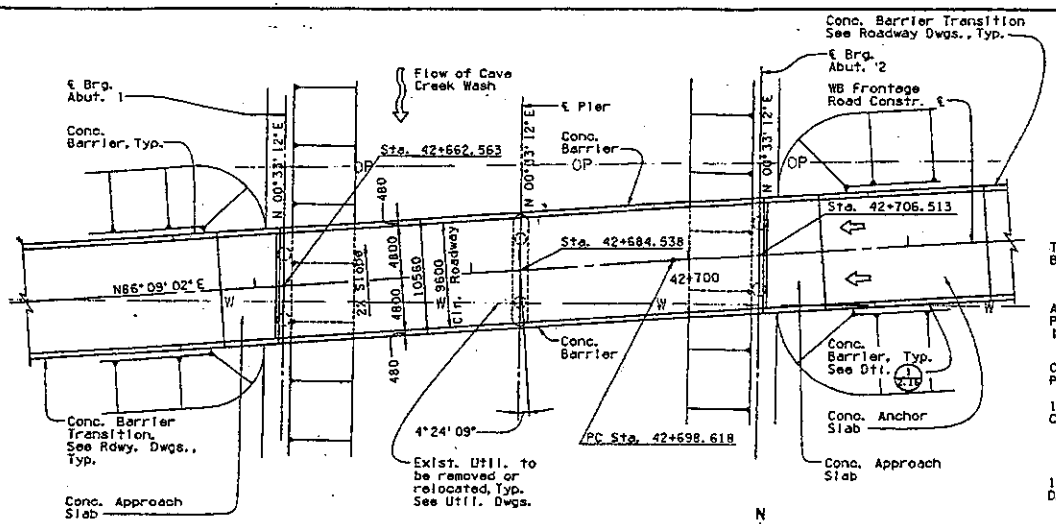
Metric

NO.	BY	DATE
1		
2		
3		

DESIGNED IN ENGLISH

eeeeeDGNeSPECIFICATIONeeeee
eeeeeSYSTIMEeeeee
VIEW NAME: CCSNTGLOGN

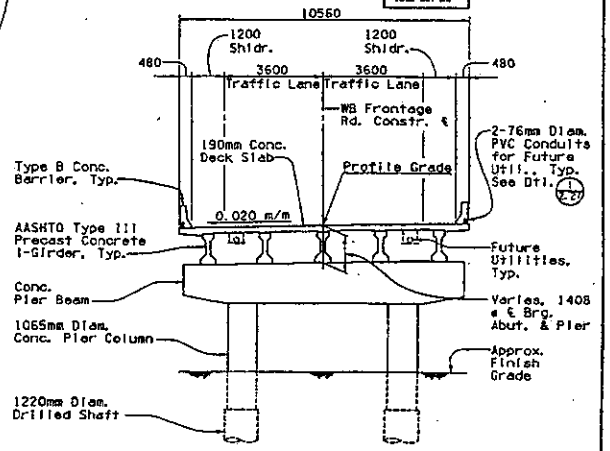
FEDERAL AID PROJ.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	B858	1030	
		10IL MA 22			



PLAN

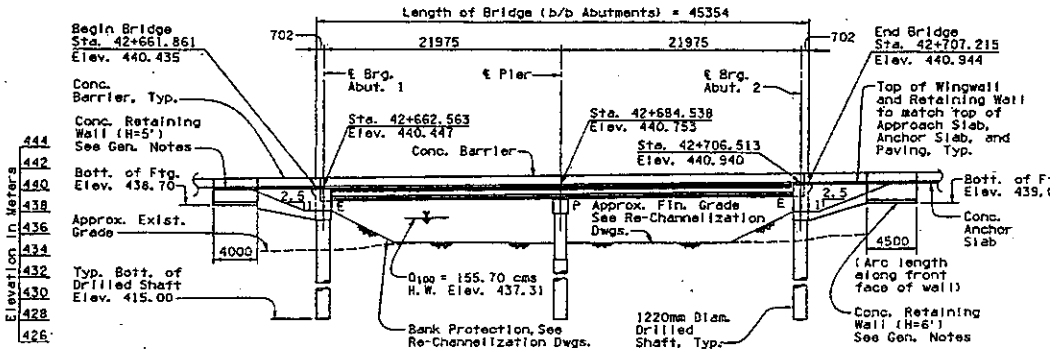
1:200

New Two-Span Bridge with AASHTO Type III Precast Prestressed Concrete Girders
Skew: 4°24' 09"



TYPICAL SECTION

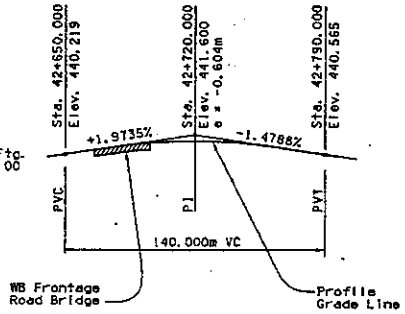
1:80



ELEVATION

1:200

(Stations, Dimensions & Elevations at top of deck along Construction ℄, u.n.o.)



PROFILE GRADE

CURVE DATA

℄ WB Frontage Road	
PC Sta.	42+698.618
PI Sta.	42+795.058
PT Sta.	42+891.441
T	96.441m
L	192.823m
Δ	3°27' 09"
R	3200.000m

	NAME	DATE
DESIGN	RG, CS	9/26/91
DRAWN	RG, DF	9/26/91
CHECKED	RG, RB	9/26/91

Cannon & Associates, Inc.
Consulting Engineers CA/CE-01

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
WBFR PLAN, ELEV, & SECTION

ROUTE 10IL | AIR FREE | STRUCTURE NO. WBFR: 2466 EBFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.2

REDUCED SIZE DO NOT SCALE

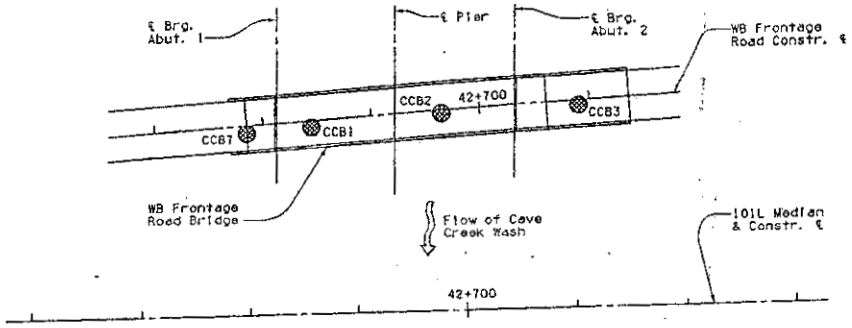
Metric

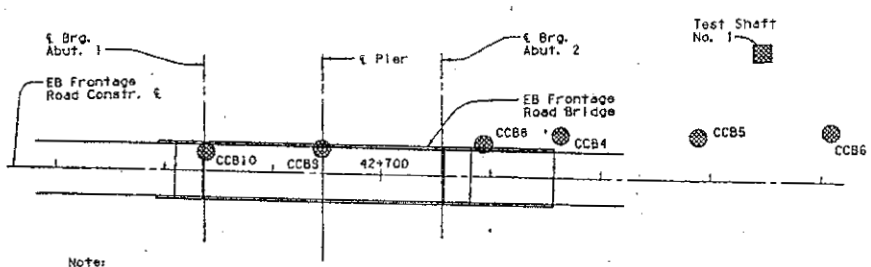
ooooooDGNcSPECIFICATIONeeeeee
ooooeSYSTIMEeeeeee

VIEW NAME: CCSN102.DGN

TRACS NO. H 3565 01C | 600-1(6)P | B858 OF 1030

F.A.S.L. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-I16(P	8861	1030	
		101L MA 22			





Note:

● Indicates approximate boring location and identification number (CCB2, etc.). See Foundation Data Sheets S-2.5 through S-2.8 for boring logs.

▩ Indicates approximate location of Test Shaft No. 1. See Large Diameter Test Shaft Drilling Report by AGRA Earth & Environmental, Inc. dated January 20, 1997.

BORING LOCATION PLAN

No Scale

N

NOTES:

Information contained on the Foundation Data Sheets is made available to prospective bidders for information purposes only and is not to be considered a part of the contract papers.

Information is developed as accurately as possible by the methods utilized. However, the State accepts no responsibility for any conditions encountered which may be at variance from information contained herein.

The absence of a ground water indication does not constitute a representation that the ground water will not be present during construction. Ground water is indicated herein only when found during the foundation investigation and represents that condition only on the date of the investigation.

Classification of materials is in accordance with the Unified Soil Classification System (ASTM D2487). Is based upon field inspection, and is not to be construed to imply mechanical analysis.

The boring logs were prepared by AGRA Earth & Environmental, Inc., the Geotechnical Engineer for the project. For further information, refer to Geotechnical Investigation Report dated January 4, 1996, Foundation Design Report dated January 8, 1996 with Addenda dated May 17, 1996, July 11, 1996, July 15, 1996, July 26, 1996 and October 10, 1996 by AGRA Earth & Environmental, Inc.

SAMPLE TYPE LEGEND

A - Drill Cuttings
S - 51mm O.D. 35mm I.D. Tube Sample.
U - 51mm I.D. California Tube Sample.
NR - No Recovery

LOG OF BORING NO. CCB1

LOCATION: 101L Sta. 42+672, 48m Lt.
RIG TYPE: Sprague 1640
BORING TYPE: 51mm Dual Percussion Hammer
SURFACE ELEV.: 215.5m
DATUM: State of Arizona

Depth Scale	Depth Below Surface	Drill Rate Min/Meter	Graphical Log	Sample	Sample Type	Blow Counts	Dry Density Kg/m³	Cobble meter.	Percent Gravel	Percent Sand	Percent Fines	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0.00													slightly moist	SILTY SAND, GRAVEL & COBBLES, trace of boulders, angular to subangular, nonplastic to low plasticity, brown
1.22												GP-GM		
2.44				A									moist to very moist moderately firm	CLAYEY SAND, some fine grained gravel, well graded sand, subrounded to subangular, low to medium plasticity, dark brown
3.66					S	50/ 152mm						SC		
4.88				A									moist hard	SAND, GRAVEL & COBBLES, trace of clay, occasional boulder, angular, nonplastic to low plasticity, brown
6.10					S	50/ 127mm						GP-GC		
7.32				A										
8.54														
9.76														
10.98														
12.20				A									moist very firm to hard	CLAYEY SAND, predominantly fine to medium grained sand, subrounded to subangular, weakly to moderately cemented, low plasticity, brown
					S	50-25-25	21							note: some nodules of moderately cemented clay
13.42												SC		
14.64														
15.86					S	50-40-40	40							
17.08				A										
18.30					S	50-18-30								
19.52														
20.74														
21.96					S	50-45-50								
23.18				A										
24.40					S	50-40-50								
25.62														Stopped Hammer at 24.4m Stopped Sampler at 24.8m
26.84														
28.06														

Groundwater: none

Date: 10-24-95

	NAME	DATE
DESIGN	SJC	3/26/97
DRAWN	MP	3/26/97
CHECKED	MHS	3/26/97

AGRA Earth & Environmental

ARIZONA DEPARTMENT OF TRANSPORTATION
MULTIMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
FOUNDATION DATA

ROUTE: 101L
MM POST:
STRUCTURE NO.: 8861FR/2466 EB/FR 2281
LOCATION: PIMA FWY-JCT. I-17 TO 56TH ST.
DWG NO. S-2.5

TRACS NO. H 3565 01C | 600-I16(P | 8861 OF 1030

REDUCED SIZE DO NOT SCALE

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2466
RTE. MP

Metric

VIEW NAME: CCSHT05.DGN

ooooDGNcSPECIFICATIONoooo
ooooSYSTIMEoooo

FAILL. REASON	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	B863	1030	

IOIL MA 22

LOG OF BORING NO. CCB5

LOCATION 10IL Sta. 42+754, 50m Rt.
RIG TYPE AP-1000
BORING TYPE 203mm Dual Parcussion Hammer
SURFACE ELEV. 315.5m
DATUM State of Arizona

REMARKS	VISUAL CLASSIFICATION
very moist	SILTY SAND & GRAVEL, predominantly fine grained gravel, well graded sand, subrounded to subangular, low to medium plasticity, brown
moist to slightly moist hard	SAND, GRAVEL & COBBLES, occasional boulder, some clay, poorly graded sand & gravel, subrounded to subangular, nonplastic to low plasticity, brown
moist very firm to hard	CLAYEY SAND, predominantly medium to fine grained sand, subrounded to subangular, weakly cemented, low to medium plasticity, brown

Stopped Hammer at 21.1m
Stopped Sampler at 27.6m

Groundwater: none

Date: 11-10-95

LOG OF BORING NO. CCB6

LOCATION 10IL Sta. 42+778, 50m Rt.
RIG TYPE AP-1000
BORING TYPE 203mm Dual Wall Parcussion Hammer
SURFACE ELEV. 315.0m
DATUM State of Arizona

REMARKS	VISUAL CLASSIFICATION
slightly moist to moist hard	SAND, GRAVEL & COBBLES, some clay, coarse to medium grained sand, well graded gravel, subrounded to rounded, lime cement, nonplastic, brown note increase in clay content below 1.52m
moist to very moist hard	CLAYEY SAND, coarse to medium grained sand, some fine grained gravel, subangular to subrounded, weakly to moderately cemented, medium plasticity, dark brown

Stopped Drill at 21.1m
Sampler refused at 21.3m

Groundwater: none

Date: 11-1-95

LOG OF BORING NO. CCB7

LOCATION 10IL Sta. 42+880, 47m Lt.
RIG TYPE AP-1000
BORING TYPE 203mm Dual-Wall Parcussion Hammer
SURFACE ELEV. 315.6m
DATUM State of Arizona

REMARKS	VISUAL CLASSIFICATION
slightly moist very dense	SAND, GRAVEL & COBBLES predominantly medium grained sand, poorly graded subrounded gravel, no lime to weakly lime cemented, nonplastic, brown note some clay below 4.0m note possible boulders from 6.4m to 9.0m
slightly moist to moist hard	SANDY SILT, some fine grained gravel, predominantly fine grained sand, low plasticity, brown
slightly moist hard to very firm	SILTY SAND, trace of clay, some to considerable fine grained subangular gravel, weakly to moderately lime cemented, low plasticity, brown

Stopped Hammer at 25.6m
Sampler refused at 27.5m

Groundwater: none

Date: 4-12-96

	NAME	DATE
DESIGN	CHD	9/26/97
DRAWN	TWP	9/26/97
CHECKED	MHR	9/26/97

AGRA Earth & Environmental

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
FOUNDATION DATA

STATE: IOIL | FED. AID PROJ.: | ESTMATING INC.: WBFN: 2466, EBFN: 2281 | LOCATION: PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.7

TRACS NO. H 3565 OIC | 600-1(6)P | B863 OF 1030

Note:
For Boring Location Plan and Notes, see Sheet S-2.5

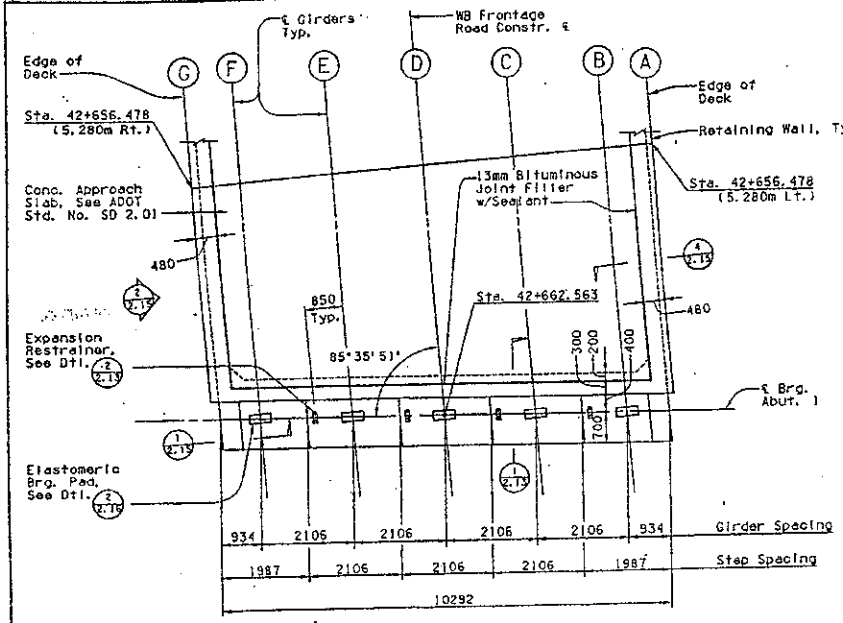
REDUCED SIZE DO NOT SCALE

Metric

oooooONeSPECIFICATIONeeeeee
ooooeSYSTEMeeeeee
VIEW NAME: CCSHTOT.DGN

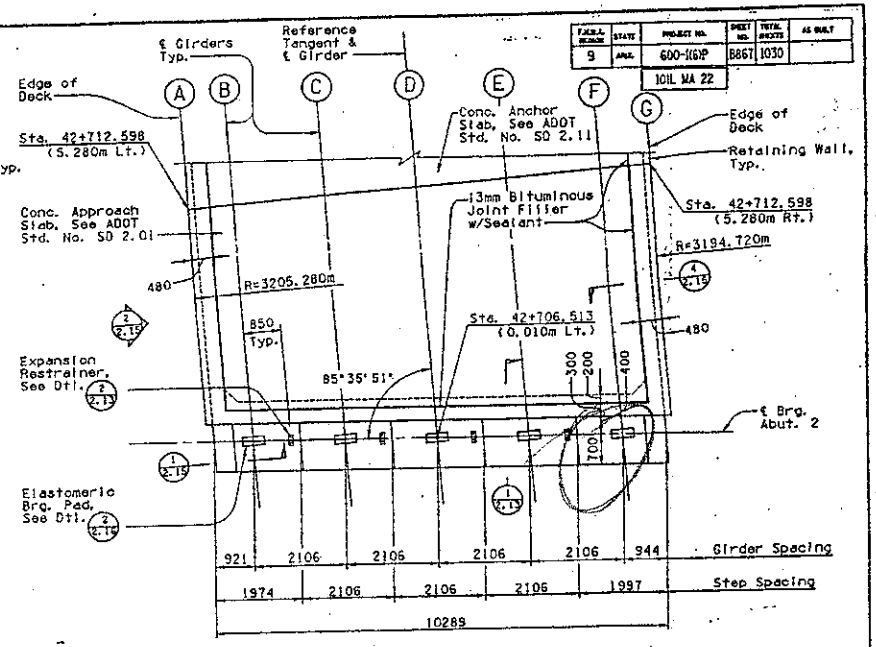
F.A.P. NO.	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(61)P	B867	1030	

101L MA 22



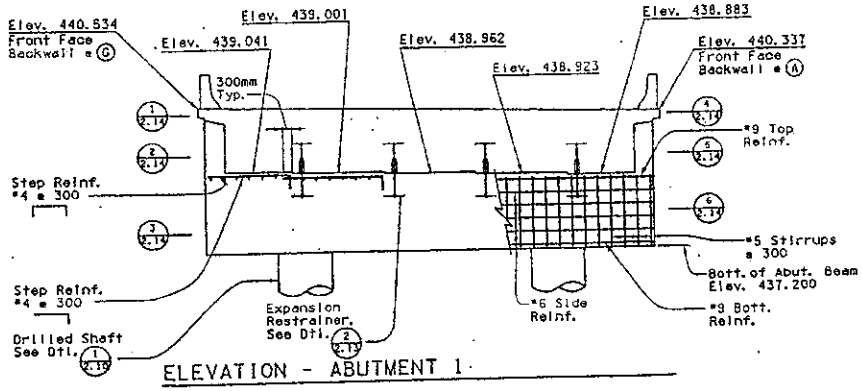
PLAN - ABUTMENT 1

1:50



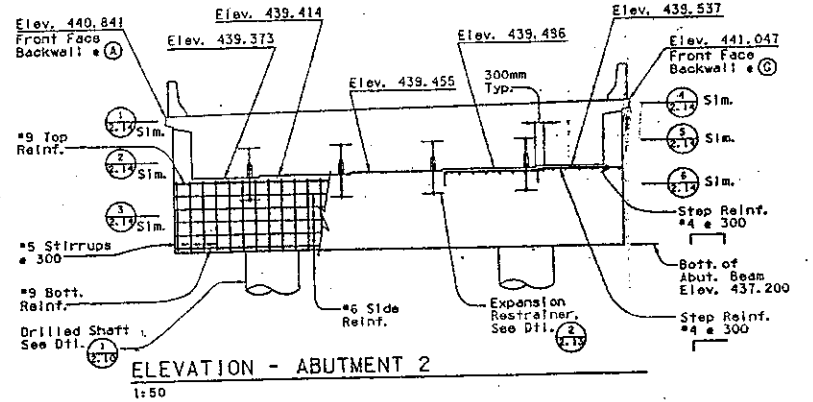
PLAN - ABUTMENT 2

1:50



ELEVATION - ABUTMENT 1

1:50



ELEVATION - ABUTMENT 2

1:50

NOTES:

1. See General Notes, Sheet S-2.4.
2. Girder Bearing Elevations are to top of concrete.
3. Provide #4 Step Reinf. @ 300 each way where conc. coverage above #9 Top Reinf. exceeds 100mm.

	NAME	DATE
DESIGN	RS, TS	9/26/97
DRAWN	RL, DF	9/26/97
CHECKED	RL, SA	9/26/97

Carnan & Associates, Inc. Consulting Engineers (CLIENTS)

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
WBFR ABUTMENT PLAN & ELEV.

ROUTE	SHEET	STRUCTURE NO.	LOCATION
101L		WBFR# 2456 EBFR# 2281	PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.11

TRACS NO. H 3565 01C

600-1(61)P

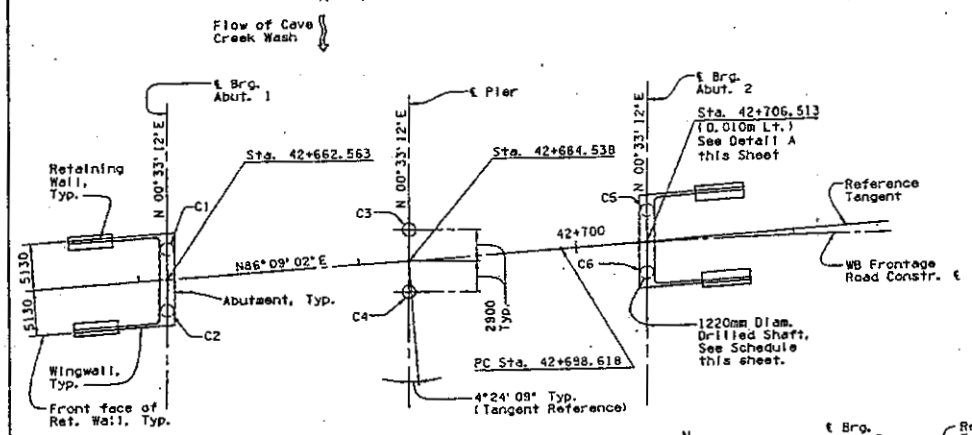
B867 OF 1030

REDUCED SIZE DO NOT SCALE

Metric

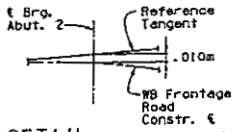
VIEW NAME: CCSHT11.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-I(6)P	1865	1030	
		10IL MA 22			



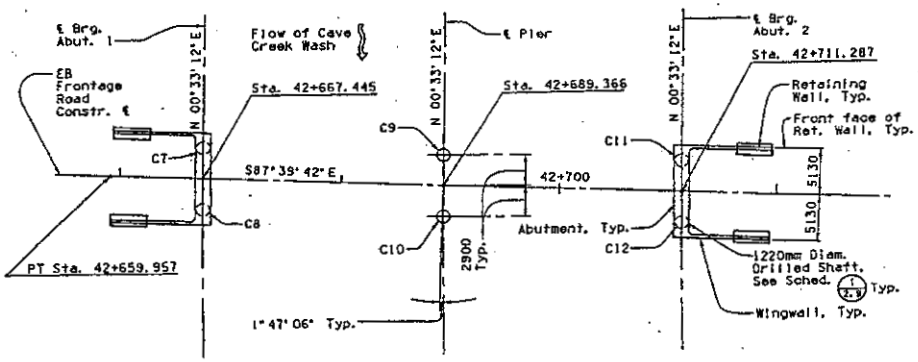
WBFR FOUNDATION PLAN

No Scale



DETAIL (A)

No Scale



EBFR FOUNDATION PLAN

No Scale

Foundation Plan Notes:

1. See General Notes, Sheet S-2.4
2. Abutment and piers are to be supported on 1220mm diameter cast-in-place concrete drilled shafts with a minimum allowable downward capacity of 2400 kN.

   Excavation of adjacent drilled shafts within 4 shaft diameters measured center to center will not be permitted until 48 hours after the adjacent drilled shaft has been concreted.

   Tops of drilled shafts shall be within 40mm of plan dimensions and shall not deviate more than 15mm in 1 meter from plumb.

   Construction joints not shown on the project plans will require approval of the Engineer prior to construction.

   Contractor shall be responsible for providing support of reinforcing cages during fabrication, erection and placement of concrete. Plans showing reinforcing cage support and methods of erection shall be submitted to the Engineer for review and approval prior to construction.

   Vertical reinforcement shall consist of as long a length bars as practical with lap splices located in lower portion of shafts.

   Contractor may select any one of the abutment shafts as the required Confirmation Shaft. See Special Provisions.
3. Retaining walls are to be supported on spread footings that bear on undisturbed native soil or engineered fill with a minimum allowable bearing capacity of 100 kPa.

	Mark	Top of Conc. Column Elev.	Drilled Shaft Cut-off Elev.	Bott. of Drilled Shaft Elev.	Detail	Location
WBFR	C1	——	437.275	415.000	1/2.10	Abut. 1
	C2	——	437.275	415.000	1/2.10	Abut. 1
	C3	437.814	433.800	415.000	2/2.10	Pier
	C4	437.814	433.800	415.000	2/2.10	Pier
	C5	——	437.275	415.000	1/2.10	Abut. 2
	C6	——	437.275	415.000	1/2.10	Abut. 2
EBFR	C7	——	436.375	415.000	1/2.10	Abut. 1
	C8	——	436.375	415.000	1/2.10	Abut. 1
	C9	436.733	433.200	415.000	2/2.10	Pier
	C10	436.733	433.200	415.000	2/2.10	Pier
	C11	——	436.375	415.000	1/2.10	Abut. 2
	C12	——	436.375	415.000	1/2.10	Abut. 2

DRILLED SHAFT SCHEDULE

PROPERTY OF
BRIDGE MANAGEMENT
STRUCTURE NO. 2466 (1)
RTE. MP

	NAME	DATE
DESIGN	R. C.	9/97
CHECK	R. W.	9/97
DRAWN	R. G.	9/97

Carson & Associates, Inc.
Consulting Engineers CARSON

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
FOUNDATION PLAN & SCHEDULE

STATE 10IL | Sim FHWA | STRUCTURE NO. WBFR(1)2466 EBFR 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.9

TRACS NO. H 3565 01C | 600-I(6)P | 1865 OF 1030

REDUCED SIZE DO NOT SCALE

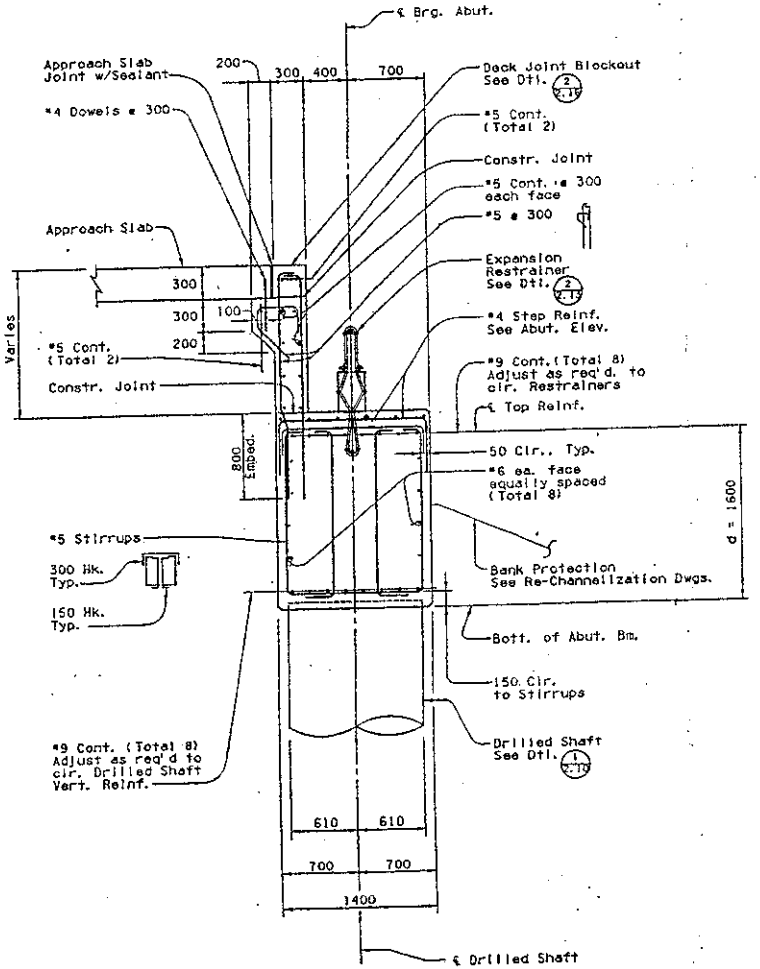
Metric

eeeccDGNeSPECIFICATIONeeeee
ccccccSYSTIMEeeeeee

VIEW NAME: CCSHT09.DGN

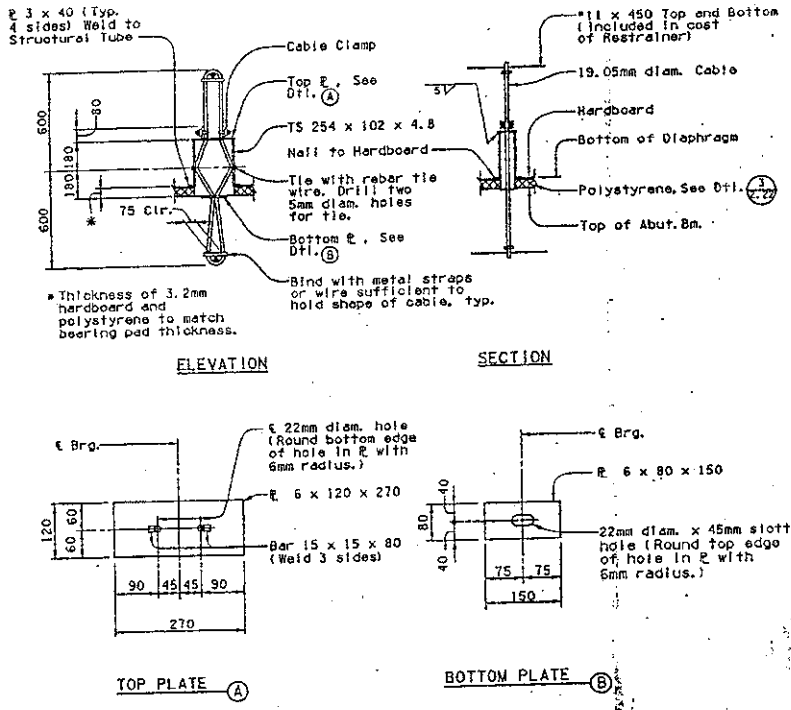
FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	B869	1030	

101L MA 22



SECTION 1

1:20



Notes:

1. Seal all openings in structural tube to prohibit concrete intrusion.
2. Restrainer cables shall be 19.05mm diam. preformed 6 x 19 galvanized cable with minimum breaking strength of 187 kN. A one meter long sample of cable shall be furnished to the Engineer for testing.
3. For additional information not shown or noted, see Standard Specifications.

EXPANSION RESTRAINER DETAIL 2

No Scale

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2466
RTE. MP

REDUCED SIZE DO NOT SCALE

Metric

	NAME	DATE
DESIGN	RS, CS	1/26/97
DRAWN	RL, BP	1/26/97
CHECKED	RL, RB	1/26/97

Carron & Associates, Inc.
Consulting Engineers CA-ENG-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
ABUTMENT DETAILS

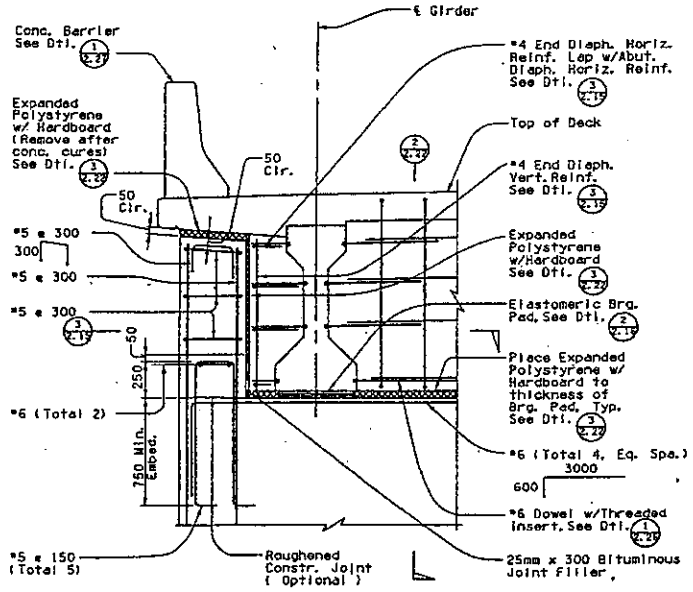
ROUTE 101L | SHEET | STRUCTURE NO. WBFR-2466 EBFR 2261 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.13

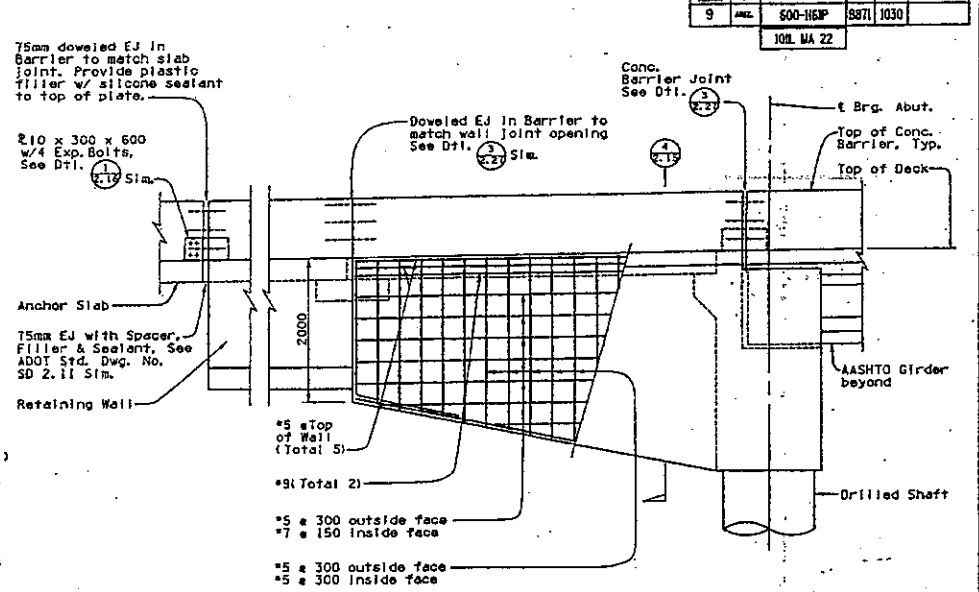
TRACS NO. H 3565 OIC | 600-1(6)P | B869 OF 1030

ccccc DGN=SPECIFICATIONccccc VIEW NAME: CCSMT13.DGN
ccccc SYSTEM=Cccccc

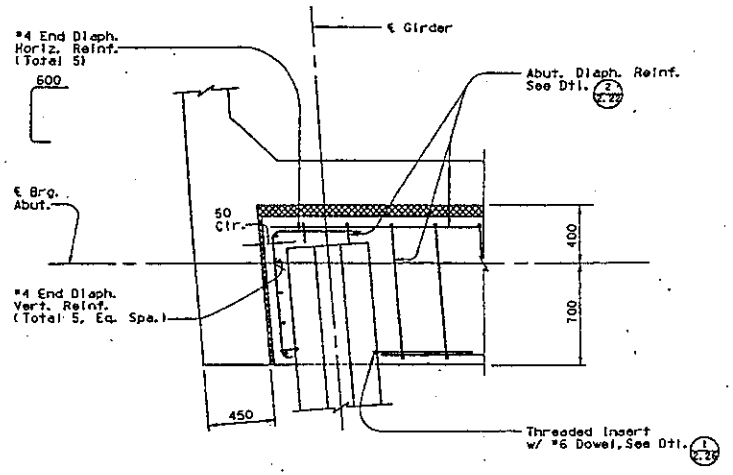
FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	8871	1030	
		101L MA 22			



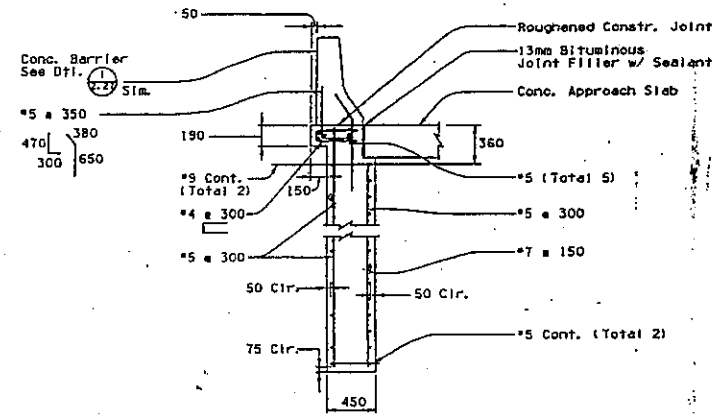
SECTION - KEY ①
1:15



TYP. WINGWALL ELEVATION ②
1:30



PLAN - ABUTMENT END DIAPHRAGM ③
1:15



TYP. WINGWALL SECTION ④
1:20

	NAME	DATE
DESIGN	RL CS	1/26/97
DRAWN	RL CF	1/26/97
CHECKED	RL KB	1/26/97

Cannon & Associates, Inc.
Consulting Engineers CAA-010-1

ROUTE 101L | SR FREE | STRUCTURE NO. WSFR: 2466 EBFR: 2281

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
ABUTMENT DETAILS

LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-215

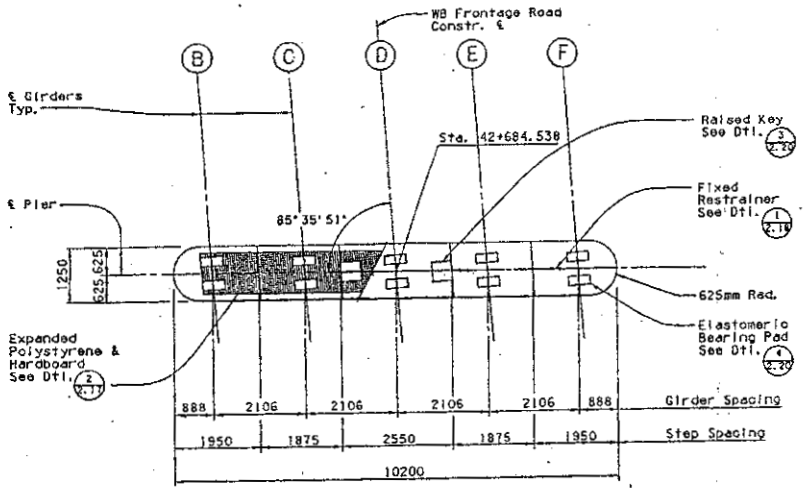
TRACS NO. H 3565 01C | 600-1(6)P | 8871 OF 1030

REDUCED SIZE DO NOT SCALE

Metric

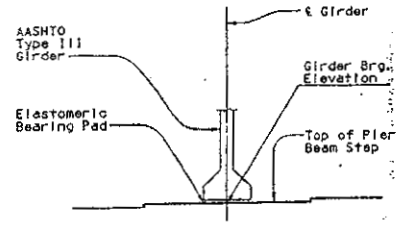
cccc:DGN=SPECIFICATIONcccc
cccc:SYSTEMcccc
VIEW NAME: CCSNT15.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-I(6)P	B873	1030	
		101L MA 22			



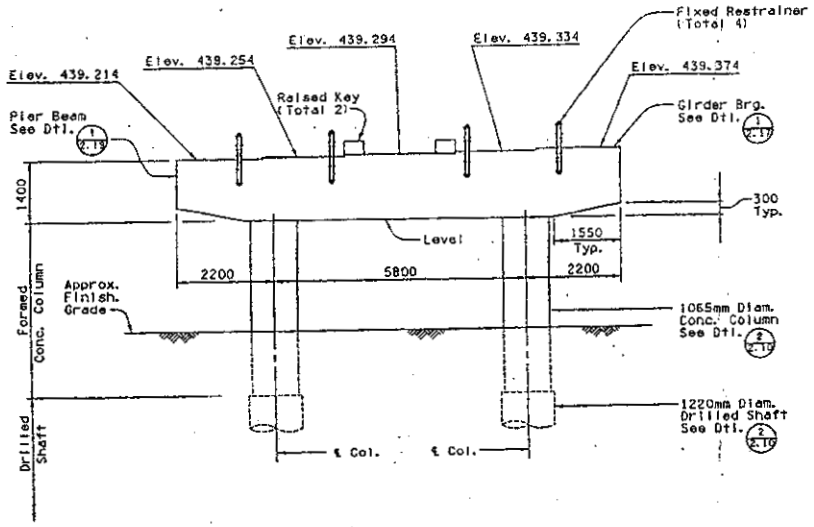
PLAN - WBFR PIER

1:50



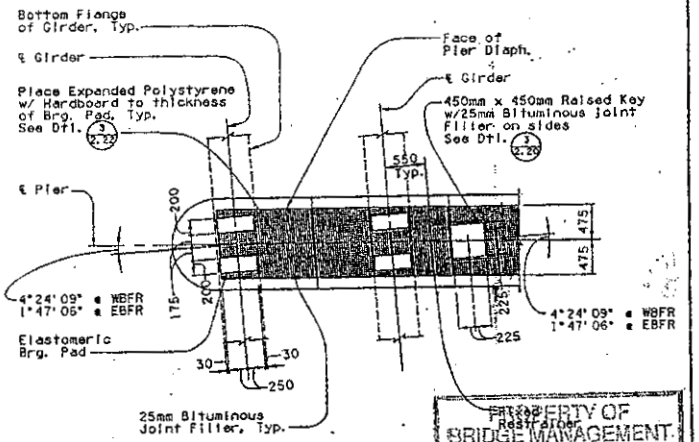
GIRDER BEARING DETAIL (1)

No Scale



ELEVATION - WBFR PIER

1:50



PARTIAL PLAN - PIER

1:30

PROPERTY OF BRIDGE MANAGEMENT

Fixed Restrainer

STRUCTURE NO. 2466

RTE. MP.

REDUCED SIZE DO NOT SCALE

	NAME	DATE
DESIGN	RC, CS	5/26/97
DRAWN	RA, DF	5/26/97
CHECKED	RT, MB	5/26/97

Cannon & Associates, Inc.
Consulting Engineers CAINCO-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
WBFR PIER PLAN, ELEV. & DTLS.

ROUTE 101L | NO. FIELD | STRUCTURE NO. WBFR# 2466 EBFR# 2251 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.17

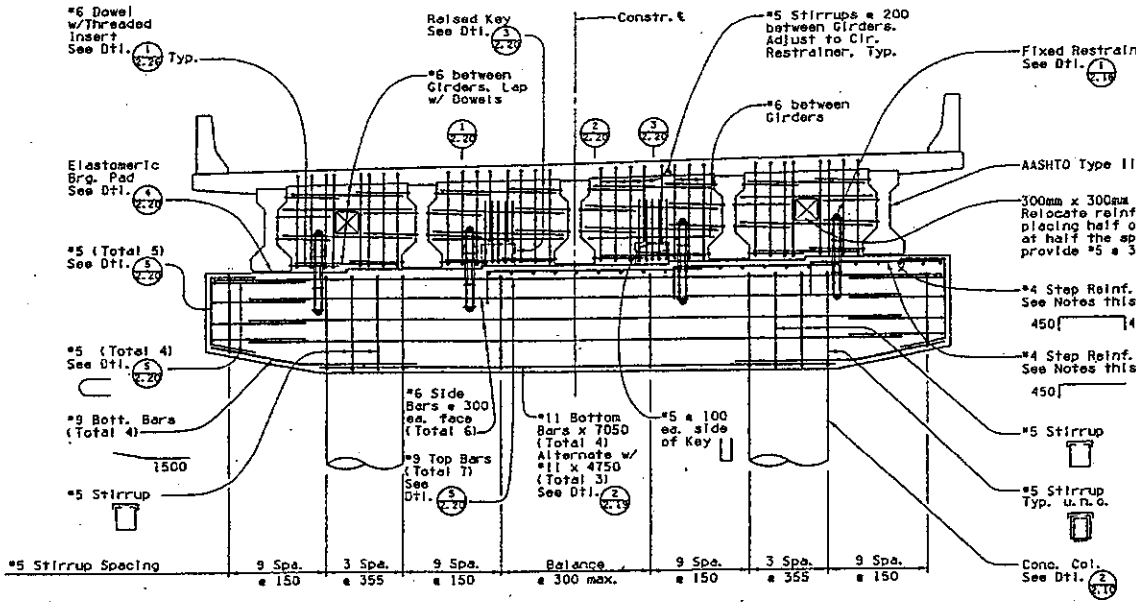
TRACS NO. H 3565 01C | 600-I(6)P | B873 OF 1030

Metric

00000DGN\SPECIFICATION\00000
00000SYSTIME00000

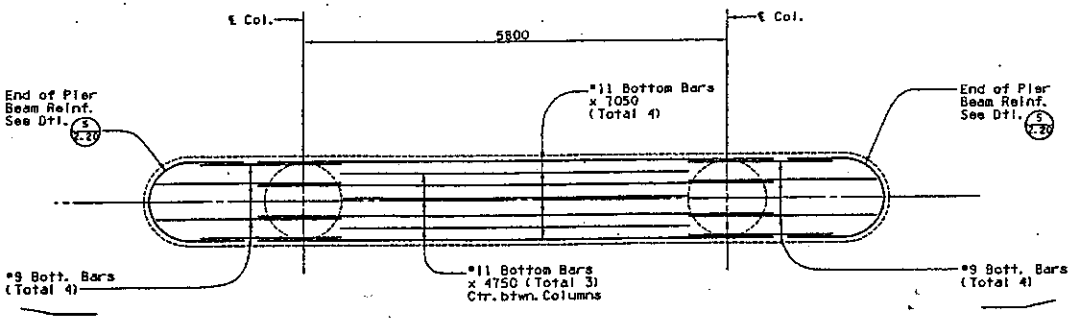
VIEW NAME: CCSKT17.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	8875	1030	
		101L MA 22			



PIER REINFORCING - ELEVATION (1)

1:30

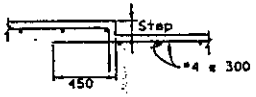


BAR PLACING DIAGRAM - BOTTOM OF PIER BEAM (2)

1:30

Notes:

1. See General Notes, Sheet S-2.4
2. Adjust pier beam reinf. to clear column vertical reinf. See Dtl. 2/S-2.19. All adjustments subject to approval of the Engineer.
3. Provide *4 Step Reinf. @ 300 each way where conc. coverage above *9 Top Reinf. exceeds 100mm



	NAME	DATE
DESIGN	DC CS	5/26/97
DRAWN	RL CP	5/26/97
CHECKED	RT KB	5/26/97

Cannon & Associates, Inc.
Consulting Engineers C-04040-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTRAMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
PIER DETAILS

ROUTE 101L | AIR PROJ | STRUCTURE NO. BBFR: 2466 ESFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DSC NO. S-2.19

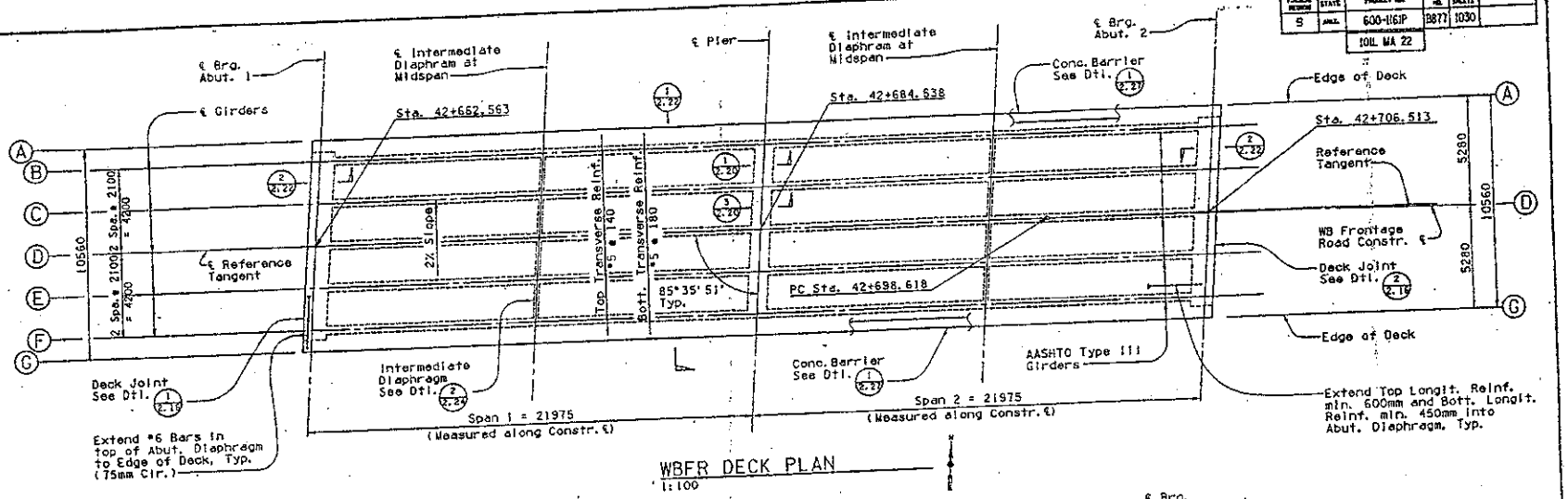
REDUCED SIZE DO NOT SCALE

Metric

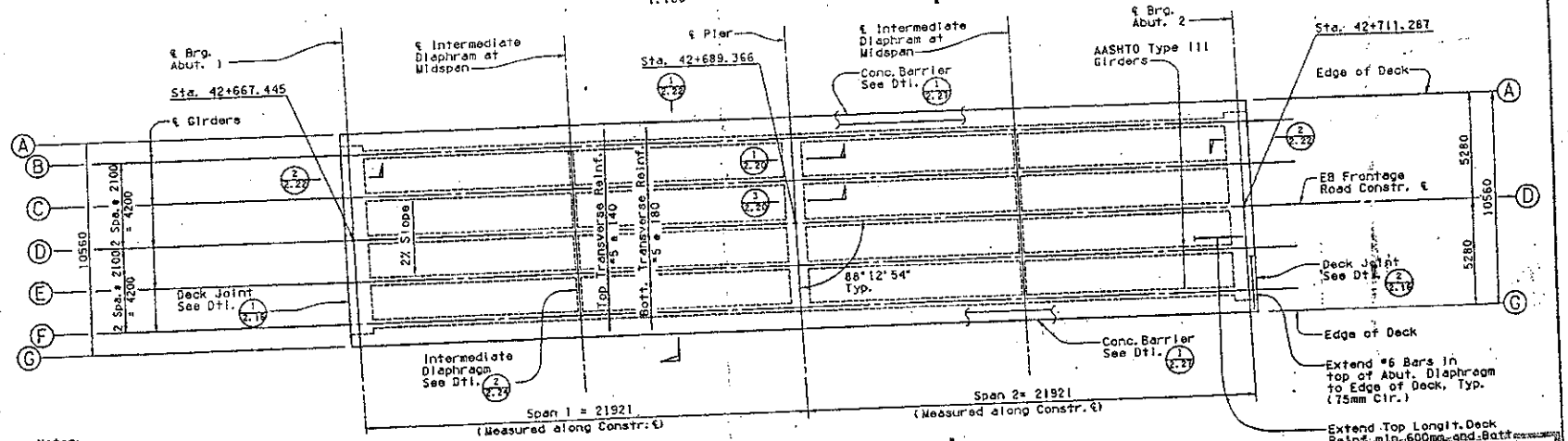
TRACS NO. H 3565 01C | 600-1(6)P | 8875 OF 1030

VIEW NAME: CCSHT19.DGN

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(16)P	8877	1030	
		10IL MA 22			



WBFR DECK PLAN
1:100



EBFR DECK PLAN
1:100

REDUCED SIZE DO NOT SCALE

Notes:

1. See General Notes, Sheet S-2.4
2. WBFR Girders to be parallel to Reference Tangent while Edges of Deck to be parallel to Constr. ℄
3. Transverse top and bott. deck reinf. to be placed normal to Constr. ℄ and shall be full length (no splices).
4. For top longitudinal reinf., see Sheet S-2.23
5. For Deck placing sequence, see Dtl. 1/2.25
6. Concrete Barrier Joints:
   Provide open joints at Abutments. See Dtl. 3/2.27
   Provide joint at ℄ Pier with 10mm bituminous joint filler. See Dtl. 2/2.27

BRIDGE MANAGEMENT
STRUCTURE NO. 2466

	NAME	DATE
DESIGN	RM, CJ	9/26/01
DRAWN	RL, DJ	9/26/01
CHECKED	AT, LB	9/26/01

Carnon & Associates, Inc.
Consulting Engineers CAINC01-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
DECK PLAN

ROUTE 10IL | JOB PART | STRUCTURE NO. WBFR: 2466 EBFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.21

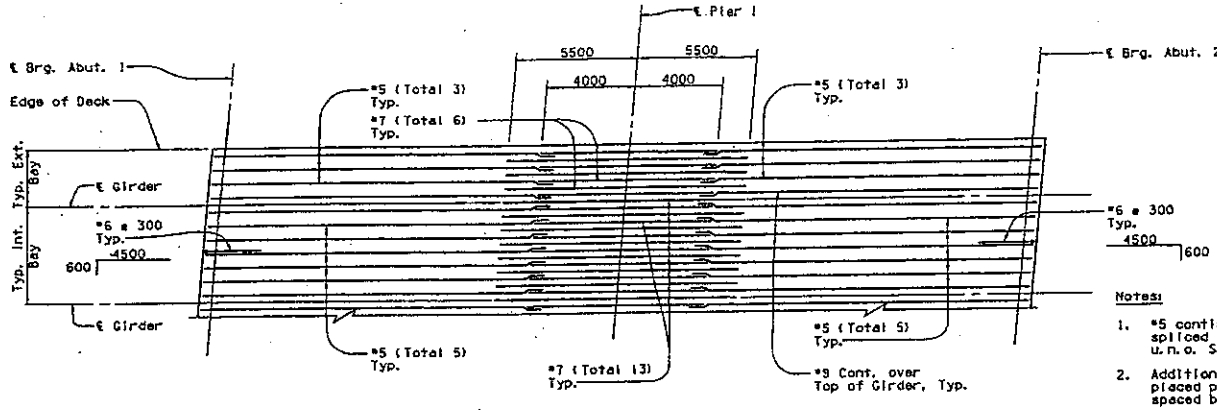
TRACS NO. H 3565 01C | 600-1(16)P | 8877 OF 1030

VIEW NAME: CCSH72LDGN

cccccDGNsSPECIFICATIONcccccc
cccccSYSTINEcccccc

Metric

F.A.H.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	8879	1030	
		10IL MA 22			

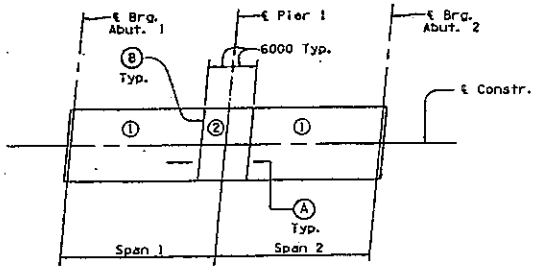


Notes:

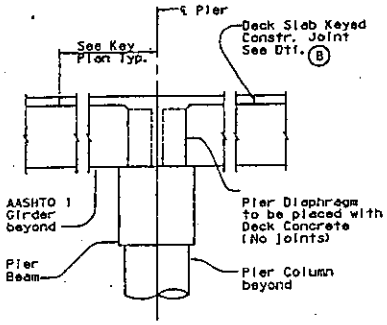
1. #5 continuous bars to be lap spliced in middle third of span only, u.n.o. Stagger all splices. See Dtl. 5/2.2
2. Additional top longitudinal reinf. to be placed parallel to girders and equally spaced between girders.
3. Deck bottom longitudinal reinf. sim.

TYP. DECK TOP LONGITUDINAL REINFORCING PLAN

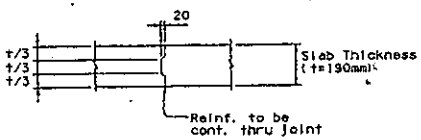
No Scale



KEY PLAN



SECTION-TYP. CONTINUOUS DECK SLAB OVER PIER — A



SECTION-TYP. DECK SLAB KEYED CONSTRUCTION JOINT — B

Notes for Deck Placing:

1. Longit. construction joints in deck shall not be allowed except as shown or approved by the Engineer. Transverse construction joints shall be located in accordance with deck placing sequence plan.
2. The numbers shown thus: 1 etc., indicate deck pouring sequence. The Contractor shall allow min. 12 hours between adjacent pours.
3. Abutment, pier and intermediate diaphragms are to be placed when deck is placed.
4. Reinf. to be continuous through construction joints.
5. Alternative pouring sequences will require a no cost supplemental agreement detailing joint locations and conditions, and shall be subject to approval of the Engineer.

DECK PLACING SEQUENCE DETAILS — 1

No Scale

	NAME	DATE
DESIGN	MS, CS	9/26/91
DRAWN	RS, D	9/26/91
CHECKED	RT, TD	9/26/91

Cannon & Associates, Inc. Consulting Engineers CAINHO-1

ARIZONA DEPARTMENT OF TRANSPORTATION INTERMODAL TRANSPORTATION DIVISION BRIDGE GROUP

STA. 42+ CAVE CREEK WASH BRIDGES DECK DETAILS

ROUTE	NO. POST	STRUCTURE NO.	LOCATION
10IL		WBFR: 2466 EBFR: 2281	PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.23

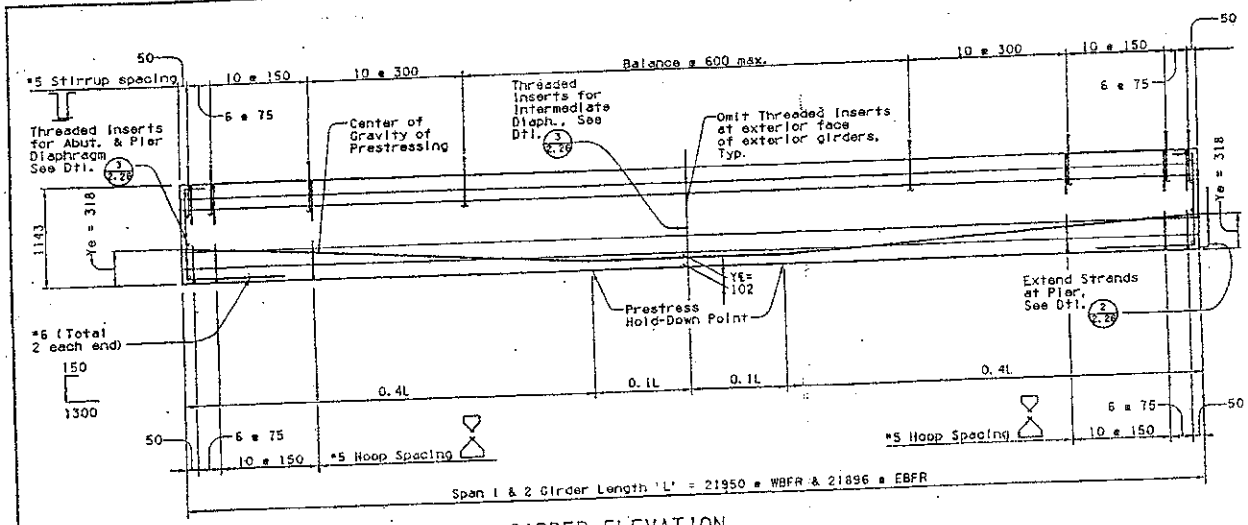
TRACS NO. H 3565 01C | 600-1(6)P | 8879 OF 1030

REDUCED SIZE DO NOT SCALE

Metric

DGN:SPECIFICATION VIEW NAME: CCSHT23.DGN
SYSTIME

FAR.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(61)P	B881	1030	
10IL MA 22					



GIRDER ELEVATION

No Scale

PRESTRESSED GIRDER NOTES

Prestressed Concrete Girders

AASHTO Type III Girders

Concrete Strength

f'ci = 31 MPa ultimate compressive strength of concrete at time of initial prestressing.
f'c = 35 MPa min. ultimate concrete strength at 28 days.

Working Force

Pw = The force remaining per girder after losses. Total assumed losses 345 MPa
Pw = 2700 kN.

Strand

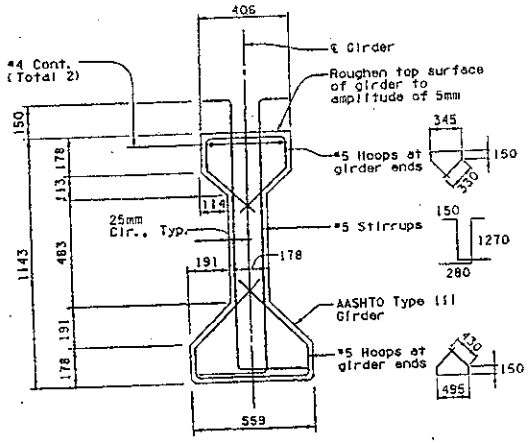
12.70mm diameter, ASTM A416M, Grade 1860 MPa 7-wire low relaxation prestressing strand with initial strand tension equal to 138 kN.
Use of masked strands will not be allowed.

Prestressing

All girders shall be prestressed by the pretensioning method only. Two hold-down points (as shown) within the girder shall be used to position the tendons. The center of gravity of the prestressing steel shall be as shown at the ends (Ye) and at midspan of the girders (Y℄). Ends of girders shall be constructed so they will be vertical when erected. Extend the prestressing strand beyond the ends of girders at pier ends only as shown. Cut all other strands flush and protect exposed steel at cut ends with asphalt coating.

Camber

Estimated midspan girder camber at release of prestress is 33mm upward. Contractor to provide measured midspan camber of girders to Engineer for evaluation. For additional information, see Girder Build-Up Profile this sheet and Screed Elevation Sheet S-2.28.

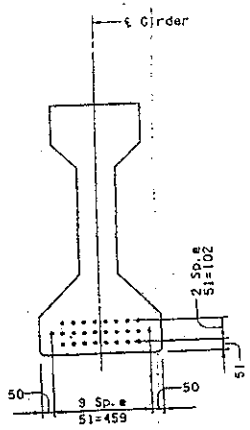


Note:

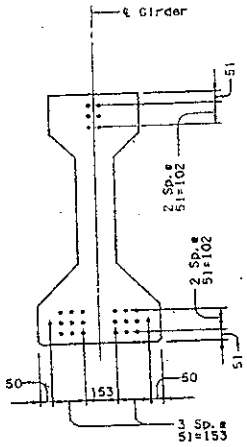
This section shows mild steel reinf. and dimensions only.

TYPICAL GIRDER SECTION

1:10



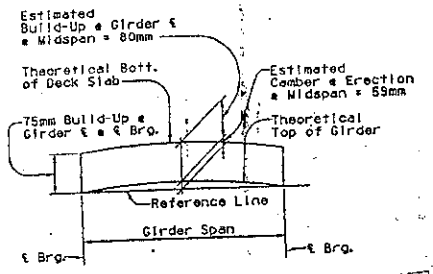
AT MIDSPAN



AT ENDS

STRAND PATTERN (26-12.70mm Diam. 7- Wire Strands)

1:10



GIRDER BUILD-UP PROFILE

No Scale

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2466
RTE. MP.

	NAME	DATE
DESIGN	R.L. C.S.	9/26/97
DRAWN	R.L. G.F.	9/26/97
CHECKED	R.L. J.B.	9/26/97

Carson & Associates, Inc.
Consulting Engineers CA#0401

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
GIRDER DETAILS

ROUTE 10IL | NO. POST | STRUCTURE NO.: WBFR: 2466 EBFR: 2281 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.25

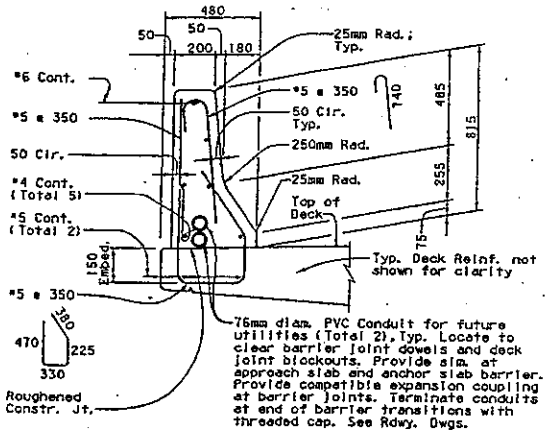
TRACS NO. H 356S 01C | 600-1(61)P | B881 OF 1030

REDUCED SIZE DO NOT SCALE

Metric

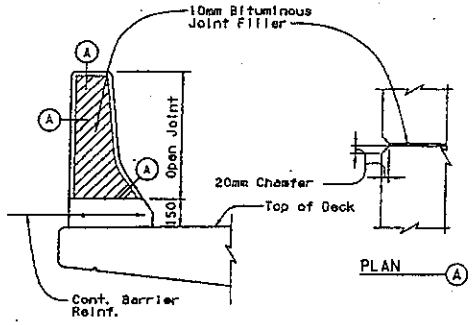
cccccDGNoSPECIFICATIONccccc
ccccSYSTIMEcccccc
VIEW NAME: ocsht25.dgn 1-22-97

FEDERAL RESERVE	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(16)P	B883	1030	
		IOIL MA 22			



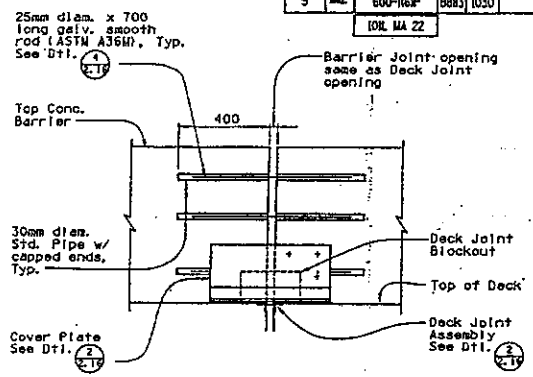
CONC. BARRIER DETAIL (1)

No Scale



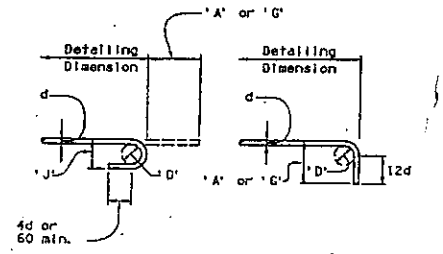
CONC. BARRIER JOINT DETAIL (2)

No Scale



ELEV. CONC. BARRIER JOINT AT ABUT. (3)

No Scale



180° & 90° Standard Hooks

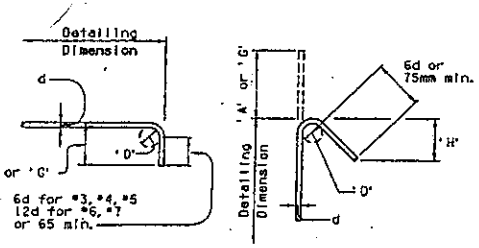
Hook (mm)	Bar Size 3	4	5	6	7	8	9	10	11
'D'	55	75	95	115	135	150	240	275	305
180° 'A' or 'G'	125	150	180	205	255	280	380	430	485
'J'	75	100	125	150	180	205	300	335	375
90° 'A' or 'G'	150	205	255	305	355	405	510	560	610

Notes:

1. Typical for all drawings u.n.o.
2. All bar bends to be cold bent.
3. Dimensions are in millimeters.

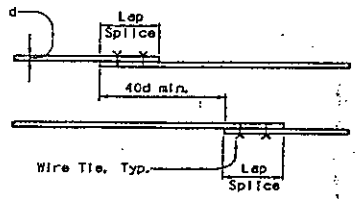
STANDARD REINF. BAR HOOK DETAILS (4)

No Scale



90° & 135° Standard Hooks (stirrups & ties)

Hook (mm)	Bar Size 3	4	5	6	7
'D'	40	50	65	115	135
135° 'A' or 'G'	125	165	205	275	320
'H' (approx.)	90	115	140	165	200
90° 'A' or 'G'	100	115	150	305	355



Bar size	3	4	5	6	7	8	9	10	11
Lap Splice (mm)	305	405	510	660	890	1145	1450	1855	2260

Notes:

1. Laps provided in table are to be used as minimum for lapping horizontal reinforcing, typical unless noted otherwise.
2. The minimum lap requirements are based on Grade 420 reinforcement and 25 MPa concrete for a Class B splice. The lap requirements shall be modified by the following appropriate factors except bars smaller than #7 shall not be modified for concrete strength:

   Bar spacing greater than 150mm = 0.80
   Top bars = 1.40
   20 MPa concrete = 1.12
   30 MPa concrete = 0.91
3. Top bars have more than 300mm of concrete cast below them.
4. Lap splices shall not be less than 300mm.
5. Deviation requires approval of the Engineer.

HORIZ. REINF. LAP SPLICE DETAIL (5)

No Scale

	NAME	DATE
DESIGN	KS, CS	9/26/97
DRAWN	RA, DE	9/26/97
CHECKED	RT, KS	9/26/97

Carmon & Associates, Inc.
Consulting Engineers Chandler

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP

STA. 42+
CAVE CREEK WASH BRIDGES
MISCELLANEOUS DETAILS

ROUTE: IOIL | SR PARK | STRUCTURE NO.: WBFR: 2466, EBFR: 2281 | LOCATION: PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.27

TRACS NO. H 3565 01C | 600-1(16)P | B883OF1030

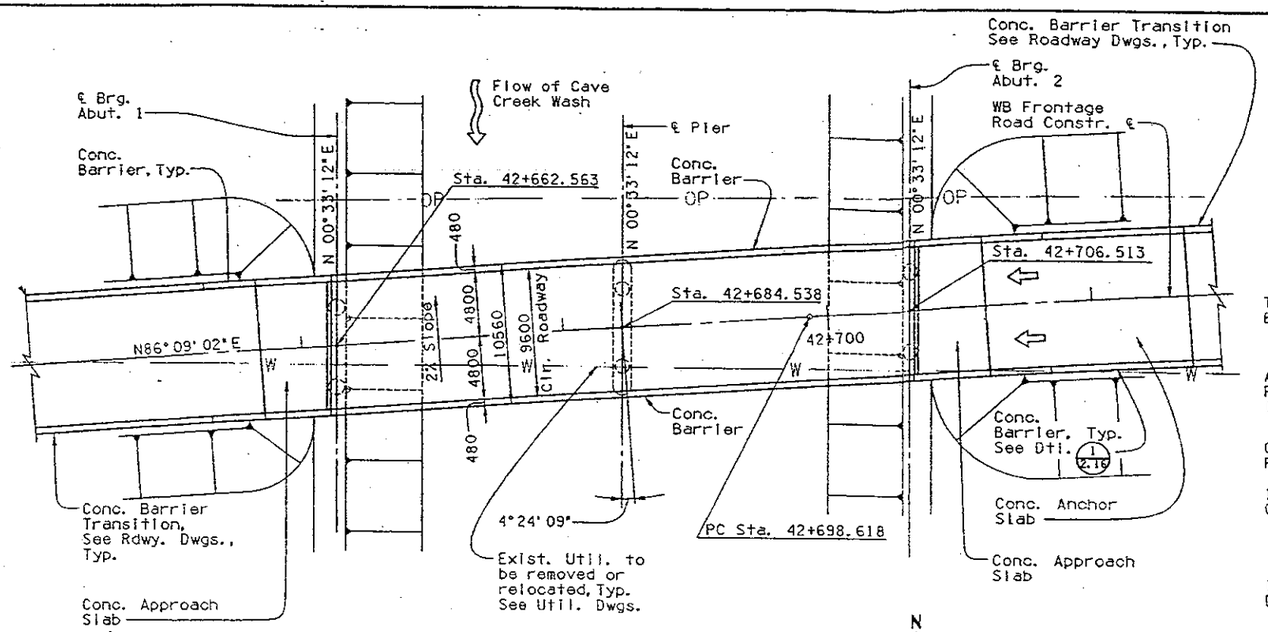
REDUCED SIZE DO NOT SCALE

Metric

MP 25.87

eeeeeDGNeSPECIFICATIONeeeee
eeeeeSYSTIMEeeeee
VIEW NAME: CCSH728.DGN

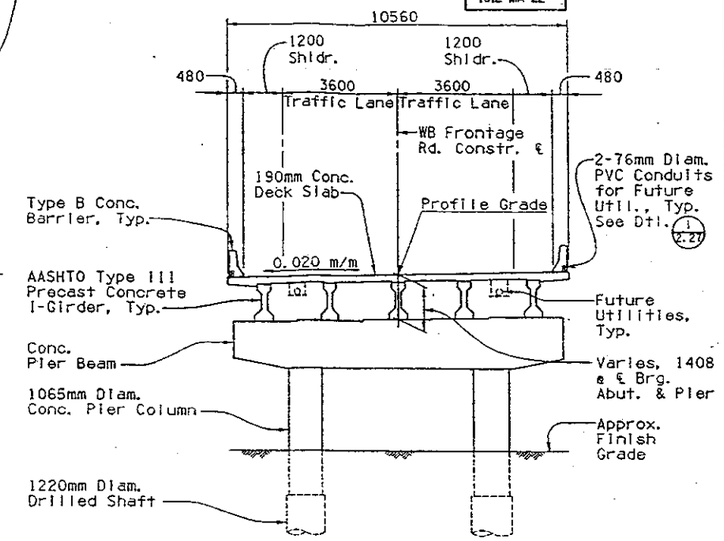
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	B858	1030	
		101L MA 22			



PLAN

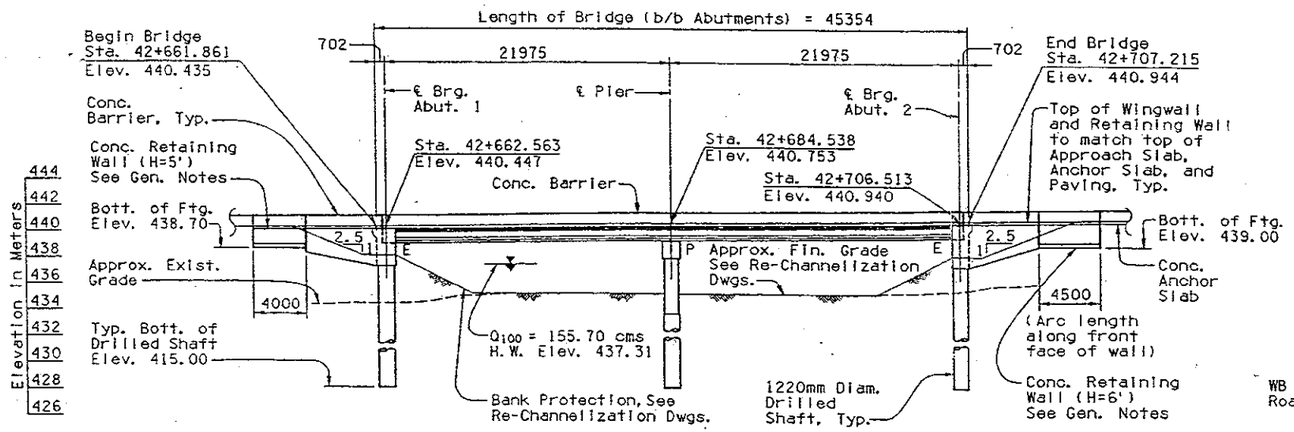
1:200

New Two-Span Bridge with AASHTO Type III Precast Prestressed Concrete Girders
Skew: 4°24' 09"



TYPICAL SECTION

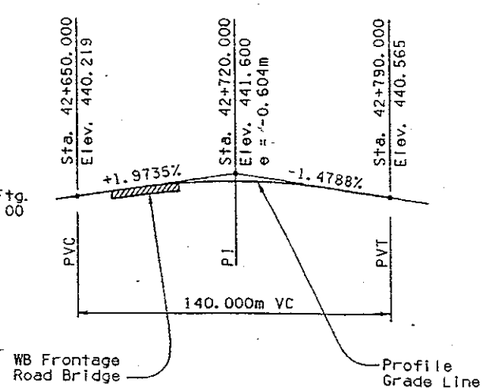
1:80



ELEVATION

1:200

(Stations, Dimensions & Elevations at top of deck along Construction ℄, u.n.o.)



PROFILE GRADE

℄ WB Frontage Road	
PC Sta.	42+698.618
PI Sta.	42+795.058
PT Sta.	42+891.441
T	96.441m
L	192.823m
Δ	3°27' 09"
R	3200.000m

CURVE DATA

	NAME	DATE
DESIGN	RS, ES	9/26/97
DRAWN	RA, DF	9/26/97
CHECKED	RT, KB	9/26/97

Cannon & Associates, Inc.
Consulting Engineers CA94040-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
WBFR PLAN, ELEV. & SECTION

ROUTE 101L | km POST | STRUCTURE NO. WBFR 2265 EBFR 2261 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST. | DWG NO. S-2.2

REDUCED SIZE DO NOT SCALE

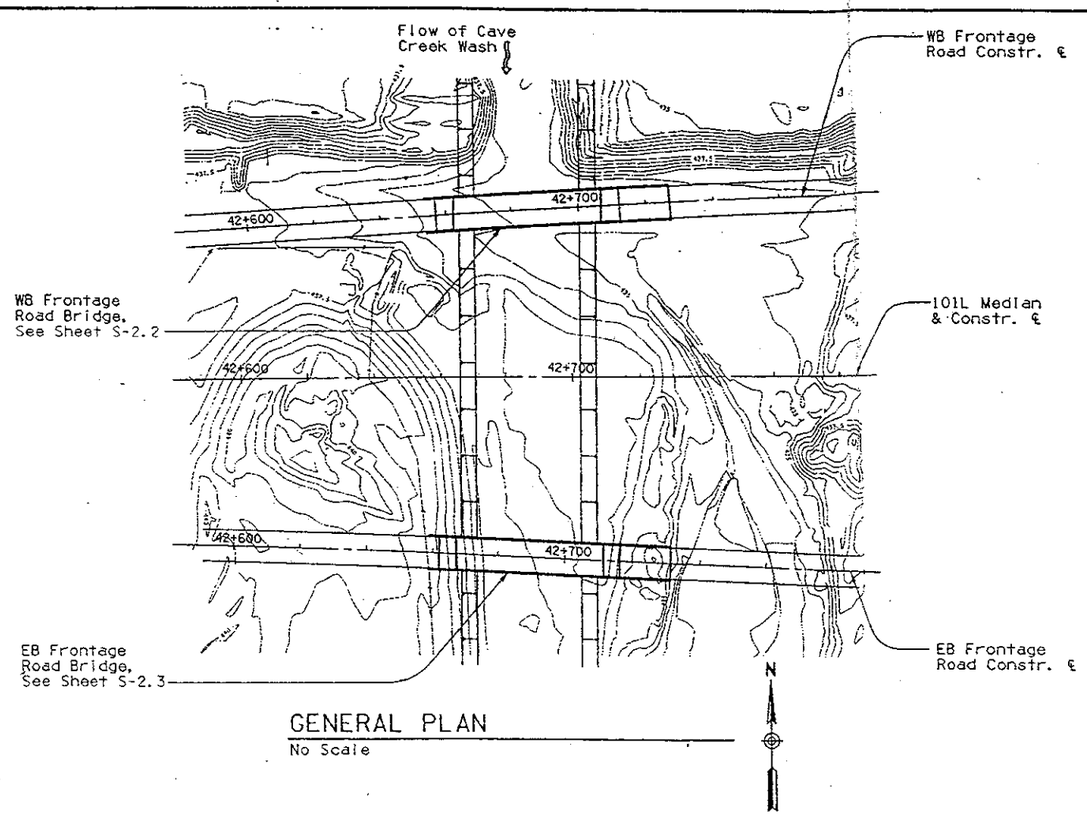
Metric

NO.	DESCRIPTION OF REVISIONS	MADE BY	DATE
1			
2			
3			
4			

cccccDGNcSPECIFICATIONcccccc
cccccSYSTIMEcccccc
VIEW NAME: CCSHT02.DGN

TRACS NO. H 3565 01C | 600-1(6)P | B858 OF 1030

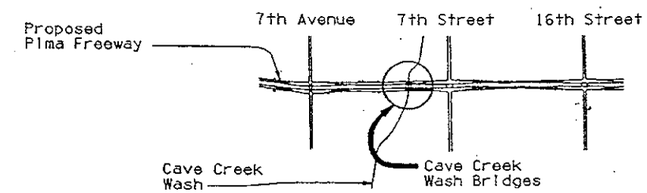
FEDERAL REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	600-1(6)P	B857	1030	
		101L MA 22			



GENERAL PLAN
No Scale

SHEET LIST

Title	Sheet No.
General Plan & Quantities	S-2.1
WB Frontage Road Plan, Elev. & Sect.	S-2.2
EB Frontage Road Plan, Elev. & Sect.	S-2.3
General Notes & Details	S-2.4
Foundation Data	S-2.5 to S-2.8
Foundation Plan & Schedule	S-2.9
Foundation Details	S-2.10
WBFR Abutment Plan & Elev.	S-2.11
EBFR Abutment Plan & Elev.	S-2.12
Abutment Details	S-2.13 to S-2.16
WBFR Pier Plan, Elev. & Dtls.	S-2.17
EBFR Pier Plan, Elev. & Dtls.	S-2.18
Pier Details	S-2.19 to S-2.20
Deck Plan	S-2.21
Deck Section & Details	S-2.22
Deck Details	S-2.23 to S-2.24
Girder Details	S-2.25 to S-2.26
Miscellaneous Details	S-2.27
Screed Elevations	S-2.28



KEY MAP

APPROXIMATE QUANTITIES

	Item	Structural Excavation	Structure Backfill	Class 'S' Concrete 20 MPa	Class 'S' Concrete 25 MPa	Class 'S' Concrete 30 MPa	Bridge Barrier	Deck Joint Assembly	Approach Slab	Anchor Slab	Precast Girder Type III		Vertical Restrainers Expansion	Vertical Restrainers Fixed	Reinf. Steel	Drilled Shaft 1220mm Diam.	
		m^3	m^3	m^3	m^3	m^3	m	m	m^2	m^2	m	No.	Each	Each	Kg	m	No.
WBFR	Abutment 1	30	30	—	45	—	11.4	9.6	52	—	—	—	4	—	4,180	44.6	2
WBFR	Pier 1	—	—	—	26	—	—	—	—	—	—	—	—	4	3,030	37.6	2
WBFR	Abutment 2	30	30	—	52	—	11.4	9.6	52	154	—	—	4	—	4,290	44.6	2
WBFR	Superstructure	—	—	—	—	132	89.3	—	—	—	219.5	10	—	—	22,100	—	—
WBFR	Approach Slabs	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
WBFR	Anchor Slab	—	—	—	—	—	20.4	—	—	—	—	—	—	—	—	—	—
WBFR	Retaining Walls	80	30	26	—	—	17.6	—	—	—	—	—	—	—	1020	—	—
WBFR	Total	140	90	26	123	132	150.1	19.2	104	154	219.5	10	8	4	34,620	126.8	6
WBFR	As-Built Total																
EBFR	Abutment 1	30	30	—	45	—	10.9	9.6	55	—	—	—	4	—	4,190	42.8	2
EBFR	Pier 1	—	—	—	25	—	—	—	—	—	—	—	—	4	2,920	36.4	2
EBFR	Abutment 2	30	30	—	45	—	10.9	9.6	55	156	—	—	4	—	4,190	42.8	2
EBFR	Superstructure	—	—	—	—	132	89.1	—	—	—	219.0	10	—	—	22,100	—	—
EBFR	Approach Slabs	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
EBFR	Anchor Slab	—	—	—	—	—	23.4	—	—	—	—	—	—	—	—	—	—
EBFR	Retaining Walls	50	20	17	—	—	13.2	—	—	—	—	—	—	—	750	—	—
EBFR	Total	110	80	17	115	132	147.5	19.2	110	156	219.0	10	8	4	34,150	122.0	6
EBFR	As-Built Total																

Notes:

1. Drilled shaft quantities are based on linear meter of drilled shaft including concrete and reinforcing steel in place. See Special Provisions.
2. Wingwall quantities are included in abutment quantities.
3. For limits of Structural Excavation and Structure Backfill, see ADOT. Std. No. SD 5.11 and SD 5.21.

REDUCED SIZE DO NOT SCALE

PROPERTY OF BRIDGE MANAGEMENT
STRUCTURE NO. 2466
RTE. MP. 10 1L e

	NAME	DATE
DESIGN	RS, CS	9/26/97
DRAWN	RA, DF	9/26/97
CHECKED	RT, KB	9/26/97

Cannon & Associates, Inc.
Consulting Engineers CA94040-1

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION
BRIDGE GROUP
STA. 42+
CAVE CREEK WASH BRIDGES
GENERAL PLAN & QUANTITIES

ROUTE 101L | KM POST | STRUCTURE NO. WBFR: 2466 EBFR: 2261 | LOCATION PIMA FWY-JCT. I-17 TO 56TH ST.

DWG NO. S-2.1

TRACS NO. H 3565 01C | 600-1(6)P | B857 OF 1030

NO.	REVISIONS	MADE BY	DATE
1			
2			
3			
4			

DESCRIPTION OF REVISIONS

cccccDGNcSPECIFICATIONccccc
ccccccSYSTIMEcccccc
VIEW NAME: CCSHTOL.DGN

E.5 Hydraulic Calculations

HEC-RAS Floodplain Results

River	River Sta.	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Top Width	Hydr Depth	Froude # Chl	Sta W.S. Lft	Sta W.S. Rgt
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)
Cave Creek	25.561	4900	1513.88	1510.63	6.37	115.34	6.67	0.43	9950.54	10065.87
Cave Creek	25.557	4900	1511.43	1511.43	12.64	77.65	4.99	1	9961.17	10038.83
Cave Creek	25.551	4900	1510.77	1510.77	12.92	73.11	5.19	1	9963.45	10036.55
Cave Creek	25.528	2880	1509.45	1509.45	10.88	72	3.68	1	9964	10036
Cave Creek	25.515	2880	1504.78	1500.62	4.3	157.24	7.3	0.28	9928.03	10085.27
Cave Creek	25.482	2880	1503.3	1502.62	9.42	1207.55	4.33	0.8	9758.82	11063.55
Cave Creek	25.428	2880	1501.25	1500.44	9.9	1648.92	4.85	0.79	9778.11	11441.54
Cave Creek	25.367	2880	1500.05	1498.59	8.41	1978.56	5.28	0.61	9651.12	11701.4
Cave Creek	25.299	2880	1496.6	1496.6	11.93	2024.83	4.38	1.01	9709.46	11752.35
Cave Creek	25.271	2880	1495.13	1492.09	2.38	2127.97	4.4	0.22	9570.99	11703.83
Cave Creek	25.21	2880	1494.94	1492	3.1	2178.14	4.55	0.25	9321.01	11502.05
Cave Creek	25.191	2880	1494.61	1493.02	5.16	1835.26	3.06	0.39	9618.81	11454.07
Cave Creek	25.155	2880	1493.46	1492.72	8.65	1318.18	3.56	0.67	9848.98	11437.74
Cave Creek	25.096	2880	1492.57	1491.27	7.02	1331.11	3.52	0.55	9857.64	11332.01
Cave Creek	25.039	2880	1489.75	1489.75	11.71	1081.74	3.42	0.94	9924.39	11127.79
Cave Creek	24.953	2880	1487.08	1485.23	6.93	1214.47	4.64	0.5	9922.89	11150.27
Cave Creek	24.872	2880	1485.37	1483.82	8.99	1070.11	3.3	0.6	9870.79	10964.36
Cave Creek	24.828	2880	1482.89	1482.89	12.65	899.48	4.52	0.95	9964.88	10865.83
Cave Creek	24.793	2880	1481.2	1481.2	11.67	863.44	3.9	0.93	9920.56	10808.88
Cave Creek	24.732	2880	1479.1	1478.39	8.94	681.63	3.81	0.74	9737.23	10583.87
Cave Creek	24.7	2880	1477.25	1477.25	10.87	352.14	3.48	0.96	9884.37	10303.15
Cave Creek	24.673	3090	1477.44	1474.73	5.21	308.76	4.36	0.37	9870.65	10250.59
Cave Creek	24.632	3090	1474.39	1474.39	13.17	52.94	4.91	1.01	9974.83	10027.76

River	River Sta.	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Top Width	Hydr Depth	Froude # Chl	Sta W.S. Lft	Sta W.S. Rgt
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)
Cave Creek	24.617	3090	1471.71	1471.71	10.21	251.99	2.8	0.97	9696.47	10073
Cave Creek	24.587	3090	1469.03	1468.51	7.14	356.57	2.34	0.69	9666.15	10022.72
Cave Creek	24.549	3090	1468.44	1466.63	3.78	339.44	3.32	0.33	9829.33	10168.77
Cave Creek	24.504	3300	1466.24	1466.15	9.75	132.93	2.91	0.81	9956.42	10169.79
Cave Creek	24.466	3300	1465	1464.34	6.54	218.55	2.69	0.62	9955.43	10173.98
Cave Creek	24.427	3300	1464.37	1462.57	4.35	252.34	3.36	0.37	9935.92	10189.49
Cave Creek	24.343	3300	1463.53	1460.82	3.71	258.16	3.65	0.32	9890.61	10165.08
Cave Creek	24.3	3300	1463.5	1458.86	1.88	328.89	5.58	0.14	9865.43	10194.32
Cave Creek	24.264	3300	1463.42	1458.53	2.25	257.15	5.94	0.16	9865.36	10122.51
Cave Creek	24.232	3300	1462.72	1459.89	6.21	105.99	5.08	0.46	9946.8	10052.79
Cave Creek	24.21	3300	1462.95	1457.54	2.67	189.21	6.68	0.17	9888.79	10078
Cave Creek	24.169	3300	1462.85	1457.2	2.8	175.01	6.9	0.18	9944.32	10119.34
Cave Creek	24.112	3300	1462.77	1455.94	2.48	171.47	7.94	0.15	9965.16	10136.62
Cave Creek	24.068	3300	1461.85	1458.95	6.63	71.63	6.95	0.44	9964.19	10035.82
Cave Creek	24.062	7th Street Bridge								
Cave Creek	24.057	3300	1461.28	1458.83	7.09	71.63	6.5	0.49	9964.19	10035.82
Cave Creek	23.963	3300	1459.68	1456.64	6.68	79.65	6.2	0.47	9959.27	10038.92
Cave Creek	23.883	3300	1457.9	1455.14	7.87	64.21	6.53	0.54	9968	10032.21
Cave Creek	23.822	3300	1455.38	1453.88	9.53	60.33	5.74	0.7	9967.79	10028.12
Cave Creek	23.787	3300	1455.49	1451.75	4.8	112.17	6.13	0.34	9933.22	10045.39
Cave Creek	23.756	3300	1454.74	1451.45	6.52	81.66	6.2	0.46	9960.1	10041.75
Cave Creek	23.662	3300	1452.11	1449.74	8.37	62.52	6.31	0.59	9970.07	10032.58
Cave Creek	23.567	3300	1449.58	1446.82	7.72	66.72	6.41	0.54	9963.56	10030.28
Cave Creek	23.488	3300	1447.83	1444.7	7.32	67.87	6.64	0.5	9966.62	10034.48
Cave Creek	23.389	3300	1445.02	1442.61	8.39	61.66	6.38	0.59	9971.21	10032.87

River	River Sta.	Q Total	W.S. Elev	Crit W.S.	Vel Chnl	Top Width	Hydr Depth	Froude # Chl	Sta W.S. Lft	Sta W.S. Rgt
		(cfs)	(ft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)
Cave Creek	23.307	3300	1442.67	1440.21	8.16	63.61	6.36	0.57	9966.9	10030.51
Cave Creek	23.223	3300	1440.52	1437.67	7.79	63.21	6.7	0.53	9967.15	10030.35
Cave Creek	23.204	3300	1438.07	1438.07	12.49	54.06	4.89	1	9972.4	10026.46
Cave Creek	23.192	3300	1435.57	1435.57	12.24	58.04	4.64	1	9972.29	10030.33
Cave Creek	23.15	3300	1434.09	1432.57	6.74	111.89	4.37	0.57	9945.32	10057.21
Cave Creek	23.146	North Frontage Road Bridge								
Cave Creek	23.142	3300	1433.06	1431.86	7.28	109.12	4.15	0.63	9947.35	10056.47
Cave Creek	23.138	3300	1433.02	1431.63	7.06	106.91	4.37	0.6	9945.11	10052.01
Cave Creek	23.134	North On Ramp Bridge								
Cave Creek	23.131	3300	1432.35	1431.29	7.37	113.11	3.96	0.65	9943.39	10056.5
Cave Creek	23.128	3300	1432.33	1431.16	7.21	112.59	4.07	0.63	9942.96	10055.54
Cave Creek	23.114	Loop 101 Mainline Bridges								
Cave Creek	23.101	3300	1431.65	1430.37	7.01	111.42	4.22	0.6	9944.27	10055.68
Cave Creek	23.097	3300	1431.6	1430.27	6.86	112.85	4.26	0.59	9943.71	10056.55
Cave Creek	23.093	South Off Ramp Bridge								
Cave Creek	23.09	3300	1431.45	1430.12	6.76	116.96	4.17	0.58	9944.88	10061.84
Cave Creek	23.084	3300	1431.37	1430.01	6.7	117.75	4.18	0.58	9944.86	10062.61
Cave Creek	23.081	South Frontage Road Bridge								
Cave Creek	23.077	3300	1431.24	1429.7	6.47	117.05	4.36	0.55	9944.09	10061.14
Cave Creek	23.04	3660	1429.35	1429.35	9.93	469.21	3.1	0.99	9573.66	10065.45
Cave Creek	23.019	3660	1423.08	1422.4	7.34	289.02	3.22	0.69	9777.41	10066.43
Cave Creek	22.991	3660	1422.71	1421.85	6.24	262.81	2.77	0.61	9801.09	10063.9
Cave Creek	22.88	5500	1420.05	1418.49	6.1	211.79	4.26	0.52	9952.12	10163.91

Floodway Data

Flooding Source	Floodway			Base Flood Water Surface Elevation[1]		
Cross-Section	Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Floodway (ft)	Floodplain (ft)	Increase (ft)
25.528	72	264.7	10.9	1509.45	1509.45	0.00
25.515	91	671.6	4.3	1504.81	1504.78	0.04
25.482	71	305.9	9.4	1503.30	1503.30	0.00
25.428	63	324.4	8.9	1501.79	1501.25	0.55
25.367	60	326.2	8.8	1500.08	1500.05	0.03
25.299	55	242.7	11.9	1496.62	1496.60	0.02
25.271	224	1149.3	2.5	1495.99	1495.13	0.85
25.210	195	1041.9	2.8	1495.77	1494.94	0.82
25.191	94	505.8	5.7	1495.17	1494.61	0.56
25.155	78	409.6	7.0	1494.27	1493.46	0.81
25.096	84	450.8	6.4	1493.35	1492.57	0.78
25.039	59	262.8	11.0	1490.10	1489.75	0.35
24.953	71	441.5	6.5	1487.73	1487.08	0.65
24.872	50	368.1	7.8	1486.22	1485.37	0.85
24.828	40	222.7	12.9	1483.11	1482.89	0.22
24.793	46	228.7	12.6	1481.27	1481.20	0.07
24.732	69	325.8	8.8	1479.37	1479.10	0.27
24.700	63	283	10.2	1477.80	1477.25	0.55
24.673	103	670.2	4.6	1478.23	1477.44	0.79
24.632	40	229.3	13.5	1474.86	1474.39	0.47
24.617	62	264.8	11.7	1472.51	1471.71	0.80
24.587	151	396.8	7.8	1469.48	1469.03	0.45
24.549	241	829.4	3.7	1468.65	1468.44	0.21
24.504	110	428.9	7.7	1466.86	1466.24	0.62
24.466	155	474.2	7.0	1465.29	1465.00	0.29
24.427	150	655.1	5.0	1464.57	1464.37	0.20
24.343	197	825	4.0	1463.57	1463.53	0.05
24.300	261	1587.5	2.1	1463.55	1463.50	0.04
24.264	215	1366.6	2.4	1463.45	1463.42	0.03
24.232	94	531.3	6.2	1462.74	1462.72	0.02
24.210	167	1219.6	2.7	1462.97	1462.95	0.02
24.169	152	1162.7	2.8	1462.86	1462.85	0.01
24.112	150	1310.8	2.5	1462.77	1462.77	0.00
24.068	72	497.9	6.6	1461.85	1461.85	0.00
24.062	7th Street Bridge					
24.057	72	465.7	7.1	1461.28	1461.28	0.00
23.963	80	494	6.7	1459.68	1459.68	0.00
23.883	64	419.6	7.9	1457.90	1457.90	0.00
23.822	60	346.4	9.5	1455.38	1455.38	0.00
23.787	112	687.8	4.8	1455.49	1455.49	0.00

[1]Vertical Datum: NGVD 29

Flooding Source	Floodway			Base Flood Water Surface Elevation[1]		
Cross-Section	Width (ft)	Section Area (sq ft)	Mean Velocity (ft/s)	Floodway (ft)	Floodplain (ft)	Increase (ft)
23.756	82	506.3	6.5	1454.74	1454.74	0.00
23.662	63	394.2	8.4	1452.11	1452.11	0.00
23.567	67	427.4	7.7	1449.58	1449.58	0.00
23.488	68	450.6	7.3	1447.83	1447.83	0.00
23.389	62	393.3	8.4	1445.02	1445.02	0.00
23.307	64	404.5	8.2	1442.67	1442.67	0.00
23.223	63	423.6	7.8	1440.52	1440.52	0.00
23.204	54	264.1	12.5	1438.07	1438.07	0.00
23.192	58	269.6	12.2	1435.57	1435.57	0.00
23.150	112	489.4	6.7	1434.09	1434.09	0.00
23.146	North Frontage Road Bridge					
23.142	109	453.1	7.3	1433.06	1433.06	0.00
23.138	107	467.3	7.1	1433.02	1433.02	0.00
23.134	North On Ramp Bridge					
23.131	113	447.9	7.4	1432.35	1432.35	0.00
23.128	113	457.8	7.2	1432.33	1432.33	0.00
23.114	Loop 101 Mainline Bridges					
23.101	111	470.5	7.0	1431.65	1431.65	0.00
23.097	113	480.6	6.9	1431.60	1431.60	0.00
23.093	South Off Ramp Bridge					
23.090	117	488	6.8	1431.45	1431.45	0.00
23.084	118	492.3	6.7	1431.37	1431.37	0.00
23.081	South Frontage Road Bridge					
23.077	117	509.8	6.5	1431.24	1431.24	0.00
23.040	119	368.7	9.9	1429.35	1429.35	0.00
23.019	134	530.5	6.9	1423.80	1423.08	0.72
22.991	174	505.9	7.2	1423.41	1422.71	0.70

[1]Vertical Datum: NGVD 29

HEC-RAS Version 3.1.3 May 2005
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Cave Creek
Project File : CaveCreek.prj
Run Date and Time: 8/11/2006 1:57:38 PM

Project in English units

Project Description:
Vertical Datum NGVD 1929. The stations are numbered based on reach lengths, starting at the most downstream section 25.880, which is from the Burgess & Niple HEC-2 FIS model, up to section 25.528, the most upstream new cross-section in this model. Section 25.551 and upstream are borrowed from the FIS HEC-2 model. There is a discontinuity in stationing betwen the most upstream new cross section (25.528) and 25.551. The reach length is 90 feet but stationing indicates about 121 feet difference. This occurs because the new hydraulic baseline is 14073 feet from 25.551 to 22.880, but was 14107 feet in the HEC-2 model.

PLAN DATA

Plan Title: Cave Creek
Plan File : p:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.p01

Geometry Title: Cave Creek
Geometry File : p:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.g01

Flow Title : Cave Creek
Flow File : p:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.f01

Plan Summary Information:

Number of:	Cross Sections	= 65	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 6	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed at all cross sections
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = Cave Creek Reach = 1

RS	Profile	Method	Value1	Value2
25.561	WS F-Way	1	9949	10050
25.551	WS F-Way	1	9963	10037
25.528	WS F-Way	1	9964	10036
25.515	WS F-Way	1	9951.49	10042.96
25.482	WS F-Way	1	9968.73	10053.28
25.428	WS F-Way	1	9971.84	10037.84
25.367	WS F-Way	1	9962.57	10022.47
25.299	WS F-Way	1	9976.98	10036.15
25.271	WS F-Way	1	9805.43	10029.07
25.210	WS F-Way	1	9818.45	10013.76
25.191	WS F-Way	1	9939.58	10033.84
25.155	WS F-Way	1	9954.41	10032.38
25.096	WS F-Way	1	9939.63	10023.21
25.039	WS F-Way	1	9959.56	10023.9
24.953	WS F-Way	1	9953.47	10024.8
24.872	WS F-Way	1	9975.79	10025.89
24.828	WS F-Way	1	9983	10023.05
24.793	WS F-Way	1	9974.53	10021.86

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24.732  WS F-Way                1 9971.47 10050.7
24.700  WS F-Way                1  9969.410032.14
24.673  WS F-Way                1 9983.4110086.29
24.632  WS F-Way                1 9974.2610014.59
24.617  WS F-Way                1  9961.910024.19
24.587  WS F-Way                1 9865.2210016.13
24.549  WS F-Way                1 9902.36   10143
24.504  WS F-Way                1 9886.79   10140
24.466  WS F-Way                1 9910.05   10110
24.427  WS F-Way                1 9906.8610085.11
24.343  WS F-Way                1 9850.9810103.21
24.300  WS F-Way                1 9831.12 10126.5
24.264  WS F-Way                1  9841.610080.39
24.232  WS F-Way                1 9828.8610040.78
24.210  WS F-Way                1  9867.310055.25
24.169  WS F-Way                1 9925.5510095.86
24.112  WS F-Way                1 9949.8410115.35
24.068  WS F-Way                1 9958.1910044.87
24.057  WS F-Way                1 9955.5910042.27
23.963  WS F-Way                1 9940.35 10052.6
23.883  WS F-Way                1 9954.1810048.04
23.822  WS F-Way                1 9945.0210047.76
23.787  WS F-Way                1 9913.2710066.93
23.756  WS F-Way                1 9942.3610064.85
23.662  WS F-Way                1 9953.9910049.56
23.567  WS F-Way                1  9948.310044.55
23.488  WS F-Way                1 9952.3110051.18
23.389  WS F-Way                1 9955.99 10047.1
23.307  WS F-Way                1 9955.6310044.62
23.223  WS F-Way                1 9954.9510044.22
23.204  WS F-Way                1 9952.3910045.15
23.192  WS F-Way                1 9950.03 10053.7
23.150  WS F-Way                1  9931.310097.23
23.142  WS F-Way                1 9924.22 10090.1
23.138  WS F-Way                1 9924.1110073.29
23.131  WS F-Way                1 9926.32 10074.3
23.128  WS F-Way                1 9925.8410074.34
23.101  WS F-Way                1 9927.6510076.15
23.097  WS F-Way                1 9922.1310074.66
23.090  WS F-Way                1 9923.5410076.07
23.084  WS F-Way                1 9924.9510070.78
23.077  WS F-Way                1 9926.6510067.75
23.040  WS F-Way                1 9930.4110072.84
23.019  WS F-Way                1 9933.4810084.55
22.991  WS F-Way                1    989010096.93
22.880  WS F-Way                1    9951   10120
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FLOW DATA

Flow Title: Cave Creek
Flow File : p:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.f01

Flow Data (cfs)

River	Reach	RS	WS F-Plain	WS F-Way
Cave Creek	1	25.561	4900	4900
Cave Creek	1	25.528	2880	2880
Cave Creek	1	24.673	3090	3090
Cave Creek	1	24.504	3300	3300
Cave Creek	1	23.040	3660	3660
Cave Creek	1	22.880	5500	5500

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Cave Creek	1	WS F-Plain		Known WS = 1420.05
Cave Creek	1	WS F-Way		Known WS = 1420.53

GEOMETRY DATA

Geometry Title: Cave Creek
Geometry File : p:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.g01

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.561

INPUT
Description: This section is from HEC-2 FIS model.
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

9948	1514.9	9971	1505.6	10000	1505.7	10048	1506.3	10069	1515.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9948	.035	9948	.035	10069	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9948	10069	20	21	20	.3	.5

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1514.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.63	Wt. n-Val.		0.035	
W.S. Elev (ft)	1513.88	Reach Len. (ft)	20.00	21.00	20.00
Crit W.S. (ft)	1510.63	Flow Area (sq ft)		768.85	
E.G. Slope (ft/ft)	0.001862	Area (sq ft)		768.85	
Q Total (cfs)	4900.00	Flow (cfs)		4900.00	
Top Width (ft)	115.34	Top Width (ft)		115.34	
Vel Total (ft/s)	6.37	Avg. Vel. (ft/s)		6.37	
Max Chl Dpth (ft)	8.27	Hydr. Depth (ft)		6.67	
Conv. Total (cfs)	113557.1	Conv. (cfs)		113557.1	
Length Wtd. (ft)	21.00	Wetted Per. (ft)		118.49	
Min Ch El (ft)	1505.60	Shear (lb/sq ft)		0.75	
Alpha	1.00	Stream Power (lb/ft s)		4.81	
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	69.76	147.46	952.72
C & E Loss (ft)	0.56	Cum SA (acres)	22.88	27.23	106.62

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1514.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.76	Wt. n-Val.		0.035	
W.S. Elev (ft)	1513.71	Reach Len. (ft)	20.00	21.00	20.00
Crit W.S. (ft)	1510.67	Flow Area (sq ft)		698.63	
E.G. Slope (ft/ft)	0.002246	Area (sq ft)		698.63	
Q Total (cfs)	4900.00	Flow (cfs)		4900.00	
Top Width (ft)	99.04	Top Width (ft)		99.04	
Vel Total (ft/s)	7.01	Avg. Vel. (ft/s)		7.01	
Max Chl Dpth (ft)	8.10	Hydr. Depth (ft)		7.05	
Conv. Total (cfs)	103384.3	Conv. (cfs)		103384.3	
Length Wtd. (ft)	21.00	Wetted Per. (ft)		107.35	
Min Ch El (ft)	1505.60	Shear (lb/sq ft)		0.91	
Alpha	1.00	Stream Power (lb/ft s)		6.40	
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	18.57	150.96	3.18
C & E Loss (ft)	0.52	Cum SA (acres)	4.36	27.04	0.98

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.557

INPUT
Description: This section is from HEC-2 FIS model.
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9954	1515	9973	1505.54	10027	1505.54	10046	1515

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9954	.015	9954	.015	10046	.015

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9954	10046	32	32	32	.3	.5

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1513.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.48	Wt. n-Val.		0.015	
W.S. Elev (ft)	1511.43	Reach Len. (ft)	32.00	32.00	32.00
Crit W.S. (ft)	1511.43	Flow Area (sq ft)		387.59	
E.G. Slope (ft/ft)	0.002001	Area (sq ft)		387.59	
Q Total (cfs)	4900.00	Flow (cfs)		4900.00	
Top Width (ft)	77.65	Top Width (ft)		77.65	
Vel Total (ft/s)	12.64	Avg. Vel. (ft/s)		12.64	

Max Chl Dpth (ft)	5.89	Hydr. Depth (ft)		4.99
Conv. Total (cfs)	109548.1	Conv. (cfs)		109548.1
Length Wtd. (ft)	32.00	Wetted Per. (ft)		80.42
Min Ch El (ft)	1505.54	Shear (lb/sq ft)		0.60
Alpha	1.00	Stream Power (lb/ft s)		7.61
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	69.76	147.18
952.72				
C & E Loss (ft)	0.03	Cum SA (acres)	22.88	27.18
106.62				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1513.91	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.48	Wt. n-Val.		0.015
W.S. Elev (ft)	1511.43	Reach Len. (ft)	32.00	32.00
32.00				
Crit W.S. (ft)	1511.43	Flow Area (sq ft)		387.59
E.G. Slope (ft/ft)	0.002001	Area (sq ft)		387.59
Q Total (cfs)	4900.00	Flow (cfs)		4900.00
Top Width (ft)	77.65	Top Width (ft)		77.65
Vel Total (ft/s)	12.64	Avg. Vel. (ft/s)		12.64
Max Chl Dpth (ft)	5.89	Hydr. Depth (ft)		4.99
Conv. Total (cfs)	109548.1	Conv. (cfs)		109548.1
Length Wtd. (ft)	32.00	Wetted Per. (ft)		80.42
Min Ch El (ft)	1505.54	Shear (lb/sq ft)		0.60
Alpha	1.00	Stream Power (lb/ft s)		7.61
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	18.57	150.70
3.18				
C & E Loss (ft)	0.03	Cum SA (acres)	4.36	27.00
0.98				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.551

INPUT
Description: This section is from HEC-2 FIS model. This is a REPEATED section.
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9963	1515	9964	1505.54	10036	1505.54	10037	1515

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9963	.015	9963	.015	10037	.015

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9963	10037	90	90	90	.3	.5

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1513.36	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.59	Wt. n-Val.		0.015
W.S. Elev (ft)	1510.77	Reach Len. (ft)	90.00	90.00
90.00				
Crit W.S. (ft)	1510.77	Flow Area (sq ft)		379.33
E.G. Slope (ft/ft)	0.002224	Area (sq ft)		379.33
Q Total (cfs)	4900.00	Flow (cfs)		4900.00
Top Width (ft)	73.11	Top Width (ft)		73.11
Vel Total (ft/s)	12.92	Avg. Vel. (ft/s)		12.92
Max Chl Dpth (ft)	5.23	Hydr. Depth (ft)		5.19
Conv. Total (cfs)	103892.3	Conv. (cfs)		103892.3
Length Wtd. (ft)	90.00	Wetted Per. (ft)		82.52
Min Ch El (ft)	1505.54	Shear (lb/sq ft)		0.64
Alpha	1.00	Stream Power (lb/ft s)		8.25
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	69.76	146.90
952.72				
C & E Loss (ft)	0.38	Cum SA (acres)	22.88	27.13
106.62				

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

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1513.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.59	Wt. n-Val.		0.015	
W.S. Elev (ft)	1510.77	Reach Len. (ft)	90.00	90.00	90.00
Crit W.S. (ft)	1510.77	Flow Area (sq ft)		379.33	
E.G. Slope (ft/ft)	0.002224	Area (sq ft)		379.33	
Q Total (cfs)	4900.00	Flow (cfs)		4900.00	
Top Width (ft)	73.11	Top Width (ft)		73.11	
Vel Total (ft/s)	12.92	Avg. Vel. (ft/s)		12.92	
Max Chl Dpth (ft)	5.23	Hydr. Depth (ft)		5.19	
Conv. Total (cfs)	103892.3	Conv. (cfs)		103892.3	
Length Wtd. (ft)	90.00	Wetted Per. (ft)		82.52	
Min Ch El (ft)	1505.54	Shear (lb/sq ft)		0.64	
Alpha	1.00	Stream Power (lb/ft s)		8.25	
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	18.57	150.42	3.18
C & E Loss (ft)	0.38	Cum SA (acres)	4.36	26.94	0.98

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

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.528

INPUT
Description: Overshoot elevation of 1505.77 was surveyed
Station Elevation Data num= 4

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9964	1515.27	9964	1505.77	10036	1505.77	10036	1515.27

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9964	.015	9964	.015	10036	.015

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9964	10036	73.24	71.35	71.6	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1511.29	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.84	Wt. n-Val.		0.015	
W.S. Elev (ft)	1509.45	Reach Len. (ft)	73.24	71.35	71.60
Crit W.S. (ft)	1509.45	Flow Area (sq ft)		264.66	
E.G. Slope (ft/ft)	0.002422	Area (sq ft)		264.66	
Q Total (cfs)	2880.00	Flow (cfs)		2880.00	

Top Width (ft)	72.00	Top Width (ft)		72.00
Vel Total (ft/s)	10.88	Avg. Vel. (ft/s)		10.88
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)		3.68
Conv. Total (cfs)	58524.4	Conv. (cfs)		58524.4
Length Wtd. (ft)	71.35	Wetted Per. (ft)		79.35
Min Ch El (ft)	1505.77	Shear (lb/sq ft)		0.50
Alpha	1.00	Stream Power (lb/ft s)		5.49
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	69.76	146.23
952.72				
C & E Loss (ft)	0.47	Cum SA (acres)	22.88	26.98
106.62				

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

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1511.29	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.84	Wt. n-Val.		0.015
W.S. Elev (ft)	1509.45	Reach Len. (ft)	73.24	71.35
71.60				
Crit W.S. (ft)	1509.45	Flow Area (sq ft)		264.66
E.G. Slope (ft/ft)	0.002422	Area (sq ft)		264.66
Q Total (cfs)	2880.00	Flow (cfs)		2880.00
Top Width (ft)	72.00	Top Width (ft)		72.00
Vel Total (ft/s)	10.88	Avg. Vel. (ft/s)		10.88
Max Chl Dpth (ft)	3.68	Hydr. Depth (ft)		3.68
Conv. Total (cfs)	58524.4	Conv. (cfs)		58524.4
Length Wtd. (ft)	71.35	Wetted Per. (ft)		79.35
Min Ch El (ft)	1505.77	Shear (lb/sq ft)		0.50
Alpha	1.00	Stream Power (lb/ft s)		5.49
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	18.57	149.75
3.18				
C & E Loss (ft)	0.47	Cum SA (acres)	4.36	26.79
0.98				

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

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.515

INPUT
Description:
Station Elevation Data num= 111

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9441.24	1516.13	9443.81	1516.03	9444.27	1515.97	9446.4	1515.21	9447.88	1514.88
9453.13	1513.73	9456.87	1514.27	9469.61	1512.57	9483.56	1512.04	9490.38	1511.59
9497.22	1511.73	9508.66	1511.44	9510.59	1511.46	9522.04	1511.18	9527.08	1511.08
9536.2	1510.75	9540.15	1510.68	9548.54	1510.38	9551.32	1510.34	9561.19	1510.26
9578.64	1511.68	9583.76	1509.94	9593.22	1509.28	9600.61	1511.22	9610.19	1511.03
9620.66	1510.54	9640.13	1510	9646.81	1510.02	9664.78	1509.45	9690.1	1508.92
9691.52	1508.92	9692.88	1508.84	9695.86	1508.81	9717.59	1508.8	9725.42	1508.91
9751.63	1509.16	9760.44	1509.09	9770.68	1508.6	9783.41	1509.23	9800.59	1509.09

```
 9813.01 1509.18 9822.83 1508.97 9829.01 1508.46 9834.85 1507.55 9843.85 1506.51
 9851.21 1506.58 9858.45 1506.74 9865.86 1508.17 9869.47 1508.87 9871.31 1509.14
 9872.44 1509.41 9885.41 1508.57 9908.44 1507.06 9925.91  1505.4 9940.43 1501.13
 9951.491499.359 9953.23 1499.08 9962.43 1498.31 9975.02  1497.5 9998.77 1496.67
   10010 1497.1510030.08  1497.310032.83 1497.3510033.46 1497.3110039.69 1497.58
10042.96 1498.1610052.96 1499.9110080.36 1503.7410093.85 1506.5910101.18 1507.34
10104.97 1507.4310131.37 1509.4610134.56 1509.5510147.59 1508.4410148.66 1508.38
10148.88 1508.3810173.46 1507.5310175.91 1507.56   10180 1507.5810200.87 1508.37
10210.09 1508.3510226.33 1508.3610234.29 1508.3510244.21 1508.0410249.19 1508.51
10256.39  1508.410259.71  1508.610285.35 1510.6810295.84 1510.22 10309.4 1510.68
10317.08 1510.3710317.69  1510.410333.06 1511.9110340.72 1512.0710350.34 1512.08
10351.86  1512.210360.67 1512.1710383.12 1512.2510392.49 1512.2210413.54 1512.12
10422.88 1512.0810438.15 1511.25 10445.5 1510.9810448.19 1510.8810462.73 1510.73
10474.68 1510.7110482.93 1509.9610506.51 1509.9410524.81 1510.0810536.18 1508.36
10536.44 1508.36

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9441.24    .045 9951.49    .03410042.96    .052

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9951.4910042.96            191.46  175.62  180.95              .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9441.24 9950.98              F
10042.9610536.44              F

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)          1505.06    Element                    Left OB    Channel
Right OB
  Vel Head (ft)              0.29    Wt. n-Val.                  0.045      0.034
  W.S. Elev (ft)          1504.78    Reach Len. (ft)            191.46     175.62
180.95
  Crit W.S. (ft)          1500.62    Flow Area (sq ft)            2.74     668.26
  E.G. Slope (ft/ft)     0.000684    Area (sq ft)                72.75     668.26
140.85
  Q Total (cfs)           2880.00    Flow (cfs)                   7.21    2872.80
  Top Width (ft)           157.24    Top Width (ft)              23.46      91.47
42.31
  Vel Total (ft/s)           4.29    Avg. Vel. (ft/s)             2.63       4.30
  Max Chl Dpth (ft)          8.11    Hydr. Depth (ft)             5.38       7.31
  Conv. Total (cfs)      110106.0    Conv. (cfs)                275.5   109830.5
  Length Wtd. (ft)         175.64    Wetted Per. (ft)             0.52      91.63
  Min Ch El (ft)         1496.67     Shear (lb/sq ft)             0.23       0.31
  Alpha                      1.00    Stream Power (lb/ft s)       0.60       1.34
  Frctn Loss (ft)            0.28    Cum Volume (acre-ft)        69.70     145.47
952.60
  C & E Loss (ft)            0.11    Cum SA (acres)              22.86      26.84
106.58


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.

CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)          1505.10    Element                    Left OB    Channel
Right OB
  Vel Head (ft)              0.29    Wt. n-Val.                            0.034
  W.S. Elev (ft)          1504.81    Reach Len. (ft)            191.46     175.62
180.95
  Crit W.S. (ft)          1500.60    Flow Area (sq ft)                     671.56
  E.G. Slope (ft/ft)     0.000798    Area (sq ft)                          671.56
  Q Total (cfs)           2880.00    Flow (cfs)                           2880.00
  Top Width (ft)            91.47    Top Width (ft)                         91.47
  Vel Total (ft/s)           4.29    Avg. Vel. (ft/s)                        4.29
  Max Chl Dpth (ft)          8.14    Hydr. Depth (ft)                        7.34
  Conv. Total (cfs)      101942.0    Conv. (cfs)                        101942.0
  Length Wtd. (ft)         175.62    Wetted Per. (ft)                      103.74
  Min Ch El (ft)         1496.67     Shear (lb/sq ft)                        0.32
  Alpha                      1.00    Stream Power (lb/ft s)                  1.38
  Frctn Loss (ft)            0.31    Cum Volume (acre-ft)        18.57     148.99
3.18
  C & E Loss (ft)            0.11    Cum SA (acres)               4.36      26.66
0.98


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.
Warning: The cross section had to be extended vertically during the critical depth
calculations.

CROSS SECTION
```

RIVER: Cave Creek
REACH: 1 RS: 25.482

INPUT
Description:
Station Elevation Data num= 94

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9374.7	1506.6	9376.62	1505.99	9389.32	1504.01	9392.27	1503.95	9405.75	1506.2
9408.67	1506.83	9413.23	1508.25	9413.93	1508.44	9436.79	1507.84	9440.87	1507.96
9450.2	1507.68	9462.83	1507.76	9485.61	1507.74	9498.66	1509.62	9508.53	1511.01
9509.17	1510.92	9510.62	1510.45	9514.67	1508.88	9516.08	1508.42	9521.63	1507.74
9524.13	1507.59	9528.45	1508.07	9535.11	1509.01	9536.5	1509.63	9538.59	1509.83
9541.04	1508.86	9543.95	1507.26	9546.06	1506.8	9547.77	1507.02	9558.31	1507.95
9566.47	1508.91	9566.8	1508.97	9567.38	1508.78	9576.11	1507.19	9579.02	1506.01
9580.34	1505.61	9629.19	1505.5	9693.15	1504.81	9743.82	1503.83	9840.93	1500.39
9859.84	1499.81	9878.01	1500.38	9906.24	1502.34	9906.55	1502.43	9909.15	1503.66
9918.56	1507.62	9925.32	1509.32	9929.87	1509.34	9939.64	1511.07	9945.17	1510.76
9949.99	1510.49	9959.63	1507.69	9968.73	1505.69	9984.31	1498.96	9993.25	1496.84
10018.59	1498.05	10021.64	1498.12	10023.81	1498.24	10036.76	1500.68	10043.81	1502.97
10053.28	1506.19	10061.83	1504.91	10064.7	1504.47	10075.63	1503.38	10097.31	1499.43
10107.48	1497	10110.51	1496.95	10124.03	1496.91	10144.03	1496.71	10204.52	1496.19
10271.68	1495.64	10283.43	1495.41	10297.71	1495.26	10373.63	1494.28	10420.65	1494.24
10485.04	1494.18	10543.75	1494.46	10597.26	1495.17	10651.92	1495.52	10701.68	1495.14
10787.4	1495.46	10794.99	1495.52	10804.61	1495.42	10874.82	1494.61	10906.39	1494.85
10939.38	1494.63	10962.99	1494.76	10990.56	1495.36	11001.85	1495.51	11028.87	1499.28
11044.79	1501.63	11058.27	1502.29	11072.52	1505.01	11075.25	1505.06		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9374.7	.045	9968.73	.034	10053.28	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9968.73	10053.28	195.18	281.41	364.01	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9374.7	9939.64		F
10053.28	11075.25		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1504.68	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.38	Wt. n-Val.		0.034
W.S. Elev (ft)	1503.30	Reach Len. (ft)	195.18	281.41
364.01				
Crit W.S. (ft)	1502.62	Flow Area (sq ft)		305.64
E.G. Slope (ft/ft)	0.006805	Area (sq ft)	293.89	305.64
7612.79				
Q Total (cfs)	2880.00	Flow (cfs)		2880.00
Top Width (ft)	1207.55	Top Width (ft)	149.56	70.51
987.48				
Vel Total (ft/s)	9.42	Avg. Vel. (ft/s)		9.42
Max Chl Dpth (ft)	9.12	Hydr. Depth (ft)		4.33
Conv. Total (cfs)	34912.2	Conv. (cfs)		34912.2
Length Wtd. (ft)	281.41	Wetted Per. (ft)		72.33
Min Ch El (ft)	1496.84	Shear (lb/sq ft)		1.80
Alpha	1.00	Stream Power (lb/ft s)		16.92
Frctn Loss (ft)	1.89	Cum Volume (acre-ft)	68.90	143.51
936.50				
C & E Loss (ft)	0.01	Cum SA (acres)	22.48	26.52
104.44				

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1504.68	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.38	Wt. n-Val.		0.034
W.S. Elev (ft)	1503.30	Reach Len. (ft)	195.18	281.41
364.01				
Crit W.S. (ft)	1502.62	Flow Area (sq ft)		305.90
E.G. Slope (ft/ft)	0.006788	Area (sq ft)		305.90
Q Total (cfs)	2880.00	Flow (cfs)		2880.00
Top Width (ft)	70.53	Top Width (ft)		70.53
Vel Total (ft/s)	9.41	Avg. Vel. (ft/s)		9.41
Max Chl Dpth (ft)	6.46	Hydr. Depth (ft)		4.34
Conv. Total (cfs)	34955.9	Conv. (cfs)		34955.9
Length Wtd. (ft)	281.41	Wetted Per. (ft)		72.35
Min Ch El (ft)	1496.84	Shear (lb/sq ft)		1.79
Alpha	1.00	Stream Power (lb/ft s)		16.87
Frctn Loss (ft)	1.61	Cum Volume (acre-ft)	18.57	147.02
3.18				
C & E Loss (ft)	0.05	Cum SA (acres)	4.36	26.33
0.98				

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.428

INPUT
Description:
Station Elevation Data num= 117

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9263.37	1514.8	9265.83	1514.8	9284.12	1515.41	9294.58	1515.23	9304.15	1514.86
9320.19	1514.54	9328.02	1512.09	9343.88	1509.01	9345.95	1508.53	9347.11	1508.56
9354.3	1508.5	9356.09	1509.73	9365.77	1511.68	9377.98	1507.74	9387.05	1504.87
9392.12	1504.41	9394.78	1504.62	9423.76	1504.84	9440.2	1504.42	9457.39	1504.51
9487.52	1504.41	9514.88	1503.61	9523.18	1503.38	9550.91	1503.81	9579.75	1503.39
9587.73	1503.33	9634.87	1503.89	9642.18	1504.03	9647.29	1503.87	9673.29	1503.35
9701.35	1503.42	9732.69	1502.72	9814.75	1500.06	9866.93	1499.64	9914.22	1499.53
9938.85	1499.64	9943.96	1499.57	9950.72	1499.31	9956.13	1499.02	9958.39	1499.42
9959.94	1500	9970.84	1502.7	9971.84	1502.94	9981.03	1499.64	9989.38	1495.2
10003.51	1494.82	10020.5	1494.44	10037.06	1501.45	10037.84	1501.79	10039.51	1501.25
10039.9	1501.13	10062.76	1493.87	10064.56	1493.77	10066.48	1493.73	10077.83	1493.53
10108.56	1488.94	10109.6	1488.99	10110.31	1488.93	10114.54	1488.65	10136.71	1488.18
10138.36	1488.16	10141.28	1488.24	10166.79	1487.96	10197.49	1488.27	10201.02	1488.42
10205.3	1488.42	10243.82	1487.31	10246.82	1486.82	10266.79	1485.51	10277.56	1485.16
10278.4	1485.51	10281.64	1486.42	10285.11	1487.38	10285.84	1487.15	10291.23	1485.24
10325.91	1485.54	10337.98	1485.61	10358.03	1485.98	10390.08	1486.69	10393.23	1487.39
10395.07	1487.71	10418.52	1487.78	10438.29	1487.77	10448.15	1488.74	10457.18	1490.2
10464.28	1491.77	10480.41	1491.35	10514.7	1491.53	10546.69	1491.83	10631.55	1493.12
10647.85	1493.09	10722.1	1493.59	10762.09	1494.09	10790.48	1494.72	10801.44	1494.75
10817.99	1494.71	10836.55	1495.08	10882.54	1495.43	10907.36	1495.52	10957.99	1495.47
11028.05	1495.44	11062.65	1495.21	11144.97	1494.86	11169.04	1494.88	11208.62	1495.48
11251.43	1494.62	11310.18	1494.32	11378.12	1494.18	11402.59	1493.91	11411.3	1495.17
11414.39	1495.71	11431.84	1498.34	11435.73	1499.34	11436.43	1499.52	11439.84	1500.35
11446.38	1503.81	11449.42	1505.23						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9263.37	.045	9971.84	.034	10037.84	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9971.84	10037.84	392.71	323.27	226.87	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9263.37	9971.84		F
10037.84	11449.42		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1502.77	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.52	Wt. n-Val.		0.034
W.S. Elev (ft)	1501.25	Reach Len. (ft)	392.71	323.27
226.87				
Crit W.S. (ft)	1500.44	Flow Area (sq ft)		290.87
E.G. Slope (ft/ft)	0.006649	Area (sq ft)	256.25	290.87
12245.61				
Q Total (cfs)	2880.00	Flow (cfs)		2880.00
Top Width (ft)	1648.92	Top Width (ft)	186.87	60.03
1402.02				
Vel Total (ft/s)	9.90	Avg. Vel. (ft/s)		9.90
Max Chl Dpth (ft)	16.09	Hydr. Depth (ft)		4.85
Conv. Total (cfs)	35319.9	Conv. (cfs)		35319.9
Length Wtd. (ft)	328.93	Wetted Per. (ft)		62.81
Min Ch El (ft)	1494.44	Shear (lb/sq ft)		1.92
Alpha	1.00	Stream Power (lb/ft s)		19.03
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	67.66	141.58
853.52				
C & E Loss (ft)	0.16	Cum SA (acres)	21.72	26.09
94.46				

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1503.02	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.22	Wt. n-Val.		0.034
W.S. Elev (ft)	1501.79	Reach Len. (ft)	392.71	323.27
226.87				
Crit W.S. (ft)	1500.42	Flow Area (sq ft)		324.45
E.G. Slope (ft/ft)	0.004915	Area (sq ft)		324.45
Q Total (cfs)	2880.00	Flow (cfs)		2880.00
Top Width (ft)	62.81	Top Width (ft)		62.81

Vel Total (ft/s)	8.88	Avg. Vel. (ft/s)			8.88
Max Chl Dpth (ft)	7.35	Hydr. Depth (ft)			5.17
Conv. Total (cfs)	41078.2	Conv. (cfs)			41078.2
Length Wtd. (ft)	325.09	Wetted Per. (ft)			65.80
Min Ch El (ft)	1494.44	Shear (lb/sq ft)			1.51
Alpha	1.00	Stream Power (lb/ft s)			13.43
Frctn Loss (ft)	1.60	Cum Volume (acre-ft)	18.57	144.98	3.18
C & E Loss (ft)	0.01	Cum SA (acres)	4.36	25.90	0.98

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.367

INPUT
Description:
Station Elevation Data num= 164

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9498.75	1503.28	9525.16	1504.08	9529.09	1504.26	9529.85	1504.25	9531.55	1504.28
9562.88	1504.97	9572.62	1505.14	9586.13	1505.71	9597.23	1505.01	9615.61	1503.97
9627.84	1508.91	9629.55	1509.7	9631.99	1508.53	9653.21	1499.12	9663.09	1497.53
9681.65	1495.8	9687.54	1495.21	9691.79	1495.25	9798.51	1494.01	9803.7	1494.1
9805.97	1494.2	9839.33	1495.51	9843.06	1495.7	9845.22	1495.81	9864.26	1503.83
9870.74	1505.27	9872.73	1505.81	9878.5	1505.69	9880.19	1506.35	9887.14	1505.82
9895.53	1502.44	9906.8	1500.23	9918.48	1495.94	9918.61	1495.95	9922.34	1496.03
9958.33	1495.38	9963.52	1495.38	9970.63	1497.46	9973.22	1498.22	9974.21	1498.53
9974.61	1498.38	9988.94	1492.77	10009.26	1492.38	10010.01	1492.37	10010.75	1492.66
10022.47	1497.39	10024.9	1496.69	10027.62	1495.92	10030.2	1494.98	10034.32	1494.68
10051.17	1494.32	10058.52	1494.16	10061.46	1493.56	10079.68	1490.2	10090.19	1489.04
10096.41	1488.7	10151.34	1488.76	10174.7	1489.29	10193.05	1488.35	10204.32	1488.75
10206.29	1488.68	10207.43	1488.64	10235.08	1486.78	10252.34	1486.47	10257.05	1486.38
10267.28	1481.18	10272.28	1482.48	10275.93	1484.1	10278.83	1485.29	10289.09	1485.93
10292.61	1485.41	10296.37	1485.48	10305.71	1485.57	10311.6	1485.97	10413.77	1485.08
10417.54	1485.03	10418.59	1484.97	10419.04	1485.01	10419.89	1485.02	10422.99	1485.01
10481.89	1484.82	10486.96	1485.15	10490.59	1485.38	10498.59	1488.52	10499.9	1488.93
10523.04	1488.67	10523.51	1488.66	10545.54	1491.61	10546.25	1491.6	10569.51	1492.11
10575.24	1492.38	10584.15	1492.68	10590.26	1493.61	10593.7	1494.06	10605.58	1497.86
10609.76	1497.62	10626.31	1492.76	10631.24	1492.56	10633.79	1492.4	10642.2	1492.11
10659.74	1492.45	10678.33	1492.48	10711.22	1492.56	10743.75	1493.1	10789.8	1495.83
10820.25	1496.92	10823.41	1497.09	10848.57	1498.52	10857.15	1498.92	10863.17	1498.93
10867.45	1498.81	10867.97	1498.84	10870.3	1498.96	10874.89	1499.56	10877.39	1498.1
10878.02	1497.21	10889.35	1489.82	10890.91	1489.57	10907.79	1485.12	10908.85	1484.76
10917.65	1482.73	10923.68	1481.41	10930.81	1482.03	10937.66	1481.84	10945	1481.64
10962.73	1481.12	10989.12	1481.93	11000.77	1481.67	11011.94	1481.71	11014.68	1481.74
11020.51	1481.91	11023.04	1481.63	11033.11	1481.26	11049.54	1481.4	11107.95	1481.03
11142.78	1481.13	11154.83	1481.24	11199.62	1481.08	11229.96	1480.88	11235.77	1481.06
11236.76	1481.23	11251.37	1485.75	11265.15	1483.14	11266.46	1483.07	11284.05	1484.18
11306.13	1486.47	11334.19	1486.57	11444.75	1485.49	11447.87	1485.52	11450.59	1485.47
11481.02	1485.39	11523.56	1485.45	11527.25	1485.51	11601.85	1484.21	11622.43	1484.75
11636.32	1484.84	11647.12	1488.8	11654.76	1492.26	11662.74	1494.81	11685.85	1502.92
11690.93	1501.21	11694.17	1500.93	11697.71	1499.95	11721.05	1500.56		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9498.75	.045	9974.21	.034	10022.47	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9974.21	10022.47	360.24	356.69	344.55	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9498.75	9950		F
10022.47	11721.05		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1501.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.98	Wt. n-Val.	0.045	0.034	0.045
W.S. Elev (ft)	1500.05	Reach Len. (ft)	360.24	356.69	344.55
Crit W.S. (ft)	1498.59	Flow Area (sq ft)	95.62	286.70	21001.60
E.G. Slope (ft/ft)	0.003636	Area (sq ft)	1223.03	286.70	21001.60
Q Total (cfs)	2880.00	Flow (cfs)	469.81	2410.19	1659.23
Top Width (ft)	1978.56	Top Width (ft)	271.07	48.26	1659.23
Vel Total (ft/s)	7.53	Avg. Vel. (ft/s)	4.91	8.41	7.53
Max Chl Dpth (ft)	19.17	Hydr. Depth (ft)	3.95	5.94	19.17
Conv. Total (cfs)	47760.3	Conv. (cfs)	7791.1	39969.2	47760.3
Length Wtd. (ft)	356.98	Wetted Per. (ft)	24.67	50.32	356.98
Min Ch El (ft)	1492.37	Shear (lb/sq ft)	0.88	1.29	1492.37
Alpha	1.11	Stream Power (lb/ft s)	4.32	10.87	1.11
Frctn Loss (ft)	2.09	Cum Volume (acre-ft)	61.00	139.44	766.94
C & E Loss (ft)	0.12	Cum SA (acres)	19.66	25.69	86.49

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1501.41	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.33	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1500.08	Reach Len. (ft)	360.24	356.69
344.55				
Crit W.S. (ft)	1498.90	Flow Area (sq ft)	37.96	288.28
E.G. Slope (ft/ft)	0.004906	Area (sq ft)	37.96	288.28
Q Total (cfs)	2880.00	Flow (cfs)	151.23	2728.77
Top Width (ft)	59.90	Top Width (ft)	11.64	48.26
Vel Total (ft/s)	8.83	Avg. Vel. (ft/s)	3.98	9.47
Max Chl Dpth (ft)	7.71	Hydr. Depth (ft)	3.26	5.97
Conv. Total (cfs)	41118.8	Conv. (cfs)	2159.2	38959.6
Length Wtd. (ft)	356.78	Wetted Per. (ft)	16.79	53.01
Min Ch El (ft)	1492.37	Shear (lb/sq ft)	0.69	1.67
Alpha	1.10	Stream Power (lb/ft s)	2.76	15.76
Frctn Loss (ft)	2.52	Cum Volume (acre-ft)	18.40	142.71
3.18				
C & E Loss (ft)	0.09	Cum SA (acres)	4.31	25.49
0.98				

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.299

INPUT
Description:
Station Elevation Data num= 127

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9614.17	1503.04	9620.63	1503.15	9638.25	1502.57	9654.68	1502.3	9662.77	1502.13
9666.66	1501.96	9668.73	1502.03	9679.84	1507.96	9681.18	1508.7	9681.91	1508.42
9710.45	1496.17	9714.91	1494.96	9752.59	1494.79	9776.29	1494.59	9786.36	1494.86
9795.01	1494.77	9852.56	1495.5	9856.73	1495.57	9858.98	1495.47	9860.93	1495.37
9889.31	1494.55	9898.16	1493.98	9906.12	1493.93	9916.99	1493.66	9933.22	1493.95
9965.17	1493.38	9969.59	1493.64	9976.98	1495.77	9977.48	1495.7	9978.72	1495.26
9978.73	1495.256	9988.63	1491.72	9995.71	1489.94	10006.7	1490.75	10007.62	1490.17
10012.93	1490.19	10020.6	1493.11	10021.23	1493.28	10028.9	1495.37	10033.36	1497.06
10035.81	1498.09	10035.82	1498.11	10036.15	1498.23	10051.19	1496.48	10070.23	1493.38
10080.15	1491.18	10105.12	1488.28	10128.22	1486.02	10137.02	1485.08	10146.03	1484.69
10156.27	1484.42	10173.06	1484.34	10195.49	1484.31	10255.21	1484.12	10282.54	1484.15
10334.6	1483.35	10389.47	1484.13	10399.74	1484.23	10423.28	1484.81	10472.91	1484.77
10476.74	1484.76	10480.53	1484.48	10482.37	1484.37	10485.25	1483.44	10494.38	1480.8
10522.02	1480.99	10547.04	1480.91	10593.38	1481.04	10636.06	1481.23	10713.58	1481.73
10734.11	1481.64	10776.08	1481.27	10805.32	1481.14	10844.82	1481.68	10856.21	1481.4
10865.06	1484.81	10871.46	1488.05	10880.18	1493.31	10893.22	1486.21	10895	1485.31
10904.34	1481.68	10932.13	1480.89	10938.37	1480.71	10939.32	1480.67	10939.82	1480.66
10961.98	1480.88	11002.68	1481.28	11005.07	1481.19	11014.56	1481.12	11104.66	1479.49
11143.64	1478.98	11155.33	1478.97	11173.07	1478.47	11215.5	1477.72	11232.25	1477.49
11240.93	1477.63	11258.2	1476.95	11296.07	1476.09	11309.58	1479.94	11317.96	1482.81
11326.28	1488.51	11327.94	1488.1	11344.6	1484.34	11346.06	1484.45	11353.23	1484.72
11369.75	1485.19	11374.63	1485.34	11380.74	1485.28	11429.93	1485.52	11476.16	1485.39
11594.65	1485.31	11618.02	1485.35	11674.24	1486.21	11690.25	1485.85	11703.83	1486.16
11710.39	1485.84	11723.74	1485.54	11766.28	1501.98	11768.24	1502.61	11771.76	1504.14
11773.91	1504.81	11785.37	1505.97	11786.63	1506.17	11797.84	1500.91	11801.59	1499.38
11803.07	1499.41	11818.78	1500.05						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9614.17	.045	9976.98	.034	10036.15	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9976.98	10036.15	190.47	149.34	83.92	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9614.17	9976.98		F
10036.15	11818.78		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1498.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.21	Wt. n-Val.		0.034	
W.S. Elev (ft)	1496.60	Reach Len. (ft)	190.47	149.34	83.92
Crit W.S. (ft)	1496.60	Flow Area (sq ft)		241.32	
E.G. Slope (ft/ft)	0.010973	Area (sq ft)	527.40	241.32	22791.15
Q Total (cfs)	2880.00	Flow (cfs)		2880.00	
Top Width (ft)	2024.83	Top Width (ft)	267.52	55.16	1702.16
Vel Total (ft/s)	11.93	Avg. Vel. (ft/s)		11.93	
Max Chl Dpth (ft)	20.51	Hydr. Depth (ft)		4.38	
Conv. Total (cfs)	27494.1	Conv. (cfs)		27494.1	
Length Wtd. (ft)	167.47	Wetted Per. (ft)		57.33	
Min Ch El (ft)	1489.94	Shear (lb/sq ft)		2.88	
Alpha	1.00	Stream Power (lb/ft s)		34.41	
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	53.76	137.28	593.75
C & E Loss (ft)	0.64	Cum SA (acres)	17.43	25.27	73.19

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

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1498.81	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.19	Wt. n-Val.		0.034	
W.S. Elev (ft)	1496.62	Reach Len. (ft)	190.47	149.34	83.92
Crit W.S. (ft)	1496.62	Flow Area (sq ft)		242.69	
E.G. Slope (ft/ft)	0.010998	Area (sq ft)		242.69	
Q Total (cfs)	2880.00	Flow (cfs)		2880.00	
Top Width (ft)	55.22	Top Width (ft)		55.22	
Vel Total (ft/s)	11.87	Avg. Vel. (ft/s)		11.87	
Max Chl Dpth (ft)	6.68	Hydr. Depth (ft)		4.39	
Conv. Total (cfs)	27462.2	Conv. (cfs)		27462.2	
Length Wtd. (ft)	166.35	Wetted Per. (ft)		58.25	
Min Ch El (ft)	1489.94	Shear (lb/sq ft)		2.86	
Alpha	1.00	Stream Power (lb/ft s)		33.95	
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	18.24	140.53	3.18
C & E Loss (ft)	0.63	Cum SA (acres)	4.26	25.07	0.98

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

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.271

INPUT
Description:
Station Elevation Data num= 123

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9525.7	1508.42	9526.96	1508.77	9527.23	1508.84	9539.06	1505.5	9553.31	1501.12
9586.53	1489.87	9593.02	1489.92	9612.57	1489.97	9672.21	1490.5	9698.88	1490.38
9740.89	1490.5	9783.77	1490.51	9859.8	1490.78	9877.91	1490.81	9919.72	1490.59
9964.6	1490.35	9975.92	1490.31	9984.2	1491.24	9987	1491.55	9992.32	1491.06
9995.47	1490.48	10000.91	1490.71	10014.91	1491.39	10017.58	1491.52	10022.78	1493.46
10028.16	1495.47	10029.07	1495.77	10029.72	1495.63	10066.32	1488.04	10069.7	1487.49
10074.19	1486.15	10085.92	1484.83	10127.2	1483.68	10137.5	1483.41	10221.76	1483.79
10243.44	1483.38	10251.9	1483.52	10263.57	1483.46	10320.97	1484.04	10346.61	1483.98
10376.87	1483.31	10397.97	1483.51	10409.21	1483.65	10411.51	1483.63	10415.86	1483.97
10423.61	1481.48	10429.86	1479.25	10447.15	1479.48	10483.06	1479.36	10521.76	1480.43
10609.49	1480.64	10620.11	1480.71	10648.44	1480.42	10682.33	1480.29	10687.41	1480.25
10715.74	1480.14	10767.22	1480.28	10778.6	1479.71	10780.35	1479.86	10796.7	1479.76
10803.38	1482.05	10807.31	1483.67	10816.55	1481.22	10820.29	1480.23	10823.33	1479.39
10841.72	1479.36	10846.57	1479.84	10854.27	1479.52	10877.37	1478.98	10909.53	1479.31
10953.23	1479.51	10997.57	1478.74	10998.73	1478.73	11001.16	1478.71	11005.56	1478.64
11105.62	1477.38	11132.5	1477.38	11135.79	1477.77	11139.27	1478.35	11154.06	1480.23
11163.93	1480.04	11171.51	1478.83	11177.84	1477.21	11181.12	1476.72	11207.35	1476.04
11214.76	1475.74	11218.02	1475.75	11220.7	1475.82	11226.48	1479.54	11229.04	1480.43
11244.8	1484.01	11249.12	1484.77	11264.9	1491.17	11266.13	1491.52	11266.33	1491.56
11266.59	1491.49	11275.3	1488.65	11284.02	1488.74	11289.62	1489.63	11305.54	1488.62
11314.82	1488.11	11319.73	1487.91	11331.68	1485.89	11387.43	1485.44	11388.21	1485.44
11389.12	1485.43	11562.01	1485.33	11569.07	1485.33	11574.7	1485.51	11576.91	1485.54
11583.51	1485.63	11647.96	1486.87	11674.46	1485.93	11693.33	1490.92	11696.26	1492.32
11696.62	1492.34	11697.13	1492.54	11699.62	1493.27	11726.26	1505.06	11731.61	1503.27
11741.23	1499.79	11749.85	1499.44	11751.55	1499.51				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9525.7	.045	9987	.034	10029.07	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9987	10029.07	284.05	324.05	255.38	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9525.7	9724.89		F
10029.07	11751.55		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1495.21	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.07	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1495.13	Reach Len. (ft)	284.05	324.05
255.38				
Crit W.S. (ft)	1492.09	Flow Area (sq ft)	1187.96	143.22
E.G. Slope (ft/ft)	0.000559	Area (sq ft)	1904.03	143.22
21045.77				
Q Total (cfs)	2880.00	Flow (cfs)	2539.36	340.64
Top Width (ft)	2127.97	Top Width (ft)	416.01	40.25
1671.71				
Vel Total (ft/s)	2.16	Avg. Vel. (ft/s)	2.14	2.38
Max Chl Dpth (ft)	19.39	Hydr. Depth (ft)	4.53	3.56
Conv. Total (cfs)	121820.1	Conv. (cfs)	107411.6	14408.6
Length Wtd. (ft)	289.02	Wetted Per. (ft)	262.18	41.01
Min Ch El (ft)	1490.48	Shear (lb/sq ft)	0.16	0.12
Alpha	1.00	Stream Power (lb/ft s)	0.34	0.29
Frctn Loss (ft)	0.17	Cum Volume (acre-ft)	48.44	136.62
551.52				
C & E Loss (ft)	0.00	Cum SA (acres)	15.94	25.11
69.94				

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1496.08	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.10	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1495.99	Reach Len. (ft)	284.05	324.05
255.38				
Crit W.S. (ft)	1492.48	Flow Area (sq ft)	970.78	178.53
E.G. Slope (ft/ft)	0.000614	Area (sq ft)	970.78	178.53
Q Total (cfs)	2880.00	Flow (cfs)	2381.60	498.40
Top Width (ft)	223.64	Top Width (ft)	181.57	42.07
Vel Total (ft/s)	2.51	Avg. Vel. (ft/s)	2.45	2.79
Max Chl Dpth (ft)	5.68	Hydr. Depth (ft)	5.35	4.24
Conv. Total (cfs)	116204.2	Conv. (cfs)	96094.5	20109.7
Length Wtd. (ft)	290.84	Wetted Per. (ft)	187.04	43.15
Min Ch El (ft)	1490.48	Shear (lb/sq ft)	0.20	0.16
Alpha	1.01	Stream Power (lb/ft s)	0.49	0.44
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	16.12	139.81
3.18				

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  C & E Loss (ft)              0.00    Cum SA (acres)              3.87      24.90
0.98


CROSS SECTION


RIVER: Cave Creek
REACH: 1                   RS: 25.210

INPUT
Description:
Station Elevation Data     num=      177
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9193.83 1501.44 9195.35 1501.45 9216.18 1500.73 9219.53 1501.06 9223.16 1501.57
 9232.78  1501.7 9247.06 1502.06 9252.85 1501.81 9258.81 1501.89 9261.19 1501.78
 9268.19 1501.54 9281.62 1506.46 9286.96 1508.38 9287.64 1508.02 9290.06 1507.36
 9304.05 1500.99 9331.67 1491.14 9336.53 1490.84 9344.06 1490.47 9354.94  1490.4
 9364.57  1490.2  9419.6 1490.55  9442.1 1490.82 9492.41 1490.86 9512.92 1490.91
  9537.7 1490.78 9607.88 1490.34 9608.44 1490.32 9608.91 1490.32 9609.45 1490.33
 9702.31 1490.84 9718.45 1490.81 9748.15 1490.17 9792.34 1490.11 9828.61 1491.22
 9847.23 1491.05 9875.87 1490.84  9910.2  1490.6 9919.95 1490.32 9943.01 1489.92
 9979.14 1489.58 9979.91 1489.56 9988.58 1490.13 9989.84 1489.72 9991.36 1489.22
 9998.73 1489.6810003.69 1489.9810006.08 1490.07 10010.9 1491.6110013.76  1492.2
10019.91 1490.8210020.19 1490.8210024.85 1490.7810032.36 1490.9410052.95 1489.88
10056.39 1489.7310057.45 1489.7210059.19 1489.8110082.53 1490.8510091.87 1491.27
10092.16 1491.4210093.04 1491.51   10099 1493.1510100.75 1493.68 10105.1 1494.59
 10107.9 1495.0210109.23 1494.9110111.04 1494.2210134.39 1489.5910141.21 1489.51
10184.67 1489.06 10185.2 1489.0510185.27 1489.0510185.32 1489.0510185.51 1489.05
10235.15 1489.7410240.68 1490.6310242.63 1490.3610253.32 1492.7510259.15 1495.19
10268.35 1492.3610275.72 1489.12 10279.4 1487.6310290.91 1488.4710292.62 1488.38
10300.26 1488.9810308.96 1488.5810321.53 1488.7310345.21 1489.3810354.57 1489.67
 10358.8 1489.8710380.97 1489.3510408.32 1489.9510409.51 1489.9310410.52 1489.89
10411.89 1489.8510418.21 1490.48 10424.7 1490.9510428.01 1489.3810433.58 1487.06
10438.17 1488.5110443.78 1489.9710445.35 1489.2710449.35  1488.210463.55 1489.35
10467.61 1489.42 10469.8 1489.5710472.13 1489.5710473.65  1489.7 10490.8 1489.49
10508.49 1489.08 10514.4 1488.2710522.09 1487.3410527.03 1487.8210534.37 1488.15
10546.15  1488.4 10553.4 1488.8910555.73 1488.4310565.83  1483.810580.75 1483.74
10594.55 1483.8110613.73  1478.210617.33 1476.9610646.25 1475.6610650.28 1475.53
10653.25 1475.4110654.68 1475.4310659.77 1475.4410717.92 1476.2610767.07 1476.62
10783.45 1476.9810817.37 1476.6910878.53  1476.1 10881.9  1476.110882.52 1476.06
10888.39 1476.0810900.42 1476.5510909.24 1476.8210913.52 1478.3810931.48 1482.85
10940.04  1485.710945.08 1488.2410947.79 1489.2510949.44 1488.9810958.92 1486.16
10967.33 1484.2710973.42 1482.2510984.78 1480.3810996.25 1476.4310998.53 1476.16
11005.76  1475.811045.94 1475.6311057.09 1475.3911088.65 1474.3811088.77 1474.37
11088.85 1474.3911116.91 1485.1811129.68 1485.7111143.84 1486.2411155.88 1486.34
11197.02 1485.8511260.36 1485.73 11327.4 1485.6611390.03 1485.57 11430.9 1486.78
11445.11 1487.0311482.98 1487.4611484.31 1487.48   11485 1487.4611485.56  1487.6
11526.35 1505.7611526.56 1505.7611532.29 1504.0411536.64  1504.511546.41 1502.51
11551.78 1501.4411553.24 1500.96

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9193.83    .045 9988.58    .03410013.76    .052

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9988.5810013.76           104.14    97.5   87.55              .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9193.83  9746.5                F
10013.7611553.24                F

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)           1495.03    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.09    Wt. n-Val.                  0.045      0.034
  W.S. Elev (ft)           1494.94    Reach Len. (ft)            104.14      97.50
87.55
  Crit W.S. (ft)           1492.00    Flow Area (sq ft)         1095.87     120.64
  E.G. Slope (ft/ft)      0.000640    Area (sq ft)              2909.06     120.64
15578.04
  Q Total (cfs)            2880.00    Flow (cfs)                2505.49     374.51
  Top Width (ft)           2178.14    Top Width (ft)             667.57      25.18
1485.40
  Vel Total (ft/s)            2.37    Avg. Vel. (ft/s)             2.29       3.10
  Max Chl Dpth (ft)          20.57    Hydr. Depth (ft)             4.53       4.79
  Conv. Total (cfs)       113811.7    Conv. (cfs)               99011.9    14799.8
  Length Wtd. (ft)          101.49    Wetted Per. (ft)           242.13      25.65
  Min Ch El (ft)           1489.22    Shear (lb/sq ft)             0.18       0.19
  Alpha                       1.03    Stream Power (lb/ft s)       0.41       0.58
  Frctn Loss (ft)             0.09    Cum Volume (acre-ft)        32.75     135.63
444.16
  C & E Loss (ft)             0.02    Cum SA (acres)              12.40      24.86
60.69


Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.

CROSS SECTION OUTPUT  Profile #WS F-Way
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E.G. Elev (ft)	1495.89	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.12	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1495.77	Reach Len. (ft)	104.14	97.50
87.55				
Crit W.S. (ft)	1492.39	Flow Area (sq ft)	900.46	141.39
E.G. Slope (ft/ft)	0.000734	Area (sq ft)	900.46	141.39
Q Total (cfs)	2880.00	Flow (cfs)	2400.95	479.05
Top Width (ft)	195.31	Top Width (ft)	170.13	25.18
Vel Total (ft/s)	2.76	Avg. Vel. (ft/s)	2.67	3.39
Max Chl Dpth (ft)	6.54	Hydr. Depth (ft)	5.29	5.62
Conv. Total (cfs)	106294.1	Conv. (cfs)	88613.5	17680.5
Length Wtd. (ft)	100.64	Wetted Per. (ft)	175.02	29.21
Min Ch El (ft)	1489.22	Shear (lb/sq ft)	0.24	0.22
Alpha	1.03	Stream Power (lb/ft s)	0.63	0.75
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	10.02	138.62
3.18				
C & E Loss (ft)	0.04	Cum SA (acres)	2.72	24.65
0.98				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.191

INPUT
Description:
Station Elevation Data num= 144

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9107.78	1501.03	9131.03	1500.85	9136.83	1502.16	9146.55	1504.95	9152.91	1504.48
9178.56	1501.67	9181.67	1501.22	9183.29	1501.07	9185.13	1501.91	9197.51	1507.6
9203.23	1504.66	9208.97	1501.73	9210.99	1500.84	9219.07	1500.7	9244.85	1500.34
9255.37	1500.46	9268.84	1500.18	9296.69	1500.05	9319.56	1499.08	9335.2	1498.86
9359	1498.89	9400.71	1497.82	9443.86	1496.75	9462.43	1496.53	9466.38	1496.44
9475.09	1496.24	9548.62	1494.94	9554.93	1494.86	9555.09	1494.85	9555.73	1494.84
9596.05	1495.41	9628.91	1494.26	9653.69	1493.59	9680.58	1493	9725.97	1494.12
9732.9	1494.23	9744.31	1494.26	9797.3	1493.46	9814.6	1493.3	9833.92	1492.93
9840.11	1491.97	9866.24	1491.717	9869.01	1491.69	9869.69	1491.67	9876.34	1491.76
9883.85	1491.66	9891.03	1491.57	9898.45	1491.75	9902.22	1491.9	9918.35	1492.38
9925.86	1492.39	9927.48	1492.4	9950.54	1491.55	9952.4	1491.48	9963.56	1490.49
9963.97	1490.48	9994.68	1489.69	9996.3	1489.54	10006.03	1488.64	10013.94	1488.56
10018.34	1488.51	10033.84	1488.02	10069.96	1488.39	10075.73	1488.57	10081.3	1488.69
10082.22	1488.61	10136.72	1488.63	10142.22	1488.41	10149.59	1488.27	10166.15	1487.95
10178.08	1487.99	10217.58	1488.81	10229.74	1489.23	10251.34	1488.97	10255.09	1489.17
10266.84	1489.61	10288.46	1489.92	10304.92	1490.67	10312.4	1490.96	10322.81	1490.8
10350	1491.27	10359.75	1492.41	10374.46	1492.81	10376.49	1492.91	10378.99	1492.94
10413.67	1492.35	10430.41	1491.83	10442.15	1491.91	10480.49	1491.21	10504.26	1491.32
10510.65	1490.78	10517.16	1490.35	10521.73	1488.58	10544.05	1486.92	10561.94	1487.15
10576.07	1483.59	10601.65	1479.18	10618.57	1476.38	10623.91	1476.11	10645.16	1482.56
10648.93	1482.46	10655.92	1480.74	10668.05	1475.19	10672.67	1474.53	10709.14	1475.49
10747.6	1476.33	10797.84	1475.92	10820.28	1475.92	10849.37	1475.92	10858.14	1475.48
10871.48	1475.53	10882.02	1475.64	10892.83	1475.75	10917.68	1476.54	10937.23	1476.47
10949.82	1476.56	10960.66	1476.47	10981.18	1476.09	10999.43	1475.58	11020.96	1476.55
11044.89	1480.11	11049.05	1480.73	11050.3	1481.18	11059.8	1483.19	11072.26	1485.92
11077.61	1486.01	11121.95	1486.38	11138.22	1486.18	11216.4	1485.99	11238.33	1485.95
11245.32	1485.93	11342.21	1485.76	11405.14	1487.57	11425.13	1487.89	11434.8	1487.98
11450.9	1493.23	11454.88	1494.97	11460.26	1497.31	11477.45	1504.64	11478.75	1503.74
11479.84	1502.93	11483.37	1502.83	11489.84	1501.53	11494.16	1501.41		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9107.78	.045	9963.97	.034	10033.84	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9963.97	10033.84	224.15	192.91	153.88	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9107.78	9769		F
10033.84	11494.16		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1494.91	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.30	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1494.61	Reach Len. (ft)	224.15	192.91
153.88				
Crit W.S. (ft)	1493.02	Flow Area (sq ft)	436.80	373.64
E.G. Slope (ft/ft)	0.001491	Area (sq ft)	559.52	373.64
14434.84				
Q Total (cfs)	2880.00	Flow (cfs)	953.06	1926.94
Top Width (ft)	1835.26	Top Width (ft)	345.16	69.87
1420.23				
Vel Total (ft/s)	3.55	Avg. Vel. (ft/s)	2.18	5.16
Max Chl Dpth (ft)	20.08	Hydr. Depth (ft)	2.24	5.35
Conv. Total (cfs)	74584.7	Conv. (cfs)	24681.8	49902.9

```
  Length Wtd. (ft)          202.54    Wetted Per. (ft)          195.13      69.94
  Min Ch El (ft)           1488.02    Shear (lb/sq ft)            0.21       0.50
  Alpha                       1.53    Stream Power (lb/ft s)      0.45       2.56
  Frctn Loss (ft)             0.49    Cum Volume (acre-ft)       28.60     135.08
414.00
  C & E Loss (ft)             0.06    Cum SA (acres)             11.19      24.76
57.77


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.

CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)           1495.73    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.55    Wt. n-Val.                  0.045      0.034
  W.S. Elev (ft)           1495.17    Reach Len. (ft)           224.15     192.91
153.88
  Crit W.S. (ft)           1492.98    Flow Area (sq ft)          92.98     412.79
  E.G. Slope (ft/ft)      0.002150    Area (sq ft)               92.98     412.79
  Q Total (cfs)            2880.00    Flow (cfs)                319.49    2560.51
  Top Width (ft)             94.26    Top Width (ft)             24.39      69.87
  Vel Total (ft/s)            5.69    Avg. Vel. (ft/s)            3.44       6.20
  Max Chl Dpth (ft)           7.15    Hydr. Depth (ft)            3.81       5.91
  Conv. Total (cfs)        62105.9    Conv. (cfs)               6889.6    55216.3
  Length Wtd. (ft)          198.05    Wetted Per. (ft)           27.66      77.09
  Min Ch El (ft)           1488.02    Shear (lb/sq ft)            0.45       0.72
  Alpha                       1.10    Stream Power (lb/ft s)      1.55       4.46
  Frctn Loss (ft)             0.53    Cum Volume (acre-ft)        8.83     138.00
3.18
  C & E Loss (ft)             0.03    Cum SA (acres)              2.49      24.54
0.98


Warning: The cross section had to be extended vertically during the critical depth
calculations.

CROSS SECTION


RIVER: Cave Creek
REACH: 1                  RS: 25.155

INPUT
Description:
Station Elevation Data     num=     138
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9066.57 1516.06 9073.61 1512.29 9080.88 1508.73 9085.88 1508.81 9099.44 1505.92
 9115.98 1503.73  9122.6 1502.64 9134.58 1500.99 9141.41 1500.72 9149.16 1501.38
 9175.47 1500.83 9186.05 1502.06 9222.13 1508.09 9239.54  1510.7 9247.33 1512.64
 9255.06 1510.27  9262.4 1507.36 9296.88  1507.9 9329.78  1508.6 9353.43 1509.12
 9376.36 1508.75 9424.28 1509.52 9486.22 1508.85 9491.51 1508.89 9545.71 1508.65
 9570.57 1508.63 9571.96 1508.61 9580.76 1508.64 9600.11 1508.56 9653.38 1502.99
  9666.8 1501.61 9696.54  1498.3 9711.54 1497.96 9760.42 1496.83 9772.82  1496.6
 9796.16 1494.55 9799.58 1494.25 9801.56 1494.01 9817.79 1495.03 9820.56 1495.14
 9838.65 1494.81 9840.03 1494.54 9842.24 1494.17 9870.81 1491.15 9871.44 1491.45
 9872.06 1491.54 9885.31 1497.09 9892.44 1496.46 9902.67 1493.99 9914.16 1493.19
 9923.17 1491.87 9938.58 1490.95  9945.6 1490.36 9955.03 1490.15 9981.09 1490.08
 9986.88 1490.09 9989.21 1489.26 9989.87 1489.04 9999.29 1485.9610004.02 1485.95
10010.93 1485.8810029.07 1492.2310032.38 1493.1710034.16 1492.6610055.08 1486.67
10056.43  1486.210057.63 1485.9410061.57 1485.9610079.98 1485.8910115.14 1485.66
10157.18 1485.9510190.31 1485.9410243.18 1486.9810259.75 1487.3210269.35 1487.46
10282.63 1488.62 10296.5 1489.0910305.05 1492.4410307.72 1493.5410311.06 1494.54
10321.04 1498.9610329.71  1498.710358.02  1498.210391.33 1499.13   10398 1499.39
10408.48 1499.4510443.47 1499.8810444.09 1499.9110445.54 1500.13   10451 1500.47
10457.53 1499.2410469.24  1497.110473.94 1495.6510477.24 1495.7810496.78  1496.6
 10503.7 1496.9210513.52 1495.0610514.45 1494.9210531.79 1494.4810557.35 1492.41
 10586.2 1489.8810614.32 1489.5310630.31 1489.27 10657.9 1487.1910680.04 1486.62
 10686.2 1486.0310698.93 1482.6210706.15 1481.5410708.89 1481.8510726.67 1479.27
10761.12 1479.0610817.39 1479.5510846.11 1479.9310898.09 1480.7210913.17 1480.44
10921.53 1479.3710938.25 1480.6810952.93 1481.2210974.23 1482.9911028.97 1484.78
11042.88 1485.2911047.66  1485.511058.63 1485.6911140.14 1486.7811207.42 1486.74
11231.15 1486.6711311.21 1486.2911336.51 1486.2311376.19 1487.3311416.35 1487.66
11419.43 1487.7711451.89 1497.8511461.13 1501.0911464.15 1503.5611468.17 1503.24
11475.55  1500.711489.11 1500.6111501.43 1500.45

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9066.57    .045 9986.88    .03410032.38    .052

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9986.8810032.38            320.2  308.35  276.99             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9066.57 9894.53                F
10032.3811501.43                F

CROSS SECTION OUTPUT  Profile #WS F-Plain
```

E.G. Elev (ft)	1494.37	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.91	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1493.46	Reach Len. (ft)	320.20	308.35
276.99				
Crit W.S. (ft)	1492.72	Flow Area (sq ft)	196.91	237.74
E.G. Slope (ft/ft)	0.004562	Area (sq ft)	229.05	237.74
9440.44				
Q Total (cfs)	2880.00	Flow (cfs)	823.24	2056.76
Top Width (ft)	1318.18	Top Width (ft)	104.21	45.50
1168.47				
Vel Total (ft/s)	6.63	Avg. Vel. (ft/s)	4.18	8.65
Max Chl Dpth (ft)	14.40	Hydr. Depth (ft)	2.57	5.23
Conv. Total (cfs)	42641.4	Conv. (cfs)	12188.9	30452.5
Length Wtd. (ft)	313.23	Wetted Per. (ft)	76.72	47.38
Min Ch El (ft)	1485.88	Shear (lb/sq ft)	0.73	1.43
Alpha	1.33	Stream Power (lb/ft s)	3.06	12.36
Frctn Loss (ft)	1.19	Cum Volume (acre-ft)	26.57	133.73
371.83				
C & E Loss (ft)	0.13	Cum SA (acres)	10.04	24.50
53.20				

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1495.16	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.89	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1494.27	Reach Len. (ft)	320.20	308.35
276.99				
Crit W.S. (ft)	1492.77	Flow Area (sq ft)	134.97	274.59
E.G. Slope (ft/ft)	0.003486	Area (sq ft)	134.97	274.59
Q Total (cfs)	2880.00	Flow (cfs)	628.42	2251.58
Top Width (ft)	77.97	Top Width (ft)	32.47	45.50
Vel Total (ft/s)	7.03	Avg. Vel. (ft/s)	4.66	8.20
Max Chl Dpth (ft)	8.39	Hydr. Depth (ft)	4.16	6.04
Conv. Total (cfs)	48776.3	Conv. (cfs)	10643.0	38133.3
Length Wtd. (ft)	312.11	Wetted Per. (ft)	36.57	48.48
Min Ch El (ft)	1485.88	Shear (lb/sq ft)	0.80	1.23
Alpha	1.16	Stream Power (lb/ft s)	3.74	10.11
Frctn Loss (ft)	1.05	Cum Volume (acre-ft)	8.24	136.48
3.18				
C & E Loss (ft)	0.05	Cum SA (acres)	2.34	24.29
0.98				

Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.096

INPUT
Description:
Station Elevation Data num= 120

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9415.7	1514.73	9424.48	1514.44	9447.22	1513.59	9491.13	1512.82	9533.82	1512.35
9556.52	1512.12	9645.98	1511.71	9670.13	1511.56	9712.69	1511.42	9727.69	1511.22
9731.96	1510.84	9762.76	1507.52	9796.14	1503.82	9797.85	1503.85	9800.18	1502.82
9813.95	1498.96	9828.23	1494.41	9837.41	1494.04	9846.63	1493.36	9853.64	1492.84
9903.73	1489.44	9917.54	1489.22	9963.84	1488.05	9968.61	1488.09	9985.4	1488.44
9990.23	1487.36	9995.81	1486.12	9997.32	1485.78	9998.06	1485.78	10008	1485.75
10008.65	1486.02	10023.21	1492.56	10023.33	1492.61	10029.94	1491.51	10046.26	1487.69
10053.19	1485.74	10100.34	1486.32	10116.87	1486.45	10127.75	1486.42	10183.82	1485.62
10209.73	1486.06	10225.51	1486.41	10233.17	1486.29	10235.03	1486.73	10240.08	1487.86
10243.06	1487.94	10281.87	1488.84	10322.2	1489.58	10332.08	1493.67	10336.92	1495.35
10348.15	1494.44	10352.5	1493.28	10359.89	1491.74	10369.9	1488.61	10376.51	1487.99
10381.36	1487.87	10385.37	1488.08	10410.91	1489.54	10419.38	1491.96	10427.5	1493.13
10429.29	1492.72	10436.43	1492.09	10441.3	1491.52	10443.78	1491.35	10448.28	1492.57
10458.35	1496.55	10463.42	1498.54	10468.82	1501.31	10477.27	1500.34	10489.33	1500.07
10499.14	1499.82	10503.97	1500.32	10507.28	1500.21	10513.52	1499.99	10523.98	1500.13
10529.08	1500.21	10541.37	1496.93	10555.37	1493.07	10559.05	1492.11	10560.89	1492.01
10604.24	1489.67	10627.01	1488.89	10666.91	1486.58	10700.17	1485.76	10760.36	1485.05
10792.99	1484.71	10859.91	1484.43	10868.97	1484.39	10952.92	1485.27	11018.55	1485.59
11067.38	1485.34	11155.09	1485.42	11155.62	1485.41	11155.72	1485.41	11155.78	1485.41
11234.87	1485.73	11236.96	1485.68	11249.88	1485.81	11261.26	1485.73	11306.84	1485.29
11311.62	1485.31	11315.78	1486.77	11336.04	1494.01	11341.55	1494.31	11342.51	1494.62
11344.13	1495.07	11354.91	1499.31	11355.61	1499.52	11365.54	1502.71	11366.31	1502.37
11368.26	1500.44	11373.94	1497.33	11379.79	1497.03	11380.46	1496.87	11382.01	1496.94
11387.88	1497.72	11391.62	1498.84	11394.56	1498.93	11402.36	1499.39	11416.07	1499.58

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9415.7	.045	9985.4	.034	10023.21	.052

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9985.410023.21 311.06 304.96 290.64 .1 .3
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9415.7	9522.53		F
10023.2	111416.07		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1493.05	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.48	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1492.57	Reach Len. (ft)	311.06	304.96
290.64				
Crit W.S. (ft)	1491.27	Flow Area (sq ft)	392.67	189.80
E.G. Slope (ft/ft)	0.003190	Area (sq ft)	392.67	189.80
6949.81				
Q Total (cfs)	2880.00	Flow (cfs)	1547.17	1332.83
Top Width (ft)	1331.11	Top Width (ft)	127.76	37.81
1165.54				
Vel Total (ft/s)	4.94	Avg. Vel. (ft/s)	3.94	7.02
Max Chl Dpth (ft)	8.18	Hydr. Depth (ft)	3.07	5.02
Conv. Total (cfs)	50987.6	Conv. (cfs)	27391.2	23596.4
Length Wtd. (ft)	307.62	Wetted Per. (ft)	127.89	39.56
Min Ch El (ft)	1485.75	Shear (lb/sq ft)	0.61	0.96
Alpha	1.27	Stream Power (lb/ft s)	2.41	6.71
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	24.29	132.21
319.72				
C & E Loss (ft)	0.11	Cum SA (acres)	9.18	24.21
45.78				

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1494.06	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.71	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1493.35	Reach Len. (ft)	311.06	304.96
290.64				
Crit W.S. (ft)	1491.51	Flow Area (sq ft)	231.44	219.31
E.G. Slope (ft/ft)	0.003224	Area (sq ft)	231.44	219.31
Q Total (cfs)	2880.00	Flow (cfs)	1197.64	1682.36
Top Width (ft)	83.58	Top Width (ft)	45.77	37.81
Vel Total (ft/s)	6.39	Avg. Vel. (ft/s)	5.17	7.67
Max Chl Dpth (ft)	7.60	Hydr. Depth (ft)	5.06	5.80
Conv. Total (cfs)	50725.1	Conv. (cfs)	21093.9	29631.2
Length Wtd. (ft)	306.91	Wetted Per. (ft)	50.47	40.35
Min Ch El (ft)	1485.75	Shear (lb/sq ft)	0.92	1.09
Alpha	1.11	Stream Power (lb/ft s)	4.78	8.39
Frctn Loss (ft)	1.65	Cum Volume (acre-ft)	6.90	134.73
3.18				
C & E Loss (ft)	0.15	Cum SA (acres)	2.05	23.99
0.98				

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 25.039

INPUT
Description:
Station Elevation Data num= 124

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9464.27	1511.14	9488.43	1510.94	9543.64	1510.81	9556.34	1510.67	9593.9	1510.27

```
 9659.32 1510.56    9736 1510.05 9745.79 1510.01 9786.71 1507.72 9803.43 1506.56
 9809.67 1506.23 9822.72 1504.99 9848.79 1502.64 9858.87 1501.54  9869.8 1500.39
 9873.56 1499.81 9880.07 1498.24 9886.24 1497.62 9896.57 1495.76 9909.62 1492.94
 9922.49 1490.06 9928.45 1489.09 9934.76 1487.52 9942.75 1487.26 9948.72 1486.62
 9960.55 1486.86 9984.26 1486.23 9990.29 1484.79 9992.86 1484.18 9995.43 1483.67
10001.75 1483.5410007.61 1483.3810015.71 1488.32 10023.9 1493.04 10024.2 1492.95
10031.67 1490.5810035.48 1489.1110036.45 1489.0510038.88 1489.0710059.94 1485.65
10090.25 1485.6610154.19 1484.4110178.35  1485.810212.58 1486.3310231.29 1486.83
10232.43 1486.2510236.21 1484.5310242.76 1484.5410257.23 1484.77 10262.3 1486.73
10265.89 1488.1510320.69 1486.57 10326.4 1486.1510331.15 1486.2510345.17 1486.46
10394.43 1486.4510406.73 1486.8210414.82 1490.2310429.01 1492.1110430.53 1492.66
10433.49 1491.5110442.67 1487.59 10445.9 1486.1410447.36 1485.9910468.61 1485.13
10474.04    148510486.38 1488.02 10525.6 1498.3110533.18  1500.110533.39 1500.22
10533.93 1500.2110546.13 1500.2410548.55 1500.49 10560.1  1496.210568.28 1493.07
10575.95 1489.33 10584.3 1489.4710599.03 1489.43 10600.8 1489.32 10607.6 1488.87
10625.45 1487.0910639.24 1485.8710686.61 1484.5610711.58 1483.1610741.58  1483.7
10866.12 1484.0810875.58 1484.0410936.19 1483.5910954.65 1483.7810980.37 1483.95
11008.01 1483.0411019.89  1482.3 11030.3 1482.2411031.87 1482.1711044.96 1481.83
11050.63 1482.9511069.16  1485.511069.47 1485.4911069.95 1485.5111085.12 1486.08
11091.26 1487.69 11092.4 1487.9911094.64  1488.311103.35    148711113.39 1487.44
 11123.8 1489.1211134.63 1490.8311136.73 1491.4211157.29  1497.7   11161  1497.9
11164.67 1497.4511172.44 1496.57 11181.5 1497.1811200.29 1494.2611205.62 1495.68
11221.02  1497.211237.56 1501.1611238.78 1501.5911247.94 1498.7111249.86 1498.46
11252.07 1498.1811260.21 1498.5211300.96 1500.2511309.37 1500.46

Manning's n Values          num=        3
     Sta   n Val     Sta   n Val     Sta   n Val
 9464.27    .045 9984.26    .034 10023.9    .052

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9984.26 10023.9            448.57     452  453.23              .1       .3
Ineffective Flow     num=        1
   Sta L   Sta R    Elev  Permanent
 10023.911309.37                F

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)           1491.36    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               1.61    Wt. n-Val.                  0.045      0.034
  W.S. Elev (ft)           1489.75    Reach Len. (ft)            448.57     452.00
453.23
  Crit W.S. (ft)           1489.75    Flow Area (sq ft)          157.73     163.15
  E.G. Slope (ft/ft)      0.009576    Area (sq ft)               157.73     163.15
4326.44
  Q Total (cfs)            2880.00    Flow (cfs)                 969.03    1910.97
  Top Width (ft)           1081.74    Top Width (ft)              59.87      33.93
987.94
  Vel Total (ft/s)            8.98    Avg. Vel. (ft/s)             6.14      11.71
  Max Chl Dpth (ft)           7.92    Hydr. Depth (ft)             2.63       4.81
  Conv. Total (cfs)        29431.0    Conv. (cfs)                9902.6    19528.4
  Length Wtd. (ft)          450.93    Wetted Per. (ft)            60.16      36.00
  Min Ch El (ft)           1483.38    Shear (lb/sq ft)             1.57       2.71
  Alpha                       1.29    Stream Power (lb/ft s)       9.63      31.74
  Frctn Loss (ft)             1.90    Cum Volume (acre-ft)        22.32     130.98
282.10
  C & E Loss (ft)             0.31    Cum SA (acres)               8.51      23.95
38.59


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

CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)           1492.26    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               2.16    Wt. n-Val.                  0.045      0.034
  W.S. Elev (ft)           1490.10    Reach Len. (ft)            448.57     452.00
453.23
  Crit W.S. (ft)           1490.10    Flow Area (sq ft)           87.59     175.22
  E.G. Slope (ft/ft)      0.010655    Area (sq ft)                87.59     175.22
  Q Total (cfs)            2880.00    Flow (cfs)                 638.94    2241.06
  Top Width (ft)             59.25    Top Width (ft)              24.70      34.54
  Vel Total (ft/s)           10.96    Avg. Vel. (ft/s)             7.30      12.79
  Max Chl Dpth (ft)           6.72    Hydr. Depth (ft)             3.55       5.07
```

Conv. Total (cfs)	27901.1	Conv. (cfs)	6189.9	21711.1
Length Wtd. (ft)	451.31	Wetted Per. (ft)	27.97	36.70
Min Ch El (ft)	1483.38	Shear (lb/sq ft)	2.08	3.18
Alpha	1.16	Stream Power (lb/ft s)	15.19	40.61
Frctn Loss (ft)	2.04	Cum Volume (acre-ft)	5.76	133.35
3.18				
C & E Loss (ft)	0.43	Cum SA (acres)	1.80	23.74
0.98				

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

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.953

INPUT
Description:
Station Elevation Data num= 115

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9571.55	1507.91	9617.01	1507.9	9648.95	1506.73	9704.04	1504.9	9745.14	1503.68
9750.53	1503.76	9795.58	1504.85	9800.09	1504.95	9818.43	1505.58	9872.19	1507.09
9882.69	1501.45	9913.79	1490.48	9932.6	1483.45	9937.47	1482.78	9972.43	1482.57
9977.24	1482.52	9979.6	1482.49	9991.44	1479.81	9992.63	1479.54	9995.02	1479.52
10007.75	1479.35	10015.04	1481.59	10023.8	1484.87	10024.8	1485.25	10030.7	1485.25
10037.55	1485.48	10047.05	1482.11	10052.21	1480.21	10064.12	1481.75	10065.29	1481.9
10068.89	1483.98	10075.88	1487.26	10079.65	1485.98	10105.74	1480.48	10140.1	1477.72
10152.6	1476.82	10160.83	1475.68	10167.5	1475.69	10192.09	1474.51	10207.4	1473.8
10216.87	1473.31	10233.56	1472.58	10242.56	1472.48	10247.73	1472.42	10262.08	1472.53
10267.48	1472.86	10275.94	1473.36	10281.27	1473.05	10292.11	1472.41	10313.8	1471.18
10320.14	1471.56	10323.41	1471.87	10332.02	1474.32	10351.86	1479.94	10361.48	1481.68
10377.62	1482.63	10398.81	1480.45	10409.81	1480.94	10428.03	1478.72	10444.54	1480.66
10458.75	1481.18	10471.62	1482.13	10472.26	1481.73	10474.65	1481.66	10475.93	1481.5
10514.46	1475.12	10523.16	1477.07	10530.82	1475.31	10542.97	1473.84	10554.74	1470.77
10576.85	1471.21	10579.34	1471.18	10579.75	1471.24	10581.48	1471.43	10595.36	1472.8
10618.41	1475.25	10619.47	1475.37	10623.21	1477.44	10624.26	1477.62	10625	1477.65
10632.42	1478.87	10672.31	1478.09	10687.84	1478.45	10699.62	1478.94	10742.32	1479.79
10801.89	1481.02	10839.43	1480.45	10873.37	1479.74	10930	1477.47	10961.98	1476.95
10970.26	1477.64	10978.24	1481.73	10994.11	1488.21	11000.54	1487.67	11007.09	1486.3
11012.6	1485.83	11024.77	1484.31	11039.21	1481.12	11053.28	1479.89	11057.78	1478.8
11061.99	1479.05	11075.78	1478.66	11078.71	1478.67	11079.85	1478.68	11090.9	1479.27
11104.09	1480.15	11112.98	1480.64	11125.93	1483.41	11135.23	1485.92	11140.42	1485.32
11149.81	1486.92	11157.83	1489.73	11169.89	1492.52	11174.69	1493.53	11189.85	1494.49

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9571.55	.045	9977.24	.034	10024.8	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9977.24	10024.8	421.96	427.96	410.54	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
10034.84	11189.85		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1487.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.59	Wt. n-Val.	0.045	0.034	0.052
W.S. Elev (ft)	1487.08	Reach Len. (ft)	421.96	427.96	410.54
Crit W.S. (ft)	1485.23	Flow Area (sq ft)	212.75	289.11	18.09
E.G. Slope (ft/ft)	0.002352	Area (sq ft)	212.75	289.11	9533.76
Q Total (cfs)	2880.00	Flow (cfs)	839.00	2003.90	37.10
Top Width (ft)	1214.47	Top Width (ft)	54.35	47.56	1112.55
Vel Total (ft/s)	5.54	Avg. Vel. (ft/s)	3.94	6.93	2.05
Max Chl Dpth (ft)	16.31	Hydr. Depth (ft)	3.91	6.08	1.80

Conv. Total (cfs)	59383.3	Conv. (cfs)	17299.5	41318.8 765.0
Length Wtd. (ft)	426.44	Wetted Per. (ft)	55.06	48.89 10.04
Min Ch El (ft)	1479.35	Shear (lb/sq ft)	0.57	0.87 0.26
Alpha	1.24	Stream Power (lb/ft s)	2.24	6.02 0.54
Frctn Loss (ft)	1.20	Cum Volume (acre-ft)	20.42	128.63 210.00
C & E Loss (ft)	0.05	Cum SA (acres)	7.93	23.53 27.67

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1488.47	Element	Left OB	Channel Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1487.73	Reach Len. (ft)	421.96	427.96 410.54
Crit W.S. (ft)	1485.42	Flow Area (sq ft)	121.62	319.87
E.G. Slope (ft/ft)	0.002482	Area (sq ft)	121.62	319.87
Q Total (cfs)	2880.00	Flow (cfs)	522.56	2357.44
Top Width (ft)	71.33	Top Width (ft)	23.77	47.56
Vel Total (ft/s)	6.52	Avg. Vel. (ft/s)	4.30	7.37
Max Chl Dpth (ft)	8.38	Hydr. Depth (ft)	5.12	6.73
Conv. Total (cfs)	57805.7	Conv. (cfs)	10488.5	47317.2
Length Wtd. (ft)	427.07	Wetted Per. (ft)	28.81	51.37
Min Ch El (ft)	1479.35	Shear (lb/sq ft)	0.65	0.96
Alpha	1.12	Stream Power (lb/ft s)	2.81	7.11
Frctn Loss (ft)	1.17	Cum Volume (acre-ft)	4.68	130.78 3.18
C & E Loss (ft)	0.03	Cum SA (acres)	1.55	23.31 0.98

Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.872

INPUT
Description:
Station Elevation Data num= 117

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9464.7	1504.23	9485.92	1504.47	9499.32	1504.71	9505.87	1505.72	9518.67	1507.24
9521.57	1506.97	9550.58	1501.08	9558.24	1499.57	9560.07	1499.07	9561.31	1499.02
9596.24	1497.25	9612.37	1496.74	9616.86	1496.56	9630	1496.22	9669.29	1496.02
9678.63	1495.43	9689.07	1494.64	9693.26	1493.21	9698.52	1492.2	9701.07	1491
9702.59	1490.02	9708.29	1490.48	9709.73	1490.59	9709.97	1490.6	9711.11	1490.64
9729.71	1491.6	9765.6	1492.37	9771.41	1492.39	9778.37	1491.99	9798.39	1493.04
9827.87	1493.97	9840.58	1493.85	9863.96	1487.57	9871.43	1485.16	9883.81	1485.63
9893.38	1486.04	9896.61	1486.05	9903.42	1484.81	9919.38	1485.14	9936.26	1483.41
9950.27	1484.72	9971.94	1481.56	9977.62	1480.24	9981.15	1479.78	9984.49	1480.35
9987.92	1480.64	9990.03	1479.8	9992.63	1478.95	9995.6	1477.97	10004.57	1477.45
10014.8	1476.74	10019.42	1479.31	10022.28	1480.68	10025.89	1482.46	10030.24	1481.85
10050.89	1478.99	10056.43	1477.59	10060.58	1477.61	10067.41	1473.35	10076.88	1467.27
10085.34	1467.42	10092.88	1468.38	10099.45	1470.12	10101.43	1470.52	10106.7	1470.27
10109.95	1470.11	10110.26	1469.99	10112.52	1470.21	10161.91	1472.71	10247.94	1473.93
10248.62	1473.96	10249.33	1473.98	10340.92	1477.25	10388.99	1478.45	10399.95	1478.5
10496.68	1477.25	10501.5	1477.23	10518.84	1477.33	10532.19	1477.61	10540.88	1474.74
10554.62	1472.46	10568.01	1468.96	10571.64	1469.08	10575.45	1469.73	10579.24	1470.05
10583.84	1470.51	10594.85	1472.18	10610.53	1473.18	10620.67	1473.42	10635.4	1473.04
10653.36	1473.16	10668.43	1474.04	10673.63	1474.05	10682.46	1475.83	10690.28	1476.76
10704.8	1477.64	10709	1477.72	10731.69	1477.55	10745.3	1477.78	10788.66	1475.7
10800.09	1475.33	10805.78	1475.5	10831.2	1476.32	10849.68	1476.81	10862.23	1477.04
10868.25	1477.01	10882.07	1476.01	10898.91	1475.31	10921.96	1475.26	10929.55	1475.78
10962.8	1485.04	10977.53	1488.13	10979.72	1489.86	11004.94	1491.66	11009.14	1491.99
11012.27	1492.04	11037.05	1492.8						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9464.7	.045	9987.92	.034	10025.89	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9987.92	10025.89	231.92	230.65	232.63	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
10025.89	11037.05	1497.6	F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1486.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.06	Wt. n-Val.	0.045	0.034	
W.S. Elev (ft)	1485.37	Reach Len. (ft)	231.92	230.65	232.63
Crit W.S. (ft)	1483.82	Flow Area (sq ft)	171.42	263.31	
E.G. Slope (ft/ft)	0.003415	Area (sq ft)	171.42	263.31	9316.87
Q Total (cfs)	2880.00	Flow (cfs)	512.16	2367.84	
Top Width (ft)	1070.11	Top Width (ft)	93.67	37.97	938.47
Vel Total (ft/s)	6.62	Avg. Vel. (ft/s)	2.99	8.99	
Max Chl Dpth (ft)	18.10	Hydr. Depth (ft)	1.83	6.93	
Conv. Total (cfs)	49279.9	Conv. (cfs)	8763.6	40516.3	
Length Wtd. (ft)	230.86	Wetted Per. (ft)	94.38	39.86	
Min Ch El (ft)	1476.74	Shear (lb/sq ft)	0.39	1.41	
Alpha	1.55	Stream Power (lb/ft s)	1.16	12.67	
Frctn Loss (ft)	1.23	Cum Volume (acre-ft)	18.56	125.92	121.17
C & E Loss (ft)	0.11	Cum SA (acres)	7.21	23.11	18.00

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1487.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.05	Wt. n-Val.	0.045	0.034	
W.S. Elev (ft)	1486.22	Reach Len. (ft)	231.92	230.65	232.63
Crit W.S. (ft)	1483.72	Flow Area (sq ft)	72.62	295.51	
E.G. Slope (ft/ft)	0.003025	Area (sq ft)	72.62	295.51	
Q Total (cfs)	2880.00	Flow (cfs)	336.47	2543.53	
Top Width (ft)	50.10	Top Width (ft)	12.13	37.97	
Vel Total (ft/s)	7.82	Avg. Vel. (ft/s)	4.63	8.61	
Max Chl Dpth (ft)	9.48	Hydr. Depth (ft)	5.99	7.78	
Conv. Total (cfs)	52362.3	Conv. (cfs)	6117.5	46244.9	
Length Wtd. (ft)	230.76	Wetted Per. (ft)	17.82	43.61	
Min Ch El (ft)	1476.74	Shear (lb/sq ft)	0.77	1.28	
Alpha	1.11	Stream Power (lb/ft s)	3.57	11.01	
Frctn Loss (ft)	1.19	Cum Volume (acre-ft)	3.74	127.76	3.18
C & E Loss (ft)	0.17	Cum SA (acres)	1.38	22.89	0.98

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
water surface was used.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.828

INPUT
Description:
Station Elevation Data num= 76

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9873.38	1489.05	9874.55	1489.48	9878.94	1489.53	9888.63	1489.27	9919.71	1488.56
9924.51	1488.81	9931.83	1489.2	9945.36	1486.86	9957.93	1485.53	9958.81	1485.58
9969.84	1480.69	9971.13	1480.71	9972.56	1480.47	9987.61	1477.63	9997.08	1475.84
9998.72	1475.78	10008.77	1475.57	10019.67	1481.53	10023.05	1483.06	10024.06	1482.9
10033.69	1481.39	10053.88	1478.33	10070.89	1476.21	10132.43	1469.21	10142.61	1468.98
10154.03	1469.26	10184.92	1469.44	10192.68	1469.51	10200.38	1469.61	10211.14	1470.24
10222.1	1469.84	10242.09	1470.38	10281.77	1469.57	10292.11	1469.28	10294.14	1469.33
10310.85	1469	10352.91	1468.03	10368.07	1468.06	10401.48	1468.02	10406.81	1467.98

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 10412.4 1468.1510437.75 1469.0710468.15 1470.2210472.33 1470.5710477.82 1470.45
10494.78 1470.7910500.13 1471.2310519.01 1471.5810523.01 1471.8610542.69 1472.08
10548.19 1472.16 10549.7  1472.210575.13 1472.6510587.88 1472.9610606.81 1473.46
10614.99 1473.6710633.71 1474.4610635.77 1474.5910637.31 1474.6910644.36 1474.91
10662.61 1475.1510682.75 1475.4610687.96 1475.8610704.52 1476.3110714.08 1474.61
 10733.1 1473.0510745.65 1471.3110751.88  1470.210792.62 1471.2810806.47 1471.13
 10809.4 1471.15 10812.8 1471.0610847.45 1478.7110901.61 1491.0210907.84  1491.4
10925.34 1492.02

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9873.38    .045 9987.61    .03410023.05    .052

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9987.6110023.05           188.99   188.4  195.18              .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
10023.0510925.34               F

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)           1485.09    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               2.20    Wt. n-Val.                  0.045      0.034
  W.S. Elev (ft)           1482.89    Reach Len. (ft)            188.99     188.40
195.18
  Crit W.S. (ft)           1482.89    Flow Area (sq ft)           69.32     191.69
  E.G. Slope (ft/ft)      0.009357    Area (sq ft)                69.32     191.69
9206.23
  Q Total (cfs)            2880.00    Flow (cfs)                 455.72    2424.28
  Top Width (ft)            899.48    Top Width (ft)              22.73      35.06
841.70
  Vel Total (ft/s)            11.03    Avg. Vel. (ft/s)             6.57      12.65
  Max Chl Dpth (ft)           14.91    Hydr. Depth (ft)             3.05       5.47
  Conv. Total (cfs)        29772.6    Conv. (cfs)                4711.1    25061.4
  Length Wtd. (ft)          188.47    Wetted Per. (ft)            23.48      37.05
  Min Ch El (ft)           1475.57    Shear (lb/sq ft)             1.72       3.02
  Alpha                       1.16    Stream Power (lb/ft s)      11.34      38.23
  Frctn Loss (ft)             1.73    Cum Volume (acre-ft)        17.92     124.71
71.70
  C & E Loss (ft)             0.07    Cum SA (acres)               6.90      22.92
13.25


Warning: The energy equation could not be balanced within the specified number of
iterations.  The
         program selected the water surface that had the least amount of error between
computed and
         assumed values.
Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross
         section.  This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set
equal to critical
         depth, the calculated water surface came back below critical depth.  This
indicates that there
         is not a valid subcritical answer.  The program defaulted to critical depth.

CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)           1485.91    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               2.80    Wt. n-Val.                  0.045      0.034
  W.S. Elev (ft)           1483.11    Reach Len. (ft)            188.99     188.40
195.18
  Crit W.S. (ft)           1483.09    Flow Area (sq ft)           23.26     199.49
  E.G. Slope (ft/ft)      0.010597    Area (sq ft)                23.26     199.49
  Q Total (cfs)            2880.00    Flow (cfs)                 145.62    2734.38
  Top Width (ft)             40.05    Top Width (ft)               4.61      35.44
  Vel Total (ft/s)            12.93    Avg. Vel. (ft/s)             6.26      13.71
  Max Chl Dpth (ft)            7.54    Hydr. Depth (ft)             5.04       5.63
  Conv. Total (cfs)        27976.7    Conv. (cfs)                1414.6    26562.1
  Length Wtd. (ft)          188.41    Wetted Per. (ft)             9.30      37.51
  Min Ch El (ft)           1475.57    Shear (lb/sq ft)             1.65       3.52
  Alpha                       1.08    Stream Power (lb/ft s)      10.36      48.22
  Frctn Loss (ft)             2.08    Cum Volume (acre-ft)         3.49     126.45
3.18
  C & E Loss (ft)             0.10    Cum SA (acres)               1.33      22.70
0.98


Warning: The cross section had to be extended vertically during the critical depth
calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross
         section.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Cave Creek
REACH: 1                  RS: 24.793
```

INPUT
Description:
Station Elevation Data num= 58

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9844.97	1482.17	9855.95	1482.48	9864.97	1486.31	9868.62	1487.86	9878.36	1488.39
9900.92	1489.49	9920.28	1481.31	9922.89	1480.24	9925.32	1480.25	9939.31	1484.61
9945.63	1482.35	9953.01	1480.43	9974.53	1477.42	9989.38	1475.34	9992.1	1475.08
9992.98	1474.96	9993.73	1474.95	9998.03	1474.91	0005.44	1474.81	10006.82	1474.78
10013.32	1477.78	10019.04	1480.42	10021.86	1481.71	0025.49	1480.81	10039.68	1477.27
10076.32	1471.61	10104.86	1468.57	10110.24	1468.31	0122.25	1468.29	10144.65	1468.66
10173.49	1468.71	0213.94	1469.49	10251.8	1470.05	10264.32	1470.06	10273.86	1469.84
10312.54	1469.39	10318.54	1470.47	10336.02	1473.77	10383.01	1474.1	10403.1	1474.33
10410.08	1474.37	10429.84	1474.47	10482.6	1474.86	10527.1	1475.29	10540.55	1475.77
10565.37	1475.22	10612.63	1475.11	10634.84	1475.01	10676.29	1474.33	10733.45	1473.11
10772.55	1474.08	10782.43	1474.26	10785.74	1474.75	10818.43	1483.86	10837.12	1489.23
10838.66	1489.26	10840.62	1489.23	10848.86	1489.28				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9844.97	.045	9974.53	.034	10021.86	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9974.53	10021.86	370.62	321.53	190.15	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9844.97	9939.25		F
10021.86	10848.86		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1483.16	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.96	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1481.20	Reach Len. (ft)	370.62	321.53
190.15				
Crit W.S. (ft)	1481.20	Flow Area (sq ft)	50.04	225.38
E.G. Slope (ft/ft)	0.009010	Area (sq ft)	54.91	225.38
6389.47				
Q Total (cfs)	2880.00	Flow (cfs)	250.58	2629.42
Top Width (ft)	863.44	Top Width (ft)	32.28	46.21
784.95				
Vel Total (ft/s)	10.46	Avg. Vel. (ft/s)	5.01	11.67
Max Chl Dpth (ft)	12.91	Hydr. Depth (ft)	2.04	4.88
Conv. Total (cfs)	30341.6	Conv. (cfs)	2639.9	27701.6
Length Wtd. (ft)	324.78	Wetted Per. (ft)	24.78	47.78
Min Ch El (ft)	1474.78	Shear (lb/sq ft)	1.14	2.65
Alpha	1.16	Stream Power (lb/ft s)	5.69	30.95
Frctn Loss (ft)	2.31	Cum Volume (acre-ft)	17.65	123.81
36.76				
C & E Loss (ft)	0.23	Cum SA (acres)	6.78	22.74
9.60				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1483.73	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.46	Wt. n-Val.		0.034
W.S. Elev (ft)	1481.27	Reach Len. (ft)	370.62	321.53
190.15				
Crit W.S. (ft)	1481.27	Flow Area (sq ft)		228.69
E.G. Slope (ft/ft)	0.011466	Area (sq ft)		228.69
Q Total (cfs)	2880.00	Flow (cfs)		2880.00
Top Width (ft)	46.37	Top Width (ft)		46.37
Vel Total (ft/s)	12.59	Avg. Vel. (ft/s)		12.59
Max Chl Dpth (ft)	6.49	Hydr. Depth (ft)		4.93
Conv. Total (cfs)	26896.0	Conv. (cfs)		26896.0
Length Wtd. (ft)	321.53	Wetted Per. (ft)		51.81
Min Ch El (ft)	1474.78	Shear (lb/sq ft)		3.16
Alpha	1.00	Stream Power (lb/ft s)		39.79
Frctn Loss (ft)	2.51	Cum Volume (acre-ft)	3.44	125.52
3.18				
C & E Loss (ft)	0.37	Cum SA (acres)	1.32	22.52
0.98				

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

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.732

INPUT
Description:
Station Elevation Data num= 77

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9562.28	1480.96	9581.24	1480.85	9589.69	1480.81	9598.74	1480.88	9603.62	1480.9
9611.73	1480.99	9622.11	1481.7	9625.69	1481.56	9632.33	1480.55	9643.45	1480.27
9653.99	1480.23	9659.79	1480.22	9663.94	1480.2	9687.78	1482.32	9689.1	1482.37
9704.46	1482.89	9716.48	1483.82	9716.79	1483.86	9721.96	1482.83	9728.54	1480.85
9736.83	1479.29	9738.18	1478.64	9744.88	1478.59	9779.96	1478.19	9793.91	1478
9828.67	1479.16	9845.5	1479.52	9846.25	1479.54	9854.71	1479.53	9925.52	1480.92
9931.18	1481.47	9947.73	1479.37	9956.84	1477.72	9971.47	1476.09	10008.83	1471.9
10009.74	1471.85	10010.56	1472.05	10011.27	1472.11	10014.14	1472.81	10050.7	1481.83
10053.03	1481.11	10054.31	1480.71	10056.96	1480.17	10061.86	1479.35	10066.86	1478.41
10072.55	1479.02	10075.88	1479.14	10081.14	1480.59	10084	1480.22	10092.32	1479.85
10095.9	1478.06	10104.56	1477.07	10111.33	1475.17	10113.15	1474.71	10130.47	1472.61
10161.84	1471.53	10172.88	1471.62	10204.46	1472.32	10280.22	1473.77	10348.51	1474.82
10356.36	1474.94	10358.78	1474.93	10391.99	1474.71	10393.26	1475.03	10404.7	1478.02
10412.7	1477.74	10425.89	1477.32	10487.77	1476.32	10536.32	1475.99	10579.8	1478.61
10603.7	1481.48	10611.96	1485.31	10617.97	1488.29	10637.8	1489.04	10640.84	1489.34
10643.57	1489.34	10677.35	1490.02						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9562.28	.045	9971.47	.034	10050.7	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9971.47	10050.7	120.58	169.1	229.97	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9562.28	9931.18		F
10050.07	10677.35		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1480.29	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.19	Wt. n-Val.	0.045	0.034
W.S. Elev (ft)	1479.10	Reach Len. (ft)	120.58	169.10
229.97				
Crit W.S. (ft)	1478.39	Flow Area (sq ft)	37.35	307.33
E.G. Slope (ft/ft)	0.005745	Area (sq ft)	97.81	307.33
2069.22				
Q Total (cfs)	2880.00	Flow (cfs)	131.24	2748.76
Top Width (ft)	681.63	Top Width (ft)	111.87	68.16
501.61				
Vel Total (ft/s)	8.36	Avg. Vel. (ft/s)	3.51	8.94
Max Chl Dpth (ft)	7.57	Hydr. Depth (ft)	1.68	4.51
Conv. Total (cfs)	37996.2	Conv. (cfs)	1731.5	36264.7
Length Wtd. (ft)	166.48	Wetted Per. (ft)	22.46	69.27
Min Ch El (ft)	1471.85	Shear (lb/sq ft)	0.60	1.59
Alpha	1.10	Stream Power (lb/ft s)	2.10	14.23
Frctn Loss (ft)	1.24	Cum Volume (acre-ft)	17.00	121.85
18.30				
C & E Loss (ft)	0.05	Cum SA (acres)	6.17	22.32
6.79				

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1480.58	Element	Left OB	Channel
Right OB				

```
  Vel Head (ft)              1.21    Wt. n-Val.                          0.034
  W.S. Elev (ft)          1479.37    Reach Len. (ft)          120.58    169.10
229.97
  Crit W.S. (ft)          1478.30    Flow Area (sq ft)                  325.76
  E.G. Slope (ft/ft)     0.005638    Area (sq ft)                       325.76
  Q Total (cfs)           2880.00    Flow (cfs)                        2880.00
  Top Width (ft)            69.25    Top Width (ft)                      69.25
  Vel Total (ft/s)           8.84    Avg. Vel. (ft/s)                     8.84
  Max Chl Dpth (ft)          7.52    Hydr. Depth (ft)                     4.70
  Conv. Total (cfs)       38354.0    Conv. (cfs)                       38354.0
  Length Wtd. (ft)         169.10    Wetted Per. (ft)                    73.67
  Min Ch El (ft)          1471.85    Shear (lb/sq ft)                     1.56
  Alpha                      1.00    Stream Power (lb/ft s)              13.76
  Frctn Loss (ft)            1.13    Cum Volume (acre-ft)        3.44    123.48
3.18
  C & E Loss (ft)            0.04    Cum SA (acres)              1.32     22.10
0.98


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross
         section.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Cave Creek
REACH: 1                  RS: 24.700

INPUT
Description:
Station Elevation Data    num=      46
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9729.78 1483.69 9743.41 1478.41  9753.3 1478.12  9805.7  1477.7  9856.9 1477.88
 9868.77 1478.06 9875.55  1477.9 9884.53 1477.24 9909.39 1478.95 9927.98 1481.77
 9944.64 1479.07  9955.7 1475.47 9961.95 1475.06  9969.4 1474.41 9985.83 1472.98
10010.97 1472.2810018.79 1472.06 10030.9 1476.8510031.08 1476.9210032.14 1477.28
10069.28 1476.2410072.32 1475.7110076.71 1475.81 10087.4    147610088.73 1475.98
10138.41 1474.8810141.78 1474.9110148.09 1473.2710148.37 1473.1410149.84 1473.06
10174.56  1471.810190.54 1473.1610230.75 1476.4710242.63 1476.7110279.81  1475.9
10295.49 1475.94 10299.2 1476.0510315.09 1480.8810315.14 1480.91 10315.3 1480.87
 10322.6 1478.3510329.52 1478.5310343.32 1478.9810347.51 1479.1810355.03 1479.22
10356.39 1478.96

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9729.78    .045  9969.4    .03410032.14    .052

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9969.410032.14           121.64  140.95  164.92             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9729.78 9927.98              F
10032.1410356.39              F

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)          1479.00    Element                   Left OB    Channel
Right OB
  Vel Head (ft)              1.74    Wt. n-Val.                 0.045      0.034
  W.S. Elev (ft)          1477.25    Reach Len. (ft)           121.64     140.95
164.92
  Crit W.S. (ft)          1477.25    Flow Area (sq ft)          36.04     248.45
  E.G. Slope (ft/ft)     0.010075    Area (sq ft)               36.04     248.45
534.75
  Q Total (cfs)           2880.00    Flow (cfs)                179.90    2700.10
  Top Width (ft)           352.14    Top Width (ft)             19.50      62.66
269.99
  Vel Total (ft/s)          10.12    Avg. Vel. (ft/s)            4.99      10.87
  Max Chl Dpth (ft)          5.45    Hydr. Depth (ft)            1.88       3.97
  Conv. Total (cfs)       28692.6    Conv. (cfs)               1792.3    26900.3
  Length Wtd. (ft)         147.12    Wetted Per. (ft)           19.50      63.71
  Min Ch El (ft)          1472.06    Shear (lb/sq ft)            1.16       2.45
  Alpha                      1.10    Stream Power (lb/ft s)      5.80      26.66
  Frctn Loss (ft)            0.41    Cum Volume (acre-ft)       16.81     120.77
11.43
  C & E Loss (ft)            0.44    Cum SA (acres)              5.99      22.07
4.76


Warning: The energy equation could not be balanced within the specified number of
iterations.  The
         program used critical depth for the water surface and continued on with the
calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross
```

section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1479.41	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.61	Wt. n-Val.		0.034
W.S. Elev (ft)	1477.80	Reach Len. (ft)	121.64	140.95
164.92				
Crit W.S. (ft)	1477.32	Flow Area (sq ft)		283.04
E.G. Slope (ft/ft)	0.008051	Area (sq ft)		283.04
Q Total (cfs)	2880.00	Flow (cfs)		2880.00
Top Width (ft)	62.74	Top Width (ft)		62.74
Vel Total (ft/s)	10.18	Avg. Vel. (ft/s)		10.18
Max Chl Dpth (ft)	5.74	Hydr. Depth (ft)		4.51
Conv. Total (cfs)	32097.1	Conv. (cfs)		32097.1
Length Wtd. (ft)	146.12	Wetted Per. (ft)		67.72
Min Ch El (ft)	1472.06	Shear (lb/sq ft)		2.10
Alpha	1.00	Stream Power (lb/ft s)		21.38
Frctn Loss (ft)	0.42	Cum Volume (acre-ft)	3.44	122.29
3.18				
C & E Loss (ft)	0.36	Cum SA (acres)	1.32	21.84
0.98				

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth calculations.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.673

INPUT
Description:
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9728.82	1481.15	9729.88	1481.82	9738.26	1484.58	9744.24	1484.48	9753.23	1481.8
9757.82	1480.12	9762.59	1481.16	9773.65	1479.92	9779.02	1479.88	9791.01	1480.94
9816.55	1483.57	9825.68	1483.01	9866.76	1478.32	9874.47	1476.58	9882.06	1476
9898.04	1475.54	9901.05	1475.48	9901.92	1475.7	9917.14	1481.46	9918.9	1480.99
9933.62	1475.01	9942.29	1477.81	9945.11	1477.34	9946.28	1477.31	9975.44	1477.44
9983.41	1477.48	9988.14	1475.79	9992.22	1472.04	9995.58	1471.26	10000.73	1469.2
10009.32	1470.12	10017.04	1470.19	10027.48	1470.78	10050.79	1472.09	10093.29	1472.88
10113.43	1472	10121.74	1472.53	10133.11	1473.62	10139.17	1476.04	10146.59	1478.26
10172.46	1476.59	10203.95	1477.89	10213.11	1477.91	10213.54	1477.87	10214.17	1477.79
10240.52	1473.89	10254.16	1478.7	10256.9	1479.69	10258.15	1479.44	10266.96	1477.75
10298.68	1479.87	10302.06	1480.13						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9728.82	.045	9983.41	.034	10027.48	.052

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9983.41	10027.48	153.22	217.5	200.24	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9728.82	9942.29		F
10146.59	10302.06		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1477.71	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.27	Wt. n-Val.	0.045	0.034
0.052				
W.S. Elev (ft)	1477.44	Reach Len. (ft)	153.22	217.50
200.24				
Crit W.S. (ft)	1474.73	Flow Area (sq ft)	2.10	270.51
563.12				
E.G. Slope (ft/ft)	0.001346	Area (sq ft)	67.04	270.51
637.99				
Q Total (cfs)	3090.00	Flow (cfs)	0.42	1408.05
1681.53				
Top Width (ft)	308.76	Top Width (ft)	80.56	43.96
184.24				
Vel Total (ft/s)	3.70	Avg. Vel. (ft/s)	0.20	5.21
2.99				
Max Chl Dpth (ft)	8.24	Hydr. Depth (ft)	0.07	6.15
4.84				

```
  Conv. Total (cfs)        84209.5    Conv. (cfs)                 11.4    38372.5
45825.6
  Length Wtd. (ft)          211.90    Wetted Per. (ft)           31.19      46.26
117.17
  Min Ch El (ft)           1469.20    Shear (lb/sq ft)            0.01       0.49
0.40
  Alpha                       1.26    Stream Power (lb/ft s)      0.00       2.56
1.21
  Frctn Loss (ft)             0.62    Cum Volume (acre-ft)       16.67     119.93
9.21
  C & E Loss (ft)             0.22    Cum SA (acres)              5.85      21.89
3.90


Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.

CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)           1478.63    Element                   Left OB    Channel
Right OB
  Vel Head (ft)               0.40    Wt. n-Val.                            0.034
0.052
  W.S. Elev (ft)           1478.23    Reach Len. (ft)           153.22     217.50
200.24
  Crit W.S. (ft)           1475.02    Flow Area (sq ft)                    305.38
364.79
  E.G. Slope (ft/ft)      0.001509    Area (sq ft)                         305.38
364.79
  Q Total (cfs)            3090.00    Flow (cfs)                          1802.22
1287.78
  Top Width (ft)            102.88    Top Width (ft)                        44.07
58.81
  Vel Total (ft/s)            4.61    Avg. Vel. (ft/s)                       5.90
3.53
  Max Chl Dpth (ft)           9.03    Hydr. Depth (ft)                       6.93
6.20
  Conv. Total (cfs)        79533.0    Conv. (cfs)                         46387.2
33145.9
  Length Wtd. (ft)          213.90    Wetted Per. (ft)                      47.13
64.34
  Min Ch El (ft)           1469.20    Shear (lb/sq ft)                       0.61
0.53
  Alpha                       1.20    Stream Power (lb/ft s)                 3.60
1.89
  Frctn Loss (ft)             0.70    Cum Volume (acre-ft)        3.44     121.34
2.49
  C & E Loss (ft)             0.24    Cum SA (acres)              1.32      21.67
0.87


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.

CROSS SECTION


RIVER: Cave Creek
REACH: 1                  RS: 24.632

INPUT
Description:
Station Elevation Data    num=      43
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9833.69 1484.52 9839.11 1484.25 9848.06 1483.72 9851.28 1483.56  9855.2 1483.92
 9870.55 1481.58 9873.54  1480.7  9874.6 1479.77  9891.9 1478.31 9892.41 1478.22
 9894.15 1477.69 9899.41 1476.65 9909.34 1476.35 9913.16 1476.21 9926.69 1475.17
 9930.14 1474.97 9944.11 1478.61 9948.55 1478.55 9956.57 1478.01 9960.15 1477.77
 9961.03 1477.63 9961.93  1477.1 9966.89 1475.67 9969.52  1474.9 9974.26  1474.6
 9984.58 1470.77 9990.41 1468.25 9996.45 1467.5110000.71 1466.7710014.59 1468.47
10017.26  1468.810019.33 1468.9810022.27 1470.8910030.64 1476.2210034.76 1476.17
10041.01 1475.5910053.64 1475.0210055.13 1475.0910068.33 1476.3110077.79 1478.95
10085.49  1478.710089.51 1478.4410097.32 1478.09

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9833.69    .045 9974.26    .03410014.59    .052

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9974.2610014.59            77.22    77.5  103.32              .1       .3
Ineffective Flow     num=        1
   Sta L   Sta R    Elev  Permanent
 9833.69 9944.11                F
```

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1476.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.48	Wt. n-Val.		0.034	0.052
W.S. Elev (ft)	1474.39	Reach Len. (ft)	77.22	77.50	103.32
Crit W.S. (ft)	1474.39	Flow Area (sq ft)		210.24	49.45
E.G. Slope (ft/ft)	0.010320	Area (sq ft)		210.24	49.45
Q Total (cfs)	3090.00	Flow (cfs)		2768.98	321.02
Top Width (ft)	52.94	Top Width (ft)		39.76	13.17
Vel Total (ft/s)	11.90	Avg. Vel. (ft/s)		13.17	6.49
Max Chl Dpth (ft)	7.62	Hydr. Depth (ft)		5.29	3.75
Conv. Total (cfs)	30417.8	Conv. (cfs)		27257.7	3160.1
Length Wtd. (ft)	80.19	Wetted Per. (ft)		41.15	14.79
Min Ch El (ft)	1466.77	Shear (lb/sq ft)		3.29	2.15
Alpha	1.13	Stream Power (lb/ft s)		43.36	13.99
Frctn Loss (ft)	1.04	Cum Volume (acre-ft)	16.55	118.73	7.63
C & E Loss (ft)	0.34	Cum SA (acres)	5.70	21.69	3.44

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1477.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.82	Wt. n-Val.		0.034	
W.S. Elev (ft)	1474.86	Reach Len. (ft)	77.22	77.50	103.32
Crit W.S. (ft)	1474.86	Flow Area (sq ft)		229.29	
E.G. Slope (ft/ft)	0.011954	Area (sq ft)		229.29	
Q Total (cfs)	3090.00	Flow (cfs)		3090.00	
Top Width (ft)	40.33	Top Width (ft)		40.33	
Vel Total (ft/s)	13.48	Avg. Vel. (ft/s)		13.48	
Max Chl Dpth (ft)	8.09	Hydr. Depth (ft)		5.69	
Conv. Total (cfs)	28261.9	Conv. (cfs)		28261.9	
Length Wtd. (ft)	77.50	Wetted Per. (ft)		48.41	
Min Ch El (ft)	1466.77	Shear (lb/sq ft)		3.53	
Alpha	1.00	Stream Power (lb/ft s)		47.64	
Frctn Loss (ft)	1.16	Cum Volume (acre-ft)	3.44	120.01	1.65
C & E Loss (ft)	0.21	Cum SA (acres)	1.32	21.46	0.73

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.617

INPUT
Description:
Station Elevation Data num= 56

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9508.74	1472.43	9525.18	1472.42	9552.55	1472.44	9560.06	1472.56	9573.57	1472.36
9585.23	1473.58	9591.92	1474.39	9606.35	1472.92	9611.45	1473.21	9614.11	1473.18
9661.53	1473.3	9675.34	1473.94	9678.86	1473.57	9680.27	1473.4	9694.57	1472.05
9710.28	1469.26	9737.47	1466.59	9740.72	1466.57	9746.36	1466.78	9778.55	1470.55
9782.82	1470.94	9787.61	1471.27	9835.7	1475.04	9852.08	1475.98	9865.01	1475.62
9888.47	1474.72	9907.73	1472.86	9910.87	1472.31	9918.56	1471.65	9926.87	1470.63
9938.66	1469.69	9949.53	1468.71	9961.9	1468.15	9964.83	1468.02	9967.09	1467.98
9970.72	1467.94	9985.08	1467.86	10016.25	1468.79	10017.58	1468.82	10017.7	1468.82
10024.19	1469.13	10028.14	1469.32	10029.35	1469.37	10054.36	1470.55	10061.97	1470.85
10084.59	1472.62	10101.69	1474	10112.68	1474.89	10118.25	1475.41	10132.72	1476.7
10137.99	1477.17	10153.6	1478.57	10154.22	1478.61	10162.94	1479.42	10166.06	1479.84
10170.19	1480.25								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9508.74	.053	9961.9	.043	10024.19	.046

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9961.91	10024.19	195.74	158.78	145.31	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9508.74	9922.68		F
10049.09	10170.19		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1473.05	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.34	Wt. n-Val.	0.053	0.043
0.046				
W.S. Elev (ft)	1471.71	Reach Len. (ft)	195.74	158.78
145.31				
Crit W.S. (ft)	1471.71	Flow Area (sq ft)	89.72	215.02
49.76				
E.G. Slope (ft/ft)	0.016754	Area (sq ft)	362.54	215.02
69.03				
Q Total (cfs)	3090.00	Flow (cfs)	564.04	2196.09
329.87				
Top Width (ft)	251.99	Top Width (ft)	140.88	62.29
48.81				
Vel Total (ft/s)	8.72	Avg. Vel. (ft/s)	6.29	10.21
6.63				
Max Chl Dpth (ft)	5.14	Hydr. Depth (ft)	2.29	3.45
2.00				
Conv. Total (cfs)	23872.7	Conv. (cfs)	4357.7	16966.5
2548.5				
Length Wtd. (ft)	173.26	Wetted Per. (ft)	39.35	62.32
24.93				
Min Ch El (ft)	1467.86	Shear (lb/sq ft)	2.38	3.61
2.09				
Alpha	1.13	Stream Power (lb/ft s)	14.99	36.86
13.84				
Frctn Loss (ft)	2.05	Cum Volume (acre-ft)	16.23	118.35
7.49				
C & E Loss (ft)	0.26	Cum SA (acres)	5.58	21.59
3.37				

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1474.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.12	Wt. n-Val.		0.043
W.S. Elev (ft)	1472.51	Reach Len. (ft)	195.74	158.78
145.31				
Crit W.S. (ft)	1472.51	Flow Area (sq ft)		264.76
E.G. Slope (ft/ft)	0.019377	Area (sq ft)		264.76
Q Total (cfs)	3090.00	Flow (cfs)		3090.00
Top Width (ft)	62.29	Top Width (ft)		62.29

Vel Total (ft/s)	11.67	Avg. Vel. (ft/s)			11.67
Max Chl Dpth (ft)	4.65	Hydr. Depth (ft)			4.25
Conv. Total (cfs)	22197.9	Conv. (cfs)			22197.9
Length Wtd. (ft)	166.75	Wetted Per. (ft)			70.06
Min Ch El (ft)	1467.86	Shear (lb/sq ft)			4.57
Alpha	1.00	Stream Power (lb/ft s)			53.36
Frctn Loss (ft)	2.98	Cum Volume (acre-ft)	3.44		119.57
1.65					
C & E Loss (ft)	0.28	Cum SA (acres)	1.32		21.37
0.73					

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The cross section had to be extended vertically during the critical depth calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.587

INPUT
Description:
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9512.1	1472.72	9516.74	1472.7	9533.85	1473	9578.84	1473.17	9588.96	1472.93
9602.82	1481.46	9602.84	1481.47	9602.92	1481.45	9620.21	1475.01	9624.09	1475.74
9629.58	1474.67	9639.26	1473.13	9677.69	1467.27	9690.36	1465.47	9709.23	1465.31
9730.04	1465.87	9768.81	1465.85	9778.95	1466.28	9836.01	1466.35	9840.54	1466.41
9842.95	1466.28	9849.06	1466.71	9886.81	1467.81	9901.05	1468.19	9928.77	1467.16
9968.44	1466.47	9970.34	1466.39	9983.04	1465.84	9996.76	1465.45	10005.14	1464.96
10011.31	1465.91	10016.13	1466.87	10019.02	1467.45	10040.05	1476.42	10048.22	1479.93
10049.78	1479.81	10066.04	1479.79	10076.97	1479.69	10087.28	1479.24	10088.64	1479.21
10090.22	1479.16	10090.82	1479.16	10094.48	1478.22	10137.67	1479.17	10147.6	1479.69
10154.03	1480.29	10203.15	1480.65						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9512.1	.053	9970.34	.04	10016.13	.046

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9970.34	10016.13	279.2	199.12	98.46	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
9512.1	9762.43		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1469.50	Element	Left OB	Channel	
Right OB					
Vel Head (ft)	0.47	Wt. n-Val.	0.053	0.043	
0.046					
W.S. Elev (ft)	1469.03	Reach Len. (ft)	279.20	199.12	
98.46					
Crit W.S. (ft)	1468.51	Flow Area (sq ft)	451.01	150.46	
8.33					
E.G. Slope (ft/ft)	0.008797	Area (sq ft)	737.73	150.46	
8.33					
Q Total (cfs)	3090.00	Flow (cfs)	1986.87	1074.73	
28.40					
Top Width (ft)	356.57	Top Width (ft)	304.19	45.79	
6.59					
Vel Total (ft/s)	5.07	Avg. Vel. (ft/s)	4.41	7.14	
3.41					
Max Chl Dpth (ft)	4.07	Hydr. Depth (ft)	2.17	3.29	
1.26					
Conv. Total (cfs)	32945.3	Conv. (cfs)	21183.9	11458.7	
302.8					
Length Wtd. (ft)	229.01	Wetted Per. (ft)	207.99	45.99	
6.97					
Min Ch El (ft)	1464.96	Shear (lb/sq ft)	1.19	1.80	
0.66					
Alpha	1.18	Stream Power (lb/ft s)	5.25	12.83	
2.24					
Frctn Loss (ft)	0.80	Cum Volume (acre-ft)	13.76	117.68	
7.36					
C & E Loss (ft)	0.09	Cum SA (acres)	4.58	21.40	
3.28					

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1470.65	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.17	Wt. n-Val.	0.053	0.043
W.S. Elev (ft)	1469.48	Reach Len. (ft)	279.20	199.12
98.46				
Crit W.S. (ft)	1469.48	Flow Area (sq ft)	225.65	171.16
E.G. Slope (ft/ft)	0.016487	Area (sq ft)	225.65	171.16
Q Total (cfs)	3090.00	Flow (cfs)	1332.03	1757.97
Top Width (ft)	150.91	Top Width (ft)	105.12	45.79
Vel Total (ft/s)	7.79	Avg. Vel. (ft/s)	5.90	10.27
Max Chl Dpth (ft)	4.52	Hydr. Depth (ft)	2.15	3.74
Conv. Total (cfs)	24064.8	Conv. (cfs)	10373.8	13691.0
Length Wtd. (ft)	213.81	Wetted Per. (ft)	107.46	48.60
Min Ch El (ft)	1464.96	Shear (lb/sq ft)	2.16	3.62
Alpha	1.24	Stream Power (lb/ft s)	12.76	37.23
Frctn Loss (ft)	1.10	Cum Volume (acre-ft)	2.93	118.77
1.65				
C & E Loss (ft)	0.28	Cum SA (acres)	1.09	21.17
0.73				

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

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.549

INPUT
Description:
Station Elevation Data num= 38

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9725.02	1488.36	9738.97	1487.26	9751.51	1486.52	9773.38	1484.2	9793.75	1480.13
9804.5	1476.3	9824.92	1469.78	9834.49	1466.87	9875.08	1462.06	9875.97	1462.06
9878.81	1462.22	9938.13	1466.09	9942.79	1466.25	9963.35	1466.01	9964.6	1465.85
9966.78	1465.57	9981.49	1463.63	10010.46	1463.34	10013.34	1463.47	10019.24	1463.83
10038.34	1465.11	10045.29	1465.56	10064.42	1465.78	10099.94	1466.17	10110.14	1466.18
10118.79	1466.04	10143.84	1465.69	10145.44	1465.92	10158.76	1467.17	10163.91	1467.54
10178.68	1470.27	10199.67	1474.18	10209.89	1475.31	10216.54	1476.54	10221.14	1476.95
10257.25	1479.07	10273.56	1480.62	10295.75	1480.59				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9725.02	.053	9966.78	.043	10064.42	.046

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9966.78	10064.42	237.02	236.9	184.43	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
9725.02	9873.33		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1468.61	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.17	Wt. n-Val.	0.053	0.043
0.046				
W.S. Elev (ft)	1468.44	Reach Len. (ft)	237.02	236.90
184.43				
Crit W.S. (ft)	1466.63	Flow Area (sq ft)	355.80	393.22
232.44				
E.G. Slope (ft/ft)	0.001871	Area (sq ft)	510.17	393.22
232.44				
Q Total (cfs)	3090.00	Flow (cfs)	1050.84	1485.81
553.35				

Top Width (ft)	339.44	Top Width (ft)	137.45	97.64	104.35
Vel Total (ft/s)	3.15	Avg. Vel. (ft/s)	2.95	3.78	2.38
Max Chl Dpth (ft)	6.38	Hydr. Depth (ft)	3.81	4.03	2.23
Conv. Total (cfs)	71433.1	Conv. (cfs)	24292.8	34348.3	12792.1
Length Wtd. (ft)	229.78	Wetted Per. (ft)	93.63	97.84	104.53
Min Ch El (ft)	1463.34	Shear (lb/sq ft)	0.44	0.47	0.26
Alpha	1.09	Stream Power (lb/ft s)	1.31	1.77	0.62
Frctn Loss (ft)	0.89	Cum Volume (acre-ft)	9.76	116.44	7.09
C & E Loss (ft)	0.12	Cum SA (acres)	3.16	21.07	3.15

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1468.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.053	0.043	0.046
W.S. Elev (ft)	1468.65	Reach Len. (ft)	237.02	236.90	184.43
Crit W.S. (ft)	1467.10	Flow Area (sq ft)	206.37	413.65	209.37
E.G. Slope (ft/ft)	0.002482	Area (sq ft)	206.37	413.65	209.37
Q Total (cfs)	3090.00	Flow (cfs)	596.00	1862.10	631.90
Top Width (ft)	240.64	Top Width (ft)	64.42	97.64	78.58
Vel Total (ft/s)	3.73	Avg. Vel. (ft/s)	2.89	4.50	3.02
Max Chl Dpth (ft)	5.31	Hydr. Depth (ft)	3.20	4.24	2.66
Conv. Total (cfs)	62018.5	Conv. (cfs)	11962.0	37373.7	12682.7
Length Wtd. (ft)	228.79	Wetted Per. (ft)	69.42	97.84	81.53
Min Ch El (ft)	1463.34	Shear (lb/sq ft)	0.46	0.66	0.40
Alpha	1.13	Stream Power (lb/ft s)	1.33	2.95	1.20
Frctn Loss (ft)	0.94	Cum Volume (acre-ft)	1.54	117.44	1.41
C & E Loss (ft)	0.08	Cum SA (acres)	0.54	20.84	0.64

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.504

INPUT
Description:
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9799.99	1477.04	9832.33	1479.72	9833.78	1479.87	9836.1	1479.76	9837.82	1479.52
9842.5	1479.51	9886.79	1478.73	9910.63	1474.24	9915.69	1473.5	9931.49	1471.19
9945.76	1467.97	9950.79	1467.06	9956.75	1466.19	9970.99	1461.89	9973.37	1461.23
9974.08	1460.95	10004.76	1459.99	10009.38	1459.89	10011.71	1459.81	10016.64	1462.84
10022.14	1464.85	10028.56	1468.61	10031.18	1470.34	10037.66	1470.88	10038.69	1470.97
10075.27	1471.22	10076.23	1471.27	10078.54	1471.38	10079.7	1471.36	10084.5	1470.47
10095.57	1469.81	10100.9	1468.12	10109.53	1464.12	10114.08	1464.23	10162.48	1465.64
10166.31	1465.71	10166.79	1465.75	10167.18	1465.86	10169.94	1466.26	10181.94	1468.12

10184.22 1468.4610194.76 1471.8710212.29 1476.6710223.41 1478.5110237.42 1478.71
10248.28 1480.2510261.98 1481.4910263.72 1481.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9799.99	.053	9886.79	.04310037.66		.046

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9886.7910037.66		200.96	205.24	210.33	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1467.60	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.36	Wt. n-Val.		0.043
0.046				
W.S. Elev (ft)	1466.24	Reach Len. (ft)	200.96	205.24
210.33				
Crit W.S. (ft)	1466.15	Flow Area (sq ft)		306.15
80.40				
E.G. Slope (ft/ft)	0.011228	Area (sq ft)		306.15
80.40				
Q Total (cfs)	3300.00	Flow (cfs)		2984.11
315.89				
Top Width (ft)	132.93	Top Width (ft)		68.09
64.83				
Vel Total (ft/s)	8.54	Avg. Vel. (ft/s)		9.75
3.93				
Max Chl Dpth (ft)	6.44	Hydr. Depth (ft)		4.50
1.24				
Conv. Total (cfs)	31143.0	Conv. (cfs)		28161.9
2981.1				
Length Wtd. (ft)	206.36	Wetted Per. (ft)		70.49
65.37				
Min Ch El (ft)	1459.80	Shear (lb/sq ft)		3.04
0.86				
Alpha	1.20	Stream Power (lb/ft s)		29.68
3.39				
Frctn Loss (ft)	1.81	Cum Volume (acre-ft)	8.37	114.54
6.42				
C & E Loss (ft)	0.24	Cum SA (acres)	2.79	20.62
2.79				

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1467.87	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.01	Wt. n-Val.		0.043
0.046				
W.S. Elev (ft)	1466.86	Reach Len. (ft)	200.96	205.24
210.33				
Crit W.S. (ft)	1465.99	Flow Area (sq ft)		350.17
78.73				
E.G. Slope (ft/ft)	0.007716	Area (sq ft)		350.17
78.73				
Q Total (cfs)	3300.00	Flow (cfs)		2942.42
357.58				
Top Width (ft)	109.80	Top Width (ft)		73.42
36.38				
Vel Total (ft/s)	7.69	Avg. Vel. (ft/s)		8.40
4.54				
Max Chl Dpth (ft)	7.06	Hydr. Depth (ft)		4.77
2.16				
Conv. Total (cfs)	37568.4	Conv. (cfs)		33497.6
4070.8				
Length Wtd. (ft)	205.93	Wetted Per. (ft)		76.03
38.88				
Min Ch El (ft)	1459.80	Shear (lb/sq ft)		2.22
0.98				
Alpha	1.10	Stream Power (lb/ft s)		18.64
4.43				
Frctn Loss (ft)	1.70	Cum Volume (acre-ft)	0.98	115.36
0.80				
C & E Loss (ft)	0.06	Cum SA (acres)	0.37	20.38
0.40				

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.466

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9836.49	1482.27	9897.84	1481.98	9910.05	1482.05	9911.51	1481.52	9938.09	1471.85
9964.03	1461.6	9968.21	1460.38	9980.21	1460.22	10010.5	1459.45	10020.59	1462.21
10024.68	1463.65	10033.66	1463.55	10044.01	1463.76	10051.57	1463.67	10056.89	1463.6
10075.19	1463.63	10115.84	1462.45	10134.66	1461.62	10139.99	1461.39	10162.72	1463.33
10177.75	1465.56	10216.29	1469.85	10228.77	1472.25	10252.74	1477.87	10256.26	1478.72

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9836.49	.033	9910.05	.043	10051.57	.046

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9910.05	10051.57	139.86	206.28	254.16	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1465.54	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.54	Wt. n-Val.		0.043
0.046				
W.S. Elev (ft)	1465.00	Reach Len. (ft)	139.86	206.28
254.16				
Crit W.S. (ft)	1464.34	Flow Area (sq ft)		330.99
256.12				
E.G. Slope (ft/ft)	0.007039	Area (sq ft)		330.99
256.12				
Q Total (cfs)	3300.00	Flow (cfs)		2166.04
1133.97				
Top Width (ft)	218.55	Top Width (ft)		96.14
122.41				
Vel Total (ft/s)	5.62	Avg. Vel. (ft/s)		6.54
4.43				
Max Chl Dpth (ft)	5.55	Hydr. Depth (ft)		3.44
2.09				
Conv. Total (cfs)	39334.0	Conv. (cfs)		25817.8
13516.2				
Length Wtd. (ft)	218.74	Wetted Per. (ft)		97.60
122.65				
Min Ch El (ft)	1459.45	Shear (lb/sq ft)		1.49
0.92				
Alpha	1.10	Stream Power (lb/ft s)		9.75
4.06				
Frctn Loss (ft)	0.83	Cum Volume (acre-ft)	8.37	113.04
5.61				
C & E Loss (ft)	0.08	Cum SA (acres)	2.79	20.23
2.34				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1466.12	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.83	Wt. n-Val.		0.043
0.046				
W.S. Elev (ft)	1465.29	Reach Len. (ft)	139.86	206.28
254.16				
Crit W.S. (ft)	1464.77	Flow Area (sq ft)		359.22
114.97				
E.G. Slope (ft/ft)	0.008844	Area (sq ft)		359.22
114.97				
Q Total (cfs)	3300.00	Flow (cfs)		2767.76
532.24				
Top Width (ft)	155.31	Top Width (ft)		96.88
58.43				
Vel Total (ft/s)	6.96	Avg. Vel. (ft/s)		7.71
4.63				
Max Chl Dpth (ft)	5.84	Hydr. Depth (ft)		3.71
1.97				
Conv. Total (cfs)	35090.9	Conv. (cfs)		29431.3
5659.6				
Length Wtd. (ft)	210.14	Wetted Per. (ft)		98.39
61.12				
Min Ch El (ft)	1459.45	Shear (lb/sq ft)		2.02
1.04				
Alpha	1.10	Stream Power (lb/ft s)		15.53
4.81				
Frctn Loss (ft)	1.03	Cum Volume (acre-ft)	0.98	113.69
0.34				
C & E Loss (ft)	0.13	Cum SA (acres)	0.37	19.97
0.17				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.427

INPUT
Description:
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9827.93	1480.33	9902.61	1479.55	9903.81	1479.55	9906.86	1479.56	9908.1	1478.72
9910.5	1477.45	9945.1	1459.64	9946.73	1459.61	9998.75	1458.81	10005.23	1459.49
10030.76	1460.73	10047.51	1460.86	10082.09	1461.22	10085.11	1461.28	10107.01	1461.73
10110.11	1462.62	10121.38	1464.48	10122	1464.35	10132.64	1462.89	10139.39	1461
10145.47	1460.77	10154.61	1461.35	10164.97	1461.56	10174.44	1462.24	10188.42	1464.31
10192.49	1464.52	10196.94	1465.5	10219.86	1471.94	10252.59	1485.61	10254.29	1486.3
10254.68	1486.47	10254.97	1486.5	10255.33	1486.61	10256.48	1486.99	10274.49	1489.58
10286.73	1489.62	10287.47	1489.55	10287.96	1489.51	10288.21	1489.43	10293.5	1488.32
10296.33	1487.86	10312.53	1483.89	10322.61	1483.19	10341.3	1481.84	10364.54	1480.15
10375.09	1479.92	10382.98	1479.65	10423.45	1479.81	10434.99	1479.58		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9827.93	.033	9906.86	.043	10085.11	.046

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9906.86	10085.11	422.06	440.98	388.41	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1464.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.26	Wt. n-Val.		0.043
0.046				
W.S. Elev (ft)	1464.37	Reach Len. (ft)	422.06	440.98
388.41				
Crit W.S. (ft)	1462.57	Flow Area (sq ft)		624.55
223.08				
E.G. Slope (ft/ft)	0.002373	Area (sq ft)		624.55
223.08				
Q Total (cfs)	3300.00	Flow (cfs)		2715.98
584.02				
Top Width (ft)	252.34	Top Width (ft)		149.19
103.14				
Vel Total (ft/s)	3.89	Avg. Vel. (ft/s)		4.35
2.62				
Max Chl Dpth (ft)	5.57	Hydr. Depth (ft)		4.19
2.16				
Conv. Total (cfs)	67743.8	Conv. (cfs)		55754.9
11988.9				
Length Wtd. (ft)	434.12	Wetted Per. (ft)		150.41
103.98				
Min Ch El (ft)	1458.80	Shear (lb/sq ft)		0.62
0.32				
Alpha	1.11	Stream Power (lb/ft s)		2.68
0.83				
Frctn Loss (ft)	0.88	Cum Volume (acre-ft)	8.37	110.78
4.21				
C & E Loss (ft)	0.02	Cum SA (acres)	2.79	19.65
1.68				

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1464.96	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.39	Wt. n-Val.		0.043
W.S. Elev (ft)	1464.57	Reach Len. (ft)	422.06	440.98
388.41				
Crit W.S. (ft)	1462.62	Flow Area (sq ft)		655.15
E.G. Slope (ft/ft)	0.003086	Area (sq ft)		655.15
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	149.59	Top Width (ft)		149.59
Vel Total (ft/s)	5.04	Avg. Vel. (ft/s)		5.04
Max Chl Dpth (ft)	5.77	Hydr. Depth (ft)		4.38
Conv. Total (cfs)	59401.6	Conv. (cfs)		59401.6
Length Wtd. (ft)	440.98	Wetted Per. (ft)		154.15
Min Ch El (ft)	1458.80	Shear (lb/sq ft)		0.82
Alpha	1.00	Stream Power (lb/ft s)		4.12
Frctn Loss (ft)	1.10	Cum Volume (acre-ft)	0.98	111.29
C & E Loss (ft)	0.04	Cum SA (acres)	0.37	19.39

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.343

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9765.12	1474.29	9781.64	1474.03	9818.12	1475.38	9850.98	1477.6	9857.93	1477.16
9862.48	1475.66	9867.02	1474.16	9882.1	1469.1	9891.03	1463.25	9897.3	1458.88
9907.84	1458.79	9918.22	1458.68	9930.06	1458.62	9932.66	1458.57	9976.47	1458.22
9981.02	1458.22	9988.99	1456.5	9990.6	1455.94	9997.99	1455.61	10004.18	1455.33
10016.29	1458.56	10032.01	1462.33	10036.62	1464.71	10055.79	1463.09	10072.49	1461.66
10079.31	1461.31	10088.55	1461.53	10102.24	1461.39	10103.21	1461.35	10112.69	1460.96
10116.86	1460.54	10134.6	1460.94	10151.03	1462.09	10159.25	1462.88	10166.38	1463.67
10178.86	1465.78	10201.46	1469.04	10206.93	1469.8	10209.41	1470.04	10218.98	1470.65
10232.08	1472.06	10237.11	1472.12	10259.7	1473.16	10289.68	1473.37	10310.69	1474.33
10317.37	1474.18	10339.48	1473.49	10346.56	1473.66	10364.48	1473.43	10370.89	1473.52
10371.82	1473.55								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9765.12	.033	9850.98	.043	10103.21	.046

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9850.98	10103.21	239.12	226.51	216.51	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1463.73	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.20	Wt. n-Val.		0.043
0.046				
W.S. Elev (ft)	1463.53	Reach Len. (ft)	239.12	226.51
216.51				
Crit W.S. (ft)	1460.82	Flow Area (sq ft)		815.72
126.93				
E.G. Slope (ft/ft)	0.001757	Area (sq ft)		815.72
126.93				
Q Total (cfs)	3300.00	Flow (cfs)		3022.98
277.02				
Top Width (ft)	258.16	Top Width (ft)		196.29
61.87				
Vel Total (ft/s)	3.50	Avg. Vel. (ft/s)		3.71
2.18				
Max Chl Dpth (ft)	8.20	Hydr. Depth (ft)		4.16
2.05				
Conv. Total (cfs)	78736.8	Conv. (cfs)		72127.1
6609.7				
Length Wtd. (ft)	225.59	Wetted Per. (ft)		199.29
62.01				
Min Ch El (ft)	1455.33	Shear (lb/sq ft)		0.45
0.22				
Alpha	1.06	Stream Power (lb/ft s)		1.66
0.49				
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	8.37	103.49
2.65				
C & E Loss (ft)	0.04	Cum SA (acres)	2.79	17.90
0.95				

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1463.82	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.25	Wt. n-Val.		0.043
W.S. Elev (ft)	1463.57	Reach Len. (ft)	239.12	226.51
216.51				
Crit W.S. (ft)	1460.78	Flow Area (sq ft)		825.01
E.G. Slope (ft/ft)	0.002056	Area (sq ft)		825.01
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	197.01	Top Width (ft)		197.01
Vel Total (ft/s)	4.00	Avg. Vel. (ft/s)		4.00
Max Chl Dpth (ft)	8.24	Hydr. Depth (ft)		4.19
Conv. Total (cfs)	72779.6	Conv. (cfs)		72779.6
Length Wtd. (ft)	226.51	Wetted Per. (ft)		202.26
Min Ch El (ft)	1455.33	Shear (lb/sq ft)		0.52
Alpha	1.00	Stream Power (lb/ft s)		2.09
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	0.98	103.79
C & E Loss (ft)	0.05	Cum SA (acres)	0.37	17.64

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.300

INPUT
Description:
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9767.11	1479.35	9778.14	1479.6	9799.59	1480.03	9814.28	1480.33	9831.12	1480.62
9833.04	1479.7	9854.59	1469.28	9870.06	1461.04	9885.42	1459.77	9918.35	1458.76
9922.59	1458.66	9926.15	1458.42	9950.61	1456.45	9962.31	1455.46	9967.28	1454.99
9970.13	1455.23	9999.2	1456.11	10008.35	1456.21	10020.99	1455.93	10027.4	1456.61
10064.43	1457.28	10074.81	1457.29	10080.25	1457.51	10084.1	1457.16	10086.5	1457.22
10090.19	1457.31	10101.58	1457.91	10126.5	1457.95	10131.91	1457.95	10137.05	1458.12
10152.71	1458.86	10162.6	1459.36	10172.19	1459.69	10187.37	1462.64	10191.8	1463.16
10195.47	1463.66	10220.61	1465.55	10236.37	1467.17	10244.28	1468.93	10256.81	1471.82
10278.23	1474.05	10287.21	1474.81	10316.15	1477.58	10317.19	1477.68	10329.58	1479.58
10353.61	1480.01								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9767.11	.033	9831.12	.043	10126.5	.046

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9831.12	10126.5	255.26	190.58	121.86	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1463.56	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.		0.043	0.046
W.S. Elev (ft)	1463.50	Reach Len. (ft)	255.26	190.58	121.86
Crit W.S. (ft)	1458.86	Flow Area (sq ft)		1576.77	256.90
E.G. Slope (ft/ft)	0.000271	Area (sq ft)		1576.77	256.90
Q Total (cfs)	3300.00	Flow (cfs)		2969.10	330.90
Top Width (ft)	328.89	Top Width (ft)		261.07	67.82
Vel Total (ft/s)	1.80	Avg. Vel. (ft/s)		1.88	1.29
Max Chl Dpth (ft)	8.51	Hydr. Depth (ft)		6.04	3.79
Conv. Total (cfs)	200362.6	Conv. (cfs)		180271.9	20090.8
Length Wtd. (ft)	184.63	Wetted Per. (ft)		262.01	68.20
Min Ch El (ft)	1454.99	Shear (lb/sq ft)		0.10	0.06
Alpha	1.04	Stream Power (lb/ft s)		0.19	0.08
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	8.37	97.27	1.70
C & E Loss (ft)	0.00	Cum SA (acres)	2.79	16.71	0.63

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1463.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.		0.043	
W.S. Elev (ft)	1463.55	Reach Len. (ft)	255.26	190.58	121.86
Crit W.S. (ft)	1458.86	Flow Area (sq ft)		1587.48	
E.G. Slope (ft/ft)	0.000337	Area (sq ft)		1587.48	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	261.14	Top Width (ft)		261.14	
Vel Total (ft/s)	2.08	Avg. Vel. (ft/s)		2.08	
Max Chl Dpth (ft)	8.55	Hydr. Depth (ft)		6.08	
Conv. Total (cfs)	179727.9	Conv. (cfs)		179727.9	
Length Wtd. (ft)	190.58	Wetted Per. (ft)		267.69	
Min Ch El (ft)	1454.99	Shear (lb/sq ft)		0.12	
Alpha	1.00	Stream Power (lb/ft s)		0.26	
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.98	97.52	
C & E Loss (ft)	0.00	Cum SA (acres)	0.37	16.44	

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.264

INPUT
Description:
Station Elevation Data num= 66

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9703.45	1472.21	9707.73	1472.17	9712.91	1472.3	9737.33	1472.91	9738.14	1472.95
9742.28	1473.16	9744.06	1473.24	9748.85	1473.49	9750.88	1473.92	9753.51	1474.36
9756.45	1475.76	9759.7	1477.13	9767.47	1481.05	9772.71	1480.93	9796.15	1480.84
9804.68	1480.6	9811.1	1480.4	9812.4	1479.86	9819.71	1477.66	9824.1	1475.83
9829.29	1474.98	9831.48	1475.24	9838.36	1475.75	9841.6	1475.99	9854.17	1468.2
9858.98	1465.62	9869.26	1462.08	9878.43	1460.04	9888.93	1459.73	9892.93	1459.64
9903.97	1459.7	9922.8	1457.46	9930.31	1456.72	9935.84	1456.39	9963.92	1455.17
9965.7	1455.29	9968.49	1455.37	9993.42	1455.64	9998.09	1455.84	10011.24	1456.04
10026.55	1455.66	10036.09	1456.03	10043.61	1456.49	10077.03	1457.18	10079.75	1457.24
10080.39	1457.26	10089.62	1457.55	10096.96	1457.79	10104.1	1459.67	10105.12	1459.9
10106.21	1460.17	10119.09	1462.67	10127.55	1464.53	10138.2	1466.45	10159.54	1469.59
10162.23	1469.77	10163.72	1470.16	10177.61	1473.47	10198.98	1477.87	10201.46	1478.04
10206.24	1478.24	10215.97	1480.22	10233.89	1482.53	10243.3	1484.31	10272.77	1492.8
10277.28	1493.93								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9703.45	.033	9841.6	.042	10080.39	.047

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9841.6	10080.39	70.64	169.22	186.13	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

			Left OB	Channel	Right OB
E.G. Elev (ft)	1463.50	Element			
Vel Head (ft)	0.08	Wt. n-Val.		0.042	0.047
W.S. Elev (ft)	1463.42	Reach Len. (ft)	70.64	169.22	186.13
Crit W.S. (ft)	1458.53	Flow Area (sq ft)		1360.97	165.74
E.G. Slope (ft/ft)	0.000346	Area (sq ft)		1360.97	165.74
Q Total (cfs)	3300.00	Flow (cfs)		3059.35	240.65
Top Width (ft)	257.15	Top Width (ft)		215.03	42.12
Vel Total (ft/s)	2.16	Avg. Vel. (ft/s)		2.25	1.45
Max Chl Dpth (ft)	8.25	Hydr. Depth (ft)		6.33	3.93
Conv. Total (cfs)	177323.3	Conv. (cfs)		164392.3	12931.0
Length Wtd. (ft)	169.87	Wetted Per. (ft)		215.73	42.75
Min Ch El (ft)	1455.17	Shear (lb/sq ft)		0.14	0.08
Alpha	1.04	Stream Power (lb/ft s)		0.31	0.12
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	8.37	90.84	1.11
C & E Loss (ft)	0.05	Cum SA (acres)	2.79	15.67	0.47

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

			Left OB	Channel	Right OB
E.G. Elev (ft)	1463.54	Element			
Vel Head (ft)	0.09	Wt. n-Val.		0.042	
W.S. Elev (ft)	1463.45	Reach Len. (ft)	70.64	169.22	186.13
Crit W.S. (ft)	1458.51	Flow Area (sq ft)		1366.56	
E.G. Slope (ft/ft)	0.000413	Area (sq ft)		1366.56	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	215.10	Top Width (ft)		215.10	
Vel Total (ft/s)	2.41	Avg. Vel. (ft/s)		2.41	
Max Chl Dpth (ft)	8.28	Hydr. Depth (ft)		6.35	
Conv. Total (cfs)	162389.3	Conv. (cfs)		162389.3	
Length Wtd. (ft)	169.22	Wetted Per. (ft)		222.00	
Min Ch El (ft)	1455.17	Shear (lb/sq ft)		0.16	
Alpha	1.00	Stream Power (lb/ft s)		0.38	
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	0.98	91.06	
C & E Loss (ft)	0.05	Cum SA (acres)	0.37	15.40	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.232

INPUT
Description:
Station Elevation Data num= 55

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9642.83	1471.7	9658.4	1471.53	9707.96	1471.57	9716.78	1471.64	9723.82	1471.57
9728.75	1471.52	9762.57	1472.67	9763.87	1472.72	9764.38	1472.74	9764.86	1472.77
9781.66	1473.04	9788.06	1472.82	9804.67	1472.59	9826.37	1473.14	9828.86	1473.2
9829.54	1472.91	9847.22	1465.2	9858.35	1465.07	9865.11	1465.24	9885.95	1465.05
9891.18	1465.01	9903.94	1464.82	9916.03	1464.12	9938.06	1463.98	9949.12	1462.38
9952.96	1461.6	9965.02	1458.2	9969.02	1457.86	9978.56	1457.05	9991.89	1453.62
9994.1	1452.94	9994.96	1452.86	10009.61	1452.77	10011.21	1452.86	10011.85	1453.12
10017.34	1455.55	10025.1	1458.94	10027.27	1459.41	10034.96	1460.47	10040.78	1461.2
10054.49	1462.93	10060.19	1463.75	10067.38	1464.93	10083.35	1467.21	10117.28	1469.16
10122.8	1469.72	10126.1	1469.93	10145.14	1471.19	10146.22	1471.29	10147.85	1471.42
10161.87	1472.11	10168.48	1472.21	10175.71	1472.39	10182.51	1473.05	10202.72	1477.14

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9642.83	.033	9828.86	.042	10040.78	.047

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9828.86	10040.78	119.69	115.9	115.89	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1463.31	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.60	Wt. n-Val.		0.042
0.047				
W.S. Elev (ft)	1462.72	Reach Len. (ft)	119.69	115.90
115.89				
Crit W.S. (ft)	1459.89	Flow Area (sq ft)		529.29
9.10				
E.G. Slope (ft/ft)	0.003188	Area (sq ft)		529.29
9.10				
Q Total (cfs)	3300.00	Flow (cfs)		3286.56
13.44				
Top Width (ft)	105.99	Top Width (ft)		93.98
12.01				
Vel Total (ft/s)	6.13	Avg. Vel. (ft/s)		6.21
1.48				
Max Chl Dpth (ft)	9.95	Hydr. Depth (ft)		5.63
0.76				
Conv. Total (cfs)	58443.0	Conv. (cfs)		58205.1
238.0				
Length Wtd. (ft)	115.90	Wetted Per. (ft)		96.59
12.11				
Min Ch El (ft)	1452.77	Shear (lb/sq ft)		1.09
0.15				
Alpha	1.02	Stream Power (lb/ft s)		6.77
0.22				
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	8.37	87.17
0.74				
C & E Loss (ft)	0.15	Cum SA (acres)	2.79	15.07
0.36				

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1463.34	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.60	Wt. n-Val.		0.042
W.S. Elev (ft)	1462.74	Reach Len. (ft)	119.69	115.90
115.89				
Crit W.S. (ft)	1459.89	Flow Area (sq ft)		531.29
E.G. Slope (ft/ft)	0.003248	Area (sq ft)		531.29
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	94.13	Top Width (ft)		94.13
Vel Total (ft/s)	6.21	Avg. Vel. (ft/s)		6.21
Max Chl Dpth (ft)	9.97	Hydr. Depth (ft)		5.64
Conv. Total (cfs)	57899.8	Conv. (cfs)		57899.8
Length Wtd. (ft)	115.90	Wetted Per. (ft)		98.27
Min Ch El (ft)	1452.77	Shear (lb/sq ft)		1.10
Alpha	1.00	Stream Power (lb/ft s)		6.81
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	0.98	87.37
C & E Loss (ft)	0.15	Cum SA (acres)	0.37	14.80

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.210

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9661.61	1471.29	9672.65	1471.27	9697.43	1471.22	9720.88	1470.89	9733.64	1470.79
9736.91	1470.81	9738.44	1470.81	9740.31	1470.82	9742.15	1470.83	9743.88	1470.83
9745.53	1470.84	9747.06	1470.85	9764.18	1470.95	9766.53	1470.88	9791.32	1470.54
9840.84	1470.37	9856.95	1470.48	9863.71	1470.58	9867.3	1470.64	9867.95	1470.65
9900.42	1458.66	9902.31	1457.95	9919.41	1456.8	9927.93	1456.26	9973.8	1454.05
9982.38	1454.31	9992.43	1453.91	9998.93	1453.47	10003.1	1453.19	10006.76	1453.34
10009.32	1453.45	10011.95	1453.56	10025.49	1453.63	10035.05	1455.34	10038.25	1455.91
10043.6	1456.79	10055.25	1458.88	10077.68	1462.91	10092.12	1465.35	10105.95	1466.51
10112.18	1467.77	10119.53	1468.42	10125.9	1468.55	10127.5	1468.34	10145.62	1469.93
10152.05	1470.58	10194.89	1469.83	10203.82	1469.71	10204.77	1469.67	10205.59	1469.69
10211.8	1469.83								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9661.61	.033	9867.3	.042	10055.25	.047

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9867.31	10055.25	199.99	214.34	212.37	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1463.06	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.11	Wt. n-Val.		0.042
0.047				
W.S. Elev (ft)	1462.95	Reach Len. (ft)	199.99	214.34
212.37				
Crit W.S. (ft)	1457.54	Flow Area (sq ft)		1217.00
46.30				
E.G. Slope (ft/ft)	0.000407	Area (sq ft)		1217.00
46.30				
Q Total (cfs)	3300.00	Flow (cfs)		3253.06
46.94				
Top Width (ft)	189.21	Top Width (ft)		166.46
22.75				
Vel Total (ft/s)	2.61	Avg. Vel. (ft/s)		2.67
1.01				
Max Chl Dpth (ft)	9.76	Hydr. Depth (ft)		7.31
2.04				
Conv. Total (cfs)	163544.4	Conv. (cfs)		161218.0
2326.4				
Length Wtd. (ft)	214.31	Wetted Per. (ft)		167.97
23.11				
Min Ch El (ft)	1453.19	Shear (lb/sq ft)		0.18
0.05				
Alpha	1.03	Stream Power (lb/ft s)		0.49
0.05				
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	8.37	84.84
0.66				
C & E Loss (ft)	0.00	Cum SA (acres)	2.79	14.73
0.31				

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1463.08	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.11	Wt. n-Val.		0.042
W.S. Elev (ft)	1462.97	Reach Len. (ft)	199.99	214.34
212.37				
Crit W.S. (ft)	1457.54	Flow Area (sq ft)		1219.60
E.G. Slope (ft/ft)	0.000430	Area (sq ft)		1219.60
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	166.50	Top Width (ft)		166.50
Vel Total (ft/s)	2.71	Avg. Vel. (ft/s)		2.71
Max Chl Dpth (ft)	9.78	Hydr. Depth (ft)		7.32
Conv. Total (cfs)	159191.2	Conv. (cfs)		159191.2
Length Wtd. (ft)	214.34	Wetted Per. (ft)		172.10
Min Ch El (ft)	1453.19	Shear (lb/sq ft)		0.19
Alpha	1.00	Stream Power (lb/ft s)		0.51
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.98	85.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.37	14.46

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.169

INPUT
Description:
Station Elevation Data num= 55

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9718.68	1470.5	9722.99	1470.51	9726.97	1470.54	9731.88	1470.57	9750.48	1470.46
9752.74	1470.44	9754.98	1470.42	9755.17	1470.42	9755.44	1470.41	9756.15	1470.39
9774.11	1469.92	9778.07	1469.81	9778.38	1469.81	9782.18	1469.75	9794.92	1469.73
9806.78	1469.62	9831.85	1469.93	9841.81	1469.99	9844.64	1470.02	9849.25	1470.07
9853.81	1470.19	9895.67	1469.75	9903	1469.64	9908.45	1469.99	9911.06	1470.97
9921.71	1472.41	9925.55	1472.93	9933.72	1467.82	9961.26	1454.92	9966.18	1453.97
9990.92	1453.9	9996.44	1453.92	9997.06	1453.92	9999.98	1453.79	10001.84	1453.63
10016.98	1452.5	10025.72	1453.18	10028.12	1453.44	10037.31	1454.17	10067.14	1456.1
10076.44	1456.46	10078.36	1456.49	10095.86	1459.11	10112.52	1461.61	10118.92	1462.76
10133.3	1465.97	10138.91	1467.11	10142.44	1467.43	10150.24	1467.73	10163.01	1468.17
10176.94	1468.43	10226.86	1469.35	10233.06	1469.31	10250.57	1469.16	10252.42	1469.13

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9718.68	.033	9925.55	.042	10095.86	.047

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9925.55	10095.86	296.65	301.29	297.76	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1462.97	Element	Left OB	Channel
Vel Head (ft)	0.12	Wt. n-Val.		0.042
W.S. Elev (ft)	1462.85	Reach Len. (ft)	296.65	301.29
Crit W.S. (ft)	1457.20	Flow Area (sq ft)		1161.14
E.G. Slope (ft/ft)	0.000424	Area (sq ft)		1161.14
Q Total (cfs)	3300.00	Flow (cfs)		3253.82
Top Width (ft)	175.01	Top Width (ft)		151.54
Vel Total (ft/s)	2.73	Avg. Vel. (ft/s)		2.80
Max Chl Dpth (ft)	10.35	Hydr. Depth (ft)		7.66
Conv. Total (cfs)	160351.5	Conv. (cfs)		158107.8
Length Wtd. (ft)	301.24	Wetted Per. (ft)		153.78
Min Ch El (ft)	1452.50	Shear (lb/sq ft)		0.20
Alpha	1.04	Stream Power (lb/ft s)		0.56
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	8.37	78.99
C & E Loss (ft)	0.01	Cum SA (acres)	2.79	13.94

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1462.99	Element	Left OB	Channel
Vel Head (ft)	0.13	Wt. n-Val.		0.042
W.S. Elev (ft)	1462.86	Reach Len. (ft)	296.65	301.29
Crit W.S. (ft)	1457.20	Flow Area (sq ft)		1162.65
E.G. Slope (ft/ft)	0.000448	Area (sq ft)		1162.65
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	151.56	Top Width (ft)		151.56
Vel Total (ft/s)	2.84	Avg. Vel. (ft/s)		2.84
Max Chl Dpth (ft)	10.36	Hydr. Depth (ft)		7.67
Conv. Total (cfs)	155910.0	Conv. (cfs)		155910.0
Length Wtd. (ft)	301.29	Wetted Per. (ft)		157.56
Min Ch El (ft)	1452.50	Shear (lb/sq ft)		0.21
Alpha	1.00	Stream Power (lb/ft s)		0.59
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	0.98	79.18
C & E Loss (ft)	0.01	Cum SA (acres)	0.37	13.67

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.112

INPUT
Description:
Station Elevation Data num= 71

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9795.98	1468.9	9802.4	1468.97	9810.44	1468.98	9815.08	1468.99	9820.43	1469.01
9827.72	1469.05	9829.29	1469.05	9831.66	1469.05	9835.77	1469.06	9844.8	1469.09
9850.76	1469.09	9852.45	1469.08	9854.8	1469.1	9865.99	1469.1	9866.9	1469.11
9868.04	1469.11	9869	1469.11	9869.5	1469.12	9871.85	1469.17	9873.7	1469.23
9873.93	1469.24	9873.97	1469.24	9875.86	1469.25	9875.92	1469.25	9882.9	1469.11

```
 9884.59 1469.08 9885.33 1469.06 9885.74 1469.05 9885.99 1469.05  9886.1 1469.04
 9886.23 1469.04 9886.78 1469.02  9897.9  1468.8 9898.12 1468.79  9898.5  1468.8
 9906.86 1468.83 9927.98  1468.6 9947.61 1468.22 9949.84 1468.19 9950.69 1467.97
 9950.89 1467.93 9956.98 1466.71 9961.31 1464.44  9987.1 1453.23 9990.85 1452.78
 9993.84  1452.810008.71 1452.1510012.68 1451.9810029.06 1452.2610035.42 1452.36
 10037.2 1452.3310039.74 1452.2510053.35 1451.7610057.71 1452.0410093.68 1455.66
10094.06 1455.6910095.35 1455.6610101.21  1455.410104.73 1455.7210107.67 1456.28
10115.35    145810119.97 1459.0410149.14 1465.5710181.66 1466.9310207.22 1467.73
 10213.3 1467.4310221.71 1467.0310227.45 1467.1610254.57 1467.37 10286.3 1467.22
 10303.6 1467.17

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9795.98    .033 9949.84    .04210115.35    .047

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9949.8410115.35           279.21  236.46  183.86             .3       .5

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)           1462.86    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.09    Wt. n-Val.                            0.042
0.047
  W.S. Elev (ft)           1462.77    Reach Len. (ft)           279.21     236.46
183.86
  Crit W.S. (ft)           1455.94    Flow Area (sq ft)                   1310.19
50.67
  E.G. Slope (ft/ft)      0.000280    Area (sq ft)                        1310.19
50.67
  Q Total (cfs)            3300.00    Flow (cfs)                          3252.93
47.07
  Top Width (ft)            171.47    Top Width (ft)                       150.19
21.27
  Vel Total (ft/s)            2.42    Avg. Vel. (ft/s)                       2.48
0.93
  Max Chl Dpth (ft)          11.01    Hydr. Depth (ft)                       8.72
2.38
  Conv. Total (cfs)       197089.0    Conv. (cfs)                        194277.9
2811.1
  Length Wtd. (ft)          236.08    Wetted Per. (ft)                     152.69
21.80
  Min Ch El (ft)           1451.76    Shear (lb/sq ft)                       0.15
0.04
  Alpha                       1.04    Stream Power (lb/ft s)                 0.37
0.04
  Frctn Loss (ft)             0.16    Cum Volume (acre-ft)        8.37      70.45
0.11
  C & E Loss (ft)             0.18    Cum SA (acres)              2.79      12.90
0.04


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.

CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)           1462.87    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.10    Wt. n-Val.                            0.042
  W.S. Elev (ft)           1462.77    Reach Len. (ft)           279.21     236.46
183.86
  Crit W.S. (ft)           1455.95    Flow Area (sq ft)                   1310.77
  E.G. Slope (ft/ft)      0.000300    Area (sq ft)                        1310.77
  Q Total (cfs)            3300.00    Flow (cfs)                          3300.00
  Top Width (ft)            150.20    Top Width (ft)                       150.20
  Vel Total (ft/s)            2.52    Avg. Vel. (ft/s)                       2.52
  Max Chl Dpth (ft)          11.01    Hydr. Depth (ft)                       8.73
  Conv. Total (cfs)       190466.6    Conv. (cfs)                        190466.6
  Length Wtd. (ft)          236.46    Wetted Per. (ft)                     157.47
  Min Ch El (ft)           1451.76    Shear (lb/sq ft)                       0.16
  Alpha                       1.00    Stream Power (lb/ft s)                 0.39
  Frctn Loss (ft)             0.17    Cum Volume (acre-ft)        0.98      70.63
  C & E Loss (ft)             0.18    Cum SA (acres)              0.37      12.63


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is
less than
         0.7 or greater than 1.4.  This may indicate the need for additional cross
sections.

CROSS SECTION


RIVER: Cave Creek
REACH: 1                  RS: 24.068
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INPUT
Description:
Station Elevation Data     num=       36
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
9878.216     14649878.239     14649887.276 1464.169896.518 1464.259905.951 1464.42
9908.824 1464.449921.089 1465.019921.897 1465.01 9922.73 1465.029937.162 1464.45
9944.928 1464.559952.061 1464.629960.613 1464.36 9964.19 1462.02 9964.19 1455.15
9975.012 1455.159975.258 1454.949975.465 1454.949975.536 1454.949975.742 1454.94
9996.972 1455.0710015.21 1454.1110024.79 1454.9110030.63 1455.3910035.82 1455.39
10035.82 1462.7510035.89 1462.7510042.44 1463.4910052.34 1463.5810058.24 1463.69
10071.87 1464.6510078.74  1464.7 10084.4 1464.7510093.43 1464.4210099.96 1465.56
   10100 1465.56

Manning's n Values         num=        3
     Sta   n Val      Sta   n Val      Sta   n Val
9878.216    .0339960.613    .04210042.44    .047

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      9960.61310042.44            53.71   53.62   54.97              .3       .5
Skew Angle = 37.5

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)           1462.53    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.68    Wt. n-Val.                            0.042
  W.S. Elev (ft)           1461.85    Reach Len. (ft)              3.80       3.80
3.80
  Crit W.S. (ft)           1458.95    Flow Area (sq ft)                    497.91
  E.G. Slope (ft/ft)      0.003320    Area (sq ft)                         497.91
  Q Total (cfs)            3300.00    Flow (cfs)                          3300.00
  Top Width (ft)             71.63    Top Width (ft)                        71.63
  Vel Total (ft/s)            6.63    Avg. Vel. (ft/s)                       6.63
  Max Chl Dpth (ft)           7.74    Hydr. Depth (ft)                       6.95
  Conv. Total (cfs)        57270.5    Conv. (cfs)                         57270.5
  Length Wtd. (ft)            3.80    Wetted Per. (ft)                      84.94
  Min Ch El (ft)           1454.11    Shear (lb/sq ft)                       1.22
  Alpha                       1.00    Stream Power (lb/ft s)                 8.05
  Frctn Loss (ft)                     Cum Volume (acre-ft)         8.37      65.54
  C & E Loss (ft)                     Cum SA (acres)               2.79      12.30


CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)           1462.53    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.68    Wt. n-Val.                            0.042
  W.S. Elev (ft)           1461.85    Reach Len. (ft)              3.80       3.80
3.80
  Crit W.S. (ft)           1458.95    Flow Area (sq ft)                    497.92
  E.G. Slope (ft/ft)      0.003320    Area (sq ft)                         497.92
  Q Total (cfs)            3300.00    Flow (cfs)                          3300.00
  Top Width (ft)             71.63    Top Width (ft)                        71.63
  Vel Total (ft/s)            6.63    Avg. Vel. (ft/s)                       6.63
  Max Chl Dpth (ft)           7.74    Hydr. Depth (ft)                       6.95
  Conv. Total (cfs)        57272.1    Conv. (cfs)                         57272.1
  Length Wtd. (ft)            3.80    Wetted Per. (ft)                      84.94
  Min Ch El (ft)           1454.11    Shear (lb/sq ft)                       1.22
  Alpha                       1.00    Stream Power (lb/ft s)                 8.05
  Frctn Loss (ft)                     Cum Volume (acre-ft)         0.98      65.72
  C & E Loss (ft)                     Cum SA (acres)               0.37      12.03


BRIDGE


RIVER: Cave Creek
REACH: 1                    RS: 24.062

INPUT
Description: 7th Street Bridge
Distance from Upstream XS =      3.8
Deck/Roadway Width        =    46.01
Weir Coefficient          =      2.6
Upstream  Deck/Roadway Coordinates
    num=        8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
 9878.21 1466.52        0 9964.19 1467.02        0 9964.19 1467.02  1463.2
 9986.12 1467.22 1463.0510013.89 1467.51 1463.2710035.82 1467.69 1463.78
10035.82 1467.69        0   10100 1468.36        0

Upstream Bridge Cross Section Data
Station Elevation Data     num=       36
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
9878.216     14649878.239     14649887.276 1464.169896.518 1464.259905.951 1464.42
9908.824 1464.449921.089 1465.019921.897 1465.01 9922.73 1465.029937.162 1464.45
9944.928 1464.559952.061 1464.629960.613 1464.36 9964.19 1462.02 9964.19 1455.15
9975.012 1455.159975.258 1454.949975.465 1454.949975.536 1454.949975.742 1454.94
9996.972 1455.0710015.21 1454.1110024.79 1454.9110030.63 1455.3910035.82 1455.39
10035.82 1462.7510035.89 1462.7510042.44 1463.4910052.34 1463.5810058.24 1463.69
10071.87 1464.6510078.74  1464.7 10084.4 1464.7510093.43 1464.4210099.96 1465.56
   10100 1465.56
```

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Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
9878.216    .0339960.613    .04210042.44    .047

Bank Sta: Left   Right    Coeff Contr.   Expan.
      9960.61310042.44              .3       .5
Skew Angle = 37.5

Downstream  Deck/Roadway Coordinates
    num=        8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
 9895.86 1466.74        0 9964.19 1466.83        0 9964.19 1466.83 1462.97
 9986.12 1467.01  1462.910013.89 1467.31 1463.1610035.82  1467.5 1463.61
10035.82  1467.5        0   10127 1468.88        0

Downstream Bridge Cross Section Data
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
9895.858 1464.419900.253 1464.429908.789  1464.59915.596 1464.559922.847 1464.49
9929.639 1464.699937.501 1464.769943.063  1464.69955.589  1464.79960.738 1463.92
9964.182 1461.43 9964.19 1461.43 9964.19 1454.669975.296 1454.669977.335 1454.61
9981.151  1454.69985.165  1454.710011.15 1454.5610022.99 1455.1810032.24 1455.26
10035.82 1455.2610035.82  1461.410042.27 1465.4210050.54 1465.4410057.15  1465.2
10069.11 1465.3710072.56 1465.3710076.97 1465.3810087.57 1465.5310094.24 1465.79
   101001465.439

Manning's n Values          num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
9895.858    .0589955.589    .04210042.27    .067

Bank Sta: Left   Right    Coeff Contr.   Expan.
      9955.58910042.27              .3       .5
Skew Angle = 37.5

Upstream Embankment side slope                =       0 horiz. to 1.0 vertical
Downstream Embankment side slope              =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins           =
Energy head used in spillway design           =
Spillway height used in design                =
Weir crest shape                              = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream= 9986.11    Downstream= 9986.11
Upstream     num=       2
    Width   Elev    Width   Elev
       1    1450       1    1464
Downstream     num=       2
    Width   Elev    Width   Elev
       1    1450       1    1464

Pier Data
Pier Station     Upstream=10013.89    Downstream=10013.89
Upstream     num=       2
    Width   Elev    Width   Elev
       1    1450       1    1464
Downstream     num=       2
    Width   Elev    Width   Elev
       1    1450       1    1464

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum                Cd   =       2
       Yarnell                 KVal =    1.25
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #WS F-Plain

  E.G. US. (ft)                1462.53    Element                  Inside BR US  Inside BR
DS
  W.S. US. (ft)                1461.85    E.G. Elev (ft)               1462.47
1462.08
  Q Total (cfs)                3300.00    W.S. Elev (ft)               1461.72
1461.25
  Q Bridge (cfs)               3300.00    Crit W.S. (ft)               1459.02
1458.89
  Q Weir (cfs)                            Max Chl Dpth (ft)               7.61
6.69
  Weir Sta Lft (ft)                       Vel Total (ft/s)                6.95
7.33
```

Weir Sta Rgt (ft)	450.09	Flow Area (sq ft)	474.94
Weir Submerg	0.51	Froude # Chl	0.47
Weir Max Depth (ft)	2208.13	Specif Force (cu ft)	2335.47
Min El Weir Flow (ft)	1466.53	Hydr Depth (ft)	6.82
Min El Prs (ft)	1463.78	W.P. Total (ft)	111.22
Delta EG (ft)	0.46	Conv. Total (cfs)	44225.9
Delta WS (ft)	0.56	Top Width (ft)	69.63
BR Open Area (sq ft)	579.85	Frctn Loss (ft)	
BR Open Vel (ft/s)	7.33	C & E Loss (ft)	
Coef of Q	1.67	Shear Total (lb/sq ft)	1.48
Br Sel Method	Momentum	Power Total (lb/ft s)	12.23

BRIDGE OUTPUT Profile #WS F-Way

E.G. US. (ft)	1462.53	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	1461.85	E.G. Elev (ft)	1462.47	1462.08
Q Total (cfs)	3300.00	W.S. Elev (ft)	1461.72	1461.25
Q Bridge (cfs)	3300.00	Crit W.S. (ft)	1459.03	1458.92
Q Weir (cfs)		Max Chl Dpth (ft)	7.61	6.69
Weir Sta Lft (ft)		Vel Total (ft/s)	6.95	7.33
Weir Sta Rgt (ft)		Flow Area (sq ft)	474.95	450.09
Weir Submerg		Froude # Chl	0.47	0.51
Weir Max Depth (ft)		Specif Force (cu ft)	2335.52	2208.17
Min El Weir Flow (ft)	1467.00	Hydr Depth (ft)	6.82	6.46
Min El Prs (ft)	1463.78	W.P. Total (ft)	111.22	108.42
Delta EG (ft)	0.46	Conv. Total (cfs)	44227.0	41131.8
Delta WS (ft)	0.56	Top Width (ft)	69.63	69.63
BR Open Area (sq ft)	579.85	Frctn Loss (ft)		
BR Open Vel (ft/s)	7.33	C & E Loss (ft)		
Coef of Q		Shear Total (lb/sq ft)	1.48	1.67
Br Sel Method	Momentum	Power Total (lb/ft s)	10.31	12.23

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 24.057

INPUT
Description:
Station Elevation Data num= 31

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9895.858	1464.419	9900.253	1464.429	9908.789	1464.59	9915.596	1464.559	9922.847	1464.49
9929.639	1464.699	9937.501	1464.769	9943.063	1464.69	9955.589	1464.79	9960.738	1463.92
9964.182	1461.43	9964.19	1461.43	9964.19	1454.669	9975.296	1454.669	9977.335	1454.61
9981.151	1454.69	9985.165	1454.71	9011.15	1454.561	9022.99	1455.181	9032.24	1455.26
10035.82	1455.261	0035.82	1461.41	0042.27	1465.421	0050.54	1465.441	0057.15	1465.2
10069.11	1465.371	0072.56	1465.371	0076.97	1465.381	0087.57	1465.531	0094.24	1465.79
10100	1465.439								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9895.858	.058	9955.589	.042	10042.27	.067

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9955.589	10042.27	436.59	500.04	566.57	.3	.5

Skew Angle = 37.5

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1462.06	Element	Left OB	Channel
Vel Head (ft)	0.78	Wt. n-Val.		0.042
W.S. Elev (ft)	1461.28	Reach Len. (ft)	436.59	500.04
Crit W.S. (ft)	1458.83	Flow Area (sq ft)		465.68
E.G. Slope (ft/ft)	0.004108	Area (sq ft)		465.68
Q Total (cfs)	3300.00	Flow (cfs)		3300.00

Top Width (ft)	71.63	Top Width (ft)			71.63
Vel Total (ft/s)	7.09	Avg. Vel. (ft/s)			7.09
Max Chl Dpth (ft)	6.72	Hydr. Depth (ft)			6.50
Conv. Total (cfs)	51485.4	Conv. (cfs)			51485.4
Length Wtd. (ft)	500.04	Wetted Per. (ft)			84.29
Min Ch El (ft)	1454.56	Shear (lb/sq ft)			1.42
Alpha	1.00	Stream Power (lb/ft s)			10.04
Frctn Loss (ft)	1.65	Cum Volume (acre-ft)		8.37	64.97
C & E Loss (ft)	0.04	Cum SA (acres)		2.79	12.21

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1462.06	Element		Left OB	Channel
Right OB					
Vel Head (ft)	0.78	Wt. n-Val.			0.042
W.S. Elev (ft)	1461.28	Reach Len. (ft)		436.59	500.04
566.57					
Crit W.S. (ft)	1458.83	Flow Area (sq ft)			465.68
E.G. Slope (ft/ft)	0.004108	Area (sq ft)			465.68
Q Total (cfs)	3300.00	Flow (cfs)			3300.00
Top Width (ft)	71.63	Top Width (ft)			71.63
Vel Total (ft/s)	7.09	Avg. Vel. (ft/s)			7.09
Max Chl Dpth (ft)	6.72	Hydr. Depth (ft)			6.50
Conv. Total (cfs)	51485.4	Conv. (cfs)			51485.4
Length Wtd. (ft)	500.04	Wetted Per. (ft)			84.29
Min Ch El (ft)	1454.56	Shear (lb/sq ft)			1.42
Alpha	1.00	Stream Power (lb/ft s)			10.04
Frctn Loss (ft)	1.65	Cum Volume (acre-ft)		0.98	65.15
C & E Loss (ft)	0.04	Cum SA (acres)		0.37	11.94

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 *RS: 23.963*

INPUT
Description:
Station Elevation Data num= 45

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9819.02	1465.45	9831.5	1465.28	9844.74	1465.69	9853.04	1465.77	9864.75	1465.86
9885.18	1465.79	9939.49	1465.48	9939.58	1465.48	9940.35	1465.49	9943.61	1464.14
9953.26	1461.54	9989.25	1450.4	9996.42	1450.48	10018.88	1450.96	10041.7	1460.89
10042.91	1461.42	10043.99	1462.06	10052.12	1466.68	10052.6	1466.71	10057.54	1466.87
10064.06	1467.02	10067.71	1464.93	10068.17	1464.67	10070.76	1464.61	10082.56	1464.29
10087.14	1464.14	10089.68	1464.09	10095.75	1464.07	10119.01	1463.95	10119.5	1464.16
10139.44	1476.86	10141.13	1477.88	10143.09	1479.23	10152.59	1485.14	10159.52	1485.19
10172.13	1484.51	10175.96	1484.03	10179.15	1483.89	10221.34	1481.77	10223.82	1481.83
10224.25	1481.86	10224.89	1481.81	10242.42	1482.51	10242.96	1482.51	10251.29	1482.76

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9819.02	.058	9940.35	.038	10052.6	.067

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9940.35	10052.6	414.65	418.62	423.5	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1460.37	Element		Left OB	Channel
Right OB					
Vel Head (ft)	0.69	Wt. n-Val.			0.038
W.S. Elev (ft)	1459.68	Reach Len. (ft)		414.65	418.62
423.50					
Crit W.S. (ft)	1456.64	Flow Area (sq ft)			493.96
E.G. Slope (ft/ft)	0.002701	Area (sq ft)			493.96
Q Total (cfs)	3300.00	Flow (cfs)			3300.00
Top Width (ft)	79.65	Top Width (ft)			79.65
Vel Total (ft/s)	6.68	Avg. Vel. (ft/s)			6.68
Max Chl Dpth (ft)	9.28	Hydr. Depth (ft)			6.20
Conv. Total (cfs)	63497.5	Conv. (cfs)			63497.5
Length Wtd. (ft)	418.62	Wetted Per. (ft)			82.87
Min Ch El (ft)	1450.40	Shear (lb/sq ft)			1.01
Alpha	1.00	Stream Power (lb/ft s)			6.71
Frctn Loss (ft)	1.48	Cum Volume (acre-ft)		8.37	59.46
C & E Loss (ft)	0.03	Cum SA (acres)		2.79	11.34

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1460.37	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.69	Wt. n-Val.		0.038
W.S. Elev (ft)	1459.68	Reach Len. (ft)	414.65	418.62
423.50				
Crit W.S. (ft)	1456.64	Flow Area (sq ft)		493.96
E.G. Slope (ft/ft)	0.002701	Area (sq ft)		493.96
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	79.65	Top Width (ft)		79.65
Vel Total (ft/s)	6.68	Avg. Vel. (ft/s)		6.68
Max Chl Dpth (ft)	9.28	Hydr. Depth (ft)		6.20
Conv. Total (cfs)	63497.5	Conv. (cfs)		63497.5
Length Wtd. (ft)	418.62	Wetted Per. (ft)		82.87
Min Ch El (ft)	1450.40	Shear (lb/sq ft)		1.01
Alpha	1.00	Stream Power (lb/ft s)		6.71
Frctn Loss (ft)	1.48	Cum Volume (acre-ft)	0.98	59.64
C & E Loss (ft)	0.03	Cum SA (acres)	0.37	11.07

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.883

INPUT
Description:
Station Elevation Data num= 48

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9823.08	1460.33	9842.4	1460.84	9872.77	1461.79	9926.53	1461.26	9934.3	1461.17
9935.26	1461.65	9943.14	1464.72	9943.86	1464.97	9945.28	1464.94	9954.18	1464.68
9954.44	1464.67	9959.91	1461.85	9973.44	1455.25	9990.81	1447.45	10005.67	1447.34
10006.05	1447.34	10006.61	1447.56	10007.94	1448.09	10048.04	1464.31	10049.91	1464.4
10059.71	1464.95	10062.91	1465.14	10065.41	1463.16	10068.76	1460.55	10076.11	1460.6
10089.51	1460.72	10094.75	1462.44	10106.66	1466.66	10113.11	1468.64	10115.07	1469.08
10124.97	1469.16	10132.43	1469.09	10135.96	1469.19	10140.03	1469.35	10163.27	1469.46
10176.89	1469.21	10189.81	1469.36	10220.51	1469.14	10222.12	1469.18	10223.89	1469.18
10254.28	1470.28	10261.39	1470.55	10262.36	1470.57	10263.37	1470.63	10263.91	1470.58
10287.37	1470.18	10310.32	1470.03	10312.79	1470.05				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9823.08	.037	9954.18	.044	10048.04	.037

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9954.18	10048.04	312.31	324.13	335.74	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1458.86	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.96	Wt. n-Val.		0.044
W.S. Elev (ft)	1457.90	Reach Len. (ft)	312.31	324.13
335.74				
Crit W.S. (ft)	1455.14	Flow Area (sq ft)		419.56
E.G. Slope (ft/ft)	0.004845	Area (sq ft)		419.56
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	64.21	Top Width (ft)		64.21
Vel Total (ft/s)	7.87	Avg. Vel. (ft/s)		7.87
Max Chl Dpth (ft)	10.56	Hydr. Depth (ft)		6.53
Conv. Total (cfs)	47409.5	Conv. (cfs)		47409.5
Length Wtd. (ft)	324.13	Wetted Per. (ft)		68.55
Min Ch El (ft)	1447.34	Shear (lb/sq ft)		1.85
Alpha	1.00	Stream Power (lb/ft s)		14.56
Frctn Loss (ft)	2.03	Cum Volume (acre-ft)	8.37	55.07
C & E Loss (ft)	0.04	Cum SA (acres)	2.79	10.65

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1458.86	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.96	Wt. n-Val.		0.044
W.S. Elev (ft)	1457.90	Reach Len. (ft)	312.31	324.13
335.74				
Crit W.S. (ft)	1455.16	Flow Area (sq ft)		419.56
E.G. Slope (ft/ft)	0.004845	Area (sq ft)		419.56
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	64.21	Top Width (ft)		64.21
Vel Total (ft/s)	7.87	Avg. Vel. (ft/s)		7.87
Max Chl Dpth (ft)	10.56	Hydr. Depth (ft)		6.53
Conv. Total (cfs)	47409.5	Conv. (cfs)		47409.5
Length Wtd. (ft)	324.13	Wetted Per. (ft)		68.55
Min Ch El (ft)	1447.34	Shear (lb/sq ft)		1.85
Alpha	1.00	Stream Power (lb/ft s)		14.56
Frctn Loss (ft)	2.03	Cum Volume (acre-ft)	0.98	55.25

C & E Loss (ft)	0.04	Cum SA (acres)	0.37	10.38

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.822

INPUT
Description:
Station Elevation Data num= 47

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9798.18	1456.41	9802.11	1456.52	9807.41	1456.68	9814.62	1456.89	9826.48	1457.11
9838.28	1457.34	9840.11	1457.38	9841.69	1457.41	9851.47	1457.42	9855.83	1457.44
9863.33	1457.51	9871.5	1457.72	9878.28	1457.89	9892.85	1458.42	9898.68	1458.65
9907.96	1458.76	9914.96	1458.66	9920.57	1460.16	9931.21	1463.2	9938.04	1463.48
9945.02	1463.35	9946.19	1462.98	9947.74	1462.43	9950.08	1461.61	9994.99	1445.82
9997.83	1445.75	10006.1	1445.88	10007.14	1445.88	10008.61	1446.45	10012.29	1448.2
10047.76	1464.29	10049.46	1464.22	10062.31	1463.71	10062.53	1463.69	10065.87	1461.51
10070.06	1458.76	10090.89	1459.29	10091.01	1459.29	10091.03	1459.29	10091.16	1459.33
10118.5	1467.14	10125.16	1469.15	10141.23	1473.76	10156.65	1477.74	10161.81	1478.47
10188.17	1478.64	10228.27	1478.51						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9798.18	.037	9945.02	.044	10047.76	.037

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9945.02	10047.76	179.46	183.6	187.59	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1456.79	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.41	Wt. n-Val.		0.044
W.S. Elev (ft)	1455.38	Reach Len. (ft)	179.46	183.60
187.59				
Crit W.S. (ft)	1453.88	Flow Area (sq ft)		346.38
E.G. Slope (ft/ft)	0.008379	Area (sq ft)		346.38
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	60.33	Top Width (ft)		60.33
Vel Total (ft/s)	9.53	Avg. Vel. (ft/s)		9.53
Max Chl Dpth (ft)	9.63	Hydr. Depth (ft)		5.74
Conv. Total (cfs)	36050.7	Conv. (cfs)		36050.7
Length Wtd. (ft)	183.60	Wetted Per. (ft)		64.02
Min Ch El (ft)	1445.75	Shear (lb/sq ft)		2.83
Alpha	1.00	Stream Power (lb/ft s)		26.96
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	8.37	52.22
C & E Loss (ft)	0.32	Cum SA (acres)	2.79	10.19

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1456.79	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.41	Wt. n-Val.		0.044
W.S. Elev (ft)	1455.38	Reach Len. (ft)	179.46	183.60
187.59				
Crit W.S. (ft)	1453.89	Flow Area (sq ft)		346.38
E.G. Slope (ft/ft)	0.008379	Area (sq ft)		346.38
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	60.33	Top Width (ft)		60.33
Vel Total (ft/s)	9.53	Avg. Vel. (ft/s)		9.53
Max Chl Dpth (ft)	9.63	Hydr. Depth (ft)		5.74
Conv. Total (cfs)	36050.7	Conv. (cfs)		36050.7
Length Wtd. (ft)	183.60	Wetted Per. (ft)		64.02
Min Ch El (ft)	1445.75	Shear (lb/sq ft)		2.83
Alpha	1.00	Stream Power (lb/ft s)		26.96
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	0.98	52.40
C & E Loss (ft)	0.32	Cum SA (acres)	0.37	9.92

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.787

INPUT
Description:
Station Elevation Data num= 52

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9795.34	1462.95	9816.98	1463.48	9817.01	1463.48	9817.25	1463.45	9823.58	1462.72
9824.58	1462.74	9832.34	1462.01	9836.32	1462.2	9843.65	1458.91	9853.85	1455.13
9864.62	1455.14	9864.63	1455.14	9874.82	1455.86	9878.38	1456.67	9880.37	1458.19
9882.5	1459.01	9887.92	1461.08	9899.23	1461.13	9908.66	1461.16	9913.27	1461.2
9914.14	1460.95	9941.28	1453.18	9952.19	1450.27	9968.09	1448.71	9974.17	1448.06
9977.8	1447.78	9979.81	1447.64	9986.86	1447.54	10004.85	1447.11	10009.03	1447.22
10010.95	1446.96	10017.69	1446.65	10021.52	1446.32	10046.41	1455.88	10053.01	1458.17
10057.13	1459.83	10066.93	1463.19	10069.78	1463.12	10071.3	1463.08	10080.2	1462.95
10085.06	1460.14	10089.25	1457.61	10093.22	1457.55	10121.68	1457.86	10140.88	1463.47
10144.51	1464.51	10147.49	1465.33	10190.6	1477.36	10211.36	1478.17	10221.08	1478.27
10235.33		10254.44	1478.11						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9795.34	.037	9913.27	.044	10066.93	.037

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9913.27	10066.93	163.55	167.37	171.81	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
9795.34	9895.9	1457.12

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1455.85	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.36	Wt. n-Val.		0.044
W.S. Elev (ft)	1455.49	Reach Len. (ft)	163.55	167.37
171.81				
Crit W.S. (ft)	1451.75	Flow Area (sq ft)		687.82
E.G. Slope (ft/ft)	0.001854	Area (sq ft)		687.82
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	112.17	Top Width (ft)		112.17
Vel Total (ft/s)	4.80	Avg. Vel. (ft/s)		4.80
Max Chl Dpth (ft)	9.17	Hydr. Depth (ft)		6.13
Conv. Total (cfs)	76649.7	Conv. (cfs)		76649.7
Length Wtd. (ft)	167.37	Wetted Per. (ft)		114.75
Min Ch El (ft)	1446.32	Shear (lb/sq ft)		0.69
Alpha	1.00	Stream Power (lb/ft s)		3.33
Frctn Loss (ft)	0.41	Cum Volume (acre-ft)	8.37	50.04
C & E Loss (ft)	0.03	Cum SA (acres)	2.79	9.82

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1455.85	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.36	Wt. n-Val.		0.044
W.S. Elev (ft)	1455.49	Reach Len. (ft)	163.55	167.37
171.81				
Crit W.S. (ft)	1451.75	Flow Area (sq ft)		687.82
E.G. Slope (ft/ft)	0.001854	Area (sq ft)		687.82
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	112.17	Top Width (ft)		112.17
Vel Total (ft/s)	4.80	Avg. Vel. (ft/s)		4.80
Max Chl Dpth (ft)	9.17	Hydr. Depth (ft)		6.13
Conv. Total (cfs)	76649.7	Conv. (cfs)		76649.7
Length Wtd. (ft)	167.37	Wetted Per. (ft)		114.75
Min Ch El (ft)	1446.32	Shear (lb/sq ft)		0.69
Alpha	1.00	Stream Power (lb/ft s)		3.33
Frctn Loss (ft)	0.41	Cum Volume (acre-ft)	0.98	50.22
C & E Loss (ft)	0.03	Cum SA (acres)	0.37	9.56

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.756

INPUT
Description:
Station Elevation Data num= 49

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9793.93	1470.51	9808.47	1470.3	9845.24	1470.18	9855.66	1470.22	9857.67	1469.44
9872.66	1464.55	9890.41	1459.63	9898.98	1457.74	9907.11	1458.15	9912.52	1458.17
9915.92	1458.69	9924.14	1461.13	9924.16	1461.13	9924.18	1461.13	9934.9	1461.18
9942.36	1461.29	9944.49	1460.59	9944.59	1460.56	9961.78	1454.11	9986.46	1444.59
9988.8	1444.33	10003.93	1444.32	10006.03	1444.64	10021.83	1449.72	10052.02	1457.33
10052.65	1457.36	10055.7	1457.83	10057.53	1458.12	10064.85	1459.28	10066.25	1458.79
10071.19	1457.47	10073.38	1456.88	10073.84	1456.85	10077.43	1456.64	10094.49	1456.7
10104.43	1456.88	10115.33	1457.86	10117.77	1457.98	10137.07	1459.58	10143.18	1459.76
10146.77	1459.78	10147.57	1459.88	10192.92	1467.85	10196.13	1468.67	10199.98	1469.72
10202.35	1470.34	10223.42	1476.24	10233.56	1476.06	10251.65	1476.19		

```
Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
 9793.93     .037 9942.36     .04410064.85     .037

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
       9942.3610064.85            472.08  491.75  516.19              .1         .3

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)            1455.40    Element                     Left OB    Channel
Right OB
  Vel Head (ft)                0.66    Wt. n-Val.                             0.044
  W.S. Elev (ft)            1454.74    Reach Len. (ft)             472.08    491.75
516.19
  Crit W.S. (ft)            1451.45    Flow Area (sq ft)                     506.31
  E.G. Slope (ft/ft)       0.003450    Area (sq ft)                          506.31
  Q Total (cfs)             3300.00    Flow (cfs)                           3300.00
  Top Width (ft)              81.66    Top Width (ft)                         81.66
  Vel Total (ft/s)             6.52    Avg. Vel. (ft/s)                        6.52
  Max Chl Dpth (ft)           10.42    Hydr. Depth (ft)                        6.20
  Conv. Total (cfs)         56184.9    Conv. (cfs)                          56184.9
  Length Wtd. (ft)           491.75    Wetted Per. (ft)                       85.00
  Min Ch El (ft)            1444.32    Shear (lb/sq ft)                        1.28
  Alpha                        1.00    Stream Power (lb/ft s)                  8.36
  Frctn Loss (ft)              2.16    Cum Volume (acre-ft)         8.37      47.75
  C & E Loss (ft)              0.04    Cum SA (acres)               2.79       9.45


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross
         section.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)            1455.40    Element                     Left OB    Channel
Right OB
  Vel Head (ft)                0.66    Wt. n-Val.                             0.044
  W.S. Elev (ft)            1454.74    Reach Len. (ft)             472.08    491.75
516.19
  Crit W.S. (ft)            1451.45    Flow Area (sq ft)                     506.31
  E.G. Slope (ft/ft)       0.003450    Area (sq ft)                          506.31
  Q Total (cfs)             3300.00    Flow (cfs)                           3300.00
  Top Width (ft)              81.66    Top Width (ft)                         81.66
  Vel Total (ft/s)             6.52    Avg. Vel. (ft/s)                        6.52
  Max Chl Dpth (ft)           10.42    Hydr. Depth (ft)                        6.20
  Conv. Total (cfs)         56184.9    Conv. (cfs)                          56184.9
  Length Wtd. (ft)           491.75    Wetted Per. (ft)                       85.00
  Min Ch El (ft)            1444.32    Shear (lb/sq ft)                        1.28
  Alpha                        1.00    Stream Power (lb/ft s)                  8.36
  Frctn Loss (ft)              2.16    Cum Volume (acre-ft)         0.98      47.93
  C & E Loss (ft)              0.04    Cum SA (acres)               0.37       9.18


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross
         section.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: Cave Creek
REACH: 1                    RS: 23.662

INPUT
Description:
Station Elevation Data      num=       54
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
 9686.82 1489.84 9701.56 1490.19 9706.48 1490.02 9729.06 1490.11  9751.4 1490.47
 9757.48 1488.96    9761 1488.11 9800.51 1477.48 9808.86 1475.26 9810.56  1474.8
 9840.28 1464.42 9850.56 1462.04 9864.05 1458.11 9872.51 1457.69 9879.53  1458.1
 9900.68 1458.19    9901 1458.21 9901.49 1458.37  9908.6  1460.7 9915.01 1460.87
 9921.09 1460.89 9930.03 1461.03 9933.73 1459.83 9936.05 1459.19  9945.4 1459.14
  9953.1  1459.1 9953.99 1459.09 9956.83 1457.97 9979.41 1447.98 9993.77 1441.53
 9998.98 1441.5310006.53  1441.610010.81 1443.5210039.09 1454.6810048.92 1458.57
10049.56 1458.5910060.68  1458.8 10064.3 1458.8310066.71 1457.8410074.77 1454.39
10078.92 1454.25 10087.3 1454.69 10092.4 1454.8110098.22 1456.7110100.03 1457.16
 10113.4 1465.6910118.09 1468.5210120.43 1467.6110124.97 1465.7510143.71 1466.83
10153.57 1467.6610160.82  1468.310161.94 1468.4410167.16 1469.84

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
 9686.82     .037 9953.99     .04410049.56     .037

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
       9953.9910049.56            488.55  506.22  524.07              .1         .3

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)            1453.20    Element                     Left OB    Channel
Right OB
  Vel Head (ft)                1.09    Wt. n-Val.                             0.044
  W.S. Elev (ft)            1452.11    Reach Len. (ft)             488.55    506.22
524.07
  Crit W.S. (ft)            1449.74    Flow Area (sq ft)                     394.18
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E.G. Slope (ft/ft)	0.005765	Area (sq ft)		394.18
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	62.52	Top Width (ft)		62.52
Vel Total (ft/s)	8.37	Avg. Vel. (ft/s)		8.37
Max Chl Dpth (ft)	10.58	Hydr. Depth (ft)		6.31
Conv. Total (cfs)	43462.2	Conv. (cfs)		43462.2
Length Wtd. (ft)	506.22	Wetted Per. (ft)		66.82
Min Ch El (ft)	1441.53	Shear (lb/sq ft)		2.12
Alpha	1.00	Stream Power (lb/ft s)		17.78
Frctn Loss (ft)	2.64	Cum Volume (acre-ft)	8.37	42.66
C & E Loss (ft)	0.05	Cum SA (acres)	2.79	8.64

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1453.20	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.09	Wt. n-Val.		0.044
W.S. Elev (ft)	1452.11	Reach Len. (ft)	488.55	506.22
524.07				
Crit W.S. (ft)	1449.74	Flow Area (sq ft)		394.18
E.G. Slope (ft/ft)	0.005765	Area (sq ft)		394.18
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	62.52	Top Width (ft)		62.52
Vel Total (ft/s)	8.37	Avg. Vel. (ft/s)		8.37
Max Chl Dpth (ft)	10.58	Hydr. Depth (ft)		6.31
Conv. Total (cfs)	43462.2	Conv. (cfs)		43462.2
Length Wtd. (ft)	506.22	Wetted Per. (ft)		66.82
Min Ch El (ft)	1441.53	Shear (lb/sq ft)		2.12
Alpha	1.00	Stream Power (lb/ft s)		17.78
Frctn Loss (ft)	2.64	Cum Volume (acre-ft)	0.98	42.84
C & E Loss (ft)	0.05	Cum SA (acres)	0.37	8.37

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.567

INPUT
Description:
Station Elevation Data num= 42

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9743.11	1487.87	9755.86	1487.79	9798.5	1487.85	9810.23	1484.61	9812.01	1484.14
9863.16	1470.68	9868.32	1468.91	9905.43	1455.99	9905.78	1455.89	9913.87	1453.54
9919.03	1453.53	9923.61	1453.49	9932.77	1456.24	9933.22	1456.36	9933.39	1456.36
9933.64	1456.34	9944.72	1455.82	9948.3	1455.65	9958.73	1451.52	9989.23	1439.29
9997.3	1439.32	10000.98	1439.55	10006.3	1439.46	10031.22	1449.98	10040.27	1454.06
10044.55	1455.59	10047.75	1455.65	10058.39	1455.83	10060.85	1455.89	10063.31	1454.93
10072.62	1451.11	10087.78	1451.13	10106.45	1451.24	10112.02	1452.05	10154.16	1465.92
10158.78	1467.27	10160.03	1467.61	10162.95	1469.94	10173.66	1477.95	10181.39	1483.81
10188.7	1483.82	10215.17	1483.63						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9743.11	.037	9948.3	.044	10044.55	.037

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9948.3	10044.55	364.79	413.25	457.39	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1450.51	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.93	Wt. n-Val.		0.044
W.S. Elev (ft)	1449.58	Reach Len. (ft)	364.79	413.25
457.39				
Crit W.S. (ft)	1446.82	Flow Area (sq ft)		427.41
E.G. Slope (ft/ft)	0.004752	Area (sq ft)		427.41
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	66.72	Top Width (ft)		66.72
Vel Total (ft/s)	7.72	Avg. Vel. (ft/s)		7.72
Max Chl Dpth (ft)	10.29	Hydr. Depth (ft)		6.41
Conv. Total (cfs)	47871.1	Conv. (cfs)		47871.1
Length Wtd. (ft)	413.25	Wetted Per. (ft)		70.76
Min Ch El (ft)	1439.29	Shear (lb/sq ft)		1.79
Alpha	1.00	Stream Power (lb/ft s)		13.83
Frctn Loss (ft)	1.82	Cum Volume (acre-ft)	8.37	37.89
C & E Loss (ft)	0.03	Cum SA (acres)	2.79	7.89

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1450.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.93	Wt. n-Val.		0.044	
W.S. Elev (ft)	1449.58	Reach Len. (ft)	364.79	413.25	457.39
Crit W.S. (ft)	1446.85	Flow Area (sq ft)		427.41	
E.G. Slope (ft/ft)	0.004752	Area (sq ft)		427.41	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	66.72	Top Width (ft)		66.72	
Vel Total (ft/s)	7.72	Avg. Vel. (ft/s)		7.72	
Max Chl Dpth (ft)	10.29	Hydr. Depth (ft)		6.41	
Conv. Total (cfs)	47871.1	Conv. (cfs)		47871.1	
Length Wtd. (ft)	413.25	Wetted Per. (ft)		70.76	
Min Ch El (ft)	1439.29	Shear (lb/sq ft)		1.79	
Alpha	1.00	Stream Power (lb/ft s)		13.83	
Frctn Loss (ft)	1.82	Cum Volume (acre-ft)	0.98	38.07	
C & E Loss (ft)	0.03	Cum SA (acres)	0.37	7.62	

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.488

INPUT
Description:
Station Elevation Data num= 44

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9764.16	1489.36	9770.47	1489.33	9777.08	1489.19	9782.93	1488.12	9790.93	1486.32
9806.51	1481.86	9847.16	1469.19	9869.03	1461.65	9891.93	1455.01	9906.68	1454.01
9912.95	1453.43	9917.07	1452.56	9919.81	1451.99	9924.74	1452.68	9935.56	1454.11
9945.42	1454.11	9952.13	1454.08	9952.31	1454	9956.45	1452.37	9988.83	1437.91
9990.19	1437.24	9995.35	1437.33	10009.5	1437.62	10017.68	1441.12	10046.13	1452.48
10050.51	1453.91	10051.18	1453.89	10060.45	1453.84	10066.25	1453.78	10081.04	1447.43
10081.97	1447.03	10083.1	1447.01	10092.82	1446.91	10101.69	1446.96	10112.38	1447.03
10124.81	1448.41	10133.48	1450.02	10146.74	1452.92	10156.7	1455.73	10167.42	1460.07
10189.94	1469.82	10198.34	1475.43	10205.27	1480.55	10215.58	1480.87		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9764.16	.037	9952.31	.044	10051.18	.037

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9952.31	10051.18	572.19	525.53	478.28	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
10052.22	10215.58	1450.08

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1448.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.83	Wt. n-Val.		0.044	
W.S. Elev (ft)	1447.83	Reach Len. (ft)	572.19	525.53	478.28
Crit W.S. (ft)	1444.70	Flow Area (sq ft)		450.61	
E.G. Slope (ft/ft)	0.004088	Area (sq ft)		450.61	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	67.87	Top Width (ft)		67.87	
Vel Total (ft/s)	7.32	Avg. Vel. (ft/s)		7.32	
Max Chl Dpth (ft)	10.59	Hydr. Depth (ft)		6.64	
Conv. Total (cfs)	51610.2	Conv. (cfs)		51610.2	
Length Wtd. (ft)	525.53	Wetted Per. (ft)		72.15	
Min Ch El (ft)	1437.24	Shear (lb/sq ft)		1.59	
Alpha	1.00	Stream Power (lb/ft s)		11.67	
Frctn Loss (ft)	2.52	Cum Volume (acre-ft)	8.37	33.73	
C & E Loss (ft)	0.03	Cum SA (acres)	2.79	7.25	

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1448.66	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.83	Wt. n-Val.		0.044	
W.S. Elev (ft)	1447.83	Reach Len. (ft)	572.19	525.53	478.28
Crit W.S. (ft)	1444.65	Flow Area (sq ft)		450.61	
E.G. Slope (ft/ft)	0.004088	Area (sq ft)		450.61	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	67.87	Top Width (ft)		67.87	
Vel Total (ft/s)	7.32	Avg. Vel. (ft/s)		7.32	
Max Chl Dpth (ft)	10.59	Hydr. Depth (ft)		6.64	
Conv. Total (cfs)	51610.2	Conv. (cfs)		51610.2	

Length Wtd. (ft)	525.53	Wetted Per. (ft)		72.15
Min Ch El (ft)	1437.24	Shear (lb/sq ft)		1.59
Alpha	1.00	Stream Power (lb/ft s)		11.67
Frctn Loss (ft)	2.52	Cum Volume (acre-ft)	0.98	33.91
C & E Loss (ft)	0.03	Cum SA (acres)	0.37	6.98

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.389

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9756.66	1485.56	9756.84	1485.56	9789.8	1485.32	9795.79	1483.97	9807.91	1480.14
9894.54	1455.61	9909.09	1452.16	9919.62	1450.27	9929.52	1448.87	9930.04	1448.8
9930.42	1448.91	9938.92	1451.66	9945.09	1451.83	9951.01	1451.53	9955.25	1451.48
9955.99	1451.47	9960.69	1449.48	9971.76	1444.79	9994.96	1434.96	9998.16	1434.91
10010.13	1434.69	10021.53	1439.72	10042.98	1449.75	10047.1	1451.62	10049.92	1451.63
10063.43	1451.67	10064.83	1451.67	10066.39	1451.07	10079.36	1445.98	10092.63	1445.54
10101.11	1445.34	10107.52	1445.97	10136.41	1450.09	10162.48	1456.13	10186.95	1464.56
10207.1	1473.83	10214.81	1478.5	10216.1	1479.31	10218.02	1479.27	10243.67	1479.29
10250.57	1479.33								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9756.66	.037	9955.99	.044	10047.1	.037

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9955.99	10047.1	435.84	432.27	432.69	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
10056.31	10250.57	1447.77

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1446.12	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.09	Wt. n-Val.		0.044
W.S. Elev (ft)	1445.02	Reach Len. (ft)	435.84	432.27
432.69				
Crit W.S. (ft)	1442.61	Flow Area (sq ft)		393.27
E.G. Slope (ft/ft)	0.005708	Area (sq ft)		393.27
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	61.66	Top Width (ft)		61.66
Vel Total (ft/s)	8.39	Avg. Vel. (ft/s)		8.39
Max Chl Dpth (ft)	10.33	Hydr. Depth (ft)		6.38
Conv. Total (cfs)	43678.0	Conv. (cfs)		43678.0
Length Wtd. (ft)	432.27	Wetted Per. (ft)		65.94
Min Ch El (ft)	1434.69	Shear (lb/sq ft)		2.13
Alpha	1.00	Stream Power (lb/ft s)		17.83
Frctn Loss (ft)	2.40	Cum Volume (acre-ft)	8.37	28.63
C & E Loss (ft)	0.02	Cum SA (acres)	2.79	6.47

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1446.12	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.09	Wt. n-Val.		0.044
W.S. Elev (ft)	1445.02	Reach Len. (ft)	435.84	432.27
432.69				
Crit W.S. (ft)	1442.62	Flow Area (sq ft)		393.30
E.G. Slope (ft/ft)	0.005707	Area (sq ft)		393.30
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	61.66	Top Width (ft)		61.66
Vel Total (ft/s)	8.39	Avg. Vel. (ft/s)		8.39
Max Chl Dpth (ft)	10.33	Hydr. Depth (ft)		6.38
Conv. Total (cfs)	43682.0	Conv. (cfs)		43682.0
Length Wtd. (ft)	432.27	Wetted Per. (ft)		65.94
Min Ch El (ft)	1434.69	Shear (lb/sq ft)		2.13
Alpha	1.00	Stream Power (lb/ft s)		17.83
Frctn Loss (ft)	2.40	Cum Volume (acre-ft)	0.98	28.82
C & E Loss (ft)	0.02	Cum SA (acres)	0.37	6.20

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.307

INPUT
Description:
Station Elevation Data num= 51

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9721.73	1478.36	9737.21	1478.65	9745.33	1478.42	9767.46	1478.46	9771.35	1478.43
9771.81	1478.43	9773.93	1478.17	9786.08	1476.5	9793.12	1474.59	9794.94	1474.1
9796.04	1474.63	9842.62	1463.69	9842.97	1463.57	9844.12	1463.15	9856.51	1459.67
9876.69	1454.24	9883.71	1452.3	9885.15	1451.97	9885.91	1451.83	9895.87	1449.87
9913.46	1446.41	9914.77	1446.25	9917.76	1445.97	9926.63	1445.16	9928.05	1445.03
9928.75	1445.17	9941.31	1447.91	9945.79	1447.94	9955.17	1448	9955.63	1448
9972.73	1439.91	9987.66	1432.96	10004.96	1432.91	10006.45	1432.91	10007.05	1432.9
10009.17	1433.78	10044.62	1448.54	10048.6	1448.58	10057.27	1448.66	10062.25	1448.66
10067.34	1447.54	10076.9	1445.22	10089.15	1445.21	10092.48	1445.17	10094.37	1445.59
10143.38	1457.12	10165.7	1463.56	10211.48	1475.46	10217.72	1477.06	10229.76	1477.11
10308.77	1476.63								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9721.73	.037	9955.63	.044	10044.62	.037

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9955.63	10044.62	445.15	443.61	446.39	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1443.70	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.03	Wt. n-Val.		0.044
W.S. Elev (ft)	1442.67	Reach Len. (ft)	445.15	443.61
446.39				
Crit W.S. (ft)	1440.21	Flow Area (sq ft)		404.47
E.G. Slope (ft/ft)	0.005386	Area (sq ft)		404.47
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	63.61	Top Width (ft)		63.61
Vel Total (ft/s)	8.16	Avg. Vel. (ft/s)		8.16
Max Chl Dpth (ft)	9.77	Hydr. Depth (ft)		6.36
Conv. Total (cfs)	44963.7	Conv. (cfs)		44963.7
Length Wtd. (ft)	443.61	Wetted Per. (ft)		67.72
Min Ch El (ft)	1432.90	Shear (lb/sq ft)		2.01
Alpha	1.00	Stream Power (lb/ft s)		16.39
Frctn Loss (ft)	2.21	Cum Volume (acre-ft)	8.37	24.68
C & E Loss (ft)	0.03	Cum SA (acres)	2.79	5.85

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1443.70	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.03	Wt. n-Val.		0.044
W.S. Elev (ft)	1442.67	Reach Len. (ft)	445.15	443.61
446.39				
Crit W.S. (ft)	1440.19	Flow Area (sq ft)		404.59
E.G. Slope (ft/ft)	0.005382	Area (sq ft)		404.59
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	63.62	Top Width (ft)		63.62
Vel Total (ft/s)	8.16	Avg. Vel. (ft/s)		8.16
Max Chl Dpth (ft)	9.77	Hydr. Depth (ft)		6.36
Conv. Total (cfs)	44982.3	Conv. (cfs)		44982.3
Length Wtd. (ft)	443.61	Wetted Per. (ft)		67.73
Min Ch El (ft)	1432.90	Shear (lb/sq ft)		2.01
Alpha	1.00	Stream Power (lb/ft s)		16.37
Frctn Loss (ft)	2.20	Cum Volume (acre-ft)	0.98	24.86
C & E Loss (ft)	0.03	Cum SA (acres)	0.37	5.58

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.223

INPUT
Description:
Station Elevation Data num= 41

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9834.08	1461.8	9848.85	1457.52	9855.66	1455.57	9877.93	1448.6	9885.36	1446.22
9891.85	1444.88	9910.75	1440.61	9923.64	1440.26	9925.91	1440.09	9927.68	1440.19
9928.46	1440.5	9935.99	1444.24	9938.8	1445.87	9949.51	1446.07	9950.35	1446.09
9954.95	1446.19	9960.37	1443.7	9977.05	1435.88	9987.69	1430.8	9998.15	1430.63
10004.76	1430.85	10011.27	1430.85	10016.93	1433.54	10031.31	1441.02	10042.11	1445.97
10044.22	1446.52	10047.32	1446.47	10048.89	1446.45	10060.32	1446.64	10060.42	1446.64
10061.07	1446.45	10069.45	1443.97	10070.22	1443.75	10085.13	1444.42	10095.71	1444.89
10096.4	1445.02	10103.25	1447.05	10111.52	1449.59	10125.79	1455.35	10136.79	1459.2

10147.61 1461.82

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9834.08	.037	9954.95	.04410044.22		.037

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

9954.9510044.22	98.72	98.01	99.35	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
9834.08	9937.77	1442.32

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1441.47	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.94	Wt. n-Val.		0.044
W.S. Elev (ft)	1440.52	Reach Len. (ft)	98.72	98.01
99.35				
Crit W.S. (ft)	1437.67	Flow Area (sq ft)		423.61
E.G. Slope (ft/ft)	0.004616	Area (sq ft)		423.61
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	63.21	Top Width (ft)		63.21
Vel Total (ft/s)	7.79	Avg. Vel. (ft/s)		7.79
Max Chl Dpth (ft)	9.89	Hydr. Depth (ft)		6.70
Conv. Total (cfs)	48572.3	Conv. (cfs)		48572.3
Length Wtd. (ft)	98.01	Wetted Per. (ft)		67.71
Min Ch El (ft)	1430.63	Shear (lb/sq ft)		1.80
Alpha	1.00	Stream Power (lb/ft s)		14.04
Frctn Loss (ft)	0.82	Cum Volume (acre-ft)	8.37	20.46
C & E Loss (ft)	0.15	Cum SA (acres)	2.79	5.20

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1441.47	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.94	Wt. n-Val.		0.044
W.S. Elev (ft)	1440.53	Reach Len. (ft)	98.72	98.01
99.35				
Crit W.S. (ft)	1437.67	Flow Area (sq ft)		424.06
E.G. Slope (ft/ft)	0.004602	Area (sq ft)		424.06
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	63.23	Top Width (ft)		63.23
Vel Total (ft/s)	7.78	Avg. Vel. (ft/s)		7.78
Max Chl Dpth (ft)	9.90	Hydr. Depth (ft)		6.71
Conv. Total (cfs)	48644.0	Conv. (cfs)		48644.0
Length Wtd. (ft)	98.01	Wetted Per. (ft)		67.74
Min Ch El (ft)	1430.63	Shear (lb/sq ft)		1.80
Alpha	1.00	Stream Power (lb/ft s)		14.00
Frctn Loss (ft)	0.83	Cum Volume (acre-ft)	0.98	20.64
C & E Loss (ft)	0.15	Cum SA (acres)	0.37	4.93

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.204

INPUT
Description:
Station Elevation Data num= 46

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9841.03	1452.57	9842.71	1452.54	9857.37	1452.68	9860.45	1452.64	9861.48	1452.36
9877.38	1447.1	9899.14	1441.08	9906.63	1438.96	9910.5	1439.05	9923.74	1439.39
9927.05	1440.96	9930.09	1442.63	9936.35	1445.73	9945.12	1445.78	9949.97	1445.788
9950.91	1445.79	9952.39	1445.79	9956.35	1444.39	9970.08	1439.21	9978.51	1435.06
9987.04	1429.93	9998.59	1430.09	10003.5	1430.18	10009.55	1430.42	10019.18	1434.79
10021.78	1435.53	10032.06	1441.11	10042.91	1444.86	510045.15	1445.64	10045.33	1445.63
10046.42	1445.65	10058.49	1445.91	10060.13	1445.95	10061.42	1445.66	10069.35	1443.77
10071.6	1443.85	10083.43	1444.27	10094.08	1446.92	10096.26	1447.51	10102.56	1449.37
10111.51	1451.44	10122.52	1454.41	10139.33	1458.02	10145.8	1460.21	0151.82	1460.92
10151.97	1460.98								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9841.03	.037	9952.39	.04410045.15		.037

```
Bank Sta: Left   Right     Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9952.3910045.15              54.05   62.75   73.74          .1        .3
Blocked Obstructions      num=        1
   Sta L   Sta R    Elev
    9991   10009 1432.24
```

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1440.49	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.42	Wt. n-Val.		0.044
W.S. Elev (ft)	1438.07	Reach Len. (ft)	54.05	62.75
73.74				
Crit W.S. (ft)	1438.07	Flow Area (sq ft)		264.13
E.G. Slope (ft/ft)	0.019808	Area (sq ft)		264.13
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	54.06	Top Width (ft)		54.06
Vel Total (ft/s)	12.49	Avg. Vel. (ft/s)		12.49
Max Chl Dpth (ft)	8.14	Hydr. Depth (ft)		4.89
Conv. Total (cfs)	23447.1	Conv. (cfs)		23447.1
Length Wtd. (ft)	62.75	Wetted Per. (ft)		61.98
Min Ch El (ft)	1429.93	Shear (lb/sq ft)		5.27
Alpha	1.00	Stream Power (lb/ft s)		65.85
Frctn Loss (ft)	1.19	Cum Volume (acre-ft)	8.37	19.69
C & E Loss (ft)	0.03	Cum SA (acres)	2.79	5.07

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1440.49	Element	Left OB	Channel
Right OB				
Vel Head (ft)	2.45	Wt. n-Val.		0.044
W.S. Elev (ft)	1438.04	Reach Len. (ft)	54.05	62.75
73.74				
Crit W.S. (ft)	1438.04	Flow Area (sq ft)		262.74
E.G. Slope (ft/ft)	0.020111	Area (sq ft)		262.74
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	53.96	Top Width (ft)		53.96
Vel Total (ft/s)	12.56	Avg. Vel. (ft/s)		12.56
Max Chl Dpth (ft)	8.11	Hydr. Depth (ft)		4.87
Conv. Total (cfs)	23269.8	Conv. (cfs)		23269.8
Length Wtd. (ft)	62.75	Wetted Per. (ft)		61.86
Min Ch El (ft)	1429.93	Shear (lb/sq ft)		5.33
Alpha	1.00	Stream Power (lb/ft s)		66.98
Frctn Loss (ft)	1.20	Cum Volume (acre-ft)	0.98	19.86
C & E Loss (ft)	0.04	Cum SA (acres)	0.37	4.80

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there
is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.192

INPUT
Description:
Station Elevation Data num= 33

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9881.22	1443.7	9882.14	1443.48	9894.58	1441.55	9901.4	1440.01	9904.29	1439.93
9923.39	1439.13	9929.6	1442.56	9933.51	1444.9	9942.3	1445.01	9948.94	1445.05
9950.03	1445.06	9950.77	1444.82	9968.82	1437.16	9972.28	1435.57	9981.5	1429.74
9982.94	1429.73	10003.54	1429.63	10004.02	1429.64	10004.58	1429.66	10016.7	1429.95
10021.99	1432.31	10052.59	1444.26	10053.7	1444.64	10053.95	1444.64	10054.95	1444.62
10057.24	1444.59	10069.17	1444.41	10073.27	1443.31	10079.44	1441.11	10082.61	1441.83
10090.87	1443.68	10100.87	1443.96	10107.21	1443.99				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9881.22	.037	9950.03	.044	10053.7	.037

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9950.03	10053.7	220.85	226.32	232.25	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1437.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.33	Wt. n-Val.		0.044	
W.S. Elev (ft)	1435.57	Reach Len. (ft)	220.85	226.32	232.25
Crit W.S. (ft)	1435.57	Flow Area (sq ft)		269.56	
E.G. Slope (ft/ft)	0.018063	Area (sq ft)		269.56	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	58.04	Top Width (ft)		58.04	
Vel Total (ft/s)	12.24	Avg. Vel. (ft/s)		12.24	
Max Chl Dpth (ft)	5.94	Hydr. Depth (ft)		4.64	
Conv. Total (cfs)	24554.0	Conv. (cfs)		24554.0	
Length Wtd. (ft)	226.32	Wetted Per. (ft)		60.85	
Min Ch El (ft)	1429.63	Shear (lb/sq ft)		5.00	
Alpha	1.00	Stream Power (lb/ft s)		61.15	
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	8.37	19.30	
C & E Loss (ft)	0.49	Cum SA (acres)	2.79	4.99	

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

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1437.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.33	Wt. n-Val.		0.044	
W.S. Elev (ft)	1435.57	Reach Len. (ft)	220.85	226.32	232.25
Crit W.S. (ft)	1435.57	Flow Area (sq ft)		269.56	
E.G. Slope (ft/ft)	0.018063	Area (sq ft)		269.56	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	58.04	Top Width (ft)		58.04	
Vel Total (ft/s)	12.24	Avg. Vel. (ft/s)		12.24	
Max Chl Dpth (ft)	5.94	Hydr. Depth (ft)		4.64	
Conv. Total (cfs)	24554.0	Conv. (cfs)		24554.0	
Length Wtd. (ft)	226.32	Wetted Per. (ft)		60.85	
Min Ch El (ft)	1429.63	Shear (lb/sq ft)		5.00	
Alpha	1.00	Stream Power (lb/ft s)		61.15	
Frctn Loss (ft)	1.31	Cum Volume (acre-ft)	0.98	19.48	
C & E Loss (ft)	0.49	Cum SA (acres)	0.37	4.72	

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

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.150

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9870.19	1445.72	9876.72	1445.1	9889.8	1445.17	9904.52	1445.22	9909.59	1444.86
9918.32	1441.61	9924.67	1441.413	9927.35	1441.33	9927.39	1441.33	9927.95	1441.48
9931.3	1443	9937.59	1437.81	9940.82	1435.57	9955.49	1430.73	9960.44	1428.89
9978.75	1429.18	9996.5	1429.02	10009.72	1429.07	10038.99	1428.75	10048.06	1431.03
10056.9	1433.98	10061.27	1435.47	10064.61	1435.38	10067.29	1435.31	10070.49	1435.22
10072.62	1435.18	10074.3	1435.84	10082.34	1438.41	10094.14	1441.77	10097.23	1442.72
10120.82	1442.69	10123.28	1442.7						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9870.19	.046	9931.3	.031	10097.23	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9931.31	10097.23	38.5	39.21	39.72	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1434.79	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.71	Wt. n-Val.		0.031
W.S. Elev (ft)	1434.09	Reach Len. (ft)	2.20	2.20
2.20				
Crit W.S. (ft)	1432.57	Flow Area (sq ft)		489.40
E.G. Slope (ft/ft)	0.002821	Area (sq ft)		489.40
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	111.89	Top Width (ft)		111.89
Vel Total (ft/s)	6.74	Avg. Vel. (ft/s)		6.74
Max Chl Dpth (ft)	5.34	Hydr. Depth (ft)		4.37
Conv. Total (cfs)	62129.4	Conv. (cfs)		62129.4
Length Wtd. (ft)	2.20	Wetted Per. (ft)		113.55
Min Ch El (ft)	1428.75	Shear (lb/sq ft)		0.76
Alpha	1.00	Stream Power (lb/ft s)		5.12
Frctn Loss (ft)		Cum Volume (acre-ft)	8.37	17.33
C & E Loss (ft)		Cum SA (acres)	2.79	4.55

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1434.79	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.71	Wt. n-Val.		0.031
W.S. Elev (ft)	1434.09	Reach Len. (ft)	2.20	2.20
2.20				
Crit W.S. (ft)	1432.56	Flow Area (sq ft)		489.38
E.G. Slope (ft/ft)	0.002822	Area (sq ft)		489.38
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	111.89	Top Width (ft)		111.89
Vel Total (ft/s)	6.74	Avg. Vel. (ft/s)		6.74
Max Chl Dpth (ft)	5.34	Hydr. Depth (ft)		4.37
Conv. Total (cfs)	62124.4	Conv. (cfs)		62124.4
Length Wtd. (ft)	2.20	Wetted Per. (ft)		113.54
Min Ch El (ft)	1428.75	Shear (lb/sq ft)		0.76
Alpha	1.00	Stream Power (lb/ft s)		5.12
Frctn Loss (ft)		Cum Volume (acre-ft)	0.98	17.51
C & E Loss (ft)		Cum SA (acres)	0.37	4.28

BRIDGE

RIVER: Cave Creek
REACH: 1 RS: 23.146

INPUT
Description: North Frontage Road Bridge
Distance from Upstream XS = 2.2
Deck/Roadway Width = 34.75
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
9800	1448.26	0	9931	1448.26	0	9931	1448.26	1440.98
10000	1448.74	1441.46	10069	1449.26	1441.98	10069	1449.26	0
10200	1449.26	0						

Upstream Bridge Cross Section Data
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9870.19	1445.72	9876.72	1445.1	9889.8	1445.17	9904.52	1445.22	9909.59	1444.86
9918.32	1441.61	9924.67	1441.413	9927.35	1441.33	9927.39	1441.33	9927.95	1441.48
9931.3	1443	9937.59	1437.81	9940.82	1435.57	9955.49	1430.73	9960.44	1428.89
9978.75	1429.18	9996.5	1429.02	10009.72	1429.07	10038.99	1428.75	10048.06	1431.03
10056.9	1433.98	10061.27	1435.47	10064.61	1435.38	10067.29	1435.31	10070.49	1435.22
10072.62	1435.18	10074.3	1435.84	10082.34	1438.41	10094.14	1441.77	10097.23	1442.72
10120.82	1442.69	10123.28	1442.7						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9870.19	.046	9931.3	.031	10097.23	.033

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
        9931.310097.23              .1       .3

Downstream  Deck/Roadway Coordinates
    num=       7
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    9800 1448.26       0    9931 1448.26       0    9931 1448.26 1440.98
   10000 1448.74 1441.46   10069 1449.26 1441.98   10069 1449.26       0
   10200 1449.26       0

Downstream Bridge Cross Section Data
Station Elevation Data    num=      39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9868.36 1446.79 9877.26 1446.77  9879.7 1446.71 9893.54 1446.67 9896.42 1446.29
 9898.47 1445.33 9904.87 1445.24 9910.77 1445.15 9914.68 1446.18 9918.33 1445.67
 9924.22 1445.61 9924.351445.451  9925.9 1443.56 9926.83 1442.29 9926.93 1442.23
 9934.42 1437.77 9941.48 1435.18 9943.38  1434.1 9945.37 1433.79 9959.68 1428.49
 9962.73 1428.5410016.88 1428.0310022.88 1428.0510040.23 1428.3710050.71 1431.34
10057.45 1433.3510065.28 1435.6710065.381435.66810066.81 1435.6410067.96 1435.97
 10073.6 1437.5510088.72 1443.41 10090.1 1443.5910090.87 1442.0810090.95  1442.1
10117.69 1443.7610120.41 1443.6810123.04 1443.6610123.13 1443.66

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9868.36    .046 9924.22    .031 10090.1    .033

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9924.22 10090.1              .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=   10000    Downstream=   10000
Upstream     num=       4
    Width   Elev    Width   Elev    Width   Elev    Width   Elev
    3.49    1400    3.49 1436.66     4.1 1436.66     4.1    1445
Downstream     num=       4
    Width   Elev    Width   Elev    Width   Elev    Width   Elev
    3.49    1400    3.49 1436.66     4.1 1436.66     4.1    1445

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum                Cd   =     1.2
       Yarnell                 KVal =    1.05
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #WS F-Plain

  E.G. US. (ft)                1434.79    Element                  Inside BR US  Inside BR
DS
  W.S. US. (ft)                1434.09    E.G. Elev (ft)               1434.76
1433.89
  Q Total (cfs)                3300.00    W.S. Elev (ft)               1433.94
1432.96
  Q Bridge (cfs)               3300.00    Crit W.S. (ft)               1432.66
1431.94
  Q Weir (cfs)                            Max Chl Dpth (ft)               5.19
4.93
  Weir Sta Lft (ft)                       Vel Total (ft/s)                7.23
7.75
  Weir Sta Rgt (ft)                       Flow Area (sq ft)             456.35
426.07
  Weir Submerg                            Froude # Chl                    0.62
0.68
  Weir Max Depth (ft)                     Specif Force (cu ft)         1805.86
1742.58
  Min El Weir Flow (ft)        1448.27    Hydr Depth (ft)                 4.24
4.06
  Min El Prs (ft)              1441.98    W.P. Total (ft)               118.97
116.05
  Delta EG (ft)                   0.91    Conv. Total (cfs)            53600.2
48604.7
  Delta WS (ft)                   1.03    Top Width (ft)                107.54
105.05
```

```
  BR Open Area (sq ft)          1398.24    Frctn Loss (ft)
  BR Open Vel (ft/s)               7.75    C & E Loss (ft)
  Coef of Q                                Shear Total (lb/sq ft)          0.91
1.06
  Br Sel Method               Momentum     Power Total (lb/ft s)           6.56
8.18


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.

BRIDGE OUTPUT  Profile #WS F-Way

  E.G. US. (ft)                 1434.79    Element                  Inside BR US  Inside BR
DS
  W.S. US. (ft)                 1434.09    E.G. Elev (ft)               1434.76
1433.89
  Q Total (cfs)                 3300.00    W.S. Elev (ft)               1433.94
1432.96
  Q Bridge (cfs)                3300.00    Crit W.S. (ft)               1432.66
1431.94
  Q Weir (cfs)                             Max Chl Dpth (ft)               5.19
4.93
  Weir Sta Lft (ft)                        Vel Total (ft/s)                7.23
7.75
  Weir Sta Rgt (ft)                        Flow Area (sq ft)             456.32
426.05
  Weir Submerg                             Froude # Chl                    0.62
0.68
  Weir Max Depth (ft)                      Specif Force (cu ft)         1805.79
1742.52
  Min El Weir Flow (ft)         1448.27    Hydr Depth (ft)                 4.24
4.06
  Min El Prs (ft)               1441.98    W.P. Total (ft)               118.97
116.05
  Delta EG (ft)                    0.91    Conv. Total (cfs)            53595.6
48600.6
  Delta WS (ft)                    1.03    Top Width (ft)                107.54
105.04
  BR Open Area (sq ft)          1398.24    Frctn Loss (ft)
  BR Open Vel (ft/s)               7.75    C & E Loss (ft)
  Coef of Q                                Shear Total (lb/sq ft)          0.91
1.06
  Br Sel Method               Momentum     Power Total (lb/ft s)           6.57
8.19


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate
the need for
         additional cross sections.

CROSS SECTION


RIVER: Cave Creek
REACH: 1                    RS: 23.142

INPUT
Description:
Station Elevation Data     num=       39
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9868.36 1446.79 9877.26 1446.77  9879.7 1446.71 9893.54 1446.67 9896.42 1446.29
 9898.47 1445.33 9904.87 1445.24 9910.77 1445.15 9914.68 1446.18 9918.33 1445.67
 9924.22 1445.61 9924.351445.451  9925.9 1443.56 9926.83 1442.29 9926.93 1442.23
 9934.42 1437.77 9941.48 1435.18 9943.38  1434.1 9945.37 1433.79 9959.68 1428.49
 9962.73 1428.5410016.88 1428.0310022.88 1428.0510040.23 1428.3710050.71 1431.34
10057.45 1433.3510065.28 1435.6710065.381435.66810066.81 1435.6410067.96 1435.97
 10073.6 1437.5510088.72 1443.41 10090.1 1443.5910090.87 1442.0810090.95  1442.1
10117.69 1443.7610120.41 1443.6810123.04 1443.6610123.13 1443.66

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9868.36    .046 9924.22    .031 10090.1    .033

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9924.22 10090.1            19.27   20.66    21.8             .1       .3

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)              1433.88    Element                    Left OB    Channel
Right OB
  Vel Head (ft)                  0.82    Wt. n-Val.                            0.031
  W.S. Elev (ft)              1433.06    Reach Len. (ft)             19.27     20.66
21.80
  Crit W.S. (ft)              1431.86    Flow Area (sq ft)                    453.10
  E.G. Slope (ft/ft)         0.003522    Area (sq ft)                         453.10
  Q Total (cfs)               3300.00    Flow (cfs)                          3300.00
  Top Width (ft)               109.12    Top Width (ft)                       109.12
  Vel Total (ft/s)               7.28    Avg. Vel. (ft/s)                       7.28
  Max Chl Dpth (ft)              5.03    Hydr. Depth (ft)                       4.15
  Conv. Total (cfs)           55603.5    Conv. (cfs)                         55603.5
  Length Wtd. (ft)              20.66    Wetted Per. (ft)                     110.61
  Min Ch El (ft)              1428.03    Shear (lb/sq ft)                       0.90
```

Alpha	1.00	Stream Power (lb/ft s)		6.56
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	8.37	16.93
C & E Loss (ft)	0.01	Cum SA (acres)	2.79	4.45

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1433.88	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.82	Wt. n-Val.		0.031
W.S. Elev (ft)	1433.06	Reach Len. (ft)	19.27	20.66
21.80				
Crit W.S. (ft)	1431.86	Flow Area (sq ft)		453.07
E.G. Slope (ft/ft)	0.003523	Area (sq ft)		453.07
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	109.12	Top Width (ft)		109.12
Vel Total (ft/s)	7.28	Avg. Vel. (ft/s)		7.28
Max Chl Dpth (ft)	5.03	Hydr. Depth (ft)		4.15
Conv. Total (cfs)	55598.7	Conv. (cfs)		55598.7
Length Wtd. (ft)	20.66	Wetted Per. (ft)		110.60
Min Ch El (ft)	1428.03	Shear (lb/sq ft)		0.90
Alpha	1.00	Stream Power (lb/ft s)		6.56
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.98	17.11
C & E Loss (ft)	0.01	Cum SA (acres)	0.37	4.18

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.138

INPUT
Description:
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9868.14	1446.01	9880.51	1445.86	9886.75	1445.71	9898.09	1444.72	9900.8	1444.69
9903.59	1444.66	9910.48	1444.8	9916.2	1444.16	9924.11	1442.135	9926.63	1441.49
9926.73	1441.47	9927.54	1441.46	9927.73	1441.55	9935.65	1438.61	9939.88	1435.46
9940.84	1434.54	9954.45	1429.7	9959.24	1428.281	10006.54	1427.861	10037.19	1428.17
10040.93	1428.17	10042	1428.511	10044.39	1429.81	10058.96	1435.961	10068.39	1439.78
10070.77	1440.74	51007	1.62	1441.091	0073.29	1441.611	0076.21	144010076.68	1440.13
10080.15	1440.07	10095.07		1442.511	0096.83	1442.84	10111.9	1442.671	0115.58 1442.56
10126	1442.44								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9868.14	.046	9924.11	.03	110073.29	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9924.111	0073.29	39.83	39.87	39.79	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1433.80	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.77	Wt. n-Val.		0.031
W.S. Elev (ft)	1433.02	Reach Len. (ft)	2.70	2.70
2.70				
Crit W.S. (ft)	1431.63	Flow Area (sq ft)		467.33
E.G. Slope (ft/ft)	0.003105	Area (sq ft)		467.33
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	106.91	Top Width (ft)		106.91
Vel Total (ft/s)	7.06	Avg. Vel. (ft/s)		7.06
Max Chl Dpth (ft)	5.16	Hydr. Depth (ft)		4.37
Conv. Total (cfs)	59217.8	Conv. (cfs)		59217.8
Length Wtd. (ft)	2.70	Wetted Per. (ft)		108.72
Min Ch El (ft)	1427.86	Shear (lb/sq ft)		0.83
Alpha	1.00	Stream Power (lb/ft s)		5.88
Frctn Loss (ft)		Cum Volume (acre-ft)	8.37	16.71
C & E Loss (ft)		Cum SA (acres)	2.79	4.40

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1433.80	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.77	Wt. n-Val.		0.031
W.S. Elev (ft)	1433.02	Reach Len. (ft)	2.70	2.70
2.70				
Crit W.S. (ft)	1431.64	Flow Area (sq ft)		467.30
E.G. Slope (ft/ft)	0.003106	Area (sq ft)		467.30
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	106.91	Top Width (ft)		106.91
Vel Total (ft/s)	7.06	Avg. Vel. (ft/s)		7.06
Max Chl Dpth (ft)	5.16	Hydr. Depth (ft)		4.37
Conv. Total (cfs)	59212.7	Conv. (cfs)		59212.7
Length Wtd. (ft)	2.70	Wetted Per. (ft)		108.72
Min Ch El (ft)	1427.86	Shear (lb/sq ft)		0.83
Alpha	1.00	Stream Power (lb/ft s)		5.89
Frctn Loss (ft)		Cum Volume (acre-ft)	0.98	16.89
C & E Loss (ft)		Cum SA (acres)	0.37	4.13

BRIDGE

RIVER: Cave Creek
REACH: 1 RS: 23.134

INPUT
Description: North On Ramp Bridge
Distance from Upstream XS = 2.7
Deck/Roadway Width = 34.53
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
9800	1449.25	0	9931	1449.25	0	9931	1449.25	1441.15
10000	1448.6	1440.5	10069	1447.63	1439.53	10069	1447.63	0
10200	1447.63	0						

Upstream Bridge Cross Section Data
Station Elevation Data num= 36

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9868.14	1446.01	9880.51	1445.86	9886.75	1445.71	9898.09	1444.72	9900.8	1444.69
9903.59	1444.66	9910.48	1444.8	9916.2	1444.16	9924.11	1442.135	9926.63	1441.49
9926.73	1441.47	9927.54	1441.46	9927.73	1441.55	9935.65	1438.61	9939.88	1435.46
9940.84	1434.54	9954.45	1429.7	9959.24	1428.28	10006.54	1427.86	10037.19	1428.17
10040.93	1428.17	10042	1428.51	10044.39	1429.81	10058.96	1435.96	10068.39	1439.78
10070.77	1440.74	10071.62	1441.09	10073.29	1441.61	10076.21	1440	10076.68	1440.13
10080.15	1440.07	10095.07	1442.51	10096.83	1442.84	10111.9	1442.67	10115.58	1442.56
10126	1442.44								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9868.14	.046	9924.11	.031	10073.29	.033

Bank Sta: Left	Right	Coeff Contr.	Expan.
9924.11	10073.29	.1	.3

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
9800	1449.25	0	9931	1449.25	0	9931	1449.25	1441.15
10000	1448.6	1440.5	10069	1447.63	1439.53	10069	1447.63	0
10200	1447.63	0						

Downstream Bridge Cross Section Data
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9869.42	1447.6	9874.82	1447.5	9875.8	1447.46	9876.7	1447.46	9902.88	1446.95
9905.91	1446.84	9920.08	1446.56	9923.82	1446.485	9924.54	1446.47	9926.23	1446.48
9926.32	1446.48	9928.19	1444.04	9928.87	1443.14	9933.51	1437.17	9936.2	1434.59
9938.04	1433.94	9958.46	1427.86	9978.44	1427.69	9991.39	1427.82	10042.15	1427.79
10056.57	1432.37	10060.49	1434.49	10069.02	1440.16	10071.89	1442.068	10074.3	1443.67
10086.6	1443.89	10099.71	1443.82	10128.66	1443.33				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9869.42	.046	9926.32	.031	10074.3	.033

Bank Sta: Left	Right	Coeff Contr.	Expan.
9926.32	10074.3	.1	.3

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 1

Pier Data
Pier Station Upstream= 10000 Downstream= 10000
Upstream num= 4

Width	Elev	Width	Elev	Width	Elev	Width	Elev
4	1400	4	1435.53	4.92	1435.53	4.92	1445

Downstream num= 4

Width	Elev	Width	Elev	Width	Elev	Width	Elev
4	1400	4	1435.53	4.92	1435.53	4.92	1445

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Momentum Cd = 1.2
Yarnell KVal = 1.05
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Energy Only

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum

Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #WS F-Plain

E.G. US. (ft)	1433.80	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	1433.02	E.G. Elev (ft)	1433.75	1433.21
Q Total (cfs)	3300.00	W.S. Elev (ft)	1432.82	1432.24
Q Bridge (cfs)	3300.00	Crit W.S. (ft)	1431.74	1431.38
Q Weir (cfs)		Max Chl Dpth (ft)	4.96	4.55
Weir Sta Lft (ft)		Vel Total (ft/s)	7.75	7.90
Weir Sta Rgt (ft)		Flow Area (sq ft)	425.78	417.62
Weir Submerg		Froude # Chl	0.67	0.71
Weir Max Depth (ft)		Specif Force (cu ft)	1760.82	1690.73
Min El Weir Flow (ft)	1447.64	Hydr Depth (ft)	4.18	3.85
Min El Prs (ft)	1441.15	W.P. Total (ft)	113.37	118.55
Delta EG (ft)	0.61	Conv. Total (cfs)	49309.6	46344.6
Delta WS (ft)	0.68	Top Width (ft)	101.84	108.38
BR Open Area (sq ft)	1321.27	Frctn Loss (ft)		
BR Open Vel (ft/s)	7.90	C & E Loss (ft)		
Coef of Q		Shear Total (lb/sq ft)	1.05	1.12
Br Sel Method	Momentum	Power Total (lb/ft s)	8.14	8.81

BRIDGE OUTPUT Profile #WS F-Way

E.G. US. (ft)	1433.80	Element	Inside BR US	Inside BR DS
W.S. US. (ft)	1433.02	E.G. Elev (ft)	1433.75	1433.21
Q Total (cfs)	3300.00	W.S. Elev (ft)	1432.82	1432.24
Q Bridge (cfs)	3300.00	Crit W.S. (ft)	1431.74	1431.38
Q Weir (cfs)		Max Chl Dpth (ft)	4.96	4.55
Weir Sta Lft (ft)		Vel Total (ft/s)	7.75	7.90
Weir Sta Rgt (ft)		Flow Area (sq ft)	425.74	417.57
Weir Submerg		Froude # Chl	0.67	0.71
Weir Max Depth (ft)		Specif Force (cu ft)	1760.73	1690.63
Min El Weir Flow (ft)	1447.64	Hydr Depth (ft)	4.18	3.85
Min El Prs (ft)	1441.15	W.P. Total (ft)	113.37	118.55
Delta EG (ft)	0.61	Conv. Total (cfs)	49303.2	46336.0
Delta WS (ft)	0.68	Top Width (ft)	101.84	108.38
BR Open Area (sq ft)	1321.27	Frctn Loss (ft)		
BR Open Vel (ft/s)	7.90	C & E Loss (ft)		
Coef of Q		Shear Total (lb/sq ft)	1.05	1.12
Br Sel Method	Momentum	Power Total (lb/ft s)	8.14	8.81

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.131

INPUT
Description:
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9869.42	1447.6	9874.82	1447.5	9875.8	1447.46	9876.7	1447.46	9902.88	1446.95
9905.91	1446.84	9920.08	1446.56	9923.82	1446.485	9924.54	1446.47	9926.23	1446.48
9926.32	1446.48	9928.19	1444.04	9928.87	1443.14	9933.51	1437.17	9936.2	1434.59
9938.04	1433.94	9958.46	1427.86	9978.44	1427.69	9991.39	1427.82	10042.15	1427.79
10056.57	1432.37	10060.49	1434.49	10069.02	1440.16	10071.89	1442.068	10074.3	1443.67
10086.6	1443.89	10099.71	1443.82	10128.66	1443.33				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9869.42	.046	9926.32	.031	10074.3	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9926.32	10074.3	18.51	12.04	6.61	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1433.19	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.84	Wt. n-Val.		0.031
W.S. Elev (ft)	1432.35	Reach Len. (ft)	18.51	12.04
6.61				
Crit W.S. (ft)	1431.29	Flow Area (sq ft)		447.96
E.G. Slope (ft/ft)	0.003830	Area (sq ft)		447.96
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	113.11	Top Width (ft)		113.11
Vel Total (ft/s)	7.37	Avg. Vel. (ft/s)		7.37
Max Chl Dpth (ft)	4.66	Hydr. Depth (ft)		3.96
Conv. Total (cfs)	53320.3	Conv. (cfs)		53320.3
Length Wtd. (ft)	12.04	Wetted Per. (ft)		114.47
Min Ch El (ft)	1427.69	Shear (lb/sq ft)		0.94
Alpha	1.00	Stream Power (lb/ft s)		6.89
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	8.37	16.33
C & E Loss (ft)	0.01	Cum SA (acres)	2.79	4.30

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1433.19	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.84	Wt. n-Val.		0.031
W.S. Elev (ft)	1432.35	Reach Len. (ft)	18.51	12.04
6.61				
Crit W.S. (ft)	1431.28	Flow Area (sq ft)		447.89
E.G. Slope (ft/ft)	0.003832	Area (sq ft)		447.89
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	113.11	Top Width (ft)		113.11
Vel Total (ft/s)	7.37	Avg. Vel. (ft/s)		7.37
Max Chl Dpth (ft)	4.66	Hydr. Depth (ft)		3.96
Conv. Total (cfs)	53307.7	Conv. (cfs)		53307.7
Length Wtd. (ft)	12.04	Wetted Per. (ft)		114.47
Min Ch El (ft)	1427.69	Shear (lb/sq ft)		0.94
Alpha	1.00	Stream Power (lb/ft s)		6.90
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	0.98	16.50
C & E Loss (ft)	0.01	Cum SA (acres)	0.37	4.03

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.128

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9868.5	1448.47	9889.41	1448.23	9891.53	1448.19	9893.98	1448.09	9913.03	1447.46
9923.97	1447.08	1 9924.57	1447.06	9925.57	1447.11	9926.21	1447.14	9926.35	1446.95
9926.79	1446.38	9935.93	1434.58	9945.23	1431.6	9958.34	1427.71	9968.48	1427.62
9975.64	1427.71	0042.26	1427.71	0053.86	1431.42	10061.31	1435.44	10068.87	1440.46
10071.59	1442.27	310073.97	1443.86	10083.01	1444	10100.46	1443.89	10126.08	1443.42

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9868.5	.046	9926.21	.031	10073.97	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9926.21	10073.97	146.88	146.66	147.17	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1433.14	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.81	Wt. n-Val.		0.031
W.S. Elev (ft)	1432.33	Reach Len. (ft)	1.65	1.65
1.65				
Crit W.S. (ft)	1431.16	Flow Area (sq ft)		457.84
E.G. Slope (ft/ft)	0.003545	Area (sq ft)		457.84
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	112.59	Top Width (ft)		112.59
Vel Total (ft/s)	7.21	Avg. Vel. (ft/s)		7.21
Max Chl Dpth (ft)	4.71	Hydr. Depth (ft)		4.07
Conv. Total (cfs)	55422.1	Conv. (cfs)		55422.1
Length Wtd. (ft)	1.65	Wetted Per. (ft)		114.08
Min Ch El (ft)	1427.62	Shear (lb/sq ft)		0.89
Alpha	1.00	Stream Power (lb/ft s)		6.40
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	8.37	16.20
C & E Loss (ft)	0.01	Cum SA (acres)	2.79	4.27

CROSS SECTION OUTPUT Profile #WS F-Way

```
  E.G. Elev (ft)           1433.14    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.81    Wt. n-Val.                            0.031
  W.S. Elev (ft)           1432.33    Reach Len. (ft)             1.65       1.65
1.65
  Crit W.S. (ft)           1431.17    Flow Area (sq ft)                    457.77
  E.G. Slope (ft/ft)      0.003547    Area (sq ft)                         457.77
  Q Total (cfs)            3300.00    Flow (cfs)                          3300.00
  Top Width (ft)            112.59    Top Width (ft)                       112.59
  Vel Total (ft/s)            7.21    Avg. Vel. (ft/s)                       7.21
  Max Chl Dpth (ft)           4.71    Hydr. Depth (ft)                       4.07
  Conv. Total (cfs)        55409.3    Conv. (cfs)                         55409.3
  Length Wtd. (ft)            1.65    Wetted Per. (ft)                     114.08
  Min Ch El (ft)           1427.62    Shear (lb/sq ft)                       0.89
  Alpha                       1.00    Stream Power (lb/ft s)                 6.41
  Frctn Loss (ft)             0.01    Cum Volume (acre-ft)        0.98      16.38
  C & E Loss (ft)             0.01    Cum SA (acres)              0.37       4.00


BRIDGE


RIVER: Cave Creek
REACH: 1                  RS: 23.114

INPUT
Description: Loop 101 Mainline Bridges
Distance from Upstream XS =    1.65
Deck/Roadway Width        =  144.33
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       7
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    9800 1450.64       0    9931 1450.64       0    9931 1450.64 1442.59
   10000 1449.23 1441.18   10069 1448.15  1440.1   10069 1448.15       0
   10200 1448.15       0

Upstream Bridge Cross Section Data
Station Elevation Data    num=      25
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  9868.5 1448.47 9889.41 1448.23 9891.53 1448.19 9893.98 1448.09 9913.03 1447.46
 9923.971447.081 9924.57 1447.06 9925.57 1447.11 9926.21 1447.14 9926.35 1446.95
 9926.79 1446.38 9935.93 1434.58 9945.23  1431.6 9958.34 1427.71 9968.48 1427.62
 9975.64  1427.710042.26  1427.710053.86 1431.4210061.31 1435.4410068.87 1440.46
10071.591442.27310073.97 1443.8610083.01    144410100.46 1443.8910126.08 1443.42

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  9868.5    .046 9926.21    .03110073.97    .033

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9926.2110073.97             .1       .3

Downstream  Deck/Roadway Coordinates
    num=       7
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    9800  1450.6       0    9931  1450.6       0    9931  1450.6 1442.55
   10000 1449.26 1441.21   10069 1448.06 1440.01   10069 1448.06       0
   10200 1448.06       0

Downstream Bridge Cross Section Data
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9874.32 1448.01 9884.89 1447.79 9885.06 1447.79 9885.33 1447.77 9916.94 1447.11
 9922.891446.982 9924.87 1446.94 9927.45 1446.89 9927.65  1446.9  9927.9 1446.65
 9938.73 1434.37 9950.48 1428.59 9953.72 1426.99 9955.52 1426.18  9962.1 1426.85
 9968.62 1427.54 9969.57 1427.62  9993.1 1427.36 10026.8 1426.9710046.73 1426.29
10071.18 1440.9210073.28 1442.1710074.171442.70310076.15 1443.8910077.11 1443.87
10079.82 1443.8210115.15 1443.1610129.13 1442.89

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9874.32    .046 9927.65    .03110076.15    .033

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9927.6510076.15             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=   10000    Downstream=   10000
Upstream     num=       4
    Width   Elev    Width   Elev    Width   Elev    Width   Elev
        4   1400        4  1435.9    4.92  1435.9    4.92   1445
Downstream     num=       4
    Width   Elev    Width   Elev    Width   Elev    Width   Elev
```

```
       4    1400       4 1435.85    4.92 1435.85    4.92    1445

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #WS F-Plain

  E.G. US. (ft)                1433.14    Element                  Inside BR US  Inside BR
DS
  W.S. US. (ft)                1432.33    E.G. Elev (ft)               1433.11
1432.44
  Q Total (cfs)                3300.00    W.S. Elev (ft)               1432.16
1431.59
  Q Bridge (cfs)               3300.00    Crit W.S. (ft)               1431.26
1430.44
  Q Weir (cfs)                            Max Chl Dpth (ft)               4.54
5.41
  Weir Sta Lft (ft)                       Vel Total (ft/s)                7.84
7.38
  Weir Sta Rgt (ft)                       Flow Area (sq ft)             420.81
447.32
  Weir Submerg                            Froude # Chl                    0.70
0.64
  Weir Max Depth (ft)                     Specif Force (cu ft)         1695.89
1746.28
  Min El Weir Flow (ft)        1448.16    Hydr Depth (ft)                 3.91
4.17
  Min El Prs (ft)              1442.59    W.P. Total (ft)               118.07
118.64
  Delta EG (ft)                   0.72    Conv. Total (cfs)            47063.3
51940.1
  Delta WS (ft)                   0.68    Top Width (ft)                107.74
107.22
  BR Open Area (sq ft)         1544.83    Frctn Loss (ft)                 0.64
0.00
  BR Open Vel (ft/s)              7.84    C & E Loss (ft)                 0.03
0.02
  Coef of Q                               Shear Total (lb/sq ft)          1.09
0.95
  Br Sel Method            Energy only    Power Total (lb/ft s)           8.58
7.01


Warning: Pier drag coefficient of 2.0 assumed for Class B flow.

BRIDGE OUTPUT  Profile #WS F-Way

  E.G. US. (ft)                1433.14    Element                  Inside BR US  Inside BR
DS
  W.S. US. (ft)                1432.33    E.G. Elev (ft)               1433.11
1432.44
  Q Total (cfs)                3300.00    W.S. Elev (ft)               1432.16
1431.59
  Q Bridge (cfs)               3300.00    Crit W.S. (ft)               1431.26
1430.44
  Q Weir (cfs)                            Max Chl Dpth (ft)               4.54
5.41
  Weir Sta Lft (ft)                       Vel Total (ft/s)                7.84
7.38
  Weir Sta Rgt (ft)                       Flow Area (sq ft)             420.75
447.19
  Weir Submerg                            Froude # Chl                    0.70
0.64
  Weir Max Depth (ft)                     Specif Force (cu ft)         1695.76
1745.95
  Min El Weir Flow (ft)        1448.16    Hydr Depth (ft)                 3.91
4.17
  Min El Prs (ft)              1442.59    W.P. Total (ft)               118.07
118.63
  Delta EG (ft)                   0.72    Conv. Total (cfs)            47052.3
51917.3
  Delta WS (ft)                   0.68    Top Width (ft)                107.73
107.21
  BR Open Area (sq ft)         1544.83    Frctn Loss (ft)                 0.64
0.00
  BR Open Vel (ft/s)              7.84    C & E Loss (ft)                 0.03
0.02
  Coef of Q                               Shear Total (lb/sq ft)          1.09
0.95
  Br Sel Method            Energy only    Power Total (lb/ft s)           8.58
7.02
```

Warning: Pier drag coefficient of 2.0 assumed for Class B flow.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.101

INPUT
Description:
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9874.32	1448.01	9884.89	1447.79	9885.06	1447.79	9885.33	1447.77	9916.94	1447.11
9922.89	1446.98	9924.87	1446.94	9927.45	1446.89	9927.65	1446.9	9927.9	1446.65
9938.73	1434.37	9950.48	1428.59	9953.72	1426.99	9955.52	1426.18	9962.1	1426.85
9968.62	1427.54	9969.57	1427.62	9993.1	1427.36	10026.8	1426.97	10046.73	1426.29
10071.18	1440.92	10073.28	1442.17	10074.17	1442.70	310076.15	1443.89	10077.11	1443.87
10079.82	1443.82	10115.15	1443.16	10129.13	1442.89				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9874.32	.046	9927.65	.031	10076.15	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9927.65	10076.15	31.66	20.81	10.83	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1432.41	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.76	Wt. n-Val.		0.031
W.S. Elev (ft)	1431.65	Reach Len. (ft)	31.66	20.81
10.83				
Crit W.S. (ft)	1430.37	Flow Area (sq ft)		470.66
E.G. Slope (ft/ft)	0.003240	Area (sq ft)		470.66
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	111.42	Top Width (ft)		111.42
Vel Total (ft/s)	7.01	Avg. Vel. (ft/s)		7.01
Max Chl Dpth (ft)	5.47	Hydr. Depth (ft)		4.22
Conv. Total (cfs)	57975.7	Conv. (cfs)		57975.7
Length Wtd. (ft)	20.81	Wetted Per. (ft)		114.25
Min Ch El (ft)	1426.18	Shear (lb/sq ft)		0.83
Alpha	1.00	Stream Power (lb/ft s)		5.84
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	8.37	14.74
C & E Loss (ft)	0.01	Cum SA (acres)	2.79	3.91

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1432.41	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.76	Wt. n-Val.		0.031
W.S. Elev (ft)	1431.65	Reach Len. (ft)	31.66	20.81
10.83				
Crit W.S. (ft)	1430.37	Flow Area (sq ft)		470.54
E.G. Slope (ft/ft)	0.003243	Area (sq ft)		470.54
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	111.42	Top Width (ft)		111.42
Vel Total (ft/s)	7.01	Avg. Vel. (ft/s)		7.01
Max Chl Dpth (ft)	5.47	Hydr. Depth (ft)		4.22
Conv. Total (cfs)	57952.2	Conv. (cfs)		57952.2
Length Wtd. (ft)	20.81	Wetted Per. (ft)		114.24
Min Ch El (ft)	1426.18	Shear (lb/sq ft)		0.83
Alpha	1.00	Stream Power (lb/ft s)		5.85
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.98	14.92
C & E Loss (ft)	0.01	Cum SA (acres)	0.37	3.64

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.097

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9873.01	1443.84	9884.14	1443.86	9884.68	1443.85	9886.16	1443.8	9906.22	1443.78
9911.28	1443.86	9922.31	1443.869	9924.22	1443.87	9926.48	1443.87	9934.79	1437.42
9935.77	1436.61	9938.86	1434.4	9939.55	1434.03	9948.94	1428.55	9955.04	1426.13
9961.36	1426.8	9971.17	1427.58	10012.64	1427.13	10024.79	1427	10032.1	1426.65
10047.41	1426.15	10049.29	1427.26	10054.12	1430.15	10071.7	1440.65	10074.48	1442.306
10076.4	1443.45	10084.62	1443.33	10102.68	1443.11	10122.52	1442.81	10127.25	1442.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9873.01	.046	9922.3	.031	10074.48	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9922.31	10074.48	33.75	34.38	34.91	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1432.34	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.73	Wt. n-Val.		0.031
W.S. Elev (ft)	1431.60	Reach Len. (ft)	2.90	2.90
2.90				
Crit W.S. (ft)	1430.27	Flow Area (sq ft)		480.74
E.G. Slope (ft/ft)	0.003071	Area (sq ft)		480.74
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	112.85	Top Width (ft)		112.85
Vel Total (ft/s)	6.86	Avg. Vel. (ft/s)		6.86
Max Chl Dpth (ft)	5.47	Hydr. Depth (ft)		4.26
Conv. Total (cfs)	59547.6	Conv. (cfs)		59547.6
Length Wtd. (ft)	2.90	Wetted Per. (ft)		115.73
Min Ch El (ft)	1426.13	Shear (lb/sq ft)		0.80
Alpha	1.00	Stream Power (lb/ft s)		5.47
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	8.37	14.51
C & E Loss (ft)	0.01	Cum SA (acres)	2.79	3.86

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1432.34	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.73	Wt. n-Val.		0.031
W.S. Elev (ft)	1431.60	Reach Len. (ft)	2.90	2.90
2.90				
Crit W.S. (ft)	1430.27	Flow Area (sq ft)		480.60
E.G. Slope (ft/ft)	0.003074	Area (sq ft)		480.60
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	112.84	Top Width (ft)		112.84
Vel Total (ft/s)	6.87	Avg. Vel. (ft/s)		6.87
Max Chl Dpth (ft)	5.47	Hydr. Depth (ft)		4.26
Conv. Total (cfs)	59520.7	Conv. (cfs)		59520.7
Length Wtd. (ft)	2.90	Wetted Per. (ft)		115.72
Min Ch El (ft)	1426.13	Shear (lb/sq ft)		0.80
Alpha	1.00	Stream Power (lb/ft s)		5.47
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.98	14.69
C & E Loss (ft)	0.01	Cum SA (acres)	0.37	3.59

BRIDGE

RIVER: Cave Creek
REACH: 1 RS: 23.093

INPUT
Description: South Off Ramp Bridge
Distance from Upstream XS = 2.9
Deck/Roadway Width = 28.57
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
9800	1446.01	0	9931	1446.01	0	9931	1446.01	1437.91
10000	1446.07	1437.97	10069	1445.87	1437.77	10069	1445.87	0
10200	1445.87	0						

Upstream Bridge Cross Section Data
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9873.01	1443.84	9884.14	1443.86	9884.68	1443.85	9886.16	1443.8	9906.22	1443.78
9911.28	1443.86	9922.31	1443.869	9924.22	1443.87	9926.48	1443.87	9934.79	1437.42
9935.77	1436.61	9938.86	1434.4	9939.55	1434.03	9948.94	1428.55	9955.04	1426.13
9961.36	1426.8	9971.17	1427.58	10012.64	1427.13	10024.79	1427	10032.1	1426.65
10047.41	1426.15	10049.29	1427.26	10054.12	1430.15	10071.7	1440.65	10074.48	1442.306
10076.4	1443.45	10084.62	1443.33	10102.68	1443.11	10122.52	1442.81	10127.25	1442.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9873.01	.046	9922.3	.031	10074.48	.033

Bank Sta: Left	Right	Coeff Contr.	Expan.
9922.31	10074.48	.1	.3

Downstream Deck/Roadway Coordinates
num= 7

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
9800	1446.01	0	9931	1446.01	0	9931	1446.01	1437.91
10000	1446.07	1437.97	10069	1445.87	1437.77	10069	1445.87	0
10200	1445.87	0						

Downstream Bridge Cross Section Data
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9875.72	1441.92	9888.51	1442.01	9899.09	1442.09	9907.36	1441.06	9909.99	1441.08
9923.54	1438.55	9925.37	1438.21	9929.55	1437.43	9930.83	1437.44	9931.05	1437.36
9931.6	1436.74	9939.35	1434.47	9943.43	1432.3	9950.84	1427.95	9954.77	1426.1
9965.2	1426.86	9973.65	1427.54	9983.26	1427.43	10024.29	1426.96	10045.82	1425.95
10048.44	1425.83	10050.07	1426.49	10070.38	1435.04	10072.21	1435.82	10072.55	1435.96
10073.2	1436.26	10076.07	1442.19	10076.16	1442.2	10080.23	1441.03	10091.77	1440.97
10099.57	1442.09	10103.65	1442.11	10128.07	1441.87	10129.95	1441.77	10130.21	1441.77

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9875.72    .046 9923.54    .03110076.07    .033

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9923.5410076.07             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=   10000    Downstream=   10000
Upstream     num=       4
    Width   Elev    Width   Elev    Width   Elev    Width   Elev
       4    1400       4 1433.21    4.92 1433.21    4.92    1445
Downstream     num=       4
    Width   Elev    Width   Elev    Width   Elev    Width   Elev
       4    1400       4 1433.21    4.92 1433.21    4.92    1445

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #WS F-Plain

  E.G. US. (ft)                1432.34    Element                  Inside BR US  Inside BR
DS
  W.S. US. (ft)                1431.60    E.G. Elev (ft)               1432.32
1432.19
  Q Total (cfs)                3300.00    W.S. Elev (ft)               1431.48
1431.41
  Q Bridge (cfs)               3300.00    Crit W.S. (ft)               1430.35
1430.19
  Q Weir (cfs)                            Max Chl Dpth (ft)               5.35
5.58
  Weir Sta Lft (ft)                       Vel Total (ft/s)                7.34
7.06
  Weir Sta Rgt (ft)                       Flow Area (sq ft)             449.81
467.33
  Weir Submerg                            Froude # Chl                    0.63
0.61
  Weir Max Depth (ft)                     Specif Force (cu ft)         1738.04
1756.75
  Min El Weir Flow (ft)        1445.88    Hydr Depth (ft)                 4.15
4.14
  Min El Prs (ft)              1437.97    W.P. Total (ft)               119.66
123.73
  Delta EG (ft)                   0.18    Conv. Total (cfs)            52126.6
54326.6
  Delta WS (ft)                   0.15    Top Width (ft)                108.42
112.82
  BR Open Area (sq ft)         1210.24    Frctn Loss (ft)                 0.11
0.01
  BR Open Vel (ft/s)              7.34    C & E Loss (ft)                 0.02
0.02
  Coef of Q                               Shear Total (lb/sq ft)          0.94
0.87
  Br Sel Method            Energy only    Power Total (lb/ft s)           6.90
6.14


Warning: Pier drag coefficient of 2.0 assumed for Class B flow.

BRIDGE OUTPUT  Profile #WS F-Way

  E.G. US. (ft)                1432.34    Element                  Inside BR US  Inside BR
DS
  W.S. US. (ft)                1431.60    E.G. Elev (ft)               1432.31
1432.19
  Q Total (cfs)                3300.00    W.S. Elev (ft)               1431.48
1431.41
  Q Bridge (cfs)               3300.00    Crit W.S. (ft)               1430.35
1430.19
```

Q Weir (cfs)	5.58	Max Chl Dpth (ft)	5.35
Weir Sta Lft (ft)	7.06	Vel Total (ft/s)	7.34
Weir Sta Rgt (ft)	467.16	Flow Area (sq ft)	449.67
Weir Submerg	0.61	Froude # Chl	0.64
Weir Max Depth (ft)	1756.32	Specif Force (cu ft)	1737.68
Min El Weir Flow (ft)	1445.88	Hydr Depth (ft)	4.15
Min El Prs (ft)	4.14	W.P. Total (ft)	119.65
	1437.97		
Delta EG (ft)	123.73	Conv. Total (cfs)	52100.8
	0.18		
Delta WS (ft)	54297.1	Top Width (ft)	108.42
	0.15		
BR Open Area (sq ft)	112.81	Frctn Loss (ft)	0.11
	1210.24		
BR Open Vel (ft/s)	0.01	C & E Loss (ft)	0.02
	7.34		
Coef of Q	0.02	Shear Total (lb/sq ft)	0.94
Br Sel Method	0.87	Power Total (lb/ft s)	6.91
	Energy only		
	6.15		

Warning: Pier drag coefficient of 2.0 assumed for Class B flow.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.090

INPUT
Description:
Station Elevation Data num= 35

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9875.72	1441.92	9888.51	1442.01	9899.09	1442.09	9907.36	1441.06	9909.99	1441.08
9923.54	1438.55	9925.37	1438.21	9929.55	1437.43	9930.83	1437.44	9931.05	1437.36
9931.6	1436.74	9939.35	1434.47	9943.43	1432.3	9950.84	1427.95	9954.77	1426.1
9965.2	1426.86	9973.65	1427.54	9983.26	1427.43	10024.29	1426.96	10045.82	1425.95
10048.44	1425.83	10050.07	1426.49	10070.38	1435.04	910072.21	1435.82	10072.55	1435.96
10073.2	1436.26	10076.07	1442.19	10076.16	1442.2	10080.23	1441.03	10091.77	1440.97
10099.57	1442.09	10103.65	1442.11	10128.07	1441.87	10129.95	1441.77	10130.21	1441.77

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9875.72	.046	9923.54	.03	110076.07	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9923.54	10076.07	26.09	30.2	34.11	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1432.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.		0.031	
W.S. Elev (ft)	1431.45	Reach Len. (ft)	26.09	30.20	34.11
Crit W.S. (ft)	1430.12	Flow Area (sq ft)		488.18	
E.G. Slope (ft/ft)	0.003047	Area (sq ft)		488.18	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	116.96	Top Width (ft)		116.96	
Vel Total (ft/s)	6.76	Avg. Vel. (ft/s)		6.76	
Max Chl Dpth (ft)	5.62	Hydr. Depth (ft)		4.17	
Conv. Total (cfs)	59783.8	Conv. (cfs)		59783.8	
Length Wtd. (ft)	30.20	Wetted Per. (ft)		119.54	
Min Ch El (ft)	1425.83	Shear (lb/sq ft)		0.78	
Alpha	1.00	Stream Power (lb/ft s)		5.25	
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	8.37	14.15	
C & E Loss (ft)	0.00	Cum SA (acres)	2.79	3.77	

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1432.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.71	Wt. n-Val.		0.031	
W.S. Elev (ft)	1431.45	Reach Len. (ft)	26.09	30.20	34.11
Crit W.S. (ft)	1430.11	Flow Area (sq ft)		488.02	
E.G. Slope (ft/ft)	0.003050	Area (sq ft)		488.02	
Q Total (cfs)	3300.00	Flow (cfs)		3300.00	
Top Width (ft)	116.96	Top Width (ft)		116.96	
Vel Total (ft/s)	6.76	Avg. Vel. (ft/s)		6.76	
Max Chl Dpth (ft)	5.62	Hydr. Depth (ft)		4.17	
Conv. Total (cfs)	59753.6	Conv. (cfs)		59753.6	
Length Wtd. (ft)	30.20	Wetted Per. (ft)		119.54	
Min Ch El (ft)	1425.83	Shear (lb/sq ft)		0.78	
Alpha	1.00	Stream Power (lb/ft s)		5.26	
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.98	14.33	

```
  C & E Loss (ft)              0.00    Cum SA (acres)              0.37       3.50
```

CROSS SECTION

```
RIVER: Cave Creek
REACH: 1                  RS: 23.084

INPUT
Description:
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9876.01 1441.64 9893.88 1441.83 9905.21 1441.02 9908.75 1441.05 9909.44 1440.69
 9911.42 1440.26 9924.951437.433 9926.69 1437.07 9939.39 1434.43 9948.67 1429.23
 9954.64 1426.08 9967.61 1427.02 9980.66 1427.3610017.36 1426.9410048.61 1425.91
10049.35  1425.910049.65 1426.0510070.781434.71610072.52 1435.4310074.84 1436.38
10080.99 1437.7810091.36  1440.410093.57 1440.9910097.13 1441.1810100.74 1442.49
10117.73 1442.5710121.65 1442.89 10124.1 1442.83 10131.7 1442.67

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9876.01    .046 9924.95    .03110070.78    .033

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9924.9510070.78            38.02   38.84   39.72            .1        .3

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)           1432.06    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.70    Wt. n-Val.                            0.031
  W.S. Elev (ft)           1431.37    Reach Len. (ft)              2.10      2.10
2.10
  Crit W.S. (ft)           1430.01    Flow Area (sq ft)                    492.46
  E.G. Slope (ft/ft)      0.002982    Area (sq ft)                         492.46
  Q Total (cfs)            3300.00    Flow (cfs)                          3300.00
  Top Width (ft)            117.75    Top Width (ft)                       117.75
  Vel Total (ft/s)            6.70    Avg. Vel. (ft/s)                       6.70
  Max Chl Dpth (ft)           5.47    Hydr. Depth (ft)                       4.18
  Conv. Total (cfs)        60427.5    Conv. (cfs)                         60427.5
  Length Wtd. (ft)            2.10    Wetted Per. (ft)                     120.23
  Min Ch El (ft)           1425.90    Shear (lb/sq ft)                       0.76
  Alpha                       1.00    Stream Power (lb/ft s)                 5.11
  Frctn Loss (ft)             0.01    Cum Volume (acre-ft)         8.37     13.81
  C & E Loss (ft)             0.01    Cum SA (acres)               2.79      3.69

CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)           1432.06    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.70    Wt. n-Val.                            0.031
  W.S. Elev (ft)           1431.37    Reach Len. (ft)              2.10      2.10
2.10
  Crit W.S. (ft)           1430.01    Flow Area (sq ft)                    492.29
  E.G. Slope (ft/ft)      0.002986    Area (sq ft)                         492.29
  Q Total (cfs)            3300.00    Flow (cfs)                          3300.00
  Top Width (ft)            117.75    Top Width (ft)                       117.75
  Vel Total (ft/s)            6.70    Avg. Vel. (ft/s)                       6.70
  Max Chl Dpth (ft)           5.46    Hydr. Depth (ft)                       4.18
  Conv. Total (cfs)        60394.4    Conv. (cfs)                         60394.4
  Length Wtd. (ft)            2.10    Wetted Per. (ft)                     120.23
  Min Ch El (ft)           1425.90    Shear (lb/sq ft)                       0.76
  Alpha                       1.00    Stream Power (lb/ft s)                 5.12
  Frctn Loss (ft)             0.01    Cum Volume (acre-ft)         0.98     13.99
  C & E Loss (ft)             0.01    Cum SA (acres)               0.37      3.42
```

BRIDGE

```
RIVER: Cave Creek
REACH: 1                  RS: 23.081

INPUT
Description: South Frontage Road Bridge
Distance from Upstream XS =      2.1
Deck/Roadway Width        =    34.66
Weir Coefficient          =      2.6
Upstream  Deck/Roadway Coordinates
    num=        7
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    9800 1444.98       0    9931 1444.98       0    9931 1444.98 1437.63
   10000 1445.12 1437.77   10069 1444.91 1437.56   10069 1444.91       0
   10200 1444.91       0

Upstream Bridge Cross Section Data
Station Elevation Data    num=      29
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9876.01 1441.64 9893.88 1441.83 9905.21 1441.02 9908.75 1441.05 9909.44 1440.69
 9911.42 1440.26 9924.951437.433 9926.69 1437.07 9939.39 1434.43 9948.67 1429.23
 9954.64 1426.08 9967.61 1427.02 9980.66 1427.3610017.36 1426.9410048.61 1425.91
10049.35  1425.910049.65 1426.0510070.781434.71610072.52 1435.4310074.84 1436.38
```

```
10080.99 1437.7810091.36  1440.410093.57 1440.9910097.13 1441.1810100.74 1442.49
10117.73 1442.5710121.65 1442.89 10124.1 1442.83 10131.7 1442.67

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9876.01    .046 9924.95    .03110070.78    .033

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9924.9510070.78             .1       .3

Downstream  Deck/Roadway Coordinates
    num=        7
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    9800 1444.98       0    9931 1444.98       0    9931 1444.98 1437.63
   10000 1445.12 1437.77   10069 1444.91 1437.56   10069 1444.91       0
   10200 1444.91       0

Downstream Bridge Cross Section Data
Station Elevation Data    num=      32
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9869.05 1440.89 9886.83  1441.2 9906.08 1441.52 9909.83 1440.82 9910.29  1440.5
 9914.14 1439.64 9926.651436.669 9928.29 1436.28 9935.97 1434.45 9938.38 1434.15
 9951.64 1427.38 9953.72 1426.35 9954.33 1426.05 9961.13 1426.19  9993.5 1427.03
10002.03 1426.9310009.21 1426.6910050.61 1425.9810066.281433.80610067.75 1434.54
10067.81 1434.5610067.92 1434.5910069.47 1434.7410073.12 1435.0610080.11 1435.68
10081.32 1436.0310095.02 1440.3410096.51 1440.3910100.95 1440.7910107.78 1441.57
10112.96 1441.57 10126.8 1441.48

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9869.05    .046 9926.65    .03110067.75    .033

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9926.6510067.75             .1       .3

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=   10000    Downstream=   10000
Upstream     num=       4
    Width   Elev    Width   Elev    Width   Elev    Width   Elev
    3.49    1400    3.49 1432.98     4.1 1432.98     4.1    1445
Downstream     num=       4
    Width   Elev    Width   Elev    Width   Elev    Width   Elev
    3.49    1400    3.49 1432.98     4.1 1432.98     4.1    1445

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #WS F-Plain

  E.G. US. (ft)              1432.06    Element                  Inside BR US  Inside BR
DS
  W.S. US. (ft)              1431.37    E.G. Elev (ft)              1432.05
1431.91
  Q Total (cfs)              3300.00    W.S. Elev (ft)              1431.27
1431.21
  Q Bridge (cfs)             3300.00    Crit W.S. (ft)              1430.06
1429.76
  Q Weir (cfs)                          Max Chl Dpth (ft)              5.37
5.23
  Weir Sta Lft (ft)                     Vel Total (ft/s)               7.06
6.71
  Weir Sta Rgt (ft)                     Flow Area (sq ft)            467.09
491.77
  Weir Submerg                          Froude # Chl                   0.61
0.57
  Weir Max Depth (ft)                   Specif Force (cu ft)        1746.01
1818.79
  Min El Weir Flow (ft)      1444.92    Hydr Depth (ft)                4.10
4.34
  Min El Prs (ft)            1437.77    W.P. Total (ft)              124.57
124.44
```

Delta EG (ft)	0.18	Conv. Total (cfs)	54036.9
58921.7			
Delta WS (ft)	0.13	Top Width (ft)	113.87
113.44			
BR Open Area (sq ft)	1274.31	Frctn Loss (ft)	0.12
0.01			
BR Open Vel (ft/s)	7.06	C & E Loss (ft)	0.02
0.01			
Coef of Q		Shear Total (lb/sq ft)	0.87
0.77			
Br Sel Method	Energy only	Power Total (lb/ft s)	6.17
5.19			

BRIDGE OUTPUT Profile #WS F-Way

E.G. US. (ft)	1432.06	Element	Inside BR US	Inside BR
DS				
W.S. US. (ft)	1431.37	E.G. Elev (ft)	1432.05	
1431.91				
Q Total (cfs)	3300.00	W.S. Elev (ft)	1431.27	
1431.21				
Q Bridge (cfs)	3300.00	Crit W.S. (ft)	1430.06	
1429.76				
Q Weir (cfs)		Max Chl Dpth (ft)	5.37	
5.23				
Weir Sta Lft (ft)		Vel Total (ft/s)	7.07	
6.71				
Weir Sta Rgt (ft)		Flow Area (sq ft)	466.93	
491.61				
Weir Submerg		Froude # Chl	0.62	
0.57				
Weir Max Depth (ft)		Specif Force (cu ft)	1745.59	
1818.30				
Min El Weir Flow (ft)	1444.92	Hydr Depth (ft)	4.10	
4.33				
Min El Prs (ft)	1437.77	W.P. Total (ft)	124.56	
124.43				
Delta EG (ft)	0.18	Conv. Total (cfs)	54007.5	
58891.5				
Delta WS (ft)	0.13	Top Width (ft)	113.86	
113.44				
BR Open Area (sq ft)	1274.31	Frctn Loss (ft)	0.12	
0.01				
BR Open Vel (ft/s)	7.07	C & E Loss (ft)	0.02	
0.01				
Coef of Q		Shear Total (lb/sq ft)	0.87	
0.77				
Br Sel Method	Energy only	Power Total (lb/ft s)	6.17	
5.20				

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.077

INPUT
Description:
Station Elevation Data num= 32

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9869.05	1440.89	9886.83	1441.2	9906.08	1441.52	9909.83	1440.82	9910.29	1440.5
9914.14	1439.64	9926.65	1436.669	9928.29	1436.28	9935.97	1434.45	9938.38	1434.15
9951.64	1427.38	9953.72	1426.35	9954.33	1426.05	9961.13	1426.19	9993.5	1427.03
10002.03	1426.93	10009.21	1426.69	10050.61	1425.98	10066.28	1433.80	10067.75	1434.54
10067.81	1434.56	10067.92	1434.59	10069.47	1434.74	10073.12	1435.06	10080.11	1435.68
10081.32	1436.03	10095.02	1440.34	10096.51	1440.39	10100.95	1440.79	10107.78	1441.57
10112.96	1441.57	10126.8	1441.48						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9869.05	.046	9926.65	.031	10067.75	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9926.65	10067.75	191.26	194.71	199.64	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1431.89	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.65	Wt. n-Val.		0.031
W.S. Elev (ft)	1431.24	Reach Len. (ft)	191.26	194.71
199.64				
Crit W.S. (ft)	1429.70	Flow Area (sq ft)		509.96
E.G. Slope (ft/ft)	0.002635	Area (sq ft)		509.96
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	117.05	Top Width (ft)		117.05
Vel Total (ft/s)	6.47	Avg. Vel. (ft/s)		6.47
Max Chl Dpth (ft)	5.26	Hydr. Depth (ft)		4.36
Conv. Total (cfs)	64291.6	Conv. (cfs)		64291.6
Length Wtd. (ft)	194.71	Wetted Per. (ft)		119.55
Min Ch El (ft)	1425.98	Shear (lb/sq ft)		0.70
Alpha	1.00	Stream Power (lb/ft s)		4.54

Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	8.37	13.38
C & E Loss (ft)	0.09	Cum SA (acres)	2.79	3.59

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1431.89	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.65	Wt. n-Val.		0.031
W.S. Elev (ft)	1431.24	Reach Len. (ft)	191.26	194.71
199.64				
Crit W.S. (ft)	1429.70	Flow Area (sq ft)		509.79
E.G. Slope (ft/ft)	0.002637	Area (sq ft)		509.79
Q Total (cfs)	3300.00	Flow (cfs)		3300.00
Top Width (ft)	117.04	Top Width (ft)		117.04
Vel Total (ft/s)	6.47	Avg. Vel. (ft/s)		6.47
Max Chl Dpth (ft)	5.26	Hydr. Depth (ft)		4.36
Conv. Total (cfs)	64257.9	Conv. (cfs)		64257.9
Length Wtd. (ft)	194.71	Wetted Per. (ft)		119.54
Min Ch El (ft)	1425.98	Shear (lb/sq ft)		0.70
Alpha	1.00	Stream Power (lb/ft s)		4.55
Frctn Loss (ft)	0.92	Cum Volume (acre-ft)	0.98	13.56
C & E Loss (ft)	0.09	Cum SA (acres)	0.37	3.32

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.040

INPUT
Description:
Station Elevation Data num= 84

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9562.36	1429.64	9568.42	1429.47	9601.28	1428.72	9622.07	1428.16	9631.44	1428.1
9639.42	1427.66	9657.61	1427.5	9667.36	1427.63	9676.82	1427.51	9679.48	1426.94
9694.49	1424.74	9696.06	1424.44	9696.41	1424.48	9697.92	1424.64	9709.05	1425.29
9721.09	1427.1	9729.29	1426.57	9749.35	1425.31	9756.14	1424.92	9766.88	1424.33
9780.38	1422.91	9785.33	1422.36	9787.29	1422.4	9796.44	1422.39	9807.95	1422.43
9813.43	1422.39	9819.47	1421.96	9832.97	1421.41	9837.36	1421.48	9843.58	1422.4
9852.83	1423.57	9860.2	1423.39	9865.12	1423.71	9872.63	1422.97	9884.06	1421.73
9886.21	1421.61	9887.65	1421.62	9895.1	1421.69	9898	1422.5	9914.73	1426.2
9923.07	1428.93	9929.31	1431.54	9930.41	1432	9933.32	1431.76	9937.4	1431.42
9942.86	1431.05	9953.21	1426.41	9954.85	1425.56	9959.09	1425.85	9964.96	1426.09
9985.11	1426.12	9986.16	1426.09	9986.86	1426.1	9994.57	1426.11	9996.17	1426.13
10019.2	1426.09	10019.3	1426.09	10019.64	1426.09	10029.38	1426.07	10050.23	1426.04
10050.64	1426.02	10052.58	1425.9	10057.3	1425.62	10058.95	1426.38	10069.45	1431.18
10071.62	1432.18	10072.84	1432.18	10073.94	1432.19	10079.11	1432.38	10080.85	1433.02
10084	1434.18	10089.5	1436.44	10094.02	1438.4	10097.05	1437.86	10101.27	1437.12
10108.65	1438.33	10112.32	1438.96	10113.32	1438.91	10131.42	1438.83	10137.08	1438.88
10140.47	1438.99	10166.86	1439.15	10172.08	1439.06	10174.55	1438.98		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9562.36	.046	9930.41	.031	10072.84	.033

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9930.41	10072.84	113.81	113.4	113.53	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
9562.36	9931.71		F

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1430.88	Element	Left OB	Channel
Right OB				
Vel Head (ft)	1.53	Wt. n-Val.		0.031
W.S. Elev (ft)	1429.35	Reach Len. (ft)	113.81	113.40
113.53				
Crit W.S. (ft)	1429.35	Flow Area (sq ft)		368.42
E.G. Slope (ft/ft)	0.009677	Area (sq ft)	1441.41	368.42

Q Total (cfs)	3660.00	Flow (cfs)		3660.00
Top Width (ft)	469.21	Top Width (ft)	350.41	118.80
Vel Total (ft/s)	9.93	Avg. Vel. (ft/s)		9.93
Max Chl Dpth (ft)	7.94	Hydr. Depth (ft)		3.10
Conv. Total (cfs)	37205.2	Conv. (cfs)		37205.2
Length Wtd. (ft)	113.41	Wetted Per. (ft)		120.47
Min Ch El (ft)	1425.56	Shear (lb/sq ft)		1.85
Alpha	1.00	Stream Power (lb/ft s)		18.35
Frctn Loss (ft)	0.72	Cum Volume (acre-ft)	5.20	11.42
C & E Loss (ft)	0.22	Cum SA (acres)	2.02	3.06

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

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1430.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.53	Wt. n-Val.		0.031	
W.S. Elev (ft)	1429.35	Reach Len. (ft)	113.81	113.40	113.53
Crit W.S. (ft)	1429.35	Flow Area (sq ft)		368.74	
E.G. Slope (ft/ft)	0.009651	Area (sq ft)		368.74	
Q Total (cfs)	3660.00	Flow (cfs)		3660.00	
Top Width (ft)	118.81	Top Width (ft)		118.81	
Vel Total (ft/s)	9.93	Avg. Vel. (ft/s)		9.93	
Max Chl Dpth (ft)	3.79	Hydr. Depth (ft)		3.10	
Conv. Total (cfs)	37256.0	Conv. (cfs)		37256.0	
Length Wtd. (ft)	113.40	Wetted Per. (ft)		120.49	
Min Ch El (ft)	1425.56	Shear (lb/sq ft)		1.84	
Alpha	1.00	Stream Power (lb/ft s)		18.30	
Frctn Loss (ft)	0.55	Cum Volume (acre-ft)	0.98	11.59	
C & E Loss (ft)	0.26	Cum SA (acres)	0.37	2.79	

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

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 23.019

INPUT
Description:
Station Elevation Data num= 65

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9568.04	1428.12	9591.03	1427.91	9596.19	1427.87	9619.84	1427.64	9621.43	1427.71
9623.37	1427.69	9631.58	1427.04	9639.04	1426.96	9642.74	1426.95	9650.46	1427.46
9658.76	1427.41	9665.69	1427.97	9674.85	1428.35	9680.87	1428.08	9697.72	1427.13
9705.86	1426.77	9725.05	1424.36	9732	1423.69	9738.72	1423.55	9752.8	1424.13
9755.62	1424.18	9765.07	1425.31	9774.01	1423.74	9782.71	1422.05	9790.38	1422.15
9804.14	1422.17	9810.06	1421.81	9816.03	1421.86	9839.06	1421.64	9847.25	1421.41
9853.33	1421.58	9871.82	1421.33	9875.26	1421.19	9878.92	1420.77	9889.25	1420.98
9903.07	1421.16	9911.87	1420.98	9928.18	1420.99	9933.48	1420.142	9933.74	1420.1
9934.28	1420.09	9946.85	1419.83	9953.81	1419.65	9962.66	1419.37	9978.14	1419.71
10005.8	1419.34	10035.21	1419.24	10046.84	1419.14	10054.59	1419.24	10058.1	1419.49

```
10064.76  1422.410073.59    1426 10077.2    142810081.78 1430.0810084.551431.345
10085.35 1431.7110088.02 1431.4110091.56 1431.0110095.77 1430.7710110.27 1433.86
10125.11 1436.5610125.89 1436.6910133.04 1437.07 10148.1 1437.4510160.58 1437.55

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9568.04    .046 9933.48    .03110084.55    .033

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9933.4810084.55           145.92  146.58  148.45             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
 9568.04 9900.46               F

CROSS SECTION OUTPUT  Profile #WS F-Plain

  E.G. Elev (ft)           1423.87    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.79    Wt. n-Val.                  0.046      0.031
  W.S. Elev (ft)           1423.08    Reach Len. (ft)           145.92     146.58
148.45
  Crit W.S. (ft)           1422.40    Flow Area (sq ft)          70.25     464.28
  E.G. Slope (ft/ft)      0.004465    Area (sq ft)              249.56     464.28
  Q Total (cfs)            3660.00    Flow (cfs)                250.44    3409.56
  Top Width (ft)            289.02    Top Width (ft)            156.07     132.95
  Vel Total (ft/s)            6.85    Avg. Vel. (ft/s)            3.57       7.34
  Max Chl Dpth (ft)           3.94    Hydr. Depth (ft)            2.13       3.49
  Conv. Total (cfs)        54775.1    Conv. (cfs)               3748.0    51027.1
  Length Wtd. (ft)          146.46    Wetted Per. (ft)           33.09     133.72
  Min Ch El (ft)           1419.14    Shear (lb/sq ft)            0.59       0.97
  Alpha                       1.09    Stream Power (lb/ft s)      2.11       7.11
  Frctn Loss (ft)             0.59    Cum Volume (acre-ft)        2.99      10.33
  C & E Loss (ft)             0.09    Cum SA (acres)              1.36       2.73


CROSS SECTION OUTPUT  Profile #WS F-Way

  E.G. Elev (ft)           1424.46    Element                    Left OB    Channel
Right OB
  Vel Head (ft)               0.66    Wt. n-Val.                             0.031
  W.S. Elev (ft)           1423.80    Reach Len. (ft)           145.92     146.58
148.45
  Crit W.S. (ft)           1422.45    Flow Area (sq ft)                    560.25
  E.G. Slope (ft/ft)      0.002903    Area (sq ft)                         560.25
  Q Total (cfs)            3660.00    Flow (cfs)                          3660.00
  Top Width (ft)            134.71    Top Width (ft)                       134.71
  Vel Total (ft/s)            6.53    Avg. Vel. (ft/s)                       6.53
  Max Chl Dpth (ft)           4.66    Hydr. Depth (ft)                       4.16
  Conv. Total (cfs)        67924.5    Conv. (cfs)                         67924.5
  Length Wtd. (ft)          146.54    Wetted Per. (ft)                     139.27
  Min Ch El (ft)           1419.14    Shear (lb/sq ft)                       0.73
  Alpha                       1.00    Stream Power (lb/ft s)                 4.76
  Frctn Loss (ft)             0.44    Cum Volume (acre-ft)        0.98      10.39
  C & E Loss (ft)             0.02    Cum SA (acres)              0.37       2.46


CROSS SECTION


RIVER: Cave Creek
REACH: 1                  RS: 22.991

INPUT
Description:
Station Elevation Data    num=      89
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9399.17 1429.25 9402.53 1429.32 9407.74 1429.55  9416.3 1429.27 9420.06 1429.25
 9427.78 1429.31 9435.48 1429.17  9442.4 1429.22 9446.45 1429.46 9461.36 1429.71
 9462.85  1429.8 9464.22  1429.7 9466.83 1429.52 9475.87 1428.88 9480.49 1428.63
 9499.09 1429.68 9511.27 1429.88 9514.93 1430.08 9516.22 1430.09 9536.53 1430.25
 9552.55 1429.62 9557.85  1428.7 9565.33 1427.31 9570.38 1426.63 9579.04 1425.74
  9579.9 1425.87 9580.52 1425.91 9588.38  1426.8 9591.49 1426.82 9604.01 1427.51
  9608.6 1427.41 9611.96 1427.38 9636.35 1426.52 9646.95 1426.61 9649.85 1426.63
 9657.98 1426.34 9661.99 1426.19 9665.75 1426.06 9673.89 1425.01 9679.31 1423.84
 9684.84 1423.68 9696.35  1425.2    9721 1428.45 9721.02 1428.45 9731.63 1428.17
 9746.45 1429.52 9749.25 1429.54 9764.41 1429.49 9776.07 1426.83 9784.23 1425.27
 9789.39 1423.77 9801.25  1422.7 9813.76 1421.74 9818.72 1421.41 9827.61 1420.88
 9852.99 1418.95 9858.98 1418.35  9871.7 1419.17 9883.48 1419.95  9903.6  1420.7
 9903.68  1420.7 9903.83 1420.71 9914.77  1421.3  9924.1 1421.04 9934.39 1420.01
 9935.091419.985 9935.49 1419.97 9962.29  1419.1 9996.13 1419.0510035.13 1419.37
10037.54 1419.4110038.65  1419.610040.54 1419.7410049.63 1420.6110054.14 1420.33
10058.37 1420.1510060.23 1421.0110076.32 1428.48 10092.4 1434.5310096.931436.101
10097.33 1436.2410101.29 1437.6110107.61 1436.1610113.47 1434.9510140.67 1435.69
10140.91  1435.710141.95 1435.7210166.33 1436.2110172.06 1436.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 9399.17    .046 9935.09    .03110096.93    .033

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9935.0910096.93           567.47  585.91  486.17             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
 9399.17    9764               F
```

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1423.19	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.48	Wt. n-Val.	0.046	0.031
W.S. Elev (ft)	1422.71	Reach Len. (ft)	567.47	585.91
486.17				
Crit W.S. (ft)	1421.85	Flow Area (sq ft)	314.70	414.21
E.G. Slope (ft/ft)	0.003595	Area (sq ft)	314.70	414.21
Q Total (cfs)	3660.00	Flow (cfs)	1075.29	2584.71
Top Width (ft)	262.81	Top Width (ft)	134.00	128.81
Vel Total (ft/s)	5.02	Avg. Vel. (ft/s)	3.42	6.24
Max Chl Dpth (ft)	4.36	Hydr. Depth (ft)	2.35	3.22
Conv. Total (cfs)	61041.9	Conv. (cfs)	17933.8	43108.1
Length Wtd. (ft)	583.75	Wetted Per. (ft)	134.30	129.47
Min Ch El (ft)	1419.05	Shear (lb/sq ft)	0.53	0.72
Alpha	1.23	Stream Power (lb/ft s)	1.80	4.48
Frctn Loss (ft)	2.56	Cum Volume (acre-ft)	2.05	8.85
C & E Loss (ft)	0.01	Cum SA (acres)	0.87	2.29

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1424.01	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.60	Wt. n-Val.	0.046	0.031
W.S. Elev (ft)	1423.41	Reach Len. (ft)	567.47	585.91
486.17				
Crit W.S. (ft)	1422.33	Flow Area (sq ft)	119.96	503.64
E.G. Slope (ft/ft)	0.003046	Area (sq ft)	119.96	503.64
Q Total (cfs)	3660.00	Flow (cfs)	391.82	3268.18
Top Width (ft)	175.39	Top Width (ft)	45.09	130.30
Vel Total (ft/s)	5.87	Avg. Vel. (ft/s)	3.27	6.49
Max Chl Dpth (ft)	4.35	Hydr. Depth (ft)	2.66	3.87
Conv. Total (cfs)	66312.5	Conv. (cfs)	7099.1	59213.5
Length Wtd. (ft)	585.12	Wetted Per. (ft)	48.38	131.11
Min Ch El (ft)	1419.05	Shear (lb/sq ft)	0.47	0.73
Alpha	1.12	Stream Power (lb/ft s)	1.54	4.74
Frctn Loss (ft)	2.68	Cum Volume (acre-ft)	0.78	8.60
C & E Loss (ft)	0.02	Cum SA (acres)	0.29	2.01

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Cave Creek
REACH: 1 RS: 22.880

INPUT
Description: This section is from HEC-2 FIS model.
Station Elevation Data num= 34

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9791	1427.3	9807	1427	9815	1426.5	9827	1424.8	9838	1424.6
9863	1424.8	9883	1424.8	9903	1424.5	9917	1424.7	9927	1426.4
9934	1423.9	9947	1421.4	9958	1418.5	9968	1416.1	9984	1415
9999	1414	10000	1414.3	10012	1414.5	10024	1415.2	10048	1416.1
10067	1416.5	10101	1416.4	10125	1416.2	10143	1415.5	10152	1413.2
10156	1413	10160	1414.8	10167	1424.2	10188	1426.6	10200	1428.4
10214	1430.9	10230	1433.5	10241	1433.8	10248	1433.5		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9791	.045	9927	.045	10167	.045

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
9927	10167	0	0	0	.1	.3

CROSS SECTION OUTPUT Profile #WS F-Plain

E.G. Elev (ft)	1420.63	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.58	Wt. n-Val.		0.045
W.S. Elev (ft)	1420.05	Reach Len. (ft)		
Crit W.S. (ft)	1418.49	Flow Area (sq ft)		902.23
E.G. Slope (ft/ft)	0.005059	Area (sq ft)		902.23
Q Total (cfs)	5500.00	Flow (cfs)		5500.00
Top Width (ft)	211.79	Top Width (ft)		211.79
Vel Total (ft/s)	6.10	Avg. Vel. (ft/s)		6.10
Max Chl Dpth (ft)	7.05	Hydr. Depth (ft)		4.26
Conv. Total (cfs)	77326.4	Conv. (cfs)		77326.4
Length Wtd. (ft)		Wetted Per. (ft)		215.76
Min Ch El (ft)	1413.00	Shear (lb/sq ft)		1.32
Alpha	1.00	Stream Power (lb/ft s)		8.05
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

CROSS SECTION OUTPUT Profile #WS F-Way

E.G. Elev (ft)	1421.31	Element	Left OB	Channel
Right OB				
Vel Head (ft)	0.78	Wt. n-Val.		0.045
W.S. Elev (ft)	1420.53	Reach Len. (ft)		
Crit W.S. (ft)	1419.10	Flow Area (sq ft)		774.47
E.G. Slope (ft/ft)	0.006325	Area (sq ft)		774.47
Q Total (cfs)	5500.00	Flow (cfs)		5500.00
Top Width (ft)	169.00	Top Width (ft)		169.00
Vel Total (ft/s)	7.10	Avg. Vel. (ft/s)		7.10
Max Chl Dpth (ft)	6.53	Hydr. Depth (ft)		4.58
Conv. Total (cfs)	69156.7	Conv. (cfs)		69156.7
Length Wtd. (ft)		Wetted Per. (ft)		174.16
Min Ch El (ft)	1414.00	Shear (lb/sq ft)		1.76
Alpha	1.00	Stream Power (lb/ft s)		12.47
Frctn Loss (ft)		Cum Volume (acre-ft)		
C & E Loss (ft)		Cum SA (acres)		

Warning: The cross section had to be extended vertically during the critical depth calculations.

SUMMARY OF MANNING'S N VALUES

River:Cave Creek

Reach	River Sta.	n1	n2	n3
1	25.561	.035	.035	.035
1	25.557	.015	.015	.015
1	25.551	.015	.015	.015
1	25.528	.015	.015	.015
1	25.515	.045	.034	.052
1	25.482	.045	.034	.052
1	25.428	.045	.034	.052
1	25.367	.045	.034	.052
1	25.299	.045	.034	.052
1	25.271	.045	.034	.052
1	25.210	.045	.034	.052
1	25.191	.045	.034	.052
1	25.155	.045	.034	.052
1	25.096	.045	.034	.052
1	25.039	.045	.034	.052
1	24.953	.045	.034	.052
1	24.872	.045	.034	.052
1	24.828	.045	.034	.052
1	24.793	.045	.034	.052
1	24.732	.045	.034	.052
1	24.700	.045	.034	.052
1	24.673	.045	.034	.052
1	24.632	.045	.034	.052
1	24.617	.053	.043	.046
1	24.587	.053	.043	.046
1	24.549	.053	.043	.046
1	24.504	.053	.043	.046
1	24.466	.033	.043	.046
1	24.427	.033	.043	.046
1	24.343	.033	.043	.046
1	24.300	.033	.043	.046
1	24.264	.033	.042	.047
1	24.232	.033	.042	.047
1	24.210	.033	.042	.047
1	24.169	.033	.042	.047
1	24.112	.033	.042	.047
1	24.068	.033	.042	.047
1	24.062	Bridge		
1	24.057	.058	.042	.067
1	23.963	.058	.038	.067
1	23.883	.037	.044	.037
1	23.822	.037	.044	.037
1	23.787	.037	.044	.037
1	23.756	.037	.044	.037
1	23.662	.037	.044	.037
1	23.567	.037	.044	.037
1	23.488	.037	.044	.037
1	23.389	.037	.044	.037
1	23.307	.037	.044	.037
1	23.223	.037	.044	.037
1	23.204	.037	.044	.037
1	23.192	.037	.044	.037
1	23.150	.046	.031	.033
1	23.146	Bridge		
1	23.142	.046	.031	.033
1	23.138	.046	.031	.033
1	23.134	Bridge		
1	23.131	.046	.031	.033
1	23.128	.046	.031	.033
1	23.114	Bridge		
1	23.101	.046	.031	.033

1	23.097	.046	.031	.033
1	23.093	Bridge		
1	23.090	.046	.031	.033
1	23.084	.046	.031	.033
1	23.081	Bridge		
1	23.077	.046	.031	.033
1	23.040	.046	.031	.033
1	23.019	.046	.031	.033
1	22.991	.046	.031	.033
1	22.880	.045	.045	.045

SUMMARY OF REACH LENGTHS

River: Cave Creek

Reach	River Sta.	Left	Channel	Right
1	25.561	20	21	20
1	25.557	32	32	32
1	25.551	90	90	90
1	25.528	73.24	71.35	71.6
1	25.515	191.46	175.62	180.95
1	25.482	195.18	281.41	364.01
1	25.428	392.71	323.27	226.87
1	25.367	360.24	356.69	344.55
1	25.299	190.47	149.34	83.92
1	25.271	284.05	324.05	255.38
1	25.210	104.14	97.5	87.55
1	25.191	224.15	192.91	153.88
1	25.155	320.2	308.35	276.99
1	25.096	311.06	304.96	290.64
1	25.039	448.57	452	453.23
1	24.953	421.96	427.96	410.54
1	24.872	231.92	230.65	232.63
1	24.828	188.99	188.4	195.18
1	24.793	370.62	321.53	190.15
1	24.732	120.58	169.1	229.97
1	24.700	121.64	140.95	164.92
1	24.673	153.22	217.5	200.24
1	24.632	77.22	77.5	103.32
1	24.617	195.74	158.78	145.31
1	24.587	279.2	199.12	98.46
1	24.549	237.02	236.9	184.43
1	24.504	200.96	205.24	210.33
1	24.466	139.86	206.28	254.16
1	24.427	422.06	440.98	388.41
1	24.343	239.12	226.51	216.51
1	24.300	255.26	190.58	121.86
1	24.264	70.64	169.22	186.13
1	24.232	119.69	115.9	115.89
1	24.210	199.99	214.34	212.37
1	24.169	296.65	301.29	297.76
1	24.112	279.21	236.46	183.86
1	24.068	53.71	53.62	54.97
1	24.062	Bridge		
1	24.057	436.59	500.04	566.57
1	23.963	414.65	418.62	423.5
1	23.883	312.31	324.13	335.74
1	23.822	179.46	183.6	187.59
1	23.787	163.55	167.37	171.81
1	23.756	472.08	491.75	516.19
1	23.662	488.55	506.22	524.07
1	23.567	364.79	413.25	457.39
1	23.488	572.19	525.53	478.28
1	23.389	435.84	432.27	432.69
1	23.307	445.15	443.61	446.39
1	23.223	98.72	98.01	99.35
1	23.204	54.05	62.75	73.74
1	23.192	220.85	226.32	232.25
1	23.150	38.5	39.21	39.72
1	23.146	Bridge		
1	23.142	19.27	20.66	21.8
1	23.138	39.83	39.87	39.79
1	23.134	Bridge		
1	23.131	18.51	12.04	6.61
1	23.128	146.88	146.66	147.17
1	23.114	Bridge		
1	23.101	31.66	20.81	10.83
1	23.097	33.75	34.38	34.91
1	23.093	Bridge		
1	23.090	26.09	30.2	34.11
1	23.084	38.02	38.84	39.72
1	23.081	Bridge		
1	23.077	191.26	194.71	199.64
1	23.040	113.81	113.4	113.53
1	23.019	145.92	146.58	148.45
1	22.991	567.47	585.91	486.17
1	22.880	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Cave Creek

Reach	River Sta.	Contr.	Expan.
1	25.561	.3	.5
1	25.557	.3	.5
1	25.551	.3	.5
1	25.528	.1	.3
1	25.515	.1	.3
1	25.482	.1	.3
1	25.428	.1	.3
1	25.367	.1	.3
1	25.299	.1	.3
1	25.271	.1	.3
1	25.210	.1	.3
1	25.191	.1	.3
1	25.155	.1	.3
1	25.096	.1	.3
1	25.039	.1	.3
1	24.953	.1	.3
1	24.872	.1	.3
1	24.828	.1	.3
1	24.793	.1	.3
1	24.732	.1	.3
1	24.700	.1	.3
1	24.673	.1	.3
1	24.632	.1	.3
1	24.617	.1	.3
1	24.587	.1	.3
1	24.549	.1	.3
1	24.504	.1	.3
1	24.466	.1	.3
1	24.427	.1	.3
1	24.343	.1	.3
1	24.300	.1	.3
1	24.264	.1	.3
1	24.232	.1	.3
1	24.210	.1	.3
1	24.169	.1	.3
1	24.112	.3	.5
1	24.068	.3	.5
1	24.062	Bridge	
1	24.057	.3	.5
1	23.963	.1	.3
1	23.883	.1	.3
1	23.822	.1	.3
1	23.787	.1	.3
1	23.756	.1	.3
1	23.662	.1	.3
1	23.567	.1	.3
1	23.488	.1	.3
1	23.389	.1	.3
1	23.307	.1	.3
1	23.223	.1	.3
1	23.204	.1	.3
1	23.192	.1	.3
1	23.150	.1	.3
1	23.146	Bridge	
1	23.142	.1	.3
1	23.138	.1	.3
1	23.134	Bridge	
1	23.131	.1	.3
1	23.128	.1	.3
1	23.114	Bridge	
1	23.101	.1	.3
1	23.097	.1	.3
1	23.093	Bridge	
1	23.090	.1	.3
1	23.084	.1	.3
1	23.081	Bridge	
1	23.077	.1	.3
1	23.040	.1	.3
1	23.019	.1	.3
1	22.991	.1	.3
1	22.880	.1	.3

Profile Output Table - Encroachment 3

Reach	River Sta	Profile	Top Wdth Act	Area	Vel Total	W.S. Elev	Base WS	Prof Delta WS
			(ft)	(sq ft)	(ft/s)	(ft)	(ft)	(ft)
1	25.561	WS F-Plain	115.34	768.85	6.37	1513.88	1513.88	
1	25.561	WS F-Way	99.04	698.63	7.01	1513.71	1513.88	-0.17
1	25.557	WS F-Plain	77.65	387.59	12.64	1511.43	1511.43	

1		25.557	WS	F-Way	77.65	387.59	12.64	
1511.43	1511.43		0.00					
1		25.551	WS	F-Plain	73.11	379.33	12.92	
1510.77	1510.77							
1		25.551	WS	F-Way	73.11	379.33	12.92	
1510.77	1510.77		0.00					
1		25.528	WS	F-Plain	72.00	264.66	10.88	
1509.45	1509.45							
1		25.528	WS	F-Way	72.00	264.66	10.88	
1509.45	1509.45		0.00					
1		25.515	WS	F-Plain	91.98	881.86	4.29	
1504.78	1504.78							
1		25.515	WS	F-Way	91.47	671.56	4.29	
1504.81	1504.78		0.04					
1		25.482	WS	F-Plain	70.51	8212.32	9.42	
1503.30	1503.30							
1		25.482	WS	F-Way	70.53	305.90	9.41	
1503.30	1503.30		0.00					
1		25.428	WS	F-Plain	60.03	12792.74	9.90	
1501.25	1501.25							
1		25.428	WS	F-Way	62.81	324.45	8.88	
1501.79	1501.25		0.55					
1		25.367	WS	F-Plain	72.47	22511.33	7.53	
1500.05	1500.05							
1		25.367	WS	F-Way	59.90	326.24	8.83	
1500.08	1500.05		0.03					
1		25.299	WS	F-Plain	55.16	23559.87	11.93	
1496.60	1496.60							
1		25.299	WS	F-Way	55.22	242.69	11.87	
1496.62	1496.60		0.02					
1		25.271	WS	F-Plain	302.37	23093.03	2.16	
1495.13	1495.13							
1		25.271	WS	F-Way	223.64	1149.32	2.51	
1495.99	1495.13		0.85					
1		25.210	WS	F-Plain	267.26	18607.73	2.37	
1494.94	1494.94							
1		25.210	WS	F-Way	195.31	1041.86	2.76	
1495.77	1494.94		0.82					
1		25.191	WS	F-Plain	264.84	15367.99	3.55	
1494.61	1494.61							
1		25.191	WS	F-Way	94.26	505.78	5.69	
1495.17	1494.61		0.56					
1		25.155	WS	F-Plain	122.06	9907.23	6.63	
1493.46	1493.46							
1		25.155	WS	F-Way	77.97	409.56	7.03	
1494.27	1493.46		0.81					
1		25.096	WS	F-Plain	165.57	7532.28	4.94	
1492.57	1492.57							
1		25.096	WS	F-Way	83.58	450.75	6.39	
1493.35	1492.57		0.78					
1		25.039	WS	F-Plain	93.80	4647.33	8.98	
1489.75	1489.75							
1		25.039	WS	F-Way	59.25	262.81	10.96	
1490.10	1489.75		0.35					
1		24.953	WS	F-Plain	111.95	10035.63	5.54	
1487.08	1487.08							
1		24.953	WS	F-Way	71.33	441.49	6.52	
1487.73	1487.08		0.65					
1		24.872	WS	F-Plain	131.64	9751.60	6.62	
1485.37	1485.37							
1		24.872	WS	F-Way	50.10	368.12	7.82	
1486.22	1485.37		0.85					
1		24.828	WS	F-Plain	57.79	9467.24	11.03	
1482.89	1482.89							
1		24.828	WS	F-Way	40.05	222.74	12.93	
1483.11	1482.89		0.22					
1		24.793	WS	F-Plain	70.68	6669.76	10.46	
1481.20	1481.20							
1		24.793	WS	F-Way	46.37	228.69	12.59	
1481.27	1481.20		0.07					
1		24.732	WS	F-Plain	90.41	2474.36	8.36	
1479.10	1479.10							
1		24.732	WS	F-Way	69.25	325.76	8.84	
1479.37	1479.10		0.27					

1		24.700		WS	F-Plain	81.83	819.23	10.12
1477.25	1477.25							
1		24.700		WS	F-Way	62.74	283.04	10.18
1477.80	1477.25		0.55					
1		24.673		WS	F-Plain	191.51	975.54	3.70
1477.44	1477.44							
1		24.673		WS	F-Way	102.88	670.17	4.61
1478.23	1477.44		0.79					
1		24.632		WS	F-Plain	52.94	259.69	11.90
1474.39	1474.39							
1		24.632		WS	F-Way	40.33	229.29	13.48
1474.86	1474.39		0.47					
1		24.617		WS	F-Plain	126.41	646.58	8.72
1471.71	1471.71							
1		24.617		WS	F-Way	62.29	264.76	11.67
1472.51	1471.71		0.80					
1		24.587		WS	F-Plain	260.29	896.52	5.07
1469.03	1469.03							
1		24.587		WS	F-Way	150.91	396.81	7.79
1469.48	1469.03		0.45					
1		24.549		WS	F-Plain	295.44	1135.84	3.15
1468.44	1468.44							
1		24.549		WS	F-Way	240.64	829.39	3.73
1468.65	1468.44		0.21					
1		24.504		WS	F-Plain	132.93	386.54	8.54
1466.24	1466.24							
1		24.504		WS	F-Way	109.80	428.90	7.69
1466.86	1466.24		0.62					
1		24.466		WS	F-Plain	218.55	587.10	5.62
1465.00	1465.00							
1		24.466		WS	F-Way	155.31	474.19	6.96
1465.29	1465.00		0.29					
1		24.427		WS	F-Plain	252.34	847.63	3.89
1464.37	1464.37							
1		24.427		WS	F-Way	149.59	655.15	5.04
1464.57	1464.37		0.20					
1		24.343		WS	F-Plain	258.16	942.65	3.50
1463.53	1463.53							
1		24.343		WS	F-Way	197.01	825.01	4.00
1463.57	1463.53		0.05					
1		24.300		WS	F-Plain	328.89	1833.67	1.80
1463.50	1463.50							
1		24.300		WS	F-Way	261.14	1587.48	2.08
1463.55	1463.50		0.04					
1		24.264		WS	F-Plain	257.15	1526.71	2.16
1463.42	1463.42							
1		24.264		WS	F-Way	215.10	1366.56	2.41
1463.45	1463.42		0.03					
1		24.232		WS	F-Plain	105.99	538.40	6.13
1462.72	1462.72							
1		24.232		WS	F-Way	94.13	531.29	6.21
1462.74	1462.72		0.02					
1		24.210		WS	F-Plain	189.21	1263.30	2.61
1462.95	1462.95							
1		24.210		WS	F-Way	166.50	1219.60	2.71
1462.97	1462.95		0.02					
1		24.169		WS	F-Plain	175.01	1206.96	2.73
1462.85	1462.85							
1		24.169		WS	F-Way	151.56	1162.65	2.84
1462.86	1462.85		0.01					
1		24.112		WS	F-Plain	171.47	1360.86	2.42
1462.77	1462.77							
1		24.112		WS	F-Way	150.20	1310.77	2.52
1462.77	1462.77		0.00					
1		24.068		WS	F-Plain	71.63	497.91	6.63
1461.85	1461.85							
1		24.068		WS	F-Way	71.63	497.92	6.63
1461.85	1461.85		0.00					
1		24.062	BR U	WS	F-Plain	69.63	474.94	6.95
1461.72	1461.72							
1		24.062	BR U	WS	F-Way	69.63	474.95	6.95
1461.72	1461.72		0.00					
1		24.062	BR D	WS	F-Plain	69.63	450.09	7.33
1461.25	1461.25							
1		24.062	BR D	WS	F-Way	69.63	450.09	7.33
1461.25	1461.25		0.00					

1	24.057		WS	F-Plain	71.63	465.68	7.09	
1461.28	1461.28							
1	24.057		WS	F-Way	71.63	465.68	7.09	
1461.28	1461.28		0.00					
1	23.963		WS	F-Plain	79.65	493.96	6.68	
1459.68	1459.68							
1	23.963		WS	F-Way	79.65	493.96	6.68	
1459.68	1459.68		0.00					
1	23.883		WS	F-Plain	64.21	419.56	7.87	
1457.90	1457.90							
1	23.883		WS	F-Way	64.21	419.56	7.87	
1457.90	1457.90		0.00					
1	23.822		WS	F-Plain	60.33	346.38	9.53	
1455.38	1455.38							
1	23.822		WS	F-Way	60.33	346.38	9.53	
1455.38	1455.38		0.00					
1	23.787		WS	F-Plain	112.17	687.82	4.80	
1455.49	1455.49							
1	23.787		WS	F-Way	112.17	687.82	4.80	
1455.49	1455.49		0.00					
1	23.756		WS	F-Plain	81.66	506.31	6.52	
1454.74	1454.74							
1	23.756		WS	F-Way	81.66	506.31	6.52	
1454.74	1454.74		0.00					
1	23.662		WS	F-Plain	62.52	394.18	8.37	
1452.11	1452.11							
1	23.662		WS	F-Way	62.52	394.18	8.37	
1452.11	1452.11		0.00					
1	23.567		WS	F-Plain	66.72	427.41	7.72	
1449.58	1449.58							
1	23.567		WS	F-Way	66.72	427.41	7.72	
1449.58	1449.58		0.00					
1	23.488		WS	F-Plain	67.87	450.61	7.32	
1447.83	1447.83							
1	23.488		WS	F-Way	67.87	450.61	7.32	
1447.83	1447.83		0.00					
1	23.389		WS	F-Plain	61.66	393.27	8.39	
1445.02	1445.02							
1	23.389		WS	F-Way	61.66	393.30	8.39	
1445.02	1445.02		0.00					
1	23.307		WS	F-Plain	63.61	404.47	8.16	
1442.67	1442.67							
1	23.307		WS	F-Way	63.62	404.59	8.16	
1442.67	1442.67		0.00					
1	23.223		WS	F-Plain	63.21	423.61	7.79	
1440.52	1440.52							
1	23.223		WS	F-Way	63.23	424.06	7.78	
1440.53	1440.52		0.01					
1	23.204		WS	F-Plain	54.06	264.13	12.49	
1438.07	1438.07							
1	23.204		WS	F-Way	53.96	262.74	12.56	
1438.04	1438.07		-0.03					
1	23.192		WS	F-Plain	58.04	269.56	12.24	
1435.57	1435.57							
1	23.192		WS	F-Way	58.04	269.56	12.24	
1435.57	1435.57		0.00					
1	23.150		WS	F-Plain	111.89	489.40	6.74	
1434.09	1434.09							
1	23.150		WS	F-Way	111.89	489.38	6.74	
1434.09	1434.09		0.00					
1	23.146	BR U	WS	F-Plain	107.54	456.35	7.23	
1433.94	1433.94							
1	23.146	BR U	WS	F-Way	107.54	456.32	7.23	
1433.94	1433.94		0.00					
1	23.146	BR D	WS	F-Plain	105.05	426.07	7.75	
1432.96	1432.96							
1	23.146	BR D	WS	F-Way	105.04	426.05	7.75	
1432.96	1432.96		0.00					
1	23.142		WS	F-Plain	109.12	453.10	7.28	
1433.06	1433.06							
1	23.142		WS	F-Way	109.12	453.07	7.28	
1433.06	1433.06		0.00					
1	23.138		WS	F-Plain	106.91	467.33	7.06	
1433.02	1433.02							

1		23.138		WS	F-Way	106.91	467.30	7.06
1433.02	1433.02			0.00				
1		23.134	BR U	WS	F-Plain	101.84	425.78	7.75
1432.82	1432.82							
1		23.134	BR U	WS	F-Way	101.84	425.74	7.75
1432.82	1432.82			0.00				
1		23.134	BR D	WS	F-Plain	108.38	417.62	7.90
1432.24	1432.24							
1		23.134	BR D	WS	F-Way	108.38	417.57	7.90
1432.24	1432.24			0.00				
1		23.131		WS	F-Plain	113.11	447.96	7.37
1432.35	1432.35							
1		23.131		WS	F-Way	113.11	447.89	7.37
1432.35	1432.35			0.00				
1		23.128		WS	F-Plain	112.59	457.84	7.21
1432.33	1432.33							
1		23.128		WS	F-Way	112.59	457.77	7.21
1432.33	1432.33			0.00				
1		23.114	BR U	WS	F-Plain	107.74	420.81	7.84
1432.16	1432.16							
1		23.114	BR U	WS	F-Way	107.73	420.75	7.84
1432.16	1432.16			0.00				
1		23.114	BR D	WS	F-Plain	107.22	447.32	7.38
1431.59	1431.59							
1		23.114	BR D	WS	F-Way	107.21	447.19	7.38
1431.59	1431.59			0.00				
1		23.101		WS	F-Plain	111.42	470.66	7.01
1431.65	1431.65							
1		23.101		WS	F-Way	111.42	470.54	7.01
1431.65	1431.65			0.00				
1		23.097		WS	F-Plain	112.85	480.74	6.86
1431.60	1431.60							
1		23.097		WS	F-Way	112.84	480.60	6.87
1431.60	1431.60			0.00				
1		23.093	BR U	WS	F-Plain	108.42	449.81	7.34
1431.48	1431.48							
1		23.093	BR U	WS	F-Way	108.42	449.67	7.34
1431.48	1431.48			0.00				
1		23.093	BR D	WS	F-Plain	112.82	467.33	7.06
1431.41	1431.41							
1		23.093	BR D	WS	F-Way	112.81	467.16	7.06
1431.41	1431.41			0.00				
1		23.090		WS	F-Plain	116.96	488.18	6.76
1431.45	1431.45							
1		23.090		WS	F-Way	116.96	488.02	6.76
1431.45	1431.45			0.00				
1		23.084		WS	F-Plain	117.75	492.46	6.70
1431.37	1431.37							
1		23.084		WS	F-Way	117.75	492.29	6.70
1431.37	1431.37			0.00				
1		23.081	BR U	WS	F-Plain	113.87	467.09	7.06
1431.27	1431.27							
1		23.081	BR U	WS	F-Way	113.86	466.93	7.07
1431.27	1431.27			0.00				
1		23.081	BR D	WS	F-Plain	113.44	491.77	6.71
1431.21	1431.21							
1		23.081	BR D	WS	F-Way	113.44	491.61	6.71
1431.21	1431.21			0.00				
1		23.077		WS	F-Plain	117.05	509.96	6.47
1431.24	1431.24							
1		23.077		WS	F-Way	117.04	509.79	6.47
1431.24	1431.24			0.00				
1		23.040		WS	F-Plain	118.80	1809.83	9.93
1429.35	1429.35							
1		23.040		WS	F-Way	118.81	368.74	9.93
1429.35	1429.35			0.00				
1		23.019		WS	F-Plain	165.97	713.83	6.85
1423.08	1423.08							
1		23.019		WS	F-Way	134.71	560.25	6.53
1423.80	1423.08			0.72				
1		22.991		WS	F-Plain	262.81	728.91	5.02
1422.71	1422.71							
1		22.991		WS	F-Way	175.39	623.61	5.87
1423.41	1422.71			0.69				

1	22.880	WS	F-Plain	211.79	902.23	6.10
1420.05	1420.05					
1	22.880	WS	F-Way	169.00	774.47	7.10
1420.53	1420.05	0.48				

CHECK-RAS Program: NT Check
Manning's n Value and Transition Loss Coefficient Review

Project File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.prj
Plan File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.p01
Geometry File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.g01
Flow File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.f01
Report File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.nt
Selected profiles: WS F-Plain;WS F-Way
Date: 1/23/2007
Time: 9:57:15 AM

SECNO	STRUCTURE	NLOB	NCHL	NROB	CNTR	EXP
Cave Creek,1						
25.561		-----	0.035	0.035	0.3	0.5
		-----	0.035	-----		
25.557		-----	0.015	0.015	0.3	0.5
		-----	0.015	-----		
25.551		-----	0.015	0.015	0.3	0.5
		-----	0.015	-----		
25.528		-----	0.015	0.015	0.1	0.3
		-----	0.015	-----		
25.515		0.045	0.034	0.052	0.1	0.3
25.482		0.045	0.034	0.052	0.1	0.3
25.428		0.045	0.034	0.052	0.1	0.3
25.367		0.045	0.034	0.052	0.1	0.3
25.299		0.045	0.034	0.052	0.1	0.3
25.271		0.045	0.034	0.052	0.1	0.3
25.21		0.045	0.034	0.052	0.1	0.3
25.191		0.045	0.034	0.052	0.1	0.3
25.155		0.045	0.034	0.052	0.1	0.3
25.096		0.045	0.034	0.052	0.1	0.3
25.039		0.045	0.034	0.052	0.1	0.3
24.953		0.045	0.034	0.052	0.1	0.3
24.872		0.045	0.034	0.052	0.1	0.3
24.828		0.045	0.034	0.052	0.1	0.3
24.793		0.045	0.034	0.052	0.1	0.3
24.732		0.045	0.034	0.052	0.1	0.3
24.7		0.045	0.034	0.052	0.1	0.3
24.673		0.045	0.034	0.052	0.1	0.3
24.632		0.045	0.034	0.052	0.1	0.3
24.617		0.053	0.043	0.046	0.1	0.3
24.587		0.053	0.043	0.046	0.1	0.3
24.549		0.053	0.043	0.046	0.1	0.3
24.504		0.053	0.043	0.046	0.1	0.3
24.466		0.033	0.043	0.046	0.1	0.3
24.427		0.033	0.043	0.046	0.1	0.3
24.343		0.033	0.043	0.046	0.1	0.3
24.3		0.033	0.043	0.046	0.1	0.3
24.264		0.033	0.042	0.047	0.1	0.3
24.232		0.033	0.042	0.047	0.1	0.3
24.21		0.033	0.042	0.047	0.1	0.3
24.169		0.033	0.042	0.047	0.1	0.3
24.112		0.033	0.042	0.047	0.3	0.5
24.068		0.033	0.042	0.047	0.3	0.5
24.062	Bridge-Up	0.033	0.042	0.047	0.3	0.5
24.062	Bridge-Dn	0.058	0.042	0.067	0.3	0.5
24.057		0.058	0.042	0.067	0.3	0.5
23.963		0.058	0.038	0.067	0.1	0.3
23.883		0.037	0.044	0.037	0.1	0.3
23.822		0.037	0.044	0.037	0.1	0.3
23.787		0.037	0.044	0.037	0.1	0.3
23.756		0.037	0.044	0.037	0.1	0.3
23.662		0.037	0.044	0.037	0.1	0.3
23.567		0.037	0.044	0.037	0.1	0.3
23.488		0.037	0.044	0.037	0.1	0.3
23.389		0.037	0.044	0.037	0.1	0.3
23.307		0.037	0.044	0.037	0.1	0.3
23.223		0.037	0.044	0.037	0.1	0.3
23.204		0.037	0.044	0.037	0.1	0.3
23.192		0.037	0.044	0.037	0.1	0.3
23.15		0.046	0.031	0.033	0.1	0.3
23.146	Bridge-Up	0.046	0.031	0.033	0.1	0.3
23.146	Bridge-Dn	0.046	0.031	0.033	0.1	0.3
23.142		0.046	0.031	0.033	0.1	0.3
23.138		0.046	0.031	0.033	0.1	0.3
23.134	Bridge-Up	0.046	0.031	0.033	0.1	0.3
23.134	Bridge-Dn	0.046	0.031	0.033	0.1	0.3
23.131		0.046	0.031	0.033	0.1	0.3
23.128		0.046	0.031	0.033	0.1	0.3
23.114	Bridge-Up	0.046	0.031	0.033	0.1	0.3
23.114	Bridge-Dn	0.046	0.031	0.033	0.1	0.3
23.101		0.046	0.031	0.033	0.1	0.3

23.097		0.046	0.031	0.033	0.1	0.3
23.093	Bridge-Up	0.046	0.031	0.033	0.1	0.3
23.093	Bridge-Dn	0.046	0.031	0.033	0.1	0.3
23.09		0.046	0.031	0.033	0.1	0.3
23.084		0.046	0.031	0.033	0.1	0.3
23.081	Bridge-Up	0.046	0.031	0.033	0.1	0.3
23.081	Bridge-Dn	0.046	0.031	0.033	0.1	0.3
23.077		0.046	0.031	0.033	0.1	0.3
23.04		0.046	0.031	0.033	0.1	0.3
23.019		0.046	0.031	0.033	0.1	0.3
22.991		0.046	0.031	0.033	0.1	0.3
22.88		0.045	0.045	0.045	0.1	0.3

---Summary of Statistics---

	Minimum	Maximum
Left Overbank n Value:	0.033	0.058
Right Overbank n Value:	0.015	0.067
Channel n Value:	0.015	0.045
Contraction Coefficient:	0.1	0.3
Expansion Coefficient:	0.3	0.5

ROUGHNESS COEFFICIENT CHECK

RS: 25.557
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 25.557
NT RC 03 Channel n value is equal to or less than 0.025
The n value of the channel is usually larger than 0.025.
The n value should be reevaluated it if is not representing a concrete lined channel.

RS: 25.551
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 25.551
NT RC 03 Channel n value is equal to or less than 0.025
The n value of the channel is usually larger than 0.025.
The n value should be reevaluated it if is not representing a concrete lined channel.

RS: 25.528
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 25.528
NT RC 03 Channel n value is equal to or less than 0.025
The n value of the channel is usually larger than 0.025.
The n value should be reevaluated it if is not representing a concrete lined channel.

RS: 24.466
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.427
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.343
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.3
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.264
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.232
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.21
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.169
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.112
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.068
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 24.062
NT RC 01 Left overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.883
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.822
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.787
RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.756
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.662
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.567
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.488
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.389
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.307
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.223
RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.204
NT RC 05 The left overbank n value of 0.037 and the right overbank n value
of 0.037 are less than or equal to the channel n value of 0.044
The overbank n values should be reevaluated.

RS: 23.192
NT RC 05 The left overbank n value of 0.037 and the right overbank n value of 0.037 are less than or equal to the channel n value of 0.044 The overbank n values should be reevaluated.

RS: 23.15
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.146
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.146
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.142
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.138
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.134
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.134
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.131
RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.128
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.114
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.114
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.101
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.097
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.093
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.093
RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

RS: 23.09
NT RC 01 Right overbank n value is less than 0.035
The n value for overbank is usually larger then 0.035.
The n value should be reevaluated.

```
RS:       23.084
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       23.081
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       23.081
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       23.077
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       23.04
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       23.019
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.

RS:       22.991
NT RC 01 Right overbank n value is less than 0.035
         The n value for overbank is usually larger then 0.035.
         The n value should be reevaluated.
```

TRANSITION LOSS COEFFICIENT CHECK

```
RS:       25.561
NT TL 02 Contraction and expansion loss coefficients are 0.3 and 0.5
         respectively. However, this cross section is not at the structure.
         They should be equal to 0.1 and 0.3.

RS:       25.557
NT TL 02 Contraction and expansion loss coefficients are 0.3 and 0.5
         respectively. However, this cross section is not at the structure.
         They should be equal to 0.1 and 0.3.

RS:       25.551
NT TL 02 Contraction and expansion loss coefficients are 0.3 and 0.5
         respectively. However, this cross section is not at the structure.
         They should be equal to 0.1 and 0.3.

RS:       23.192
NT TL 01 This is section 4
         Contraction and expansion loss coefficients are 0.1 and 0.3
         They should be equal to 0.3 and 0.5 respectively.

RS:       23.15
NT TL 01 This is section 3
         Contraction and expansion loss coefficients are 0.1 and 0.3
         They should be equal to 0.3 and 0.5 respectively.

RS:       23.146
NT TL 01 This is section Bridge-Up
         Contraction and expansion loss coefficients are 0.1 and 0.3
         They should be equal to 0.3 and 0.5 respectively.

RS:       23.146
NT TL 01 This is section Bridge-Dn
         Contraction and expansion loss coefficients are 0.1 and 0.3
         They should be equal to 0.3 and 0.5 respectively.

RS:       23.142
NT TL 01 This is section 2
         Contraction and expansion loss coefficients are 0.1 and 0.3
         They should be equal to 0.3 and 0.5 respectively.

RS:       23.138
NT TL 01 This is section 3
         Contraction and expansion loss coefficients are 0.1 and 0.3
         They should be equal to 0.3 and 0.5 respectively.

RS:       23.134
NT TL 01 This is section Bridge-Up
```

Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.134
NT TL 01 This is section Bridge-Dn
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.131
NT TL 01 This is section 2
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.128
NT TL 01 This is section 3
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.114
NT TL 01 This is section Bridge-Up
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.114
NT TL 01 This is section Bridge-Dn
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.101
NT TL 01 This is section 2
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.097
NT TL 01 This is section 3
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.093
NT TL 01 This is section Bridge-Up
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.093
NT TL 01 This is section Bridge-Dn
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.09
NT TL 01 This is section 2
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.084
NT TL 01 This is section 3
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.081
NT TL 01 This is section Bridge-Up
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.081
NT TL 01 This is section Bridge-Dn
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

RS: 23.077
NT TL 01 This is section 2
Contraction and expansion loss coefficients are 0.1 and 0.3
They should be equal to 0.3 and 0.5 respectively.

ROUGHNESS COEFFICIENT AT STRUCTURES

24.062
RS 02 The channel n value of 0.042 for the upstream internal bridge opening
section is equal or larger than the channel n value of 0.042 at Section 3.
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 3.
The selection of the n value(s) should be reevaluated.

RS: 24.062
NT RS 02 The channel n value of 0.042 for the downstream internal bridge opening

section is equal or larger than the channel n value of 0.042 at Section 2
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 2.
The selection of the n value(s) should be reevaluated.

RS: 23.15
NT RS 01 This is Section 3.
Channel n value of 0.031 is less than the channel n value of 0.044
at Section 4.

RS: 23.146
NT RS 02 The channel n value of 0.031 for the upstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 3.
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 3.
The selection of the n value(s) should be reevaluated.

RS: 23.146
NT RS 02 The channel n value of 0.031 for the downstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 2
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 2.
The selection of the n value(s) should be reevaluated.

RS: 23.134
NT RS 02 The channel n value of 0.031 for the upstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 3.
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 3.
The selection of the n value(s) should be reevaluated.

RS: 23.134
NT RS 02 The channel n value of 0.031 for the downstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 2
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 2.
The selection of the n value(s) should be reevaluated.

RS: 23.114
NT RS 02 The channel n value of 0.031 for the upstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 3.
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 3.
The selection of the n value(s) should be reevaluated.

RS: 23.114
NT RS 02 The channel n value of 0.031 for the downstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 2
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 2.
The selection of the n value(s) should be reevaluated.

RS: 23.093
NT RS 02 The channel n value of 0.031 for the upstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 3.
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 3.
The selection of the n value(s) should be reevaluated.

RS: 23.093
NT RS 02 The channel n value of 0.031 for the downstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 2
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 2.
The selection of the n value(s) should be reevaluated.

RS: 23.081
NT RS 02 The channel n value of 0.031 for the upstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 3.
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 3.
The selection of the n value(s) should be reevaluated.

RS: 23.081
NT RS 02 The channel n value of 0.031 for the downstream internal bridge opening
section is equal or larger than the channel n value of 0.031 at Section 2
Usually, the channel n value of the bridge opening section is
less than the channel n value of Section 2.
The selection of the n value(s) should be reevaluated.

---END---

CHECK-RAS Program, XS Check
Cross Section Location and Alignment Review

Project File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.prj
Plan File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.p01
Geometry File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.g01
Flow File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.f01
Report File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.xs
Selected profiles: WS F-Plain;WS F-Way
Date: 1/23/2007
Time: 9:56:21 AM

SECNO	Len Lob	Len Chl	Len Rob	TopWdthAct	Q Total	Flow Code
Cave Creek,1						
25.561	20	21	20	115.34	4900	
25.557	32	32	32	77.65	4900	C
25.551	90	90	90	73.11	4900	C
25.528	73.24	71.35	71.6	72	2880	C
25.515	191.46	175.62	180.95	91.98	2880	
25.482	195.18	281.41	364.01	70.51	2880	
25.428	392.71	323.27	226.87	60.03	2880	
25.367	360.24	356.69	344.55	72.47	2880	
25.299	190.47	149.34	83.92	55.16	2880	C
25.271	284.05	324.05	255.38	302.37	2880	
25.21	104.14	97.5	87.55	267.26	2880	
25.191	224.15	192.91	153.88	264.84	2880	
25.155	320.2	308.35	276.99	122.06	2880	
25.096	311.06	304.96	290.64	165.57	2880	
25.039	448.57	452	453.23	93.8	2880	C
24.953	421.96	427.96	410.54	111.95	2880	
24.872	231.92	230.65	232.63	131.64	2880	D
24.828	188.99	188.4	195.18	57.79	2880	C
24.793	370.62	321.53	190.15	70.68	2880	C
24.732	120.58	169.1	229.97	90.41	2880	
24.7	121.64	140.95	164.92	81.83	2880	C
24.673	153.22	217.5	200.24	191.51	3090	D
24.632	77.22	77.5	103.32	52.94	3090	C
24.617	195.74	158.78	145.31	126.41	3090	C
24.587	279.2	199.12	98.46	260.29	3090	
24.549	237.02	236.9	184.43	295.44	3090	
24.504	200.96	205.24	210.33	132.93	3300	D
24.466	139.86	206.28	254.16	218.55	3300	
24.427	422.06	440.98	388.41	252.34	3300	D
24.343	239.12	226.51	216.51	258.16	3300	D
24.3	255.26	190.58	121.86	328.89	3300	
24.264	70.64	169.22	186.13	257.15	3300	
24.232	119.69	115.9	115.89	105.99	3300	
24.21	199.99	214.34	212.37	189.21	3300	
24.169	296.65	301.29	297.76	175.01	3300	
24.112	279.21	236.46	183.86	171.47	3300	
24.068	53.71	53.62	54.97	71.63	3300	
24.062	Bridge #1-Up					
24.062	Bridge #1-Dn					
24.057	436.59	500.04	566.57	71.63	3300	
23.963	414.65	418.62	423.5	79.65	3300	
23.883	312.31	324.13	335.74	64.21	3300	
23.822	179.46	183.6	187.59	60.33	3300	
23.787	163.55	167.37	171.81	112.17	3300	B
23.756	472.08	491.75	516.19	81.66	3300	
23.662	488.55	506.22	524.07	62.52	3300	
23.567	364.79	413.25	457.39	66.72	3300	
23.488	572.19	525.53	478.28	67.87	3300	B
23.389	435.84	432.27	432.69	61.66	3300	B
23.307	445.15	443.61	446.39	63.61	3300	
23.223	98.72	98.01	99.35	63.21	3300	B
23.204	54.05	62.75	73.74	54.06	3300	C,B
23.192	220.85	226.32	232.25	58.04	3300	C
23.15	38.5	39.21	39.72	111.89	3300	
23.146	Bridge #1-Up					
23.146	Bridge #1-Dn					
23.142	19.27	20.66	21.8	109.12	3300	
23.138	39.83	39.87	39.79	106.91	3300	
23.134	Bridge #1-Up					
23.134	Bridge #1-Dn					
23.131	18.51	12.04	6.61	113.11	3300	
23.128	146.88	146.66	147.17	112.59	3300	
23.114	Bridge #1-Up					
23.114	Bridge #1-Dn					
23.101	31.66	20.81	10.83	111.42	3300	
23.097	33.75	34.38	34.91	112.85	3300	
23.093	Bridge #1-Up					
23.093	Bridge #1-Dn					

```
23.09     26.09     30.2      34.11     116.96         3300
23.084    38.02     38.84     39.72     117.75         3300
23.081   Bridge #1-Up
23.081   Bridge #1-Dn
23.077    191.26    194.71    199.64    117.05         3300
23.04     113.81    113.4     113.53    118.8          3660     D,C
23.019    145.92    146.58    148.45    165.97         3660
.991      567.47    585.91    486.17    262.81         3660
.88       0         0         0         211.79         5500
-----------------------------------------------------------------------------
B=blocked obstruction      XS SC 05
C=critial depth            XS SC 03
D=divided flow             XS SC 01
E=cross section extended   XS SC 02
K=known water-surface      XS SC 04


DISTANCE CHECK
----------------


SPACING CHECK
--------------


INEFFECTIVE FLOW CHECK
----------------------


DISCHARGE CHECK
----------------

RS:       25.528
XS DC 01 Discharge decreases in the downstream direction.


LOCATION CHECK
---------------

RS:       24.872
 LC 01 Lenchl Up/TopwdthAct Dn = 3.99
         MaxChlDpth Up/MaxChlDpth Dn = 1.21
         TopwdthAct Up/TopwdthAct Dn = 2.28
         This cross section is located too far upstream from the
         critical depth cross section.

RS:       24.732
XS LC 01 Lenchl Up/TopwdthAct Dn = 2.07
         MaxChlDpth Up/MaxChlDpth Dn = 1.39
         TopwdthAct Up/TopwdthAct Dn = 1.10
         This cross section is located too far upstream from the
         critical depth cross section.

RS:       23.223
XS LC 01 Lenchl Up/TopwdthAct Dn = 1.81
         MaxChlDpth Up/MaxChlDpth Dn = 1.21
         TopwdthAct Up/TopwdthAct Dn = 1.17
         This cross section is located too far upstream from the
         critical depth cross section.


BOUNDARY CONDITION CHECK
------------------------

XS BC 02 The name of the stream is Cave Creek,1
         Known WS = 1420.05 is specified as the downstream boundary
         for profile WS F-Plain

XS BC 02 The name of the stream is Cave Creek,1
         Known WS = 1420.53 is specified as the downstream boundary
         for profile WS F-Way


LATERAL WEIRS CHECK
-----------------------

-END---
```

CHECK-RAS Program: Floodway Check
Encroachment Method, Starting WSEL, Floodway Width, and Surcharge Review

Project File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.prj
Plan File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.p01
Geometry File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.g01
Flow File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.f01
Report File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.fw
Selected profiles: WS F-Plain;WS F-Way
Date: 1/23/2007
Time: 9:56:25 AM

SECNO	Method	Surcharge	EncStaL	EncStaR	LStaEff	RStaEff	Structure
Cave Creek,1							
25.561					9950.54	10065.87	
25.561	1	-0.17	9949	10050	9950.96	10050	
25.557					9961.17	10038.83	
25.557	0	0	0	0	9961.17	10038.83	
25.551					9963.45	10036.55	
25.551	1	0	9963	10037	9963.45	10036.55	
25.528					9964	10036	
25.528	1	0	9964	10036	9964	10036	
25.515					9950.98	10042.96	
25.515	19	0.04	9951.49	10042.96	9951.49	10042.96	
25.482					9974.27	10044.78	
25.482	19	0	9968.73	10053.28	9974.26	10044.79	
25.428					9976.55	10036.58	
25.428	19	0.55	9971.84	10037.84	9975.03	10037.84	
25.367					9950	10022.47	
25.367	19	0.03	9962.57	10022.47	9962.57	10022.47	
25.299					9976.98	10032.14	
25.299	19	0.02	9976.98	10036.15	9976.98	10032.2	
25.271					9724.89	10027.25	
25.271	19	0.85	9805.43	10029.07	9805.43	10029.07	
25.21					9746.5	10013.76	
25.21	19	0.82	9818.45	10013.76	9818.45	10013.76	
25.191					9769	10033.84	
25.191	19	0.56	9939.58	10033.84	9939.58	10033.84	
25.155					9910.32	10032.38	
25.155	19	0.81	9954.41	10032.38	9954.41	10032.38	
25.096					9857.64	10023.21	
25.096	19	0.78	9939.63	10023.21	9939.63	10023.21	
25.039					9924.39	10018.19	
25.039	19	0.35	9959.56	10023.9	9959.56	10018.8	
24.953					9922.89	10034.84	
24.953	19	0.65	9953.47	10024.8	9953.47	10024.8	
24.872					9870.79	10025.89	
24.872	19	0.85	9975.79	10025.89	9975.79	10025.89	
24.828					9964.88	10022.67	
24.828	1	0.22	9983	10023.05	9983	10023.05	
24.793					9950.06	10020.74	
24.793	19	0.07	9974.53	10021.86	9974.53	10020.9	
24.732					9949.23	10039.63	
24.732	19	0.27	9971.47	10050.7	9971.47	10040.72	
24.7					9950.23	10032.06	
24.7	1	0.55	9969.4	10032.14	9969.4	10032.14	
24.673					9944.5	10143.85	
24.673	19	0.79	9983.41	10086.29	9983.41	10086.29	
24.632					9974.83	10027.76	
24.632	19	0.47	9974.26	10014.59	9974.26	10014.59	
24.617					9922.68	10049.09	
24.617	1	0.8	9961.9	10024.19	9961.9	10024.19	
24.587					9762.43	10022.72	
24.587	19	0.45	9865.22	10016.13	9865.22	10016.13	
24.549					9873.33	10168.77	
24.549	19	0.21	9902.36	10143	9902.36	10143	
24.504					9956.42	10169.79	
24.504	19	0.62	9886.79	10140	9952.15	10140	
24.466					9955.43	10173.98	
24.466	19	0.29	9910.05	10110	9954.69	10110	
24.427					9935.92	10189.49	
24.427	19	0.2	9906.86	10085.11	9935.52	10085.11	
24.343					9890.61	10165.08	
24.343	19	0.05	9850.98	10103.21	9890.54	10103.21	
24.3					9865.43	10194.32	
24.3	19	0.04	9831.12	10126.5	9865.36	10126.5	
24.264					9865.36	10122.51	
24.264	1	0.03	9841.6	10080.39	9865.29	10080.39	
24.232					9946.8	10052.79	
24.232	19	0.02	9828.86	10040.78	9946.65	10040.78	
24.21					9888.79	10078	
24.21	1	0.02	9867.3	10055.25	9888.75	10055.25	
24.169					9944.32	10119.34	

24.169	19	0.01	9925.55	10095.86	9944.3	10095.86	
24.112					9965.16	10136.62	
24.112	19	0	9949.84	10115.35	9965.15	10115.35	
24.068					9964.19	10035.82	
24.068	19	0	9958.19	10044.87	9964.19	10035.82	
24.062					9964.19	10035.82	Bridge #1-Up
24.062					9964.19	10035.82	Bridge #1-Dn
24.062	0	0	9958.19	10044.87	9964.19	10035.82	Bridge #1-Up
24.062	0	0	9955.59	10042.27	9964.19	10035.82	Bridge #1-Dn
24.057					9964.19	10035.82	
24.057	19	0	9955.59	10042.27	9964.19	10035.82	
23.963					9959.27	10038.92	
23.963	19	0	9940.35	10052.6	9959.27	10038.92	
23.883					9968	10032.21	
23.883	19	0	9954.18	10048.04	9968	10032.21	
23.822					9967.79	10028.12	
23.822	19	0	9945.02	10047.76	9967.79	10028.12	
23.787					9933.22	10045.39	
23.787	19	0	9913.27	10066.93	9933.22	10045.39	
23.756					9960.1	10041.75	
23.756	19	0	9942.36	10064.85	9960.1	10041.75	
23.662					9970.07	10032.58	
23.662	19	0	9953.99	10049.56	9970.07	10032.58	
23.567					9963.56	10030.28	
23.567	1	0	9948.3	10044.55	9963.56	10030.28	
23.488					9966.62	10034.48	
23.488	19	0	9952.31	10051.18	9966.62	10034.48	
23.389					9971.21	10032.87	
23.389	19	0	9955.99	10047.1	9971.21	10032.87	
23.307					9966.9	10030.51	
23.307	19	0	9955.63	10044.62	9966.9	10030.52	
23.223					9967.15	10030.35	
23.223	19	0.01	9954.95	10044.22	9967.13	10030.37	
23.204					9972.4	10026.46	
23.204	19	-0.03	9952.39	10045.15	9972.45	10026.41	
23.192					9972.29	10030.33	
23.192	19	0	9950.03	10053.7	9972.29	10030.33	
23.15					9945.32	10057.21	
23.15	1	0	9931.3	10097.23	9945.32	10057.21	
23.146					9945.75	10056.79	Bridge #1-Up
23.146					9947.61	10056.15	Bridge #1-Dn
23.146	0	0	9931.3	10097.23	9945.75	10056.79	Bridge #1-Up
23.146	0	0	9924.22	10090.1	9947.61	10056.15	Bridge #1-Dn
23.142					9947.35	10056.47	
23.142	19	0	9924.22	10090.1	9947.35	10056.47	
23.138					9945.11	10052.01	
23.138	19	0	9924.11	10073.29	9945.11	10052.01	
23.134					9945.69	10051.53	Bridge #1-Up
23.134					9943.77	10056.15	Bridge #1-Dn
23.134	0	0	9924.11	10073.29	9945.69	10051.52	Bridge #1-Up
23.134	0	0	9926.32	10074.3	9943.77	10056.15	Bridge #1-Dn
23.131					9943.39	10056.5	
23.131	19	0	9926.32	10074.3	9943.39	10056.5	
23.128					9942.96	10055.54	
23.128	19	0	9925.84	10074.34	9942.96	10055.54	
23.114					9943.49	10055.23	Bridge #1-Up
23.114					9944.38	10055.59	Bridge #1-Dn
23.114	0	0	9925.84	10074.34	9943.49	10055.23	Bridge #1-Up
23.114	0	0	9927.65	10076.15	9944.38	10055.59	Bridge #1-Dn
23.101					9944.27	10055.68	
23.101	19	0	9927.65	10076.15	9944.27	10055.68	
23.097					9943.71	10056.55	
23.097	19	0	9922.13	10074.66	9943.71	10056.55	
23.093					9943.92	10056.35	Bridge #1-Up
23.093					9944.94	10061.76	Bridge #1-Dn
23.093	0	0	9922.13	10074.66	9943.92	10056.34	Bridge #1-Up
23.093	0	0	9923.54	10076.07	9944.94	10061.75	Bridge #1-Dn
23.09					9944.88	10061.84	
23.09	19	0	9923.54	10076.07	9944.88	10061.84	
23.084					9944.86	10062.61	
23.084	19	0	9924.95	10070.78	9944.86	10062.61	
23.081					9945.02	10062.39	Bridge #1-Up
23.081					9944.14	10061.08	Bridge #1-Dn
23.081	0	0	9924.95	10070.78	9945.03	10062.38	Bridge #1-Up
23.081	0	0	9926.65	10067.75	9944.15	10061.08	Bridge #1-Dn
23.077					9944.09	10061.14	
23.077	19	0	9926.65	10067.75	9944.09	10061.13	
23.04					9573.66	10065.45	
23.04	19	0	9930.41	10072.84	9946.65	10065.45	
23.019					9900.46	10066.43	
23.019	19	0.72	9933.48	10084.55	9933.48	10068.19	
22.991					9801.09	10063.9	
22.991	1	0.69	9890	10096.93	9890	10065.39	
22.88					9952.12	10163.91	
22.88	1	0.48	9951	10120	9951	10120	

ENCROACHMENT METHOD CHECK

RS: 25.557
FW EM 01 Floodway encroachment method is not selected at this section.

RS: 24.062
FW EM 01 Floodway encroachment method is not selected at this section.

RS: 23.146
FW EM 01 Floodway encroachment method is not selected at this section.

RS: 23.134
FW EM 01 Floodway encroachment method is not selected at this section.

RS: 23.114
FW EM 01 Floodway encroachment method is not selected at this section.

RS: 23.093
FW EM 01 Floodway encroachment method is not selected at this section.

RS: 23.081
FW EM 01 Floodway encroachment method is not selected at this section.

FLOODWAY WIDTH CHECK

RS: 25.561
FW FW 01 Left encroachment station 9949 is more than left channel bank
station 9948 and less than the right channel bank station 10069
Left encroachment station is within the channel.
The encroachment station or channel bank station should be adjusted.

RS: 25.561
FW FW 01 Right encroachment station 10050 is less than right channel bank
station 10069 and greater than the left channel bank station 9948
Right encroachment station is within the channel.
The encroachment station or channel bank station should be adjusted.

RS: 25.557
FW FW 05 The 1% annual chance flood is contained within the channel.
Left encroachment station 0 is outside the channel.
Left channel bank station is 9954
Left encroachment station and/or left channel bank station should be adjusted.

RS: 25.557
FW FW 06 The left station effective of 9961.17 for the floodway profile is more
than the left channel bank station of 9954
The left side of the floodway boundary is within the channel.
The left encroachment station of 0 is less than the left channel
bank station.
The left encroachment station should be the same as the left
channel bank station.

RS: 25.299
FW FW 03 The Left channel bank station may not be at the proper
location.

RS: 25.271
FW FW 03 The Left channel bank station may not be at the proper
location.

RS: 25.21
FW FW 03 The right channel bank station may not be at the proper
location.

RS: 25.155
FW FW 03 The right channel bank station may not be at the proper
location.

RS: 24.7
FW FW 03 The Left channel bank station may not be at the proper
location.

RS: 24.632
FW FW 03 The right channel bank station may not be at the proper
location.

RS: 24.617
FW FW 03 The Left channel bank station may not be at the proper
location.

```
RS:        24.617
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        24.466
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        24.427
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        24.264
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        24.232
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        24.169
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        24.112
FW FW 03   The right channel bank station may not be at the proper
           location.

RS:        22.88
FW FW 01   Left encroachment station 9951 is more than left channel bank
           station 9927 and less than the right channel bank station 10167
           Left encroachment station is within the channel.
           The encroachment station or channel bank station should be adjusted.

RS:        22.88
FW FW 01   Right encroachment station 10120 is less than right channel bank
           station 10167 and greater than the left channel bank station 9927
           Right encroachment station is within the channel.
           The encroachment station or channel bank station should be adjusted.

SURCHARGE CHECK
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RS:        25.561
FW SC 01   The surcharge value is negative.

DISCHARGE CHECK
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STARTING WATER-SURFACE ELEVATION CHECK
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FW SW 04   The name of the stream is Cave Creek
           Encroachment method 1 is used.
           Total conveyance for the natural profile is 77326.4
           Total conveyance for the floodway profile is 69156.7
           The difference in conveyance between the floodway profile and the
           natural profile is more than 1%.
           Normal Depth option with the same energy slope as the natural
           profile must be used for the floodway profile and rerun the plan.
           This message is not applicable for the revisions.

---END---
```

CHECK-RAS Program: Structure Check

Project File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.prj
Plan File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.p01
Geometry File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.g01
Flow File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.f01
Report File: P:\631A01 Cave Creek Delineation\RAS\Final\CaveCreek.br
Selected profiles: WS F-Plain;WS F-Way
Date: 1/23/2007
Time: 9:56:23 AM

RS	MaxLoChord	MnTpRd	EGEL	WSEL	MinChEl	Structure
Cave Creek,1						
25.561			1514.51	1513.88	1505.6	
25.557			1513.91	1511.43	1505.54	
25.551			1513.36	1510.77	1505.54	
25.528			1511.29	1509.45	1505.77	
25.515			1505.06	1504.78	1496.67	
25.482			1504.68	1503.3	1496.84	
25.428			1502.77	1501.25	1494.44	
25.367			1501.03	1500.05	1492.37	
25.299			1498.81	1496.6	1489.94	
25.271			1495.21	1495.13	1490.48	
25.21			1495.03	1494.94	1489.22	
25.191			1494.91	1494.61	1488.02	
25.155			1494.37	1493.46	1485.88	
25.096			1493.05	1492.57	1485.75	
25.039			1491.36	1489.75	1483.38	
24.953			1487.67	1487.08	1479.35	
24.872			1486.43	1485.37	1476.74	
24.828			1485.09	1482.89	1475.57	
24.793			1483.16	1481.2	1474.78	
24.732			1480.29	1479.1	1471.85	
24.7			1479	1477.25	1472.06	
24.673			1477.71	1477.44	1469.2	
24.632			1476.87	1474.39	1466.77	
24.617			1473.05	1471.71	1467.86	
24.587			1469.5	1469.03	1464.96	
24.549			1468.61	1468.44	1463.34	
24.504			1467.6	1466.24	1459.8	
24.466			1465.54	1465	1459.45	
24.427			1464.63	1464.37	1458.8	
24.343			1463.73	1463.53	1455.33	
24.3			1463.56	1463.5	1454.99	
24.264			1463.5	1463.42	1455.17	
24.232			1463.31	1462.72	1452.77	
24.21			1463.06	1462.95	1453.19	
24.169			1462.97	1462.85	1452.5	
24.112			1462.86	1462.77	1451.76	
24.068			1462.53	1461.85	1454.11	
24.062	1463.78	1466.52	1462.47	1461.72	1454.11	Bridge #1-Up
24.062	1463.61	1464.41	1462.08	1461.25	1454.56	Bridge #1-Dn
24.057			1462.06	1461.28	1454.56	
23.963			1460.37	1459.68	1450.4	
23.883			1458.86	1457.9	1447.34	
23.822			1456.79	1455.38	1445.75	
23.787			1455.85	1455.49	1446.32	
23.756			1455.4	1454.74	1444.32	
23.662			1453.2	1452.11	1441.53	
23.567			1450.51	1449.58	1439.29	
23.488			1448.66	1447.83	1437.24	
23.389			1446.12	1445.02	1434.69	
23.307			1443.7	1442.67	1432.9	
23.223			1441.47	1440.52	1430.63	
23.204			1440.49	1438.07	1429.93	
23.192			1437.89	1435.57	1429.63	
23.15			1434.79	1434.09	1428.75	
23.146	1441.98	1448.26	1434.76	1433.94	1428.75	Bridge #1-Up
23.146	1441.98	1448.26	1433.89	1432.96	1428.03	Bridge #1-Dn
23.142			1433.88	1433.06	1428.03	
23.138			1433.8	1433.02	1427.86	
23.134	1441.11	1447.63	1433.75	1432.82	1427.86	Bridge #1-Up
23.134	1441.13	1447.63	1433.21	1432.24	1427.69	Bridge #1-Dn
23.131			1433.19	1432.35	1427.69	
23.128			1433.14	1432.33	1427.62	
23.114	1442.49	1448.15	1433.11	1432.16	1427.62	Bridge #1-Up
23.114	1442.4	1448.06	1432.44	1431.59	1426.18	Bridge #1-Dn
23.101			1432.41	1431.65	1426.18	
23.097			1432.34	1431.6	1426.13	
23.093	1437.97	1445.87	1432.32	1431.48	1426.13	Bridge #1-Up
23.093	1437.97	1445.87	1432.19	1431.41	1425.83	Bridge #1-Dn
23.09			1432.16	1431.45	1425.83	
23.084			1432.06	1431.37	1425.9	

23.081	1437.77	1444.91	1432.05	1431.27	1425.9	Bridge #1-Up
23.081	1437.77	1444.91	1431.91	1431.21	1425.98	Bridge #1-Dn
23.077			1431.89	1431.24	1425.98	
23.04			1430.88	1429.35	1425.56	
23.019			1423.87	1423.08	1419.14	
22.991			1423.19	1422.71	1419.05	
22.88			1420.63	1420.05	1413	

RIVER/REACH: Cave Creek, 1
RIVER STATION: 24.062
TYPE OF STRUCTURE: Bridge

Description:	7th Street Bridge
Distance from Upstream XS:	3.8
Deck/Roadway Width:	46.01
Weir Coefficient:	2.6
Maximum allowable submergence for weir flow:	0.95
Elevation at which weir flow begins:	0
Weir crest shape:	Broad Crested

Sec	River Station	Length Channel	WSEL	Surch.	EGEL	TopWidth Actual	
4	24.112	236.46	1462.77	0	1462.86	171.47	
4	24.112	236.46	1462.77	0	1462.87	150.2	
3	24.068	53.62	1461.85	0	1462.53	71.63	
3	24.068	53.62	1461.85	0	1462.53	71.63	
	24.062	46.01	1461.72	0	1462.47	69.63	Bridge #1-Up
	24.062	3.81	1461.25	0	1462.08	69.63	Bridge #1-Dn
	24.062	46.01	1461.72	0	1462.47	69.63	Bridge #1-Up
	24.062	3.81	1461.25	0	1462.08	69.63	Bridge #1-Dn
2	24.057	500.04	1461.28	0	1462.06	71.63	
2	24.057	500.04	1461.28	0	1462.06	71.63	
1	23.963	418.62	1459.68	0	1460.37	79.65	
1	23.963	418.62	1459.68	0	1460.37	79.65	

Ineffective Flow, Section 3			Ineffective Flow, Section 2		
Sta L	Sta R	Elev	Sta L	Sta R	Elev

BRIDGE:
Bridge Name: Bridge #1
LowFlowMethod: Highest Energy Answer
Momentum Cd: 2
HighFlowMethod: Energy Only
SluiceGate Cd: 0 Submerged Cd: 0

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

MaxLowChord:	1463.78	MinTopRd:	1466.53	MinElPrs:	1463.78
	1463.78		1467		1463.78

Opening Type	StagStaL	StagStaR	EncStaL	EncStaR	LIfStaS	RIfStaS	
Bridge							U
							D
			9958.19	10044.87			U
			9958.19	10044.87			D

	LAbutSt	RAbutSt	LMnTpRd	RMnTpRd	MnTpRd	MxLoCd	
Bridge #1	9964.19	10035.82	1466.52	1467.02	1466.52	1463.78	U
	9964.19	10035.82	1464.41	1466.83	1464.41	1463.61	D
	9964.19	10035.82	1466.99	1467.02	1466.99	1463.78	U
	9964.19	10035.82	1466.82	1466.83	1466.82	1463.61	D

Name	Q Total.	Q Struc	Q Weir	Selected Method	Flow Type
Bridge #1	3300	3300	0	Momentum	Low Flow
	3300	3300	0	Momentum	Low Flow

GEOMETRIC CHECK

RS: 24.062
ST GD 04 There is only one bridge. This is upstream bridge section.
However, the low chord line crosses the ground line at more than two locations.
CHECKRAS can not check other messages.
The ground and deck/roadway data should be checked.

RS: 24.062
ST GD 03 The starting station of 9895.86 from downstream road/weir data is greater than the starting station of 9895.858 from downstream internal section.
The high chord elevation of 1466.74 for the starting road/weir station is greater than the ground elevation of 1464.41 for the same ground station.
The road/weir profile may need to be extended.

RS: 24.062
ST GD 04 There is only one bridge. This is downstream bridge section.
However, the low chord line crosses the ground line at more than two locations.
CHECKRAS can not check other messages.
The ground and deck/roadway data should be checked.

RIVER/REACH: Cave Creek, 1
RIVER STATION: 23.146
TYPE OF STRUCTURE: Bridge

Description:	North Frontage Road Bridge
Distance from Upstream XS:	2.2
Deck/Roadway Width:	34.75
Weir Coefficient:	2.6
Maximum allowable submergence for weir flow:	0.95
Elevation at which weir flow begins:	0
Weir crest shape:	Broad Crested

Sec	River Station	Length Channel	WSEL	Surch.	EGEL	TopWidth Actual	
4	23.192	226.32	1435.57	0	1437.89	58.04	
4	23.192	226.32	1435.57	0	1437.89	58.04	
3	23.15	39.21	1434.09	0	1434.79	111.89	
3	23.15	39.21	1434.09	0	1434.79	111.89	
	23.146	34.75	1433.94	0	1434.76	107.54	Bridge #1-Up
	23.146	2.26	1432.96	0	1433.89	105.05	Bridge #1-Dn
	23.146	34.75	1433.94	0	1434.76	107.54	Bridge #1-Up
	23.146	2.26	1432.96	0	1433.89	105.04	Bridge #1-Dn
2	23.142	20.66	1433.06	0	1433.88	109.12	
2	23.142	20.66	1433.06	0	1433.88	109.12	
1	23.138	39.87	1433.02	0	1433.8	106.91	
1	23.138	39.87	1433.02	0	1433.8	106.91	

Ineffective Flow, Section 3			Ineffective Flow, Section 2		
Sta L	Sta R	Elev	Sta L	Sta R	Elev

BRIDGE:
Bridge Name: Bridge #1
LowFlowMethod: Highest Energy Answer
Momentum Cd: 1.2
HighFlowMethod: Energy Only
SluiceGate Cd: 0 Submerged Cd: 0

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum

Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

---

MxLowChord:	1441.98	MinTopRd:	1448.27	MinElPrs:	1441.98
	1441.98		1448.27		1441.98

Opening Type	StagStaL	StagStaR	EncStaL	EncStaR	LIfStaS	RIfStaS	
Bridge							U
							D
			9931.3	10097.23			U
			9931.3	10097.23			D

	LAbutSt	RAbutSt	LMnTpRd	RMnTpRd	MnTpRd	MxLoCd	
Bridge #1	9933.73	10069.00	1448.26	1448.31	1448.26	1441.98	U
	9931.00	10069.00	1448.26	1448.28	1448.26	1441.98	D
	9933.73	10069.00	1448.26	1448.31	1448.26	1441.98	U
	9931.95	10069.00	1448.26	1448.28	1448.26	1441.98	D

Name	Q Total.	Q Struc	Q Weir	Selected Method	Flow Type
Bridge #1	3300	3300	0	Momentum	Low Flow
	3300	3300	0	Momentum	Low Flow

GEOMETRIC CHECK

TYPE OF FLOW CHECK

```
RS:        23.146 This is Bridge #1
LF 01      Type of flow is low flow because,
           1. EGEL 3 of 1434.79 is equal to or less than MinTopRd of 1448.3.
           2. EGEL 3 of 1434.79 is less than MxLoCdU of 1442.0.

RS:        23.146 This is Bridge #1
BR LF 01   Type of flow is low flow because,
           1. EGEL 3 of 1434.79 is equal to or less than MinTopRd of 1448.3.
           2. EGEL 3 of 1434.79 is less than MxLoCdU of 1442.0.
```

DISTANCE CHECK

```
RS:        23.146 This is Bridge #1
ST DT 01   'Distance from Upstream XS' of 2.20 is less than the height of the
           bridge opening of  13.23
           Section 3 should be placed at the foot of the road embankment or
           wing walls.
           Distances at Sections 4 & 3, and 'Distance from Upstream XS' should
           be adjusted.


RS:        23.146 This is Bridge #1
ST DT 02   The channel distance of 2.259999 at Downstream Internal Section is less than
           the height of the bridge opening of 13.95
           Section 2 should be placed at the foot of the road embankment or
           wing walls.
           Distances at Sections 4, 3 & 2 should be adjusted.
```

INEFFECTIVE FLOW CHECK

FLOODWAY CHECK

```
           23.146 This is Bridge
FW 01      Encroachment Method was not specified at this river station.
           For flood insurance studies Encroachment Methods 4 and 1
           should be used.
```

RIVER/REACH: Cave Creek, 1
RIVER STATION: 23.134

TYPE OF STRUCTURE: Bridge

Description:	North On Ramp Bridge
Distance from Upstream XS:	2.7
Deck/Roadway Width:	34.53
Weir Coefficient:	2.6
Maximum allowable submergence for weir flow:	0.95
Elevation at which weir flow begins:	0
Weir crest shape:	Broad Crested

Sec	River Station	Length Channel	WSEL	Surch.	EGEL	TopWidth Actual	
4	23.142	20.66	1433.06	0	1433.88	109.12	
4	23.142	20.66	1433.06	0	1433.88	109.12	
3	23.138	39.87	1433.02	0	1433.8	106.91	
3	23.138	39.87	1433.02	0	1433.8	106.91	
	23.134	34.53	1432.82	0	1433.75	101.84	Bridge #1-Up
	23.134	2.64	1432.24	0	1433.21	108.38	Bridge #1-Dn
	23.134	34.53	1432.82	0	1433.75	101.84	Bridge #1-Up
	23.134	2.64	1432.24	0	1433.21	108.38	Bridge #1-Dn
2	23.131	12.04	1432.35	0	1433.19	113.11	
2	23.131	12.04	1432.35	0	1433.19	113.11	
1	23.128	146.66	1432.33	0	1433.14	112.59	
1	23.128	146.66	1432.33	0	1433.14	112.59	

Ineffective Flow, Section 3			Ineffective Flow, Section 2		
Sta L	Sta R	Elev	Sta L	Sta R	Elev

BRIDGE:
Bridge Name: Bridge #1
LowFlowMethod: Highest Energy Answer
Momentum Cd: 1.2
HighFlowMethod: Energy Only
SluiceGate Cd: 0 Submerged Cd: 0

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

MaxLowChord:	1441.15	MinTopRd:	1447.64	MinElPrs:	1441.15
	1441.15		1447.64		1441.15

Opening Type	StagStaL	StagStaR	EncStaL	EncStaR	LIfStaS	RIfStaS	
Bridge							U
							D
			9924.11	10073.29			U
			9924.11	10073.29			D

	LAbutSt	RAbutSt	LMnTpRd	RMnTpRd	MnTpRd	MxLoCd	
Bridge #1	9931.00	10067.81	1447.77	1447.63	1447.63	1441.11	U
	9931.00	10068.09	1447.75	1447.63	1447.63	1441.13	D
	9931.00	10067.81	1447.77	1447.63	1447.63	1441.11	U
	9931.00	10068.09	1447.75	1447.63	1447.63	1441.13	D

Name	Q Total.	Q Struc	Q Weir	Selected Method	Flow Type
Bridge #1	3300	3300	0	Momentum	Low Flow
	3300	3300	0	Momentum	Low Flow

GEOMETRIC CHECK

TYPE OF FLOW CHECK

RS: 23.134 This is Bridge #1
BR LF 01 Type of flow is low flow because,
1. EGEL 3 of 1433.8 is equal to or less than MinTopRd of 1447.6.
2. EGEL 3 of 1433.8 is less than MxLoCdU of 1441.1.

RS: 23.134 This is Bridge #1
BR LF 01 Type of flow is low flow because,
1. EGEL 3 of 1433.8 is equal to or less than MinTopRd of 1447.6.
2. EGEL 3 of 1433.8 is less than MxLoCdU of 1441.1.

DISTANCE CHECK

RS: 23.134 This is Bridge #1
ST DT 01 'Distance from Upstream XS' of 2.70 is less than the height of the bridge opening of 13.27
Section 3 should be placed at the foot of the road embankment or wing walls.
Distances at Sections 4 & 3, and 'Distance from Upstream XS' should be adjusted.

RS: 23.134 This is Bridge #1
ST DT 02 The channel distance of 2.64 at Downstream Internal Section is less than the height of the bridge opening of 13.44
Section 2 should be placed at the foot of the road embankment or wing walls.
Distances at Sections 4, 3 & 2 should be adjusted.

INEFFECTIVE FLOW CHECK

FLOODWAY CHECK

RS: 23.134 This is Bridge
ST FW 01 Encroachment Method was not specified at this river station.
For flood insurance studies Encroachment Methods 4 and 1 should be used.

RIVER/REACH: Cave Creek, 1
RIVER STATION: 23.114
TYPE OF STRUCTURE: Bridge

Description:	Loop 101 Mainline Bridges
Distance from Upstream XS:	1.65
Deck/Roadway Width:	144.33
Weir Coefficient:	2.6
Maximum allowable submergence for weir flow:	0.95
Elevation at which weir flow begins:	0
Weir crest shape:	Broad Crested

Sec	River Station	Length Channel	WSEL	Surch.	EGEL	TopWidth Actual	
4	23.131	12.04	1432.35	0	1433.19	113.11	
4	23.131	12.04	1432.35	0	1433.19	113.11	
3	23.128	146.66	1432.33	0	1433.14	112.59	
3	23.128	146.66	1432.33	0	1433.14	112.59	
	23.114	144.33	1432.16	0	1433.11	107.74	Bridge #1-Up
	23.114	0.68	1431.59	0	1432.44	107.22	Bridge #1-Dn
	23.114	144.33	1432.16	0	1433.11	107.73	Bridge #1-Up
	23.114	0.68	1431.59	0	1432.44	107.21	Bridge #1-Dn
2	23.101	20.81	1431.65	0	1432.41	111.42	
2	23.101	20.81	1431.65	0	1432.41	111.42	
1	23.097	34.38	1431.6	0	1432.34	112.85	
1	23.097	34.38	1431.6	0	1432.34	112.84	

Ineffective Flow, Section 3			Ineffective Flow, Section 2		
Sta L	Sta R	Elev	Sta L	Sta R	Elev

BRIDGE:
Bridge Name: Bridge #1

```
LowFlowMethod:  Highest Energy Answer
Momentum Cd:     0
HighFlowMethod: Energy Only
SluiceGate Cd: 0        Submerged Cd:   0

-----------------------------------------------------------------------------
Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line
-----------------------------------------------------------------------------

-----------------------------------------------------------------------------
MaxLowChord:   1442.59  MinTopRd:  1448.16       MinElPrs:       1442.59
               1442.59             1448.16                       1442.59
-----------------------------------------------------------------------------

Opening Type      StagStaL    StagStaR  EncStaL   EncStaR   LIfStaS   RIfStaS
-----------------------------------------------------------------------------
Bridge                                                                      U
                                                                            D
                                        9925.84   10074.34                  U
                                        9925.84   10074.34                  D
-----------------------------------------------------------------------------

                  LAbutSt     RAbutSt   LMnTpRd   RMnTpRd   MnTpRd    MxLoCd
-----------------------------------------------------------------------------
Bridge #1         9931.00     10068.34  1448.27   1448.15   1448.15   1442.49 U
                  9933.61     10069.00  1448.06   1448.06   1448.06   1442.40 D
                  9931.00     10068.34  1448.27   1448.15   1448.15   1442.49 U
                  9933.61     10069.00  1448.06   1448.06   1448.06   1442.40 D
-----------------------------------------------------------------------------

Name          Q Total.  Q Struc   Q Weir    Selected Method     Flow Type
-----------------------------------------------------------------------------
Bridge #1     3300      3300      0         Energy only         Low Flow
              3300      3300      0         Energy only         Low Flow
-----------------------------------------------------------------------------

GEOMETRIC CHECK
---------------

TYPE OF FLOW CHECK
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RS:        23.114 This is Bridge #1
BR LF 01   Type of flow is low flow because,
           1. EGEL 3 of 1433.14 is equal to or less than MinTopRd of 1448.2.
           2. EGEL 3 of 1433.14 is less than MxLoCdU of 1442.5.

RS:        23.114 This is Bridge #1
BR LF 01   Type of flow is low flow because,
           1. EGEL 3 of 1433.14 is equal to or less than MinTopRd of 1448.2.
           2. EGEL 3 of 1433.14 is less than MxLoCdU of 1442.5.

DISTANCE CHECK
--------------

RS:        23.114 This is Bridge #1
ST DT 01   'Distance from Upstream XS' of 1.65 is less than the height of the
           bridge opening of  14.87
           Section 3 should be placed at the foot of the road embankment or
           wing walls.
           Distances at Sections 4 & 3, and 'Distance from Upstream XS' should
           be adjusted.


RS:        23.114 This is Bridge #1
ST DT 02   The channel distance of 0.6800019 at Downstream Internal Section is less than
           the height of the bridge opening of 16.31
           Section 2 should be placed at the foot of the road embankment or
           wing walls.
           Distances at Sections 4, 3 & 2 should be adjusted.

INEFFECTIVE FLOW CHECK
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FLOODWAY CHECK
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```

RS: 23.114 This is Bridge
ST FW 01 Encroachment Method was not specified at this river station.
For flood insurance studies Encroachment Methods 4 and 1
should be used.

RIVER/REACH: Cave Creek, 1
RIVER STATION: 23.093
TYPE OF STRUCTURE: Bridge

Description:	South Off Ramp Bridge
Distance from Upstream XS:	2.9
Deck/Roadway Width:	28.57
Weir Coefficient:	2.6
Maximum allowable submergence for weir flow:	0.95
Elevation at which weir flow begins:	0
Weir crest shape:	Broad Crested

Sec	River Station	Length Channel	WSEL	Surch.	EGEL	TopWidth Actual	
4	23.101	20.81	1431.65	0	1432.41	111.42	
4	23.101	20.81	1431.65	0	1432.41	111.42	
3	23.097	34.38	1431.6	0	1432.34	112.85	
3	23.097	34.38	1431.6	0	1432.34	112.84	
	23.093	28.57	1431.48	0	1432.32	108.42	Bridge #1-Up
	23.093	2.91	1431.41	0	1432.19	112.82	Bridge #1-Dn
	23.093	28.57	1431.48	0	1432.31	108.42	Bridge #1-Up
	23.093	2.91	1431.41	0	1432.19	112.81	Bridge #1-Dn
2	23.09	30.20	1431.45	0	1432.16	116.96	
2	23.09	30.20	1431.45	0	1432.16	116.96	
1	23.084	38.84	1431.37	0	1432.06	117.75	
1	23.084	38.84	1431.37	0	1432.06	117.75	

Ineffective Flow, Section 3			Ineffective Flow, Section 2		
Sta L	Sta R	Elev	Sta L	Sta R	Elev

BRIDGE:
Bridge Name: Bridge #1
LowFlowMethod: Highest Energy Answer
Momentum Cd: 0
HighFlowMethod: Energy Only
SluiceGate Cd: 0 Submerged Cd: 0

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

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MaxLowChord:	1437.97	MinTopRd:	1445.88	MinElPrs:	1437.97
	1437.97		1445.88		1437.97

Opening Type	StagStaL	StagStaR	EncStaL	EncStaR	LIfStaS	RIfStaS	
Bridge							U
							D
			9922.13	10074.66			U
			9922.13	10074.66			D

	LAbutSt	RAbutSt	LMnTpRd	RMnTpRd	MnTpRd	MxLoCd	
Bridge #1	9934.50	10066.89	1445.91	1445.87	1445.87	1437.97	U
	9931.00	10069.00	1445.87	1445.87	1445.87	1437.97	D
	9934.50	10066.89	1445.91	1445.87	1445.87	1437.97	U
	9931.00	10069.00	1445.87	1445.87	1445.87	1437.97	D

Name	Q Total.	Q Struc	Q Weir	Selected Method	Flow Type

Bridge #1	3300	3300	0	Energy only	Low Flow
	3300	3300	0	Energy only	Low Flow

GEOMETRIC CHECK

TYPE OF FLOW CHECK

RS: 23.093 This is Bridge #1
BR LF 01 Type of flow is low flow because,
1. EGEL 3 of 1432.34 is equal to or less than MinTopRd of 1445.9.
2. EGEL 3 of 1432.34 is less than MxLoCdU of 1438.0.

RS: 23.093 This is Bridge #1
BR LF 01 Type of flow is low flow because,
1. EGEL 3 of 1432.34 is equal to or less than MinTopRd of 1445.9.
2. EGEL 3 of 1432.34 is less than MxLoCdU of 1438.0.

DISTANCE CHECK

RS: 23.093 This is Bridge #1
ST DT 01 'Distance from Upstream XS' of 2.90 is less than the height of the bridge opening of 11.84
Section 3 should be placed at the foot of the road embankment or wing walls.
Distances at Sections 4 & 3, and 'Distance from Upstream XS' should be adjusted.

RS: 23.093 This is Bridge #1
ST DT 02 The channel distance of 2.910001 at Downstream Internal Section is less than the height of the bridge opening of 12.14
Section 2 should be placed at the foot of the road embankment or wing walls.
Distances at Sections 4, 3 & 2 should be adjusted.

EFFECTIVE FLOW CHECK

FLOODWAY CHECK

RS: 23.093 This is Bridge
ST FW 01 Encroachment Method was not specified at this river station.
For flood insurance studies Encroachment Methods 4 and 1 should be used.

RIVER/REACH: Cave Creek, 1
RIVER STATION: 23.081
TYPE OF STRUCTURE: Bridge

Description:	South Frontage Road Bridge
Distance from Upstream XS:	2.1
Deck/Roadway Width:	34.66
Weir Coefficient:	2.6
Maximum allowable submergence for weir flow:	0.95
Elevation at which weir flow begins:	0
Weir crest shape:	Broad Crested

Sec	River Station	Length Channel	WSEL	Surch.	EGEL	TopWidth Actual	
4	23.09	30.20	1431.45	0	1432.16	116.96	
4	23.09	30.20	1431.45	0	1432.16	116.96	
3	23.084	38.84	1431.37	0	1432.06	117.75	
3	23.084	38.84	1431.37	0	1432.06	117.75	
	23.081	34.66	1431.27	0	1432.05	113.87	Bridge #1-Up
	23.081	2.08	1431.21	0	1431.91	113.44	Bridge #1-Dn
	23.081	34.66	1431.27	0	1432.05	113.86	Bridge #1-Up
	23.081	2.08	1431.21	0	1431.91	113.44	Bridge #1-Dn
2	23.077	194.71	1431.24	0	1431.89	117.05	
2	23.077	194.71	1431.24	0	1431.89	117.04	
1	23.04	113.40	1429.35	0	1430.88	118.8	
1	23.04	113.40	1429.35	0	1430.88	118.81	

Ineffective Flow, Section 3			Ineffective Flow, Section 2		
Sta L	Sta R	Elev	Sta L	Sta R	Elev

BRIDGE:
Bridge Name: Bridge #1
LowFlowMethod: Highest Energy Answer
Momentum Cd: 0
HighFlowMethod: Energy Only
SluiceGate Cd: 0 Submerged Cd: 0

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

MaxLowChord:	1437.77	MinTopRd:	1444.92	MinElPrs:	1437.77
	1437.77		1444.92		1437.77

Opening Type	StagStaL	StagStaR	EncStaL	EncStaR	LIfStaS	RIfStaS	
Bridge							U
							D
			9924.95	10070.78			U
			9924.95	10070.78			D

	LAbutSt	RAbutSt	LMnTpRd	RMnTpRd	MnTpRd	MxLoCd	
Bridge #1	9931.00	10069.00	1444.91	1444.91	1444.91	1437.77	U
	9931.00	10069.00	1444.91	1444.91	1444.91	1437.77	D
	9931.00	10067.75	1444.97	1444.91	1444.91	1437.77	U
	9931.00	10067.75	1444.91	1444.91	1444.91	1437.77	D

Name	Q Total.	Q Struc	Q Weir	Selected Method	Flow Type
Bridge #1	3300	3300	0	Energy only	Low Flow
	3300	3300	0	Energy only	Low Flow

GEOMETRIC CHECK

TYPE OF FLOW CHECK

RS: 23.081 This is Bridge #1
BR LF 01 Type of flow is low flow because,
1. EGEL 3 of 1432.06 is equal to or less than MinTopRd of 1444.9.
2. EGEL 3 of 1432.06 is less than MxLoCdU of 1437.8.

RS: 23.081 This is Bridge #1
BR LF 01 Type of flow is low flow because,
1. EGEL 3 of 1432.06 is equal to or less than MinTopRd of 1444.9.
2. EGEL 3 of 1432.06 is less than MxLoCdU of 1437.8.

DISTANCE CHECK

RS: 23.081 This is Bridge #1
ST DT 01 'Distance from Upstream XS' of 2.10 is less than the height of the bridge opening of 11.87
Section 3 should be placed at the foot of the road embankment or wing walls.
Distances at Sections 4 & 3, and 'Distance from Upstream XS' should be adjusted.

RS: 23.081 This is Bridge #1
ST DT 02 The channel distance of 2.08 at Downstream Internal Section is less than the height of the bridge opening of 11.79
Section 2 should be placed at the foot of the road embankment or wing walls.

Distances at Sections 4, 3 & 2 should be adjusted.

INEFFECTIVE FLOW CHECK

RS: 23.04 This is Section 1
IF 07 Ineffective flow option was considered at this section.
However, it should be a fully expanded cross section.
Ineffective flow stations and elevations should be cleared from
this section, unless the ares beyond the ineffective flow stations
are not within the flow path of the stream.
This message should be ignored if this section is Section 3 of the downstream
structure.

FLOODWAY CHECK

RS: 23.081 This is Bridge
ST FW 01 Encroachment Method was not specified at this river station.
For flood insurance studies Encroachment Methods 4 and 1
should be used.

---END

F Erosion and Sediment Transport Analysis Supporting Documentation

Not Applicable / Not Included

NOTES TO USERS

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Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
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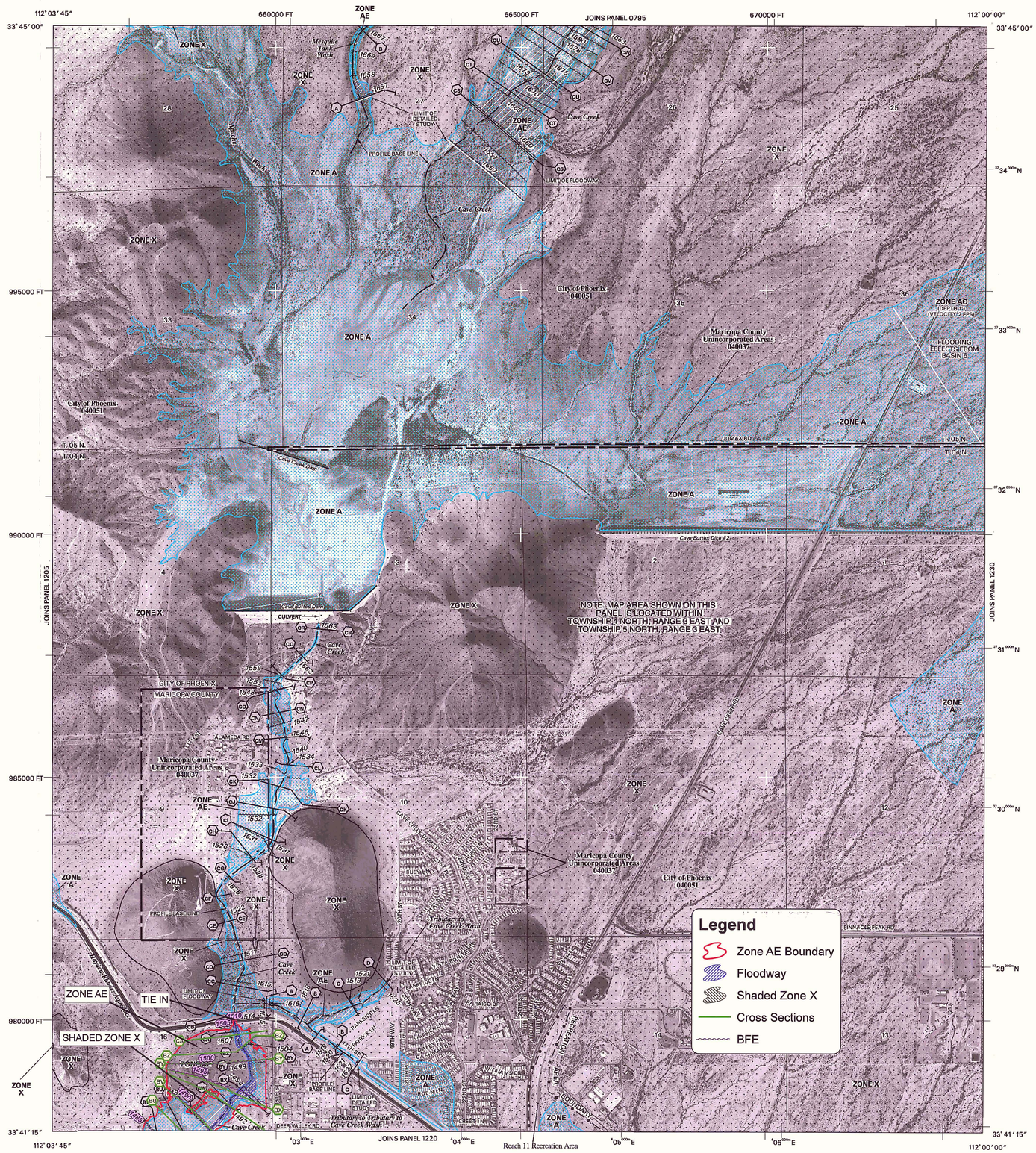

LEGEND

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

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)———(A)	Cross section line
(2)- - - -(2)	Transect line
112° 07′ 08″, 33° 25′ 41″	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.
76	1000-meter Universal Transverse Mercator grid tick values zone 12.
875000 FT	5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)
DV2313	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
December 3, 1983, September 30, 1995, July 19, 2001

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

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

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

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1210H

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

PANEL 1210 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY	040037	1210	H
PHOENIX, CITY OF	040051	1210	H

ANNOTATED FIRM
SHEET 1 OF 3
September 2006

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1210H

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

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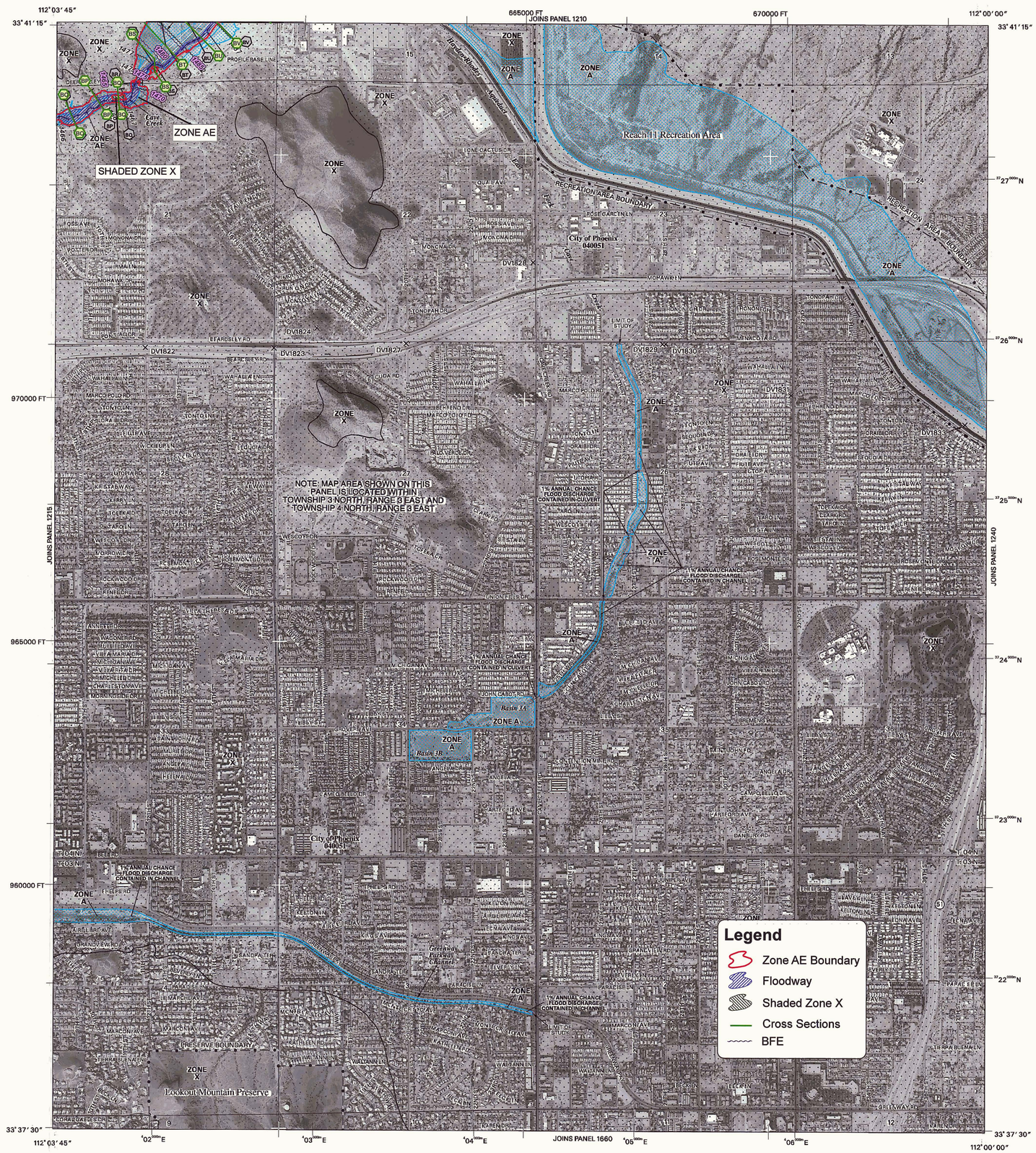

LEGEND

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FLOODWAY AREAS IN ZONE AE

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OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

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	1% annual chance floodplain boundary
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	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones, and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
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• M1.5	River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 16, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 29, 1989, December 3, 1993, September 30, 1995, July 19, 2001

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

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500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1220J

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

PANEL 1220 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PHOENIX, CITY OF	040051	1220	J

ANNOTATED FIRM
SHEET 2 OF 3
September 2006

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MAP NUMBER
04013C1220J

MAP REVISED
SEPTEMBER 30, 2005

Federal Emergency Management Agency

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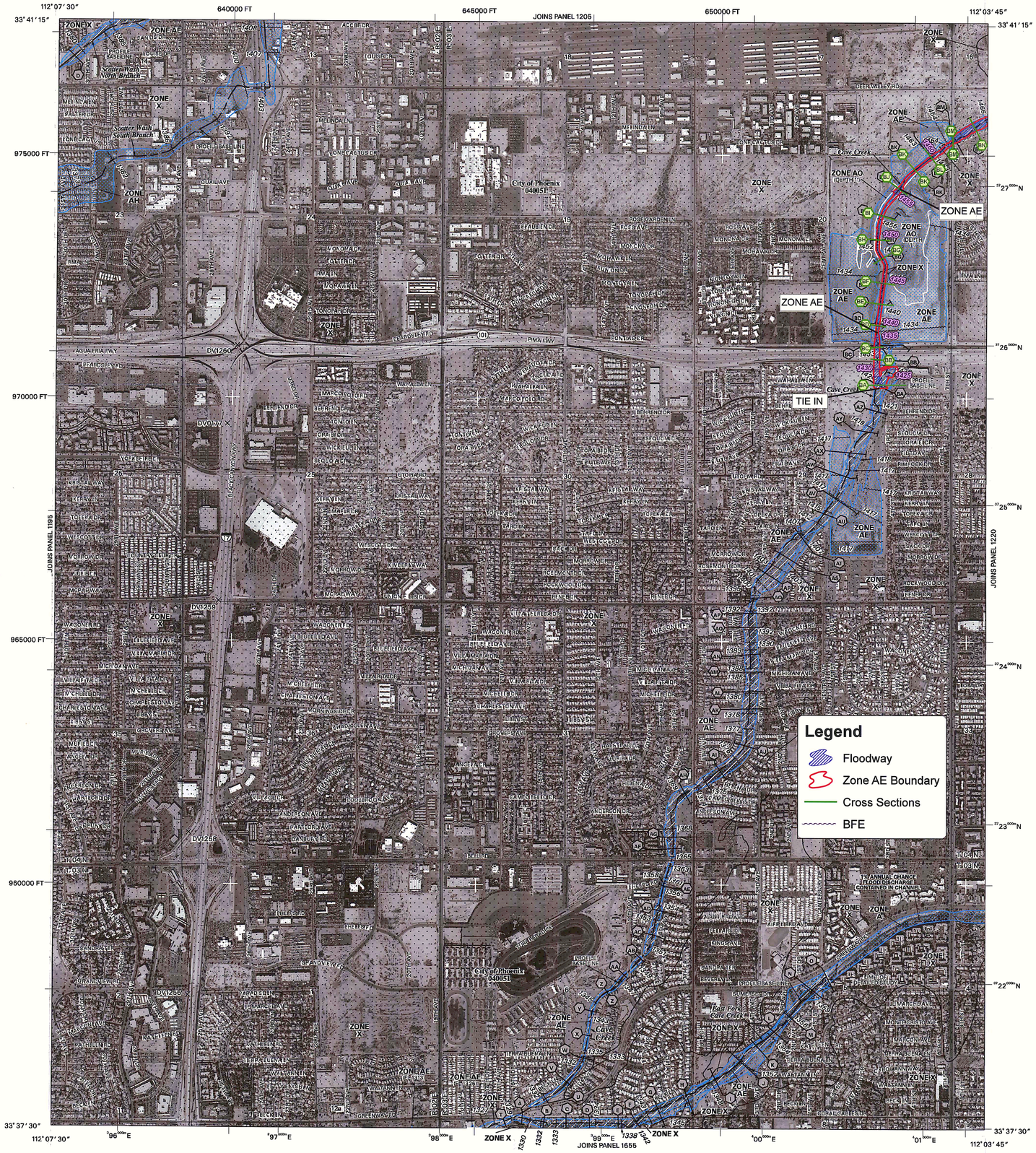

LEGEND

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ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

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OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

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

513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the National Geodetic Vertical Datum of 1929

(A)———(A)	Cross section line
(2)- - - -(2)	Transect line
112° 07′ 08″, 33° 25′ 41″	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere.
4176000m E	1000-meter Universal Transverse Mercator grid tick values zone 12.
875000 FT	5000-foot grid tick values: Arizona State Plane coordinate system, central zone (FIPSZONE 3176) NAD83 (Transverse Mercator)
×DV2313	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORY
Refer to Repositories Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
April 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
September 29, 1989, September 4, 1991, December 3, 1993, September 30, 1995, July 19, 2001

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

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

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

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1215K

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

PANEL 1215 OF 4350

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PHOENIX, CITY OF	040051	1215	K

ANNOTATED FIRM
SHEET 3 OF 3
September 2006

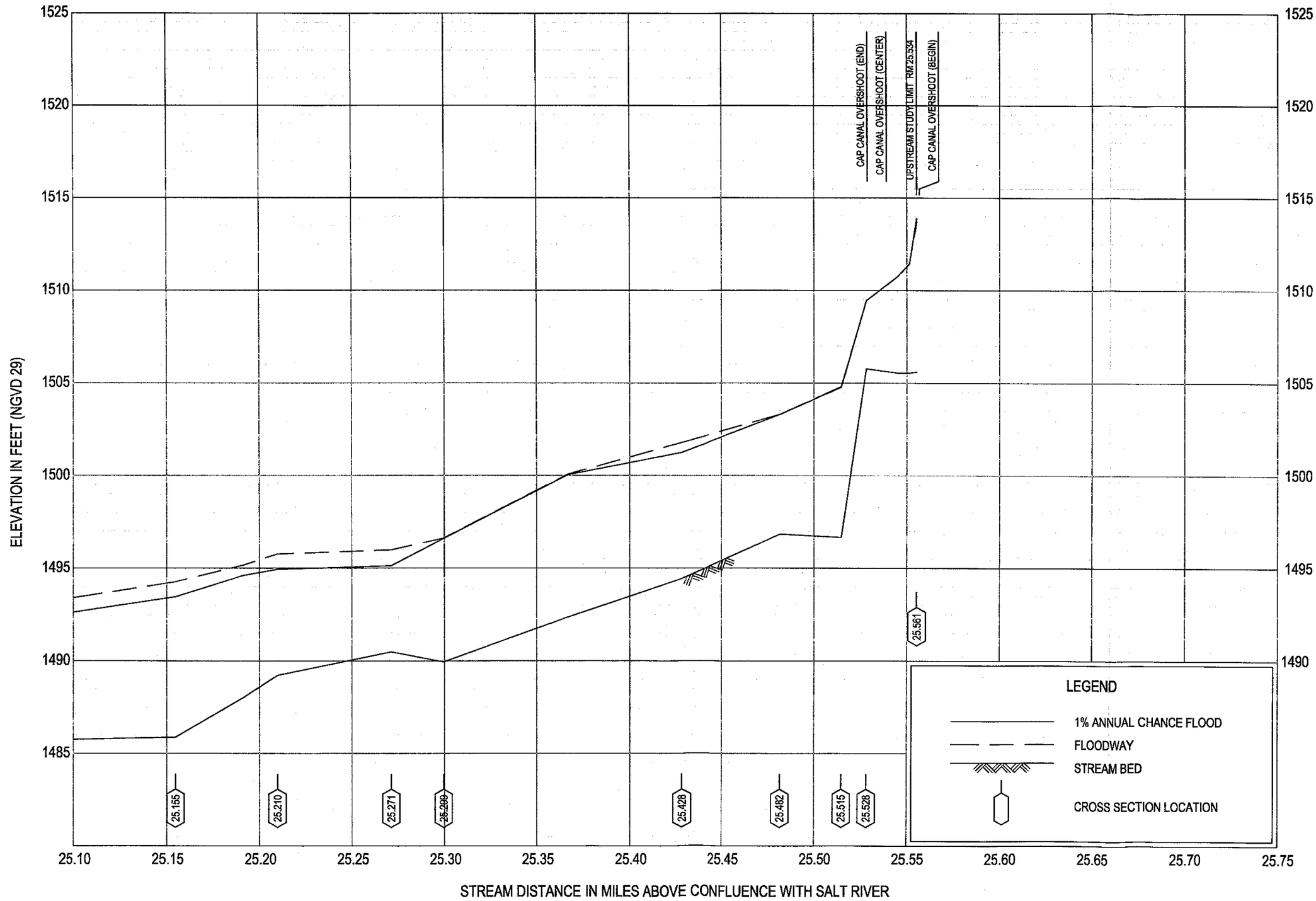
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04013C1215K

MAP REVISED

SEPTEMBER 30, 2005

Federal Emergency Management Agency

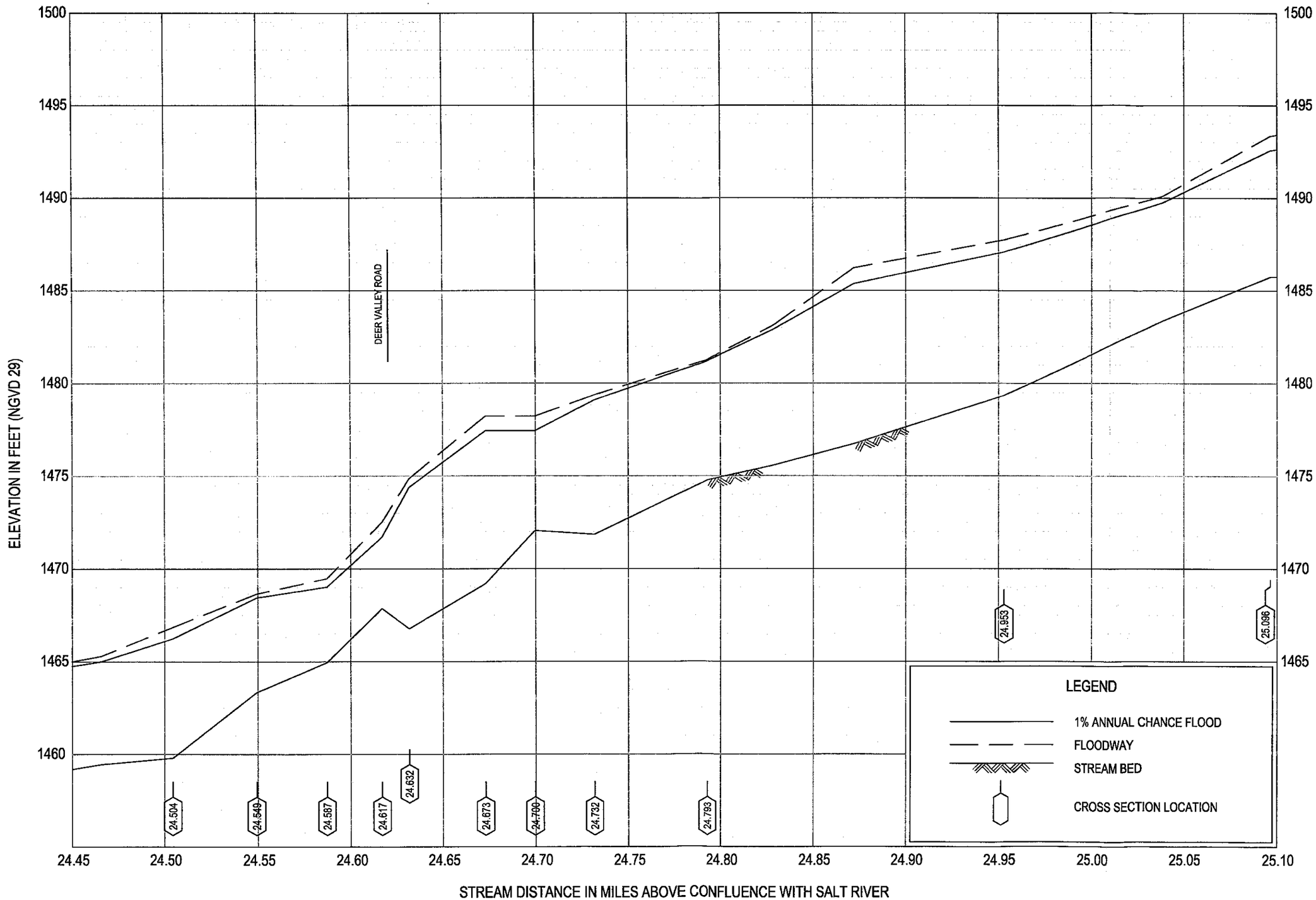


FLOOD PROFILES

CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

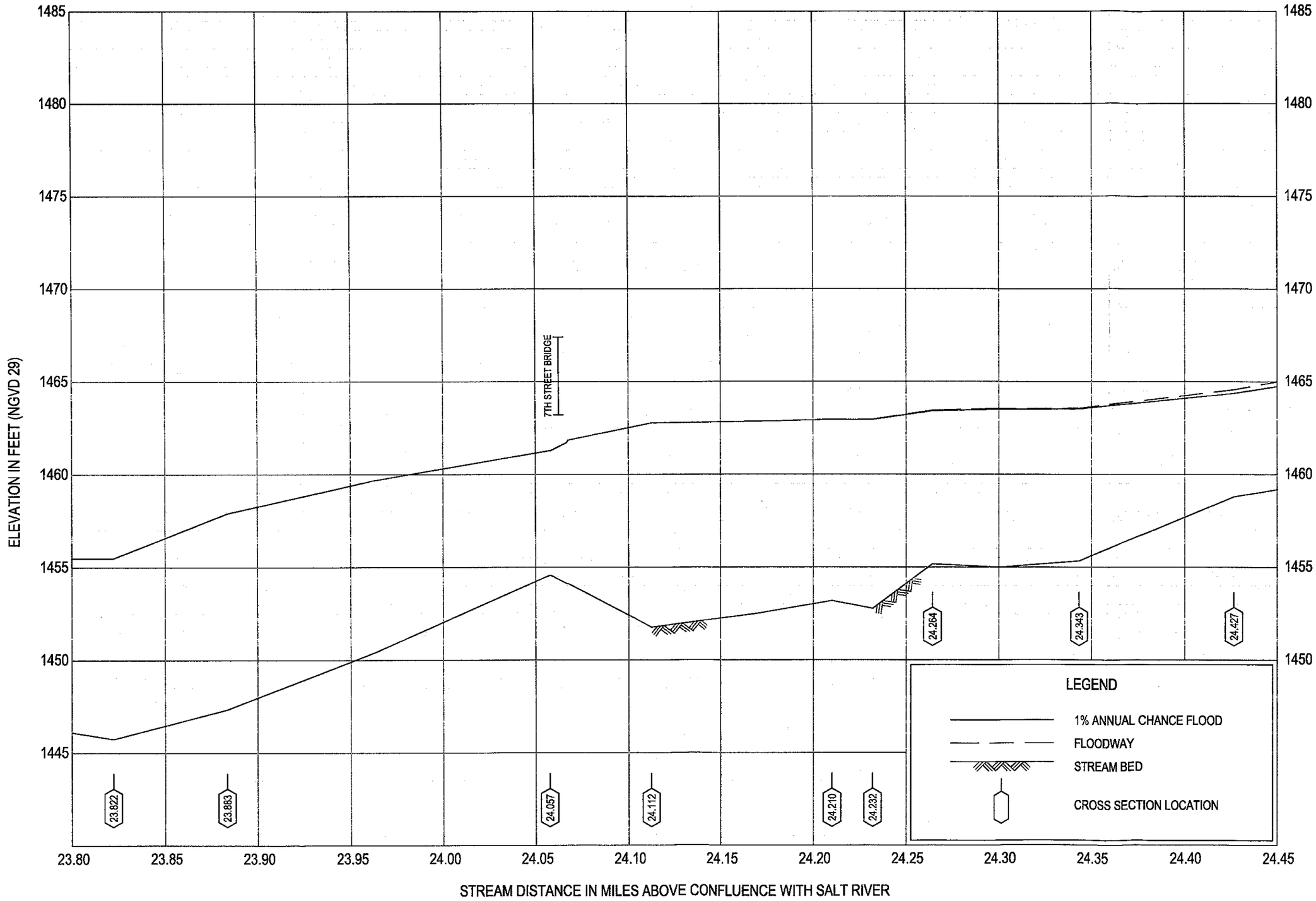


FLOOD PROFILES

CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

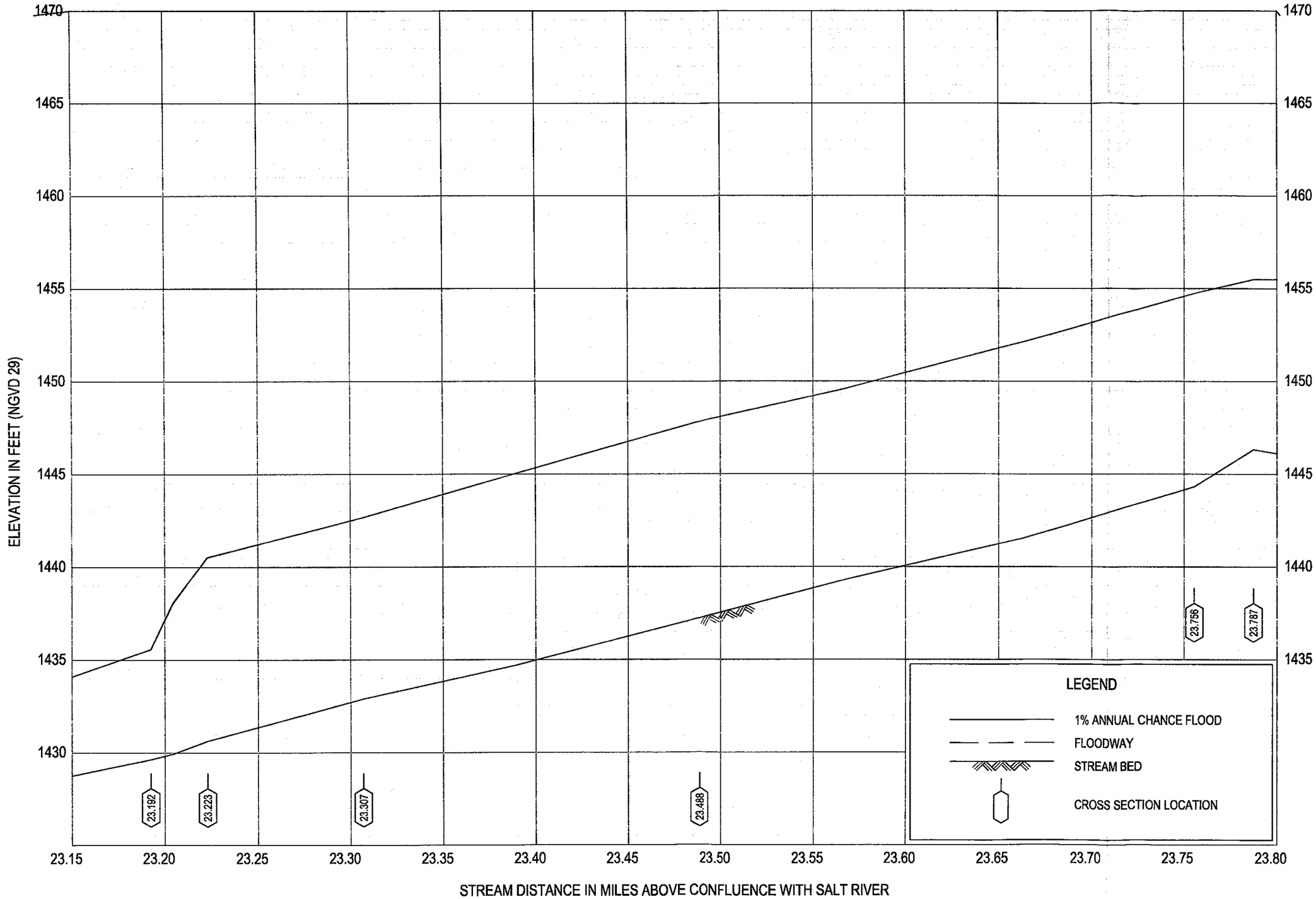


FLOOD PROFILES

CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

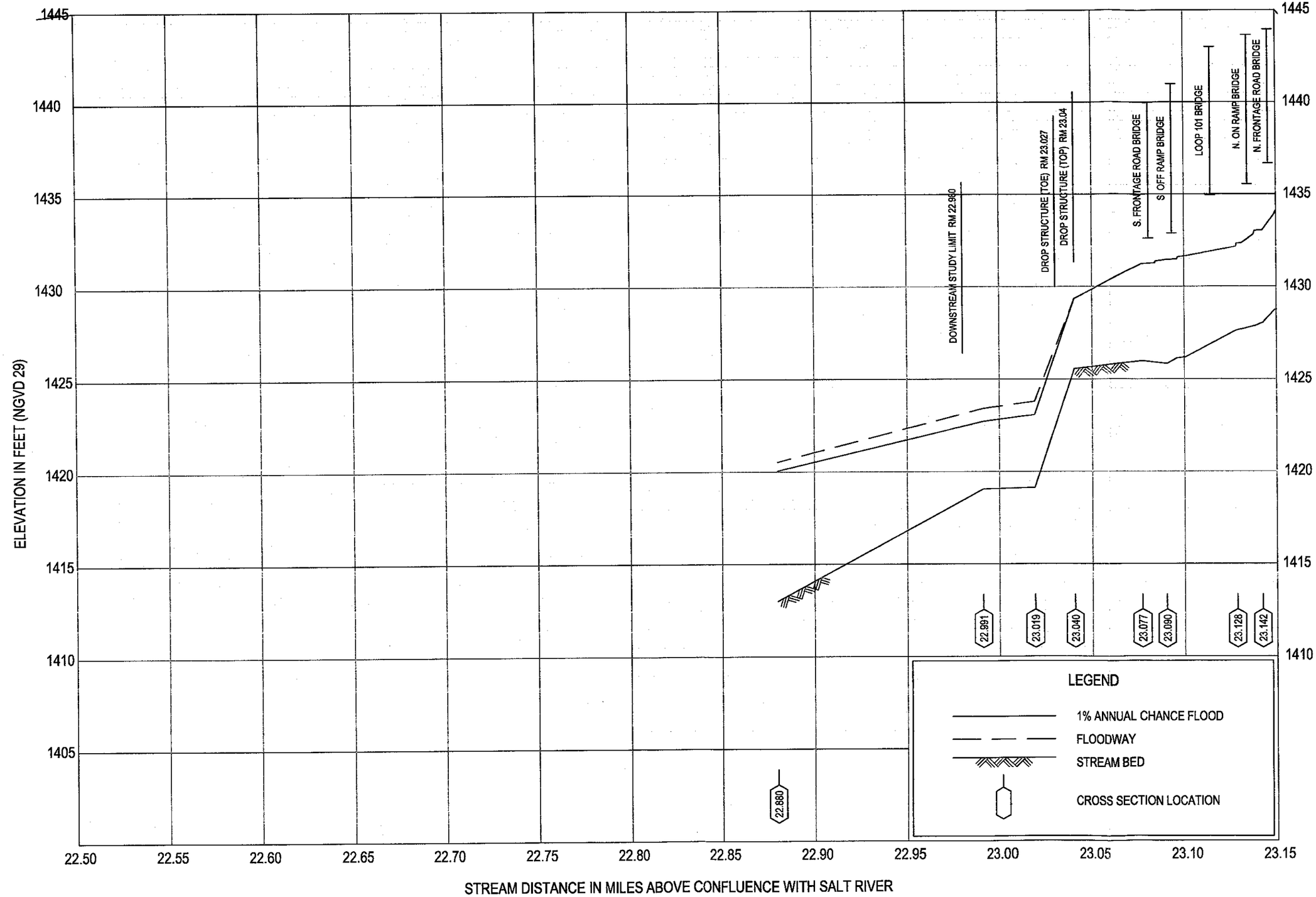


FLOOD PROFILES

CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS

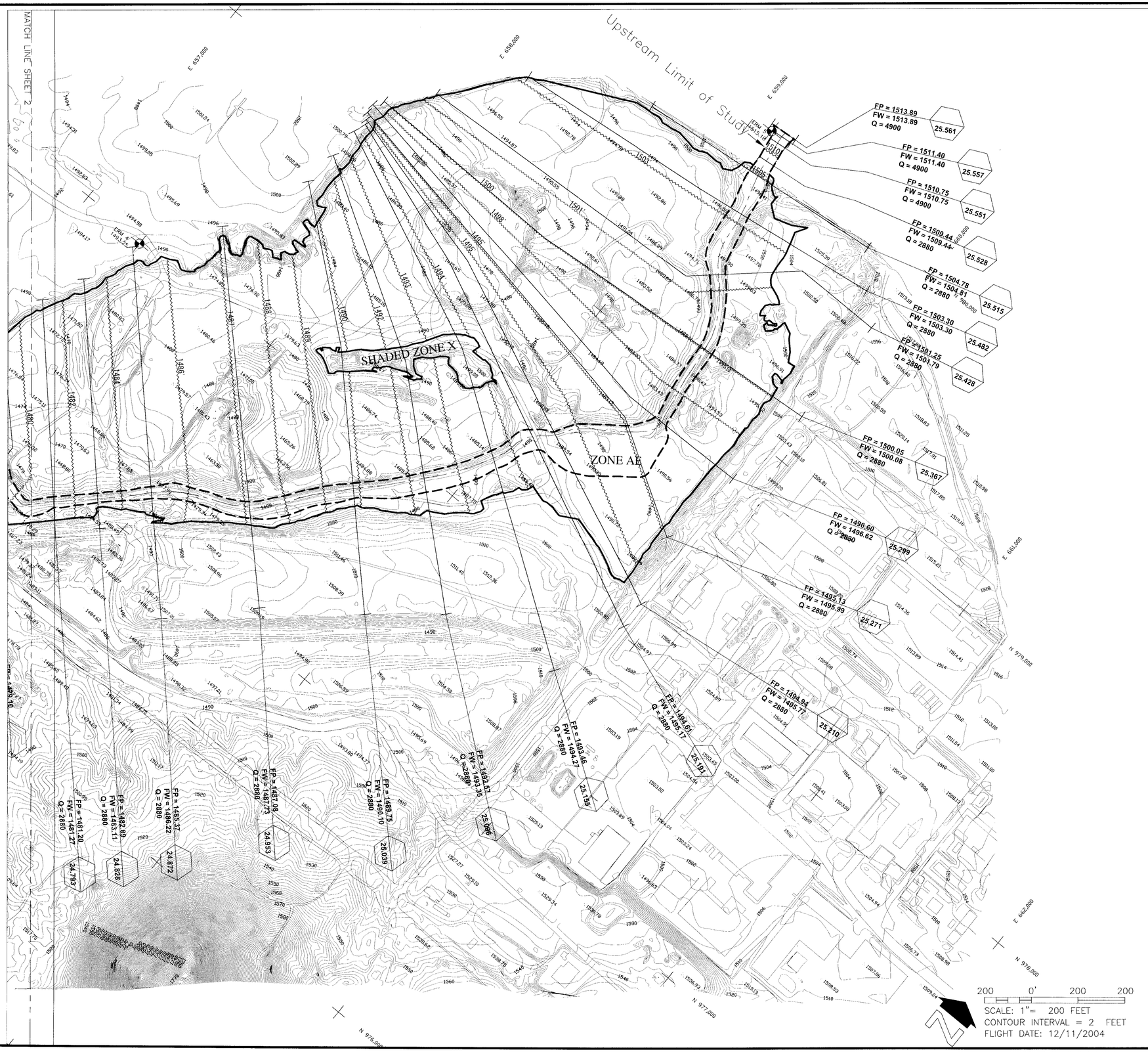


FLOOD PROFILES

CAVE CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND INCORPORATED AREAS



LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	FP= 1513.89 FW= 1513.89 Q = 4900 — 25.561
ELEVATION REFERENCE MARK	ERM 4 1493.25
BASE FLOOD ELEVATIONS	1510'
ZONE DESIGNATIONS	ZONE AE, ZONE AH

ELEVATION REFERENCE MARKS

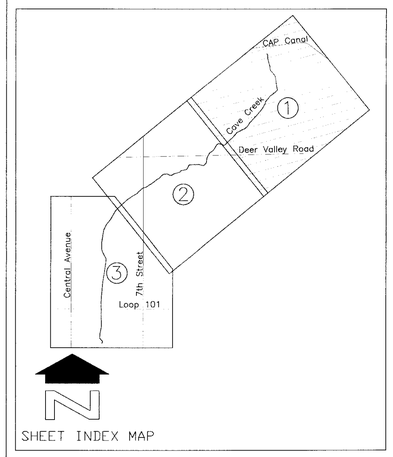
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD= 1929 NGVD + 1.87

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 4	1493.25	SET BRASS CAP FLUSH, WEST SIDE OF WASH AT +OR- 12th ST. ALIGNMENT N. OF DEER VALLEY ROAD, NEAR THE DIRT ROAD THAT CROSSES WASH
ERM 5	1515.18	SET BRASS CAP ON THE N.W. CORNER OF HEADWALL "SAWTOOTH"

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 EXCEPT CROSS-SECTIONS OUTSIDE THE STUDY LIMITS.

2- THE FOLLOWING CROSS-SECTIONS ARE OUTSIDE THE STUDY LIMITS: 22.880, 25.551, 25.557 AND 25.561.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CAVE CREEK FROM CAP CANAL TO LOOP 101 HIGHWAY FLOODPLAIN DELINEATION STUDY CONTRACT NO. 2004C024

HIGHWAY PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 41980 BRIAN THOMAS WAHLIN Date Signed 12/4/06 ARIZONA, U.S.A.

WEST CONSULTANTS, INC.

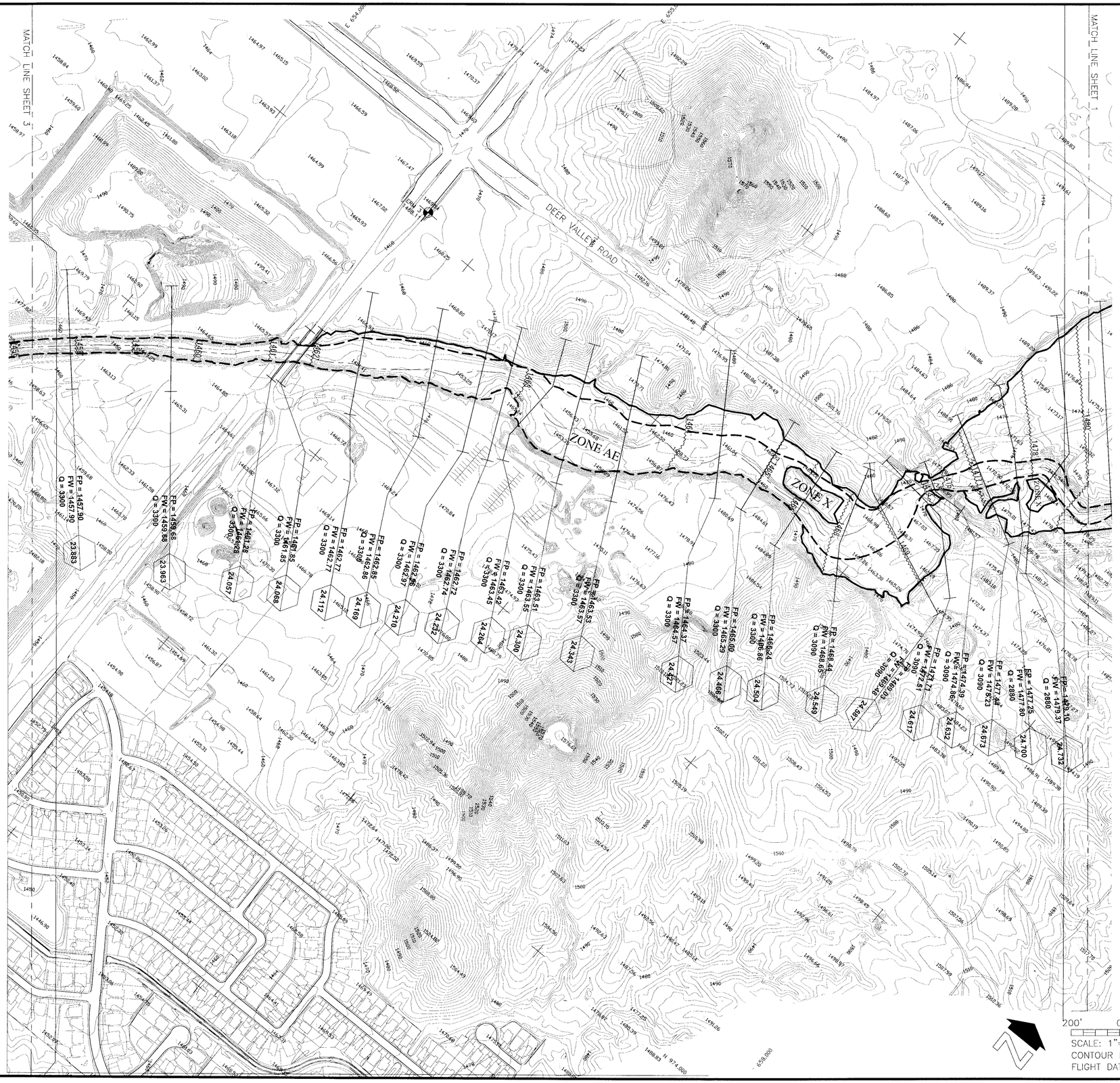
	BY	DATE
DESIGN	–	–
DESIGN CHK.	–	–
PLANS	LRK	8/06
PLANS CHK.	BTW	8/06

SHEET 1 OF 3

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

AERIAL MAPPING COMPANY: SOUTHWEST MAPPING TECHNOLOGIES, INC.

GROUND CONTROL SURVEY DATA PROVIDED BY HERSEY LAND SURVEYING, L.L.C.



200' 0' 200' 400'

SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATE: 12/11/2004

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	FP= 1479.10, FW= 1479.37, Q = 2880, 24.732
ELEVATION REFERENCE MARK	ERM 3, 1468.11
BASE FLOOD ELEVATIONS	1480'
ZONE DESIGNATIONS	ZONE AE, ZONE AH

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD= 1929 NGVD + 1.87

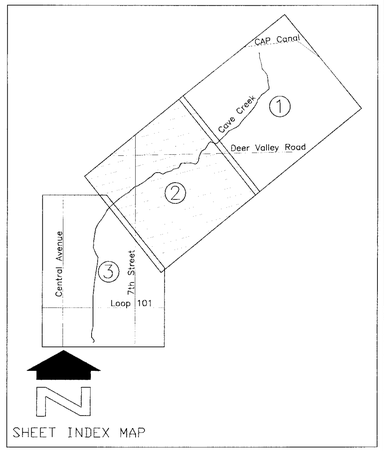
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 3	1468.11	SET BRASS CAP FLUSH, + OR - 100' SOUTH OF THE INT. OF LANDFILL RD. & CAVE CREEK WASH, AT WEST SIDE OF WASH INSIDE THE LANDFILL

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 EXCEPT CROSS-SECTIONS OUTSIDE THE STUDY LIMITS.

2- THE FOLLOWING CROSS-SECTIONS ARE OUTSIDE THE STUDY LIMITS: 22.880, 25.551, 25.557 AND 25.561.

3- THE TWO REGIONS DESIGNATED AS ZONE X ARE SHADED ZONE X.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CAVE CREEK FROM CAP CANAL TO LOOP 101 HIGHWAY
FLOODPLAIN DELINEATION STUDY
CONTRACT NO. 2004C024

Registered Professional Engineer (Civil) CERTIFICATE NO. 41980 BRIAN THOMAS WAHLIN Date Signed 12/14/06 ARIZONA, U.S.A.

WEST CONSULTANTS, INC.

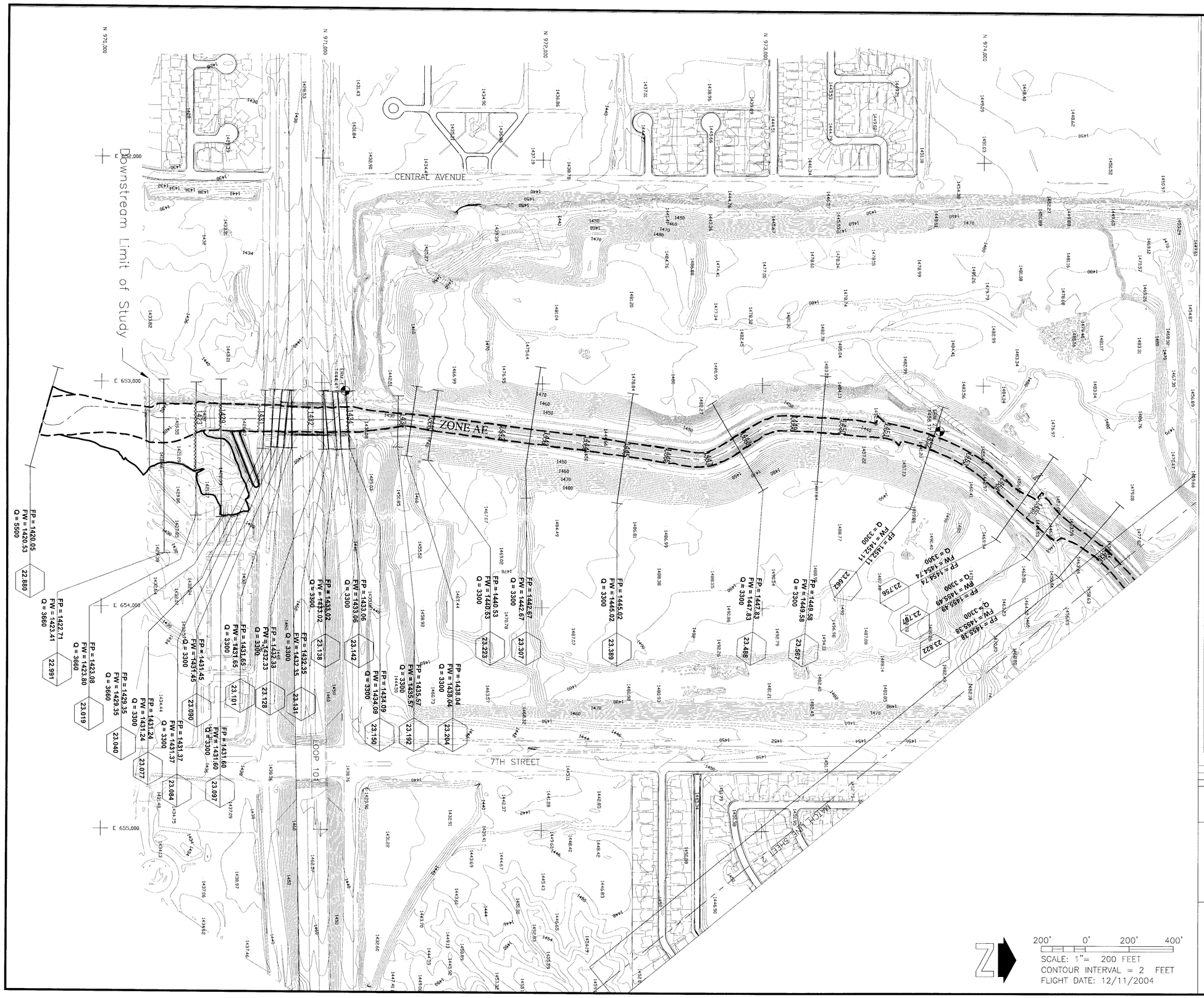
	BY	DATE
DESIGN	--	--
DESIGN CHK.	--	--
PLANS	LRK	8/06
PLANS CHK.	BTW	8/06

SHEET 2 OF 3

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

AERIAL MAPPING COMPANY: SOUTHWEST MAPPING TECHNOLOGIES, INC.

GROUND CONTROL SURVEY DATA PROVIDED BY HERSEY LAND SURVEYING, L.L.C.



LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE	
CROSS SECTION	FP= 1455.38, FW= 1455.38, Q = 3300 — 23.822
ELEVATION REFERENCE MARK	ERM 1, 1444.41
BASE FLOOD ELEVATIONS	1456'
ZONE DESIGNATIONS	ZONE AE, ZONE AH

ELEVATION REFERENCE MARKS

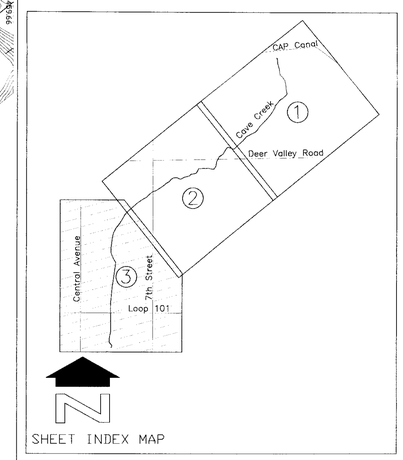
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1988 NAVD= 1929 NGVD + 1.87

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 1	1444.41	SET BRASS CAP AT WEST END OF BRIDGE BARRIER AT BEGINNING OF CURB (TOP), WEST BOUND FRONTAGE ROAD ON THE NORTH SIDE
ERM 2	1458.17	SET BRASS CAP ON TOP OF CURB, NORTH OF CURB INLET, SOUTH OF THE SOUTH END OF CURB RETURN AT S.E. CORNER OF 7th STREET & DEER VALLEY

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 EXCEPT CROSS-SECTIONS OUTSIDE THE STUDY LIMITS.

2- THE FOLLOWING CROSS-SECTIONS ARE OUTSIDE THE STUDY LIMITS: 22.880, 25.551, 25.557 AND 25.561.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CAVE CREEK FROM CAP CANAL TO LOOP 101 HIGHWAY FLOODPLAIN DELINEATION STUDY CONTRACT NO. 2004C024

Registered Professional Engineer (Civil) CERTIFICATE NO. 41980 BRIAN THOMAS WAHLIN Date Signed 1/24/07 ARIZONA, U.S.A.

WEST CONSULTANTS, INC.

	BY	DATE
DESIGN	—	—
DESIGN CHK.	—	—
PLANS	LRK	8/06
PLANS CHK.	BTW	8/06

SHEET 3 OF 3

200' 0' 200' 400'

SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATE: 12/11/2004

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

AERIAL MAPPING COMPANY: SOUTHWEST MAPPING TECHNOLOGIES, INC.

GROUND CONTROL SURVEY DATA PROVIDED BY HERSEY LAND SURVEYING, L.L.C.