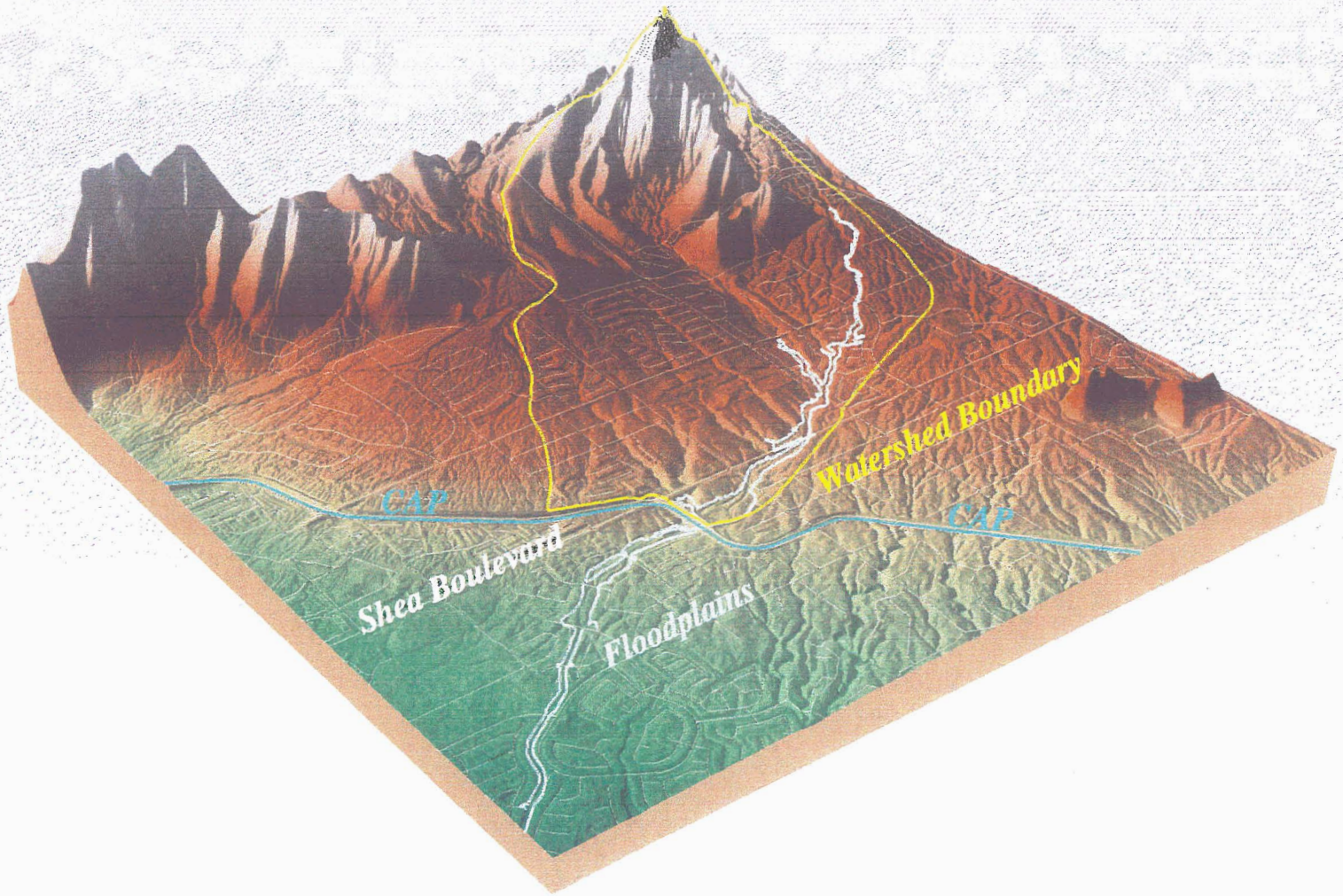
Floodplain Redelineation for Wash B



FCD 99-10

Richard Harris - FCDX

From: Richard Harris - FCDX
Sent: Wednesday, June 01, 2005 5:19 PM
To: Tim Murphy - FCDX
Cc: Richard Harris - FCDX
Subject: Wash B FIS information check.

Tim,

As you requested I have the following to report:

1. The data was submitted to FEMA in NAVD 88 and FEMA converted it to the NGVD 29 data that is contained in the Floodway Data Table of the LOMR.

2. The discharges listed on the Table 1. Summary of Discharges are correct. At first it appeared that the label for "At Shea Boulevard" should show a higher discharge than listed, but a closer look at the Hydrology modeling shows that the higher discharge occurs just downstream of the Wash B/Shea crossing. The topo maps indicate an additional crossing of tributary flows several hundred feet to the West of the Wash B crossing. You might want to field verify this.

3. The drainage area listed in Table 1 for the "At Shea Boulevard" location has the numbers listed incorrectly for the discharge listed, and should be changed to 1.63 square miles.

I hope this helps!

Richard

Tim said he'd modify label in Table 1 to say "Above Shea Boulevard"

WASH "B"
FLOODPLAIN DELINEATION

Between Shea Boulevard and Doubletree Ranch Road

FDMC CONTRACT #99-10

February 7, 2001
Revised: July 11, 2002

CVL #99-7002-01

WASH "B"
FLOODPLAIN DELINEATION

Between Shea Boulevard and Doubletree Ranch Road

FDMC CONTRACT #99-10

February 7, 2001
Revised: July 11, 2002

Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

CVL #99-7002-01

CVL

WASH B
TECHNICAL DATA NOTEBOOK

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1.0 INTRODUCTION

Coe & Van Loo Consultants, Inc., (CVL) has contracted with the Flood Control District of Maricopa County (FCDMC) to perform a Floodplain Delineation Study for a portion of Wash B located in Maricopa County, Arizona.

The project consists of topographic mapping and floodplain delineation of approximately 3.9 river miles of Wash B south of the Cactus Road alignment and north of Doubletree Ranch Road in the City of Scottsdale. In addition, topographic mapping has been produced and ponding limits established on the upstream side of the Central Arizona Project (CAP) Canal. CVL developed the hydrology for the entire watershed using the U.S. Army CORPS of Engineer's (CORPS) HEC-1 computer model. Backwater analysis has been conducted using the HEC-RAS computer model to determine floodplain delineations for the 100-year peak flood.

The specific scope of this Floodplain Delineation Study is to evaluate the existence and severity of flood hazards for Wash B.

Refer to the study area location map (Hydrology Report, Section 4) for wash location.

1.1 Description of Watershed

Hydrology is being analyzed for approximately 2.5 square miles of watershed that contributes stormwater runoff to Wash B. Wash B watershed extends approximately 2 miles north of the CAP Canal and Shea Boulevard crossing with the upper limit located within the McDowell Mountains. Numerous roads cross the watershed, including Cactus Road, Via Linda Road and Shea Boulevard with the southern boundary of the watershed being at the CAP Canal just south of Shea Boulevard.

1.2 Method Description

1.2.1 Hydrologic Model

A computerized rainfall/runoff model was developed for the Wash B watershed using the U.S. Army Corps of Engineers (CORPS) Flood Hydrograph Package, HEC-1 (Ref. 3). HEC-1 uses numerical parameters to describe the amount **and** temporal distribution of rainfall, the runoff characteristics of the watershed, and the hydraulic properties of channels and

washes that collect and convey the direct runoff to concentration points. The computer output provides runoff hydrographs at user selected locations. A network of sub-basins and connecting channels was configured that simulates the natural drainage patterns of the watershed.

The September 1990 HEC-1 computer program was used to model the Wash B watershed. The HEC-1 version 4.0, as implemented by Dodson and Associates, Inc. in their April 1991 version of ProHEC-1 was used for this study.

The following table contains the peak discharges determined in the HEC-1 model for the 100-year, **24**-hour storm that were used in the floodplain delineation.

Table 1
Peak Discharges Used for Floodplain Delineation

Wash Name	Location Section-Section	HEC-1 ID	Controlling Storm	Peak Flow 100-yr
Wash "B"	1.160-1.404	CP4	24-HR.	333
	1.449-1.819	CP5	24-HR.	739
	1.839-2.197	CP3	24-HR.	2018
	2.294-2.682	CP6	24-HR.	2509
Tributary	0.389-0.723	CP2	24-HR.	1066

1.2.2 Hydraulic Analysis

The study reach is 3.9 miles of Wash "B" and one minor tributary south of the Cactus Road Alignment to Doubletree Ranch Road. For most of the study reach Wash "B" and its tributaries are in their natural condition. There are, however, some road and structure crossings, including the C.A.P. Canal.

The existing condition 100-year frequency flood was analyzed for the hydraulics of the entire study reach. The resultant 100-year flood limits were delineated for FEMA regulatory purposes. Refer to the floodplain delineation maps in the Hydraulics Report (Section 5) for the location of the floodplain boundary.

This study has been performed to meet the National Flood Insurance Program standards and includes a flood boundary map designed to assist the FCDMC and the local communities in developing sound floodplain management measures.

The 100-year flood has been adopted by the Federal Emergency Management Agency (FEMA) as the base flood for purposes of floodplain management measures. The boundary of the 100-year flood (shown in Hydraulics Report, Section 5) has been delineated from flood elevations computed at each cross section. The boundaries were then interpolated between each cross section using topographic maps at a scale of 1" = 200' with a contour interval of 2 feet.

The CORPS HEC-RAS computer program was used to model the study reaches. The September 1998 HEC-RAS version 2.2 was used in the study. The study reaches were modeled as sub-critical profiles. The computer runs were started based on the slope area method. In some areas, the encroachment and ineffective flow options were used to model dead or non-effective flow areas. Consequently "Enc. Sta. L" and "Enc. Sta. R" do not represent the actual flooding limits, and the delineation was established based on the cross-section point elevations and the topography. In some cases "Top Width" does not represent the full width of the floodplain due to ineffective flow areas or low islands within the floodplain. These considerations were accounted for in the modeling and the delineation process.

1.3 Study Results

The National Flood Insurance Program provides for the delineation of different flood hazard zones. These zones can be used as a tool to assist local communities in providing good floodplain management.

100-year floodplains have been determined for Wash "B" and its tributary as described previously in the Hydraulic Report, under separate cover. Much of the 100-year flow is channelized with velocities varying from 2 ft/s to 10 ft/s. Based on this, the FCDMC and CVL concluded that a floodway would equal floodplain for most of the study area. Therefore, a floodway was only delineated for the sections of Wash "B" that were encroachable. The FCDMC and CVL recommend that Wash "B" and its tributary be designated as a Zone "AE".

Stormwater ponding upstream of the C.A.P. Canal has been delineated for the 100-year storm. This is described in Section 6.2 and Appendix C of the Hydraulics Report (Section 5). The FCDMC and CVL recommend that this area be designated as a Zone "A" on the Flood Insurance Rate Maps.

2.0 STUDY DOCUMENTATION ABSTRACT

STUDY DOCUMENTATION ABSTRACT		INITIAL STUDY	X	RESTUDY		LOMR		OTHER	
SECTION 1: GENERAL INFORMATION									
1A	COMMUNITY	MARICOPA COUNTY, AZ, AND INCORPORATED AREAS							
1B	COMMUNITY NUMBER								
1C	COUNTY	MARICOPA COUNTY							
1D	STATE	ARIZONA							
1E	DATE STUDY ACCEPTED								
1F	STUDY CONTRACTOR CONTACT(S) ADDRESS PHONE	COE & VAN LOO CONSULTANTS, INC. BURKE LOKEY, P.E. 4550 N. 12TH STREET, PHOENIX, AZ 85014 (602) 264-6831							
1G	TECH. REVIEWER (FEMA) PHONE								
1H	FEMA REGIONAL REVIEWER PHONE	PERNILLE BUCH-PEDERSEN 877-336-2627							
1I	STATE REVIEWER PHONE	N/A							
1J	LOCAL REVIEWER CONTACT ADDRESS PHONE	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY DAVID BOGGS, P.E. 2801 W. DURANGO, PHOENIX, AZ 85009 (602) 506-4528							
1K	RIVER OR STREAM NAME	WASH B							
1L	REACH DESCRIPTION	SOUTH OF THE CACTUS ROAD ALIGNMENT AND NORTH OF DOUBLETREE RANCH ROAD							
1M	STUDY TYPE	RIVERINE							
SECTION 2: MAPPING INFORMATION									
2A	USGS QUAD SHEET(S)	SAWIK MOUNTAIN, ARIZONA, PHOTO REVISED 1982							
2B	MAPPING FOR HYDROLOGIC STUDY TYPE/SOURCE SCALE DATE	 USGS 7.5 MINUTE QUADRANGLE (ABOVE) 1" = 2000' ABOVE							
2C	MAPPING FOR HYDRAULIC STUDY TYPE/SOURCE SCALE DATE	 AERIAL TOPOGRAPHY BY CITY OF SCOTTSDALE 1" = 200', 2' CONTOUR INTERVAL PHOTOGRAPH DATE – NOVEMBER 1999							
SECTION 3: HYDROLOGY									
3A	MODEL OR METHOD USED (including vendor and version description)	U.S. ARMY CORPS OF ENGINEERS FLOOD HYDROGRAPH PACKAGE, HEC-1 VERSION 4.0 AS SUPPLIED BY DODSON & ASSOCIATES, INC.							
3B	STORM DURATION	6-HOUR						24-HOUR	
3C	HYETOGRAPH TYPE	FCDMC						SCS TYPE II	
3D	FREQUENCIES DETERMINED	100-YEAR						100-YEAR	
3E	LIST OF GAGES USED IN FREQUENCY ANALYSIS OR CALIBRATION (Location, Years of Record, Gage Ownership)	NONE							
3F	RAINFALL AMOUNTS AND REFERENCE	3.3 INCHES NOAA ATLAS 2 VOLUME VIII						4.1 INCHES	
3G	UNIQUE CONDITIONS AND PROBLEMS								

3H	COORDINATION OF Q's (agency, date, comments)	FLOOD CONTROL DISTRICT OF MARICOPA COUNTY JOE RUMANN (602) 506-7137
SECTION 4: HYDRAULICS		
4A	MODEL OR METHOD USED (including vendor and version description)	U.S. ARMY CORPS OF ENGINEERS, VERSION 2.2 HEC-RAS
4B	REGIME	SUBCRITICAL
4C	FREQUENCIES FOR WHICH PROFILES WERE COMPUTED	100-YEAR
4D	METHOD OF FLOODWAY CALCULATION	NONE
4E	UNIQUE CONDITIONS AND PROBLEMS	

FEDERAL EMERGENCY MANAGEMENT AGENCY
REVISION REQUESTER AND COMMUNITY OFFICIAL

O.M.B No. 3067-0148
Expires April 30, 2001

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

1. REQUESTED RESPONSE FROM FEMA

This request is for a:

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

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

☐ Other Describe: _____

2. OVERVIEW

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

☐ Physical Change ☒ Improved Methodology/Data ☐ Floodway Revision

☐ Other Describe: _____

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

Flooding Source: McDowell Mountains, North & East of Wash "B"

3. Project Name/Identifier: Wash "B"

4. FEMA zone designations affected: A, AE

(example: A, AH, AO, A1-A30, A99, AE, V, V1-V30, VE, B, C, D, X)

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

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301 480287	Katy, City Harris County	TX TX	480301 48201C	0005D 0220G	02/08/83 09/28/90
045012	Scottsdale, City of	AZ	04013C	1705E	09/30/95
045012	Maricopa County	AZ	04013C	1710D	04/15/88

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

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

4. ENCROACHMENT INFORMATION

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

es, attach a copy of a letter notifying the appropriate State agency of the floodway revision and documentation of the approval of the evised floodway by the appropriate State agency.

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

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

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

5. MAINTENANCE RESPONSIBILITY

The community is willing to assume responsibility for ☐ performing ☐ overseeing compliance with the maintenance and operation plans of the _____ flood
(Name)
control structure. If not performed promptly by an owner other than the community, the community will provide the necessary services without cost to the Federal government.

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

6. REVIEW FEE

The review fee for the appropriate request category has been included. ☐ Yes Fee amount: $_____
OR
This request is based on a federally sponsored flood-control project where 50 percent or more of the project's cost is federally sponsored, or the request is based on detailed hydrologic and hydraulic studies conducted by Federal, State, or local agencies to replace approximate studies conducted by FEMA and shown on the effective FIRM; thus the project is fee exempt. ☐ Yes

Please see Instructions for Fee Amounts

7. SIGNATURE

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

Richard P. Harris
Signature of Revision Requester

Richard Harris, P.E.
Printed Name and Title of Revision Requester

Flood Control District of Maricopa County
Company Name

(602) 506-4528 06/07/01
Telephone No. Date

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

Collis Lovely
Signature of Community Official

Collis Lovely, Floodplain Administrator
Printed Name and Title of Community Official

City of Scottsdale
Community Name

(480) 313-7696 6/8/01
Telephone No. Date

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

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

Burke P. Lokey
Signature

Burke P. Lokey, P.E., Director Water Resources
Printed Name and Title of Revision Requester

Registr No. 20809 Expires (Date) 6-30-2003 State AZ

Type of License/Expertise: Civil

Check which forms have been included with this request

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

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

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Note: Fill out one form for each flooding source studied

Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. REASON FOR NEW HYDROLOGIC ANALYSIS

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

☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Other

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

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

2. METHODOLOGY FOR NEW ANALYSIS

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

3. APPROVAL OF ANALYSIS

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

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

4. COMPARISON OF BASE FLOOD DISCHARGES

Location	Drainage Area (SqMi)	FIS(cfs)	Revised (cfs)
Wash "B", Scottsdale, AZ	2.5	1380	1192

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

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

5. HISTORICAL FLOODING INFORMATION

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

ATTACHMENT D: PRECIPITATION/RUNOFF MODEL

	FIS:	Revised:
1. Method or model used:	Unknown	HEC-1 USACOE
Version:	N/A	4.0
Date:	N/A	September 1990
2. Source of rainfall depth:	N/A	FCDMC Hydrologic Design Manual
3. Source of rainfall distribution:	N/A	" "
4. Rainfall duration:	N/A	100-yr, 24-hr
5. Areal adjustment to precipitation (%):	N/A	0.99 (99%)
6. Maximum overland flow length	N/A	3.9 River Miles
7. Hydrograph development method:	N/A	S-Graph
8. Loss rate method:	N/A	Green & Ampt
Source of soils information:	N/A	SCS Soils Survey
Source of land use information:	N/A	Aguila Carefree Area Aerial Maps, COS regulations
9. Channel routing method:	N/A	Normal Depth
10. Reservoir routing:	☐ Yes ☐ No	☒ Yes ☐ No
11. Baseflow considerations:	☐ Yes ☐ No	☐ Yes ☒ No

If Yes, explain below how baseflow was determined:

12. Snowmelt considerations: ☐ Yes ☐ No ☐ Yes ☒ No

13. Model calibration: ☐ Yes ☐ No ☒ Yes ☐ No

If Yes, explain below how calibration was performed

Representative 100-yr discharges for Wash "B" as calculated in HEC-1 Model were plotted on Peak Discharges vs Drainage Area Curves for Maricopa County. The plots indicate the HEC-1 results appear to be reasonable magnitude.

14. Future land use condition: ☐ Yes ☐ No ☐ Yes ☐ No

If Yes, explain why below

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

Information and Maps provided? ☒ Yes ☐ No

NOTE: FEMA policy is to base flooding on existing conditions

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

PUBLIC BURDEN DISCLOSURE NOTICE

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Note: Fill out one form for each flooding source studied

Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. REACH TO BE REVISED

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

Downstream Limit: Doubletree Ranch Road Alignment

Upstream Limit: Cactus Road Alignment

2. MODELS SUBMITTED

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

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

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

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

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

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

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. STARTING WATER-SURFACE ELEVATIONS

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

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

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

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

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

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

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

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

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

Explanation attached with Form ☐ **Explanation provided on attached printout** ☐

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

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. Profile Transition

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

Downstream End N/A *Cross-Section #* within _____ (feet) Upstream End N/A *Cross-Section #* within _____ (feet)

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

Downstream End N/A *Cross-Section #* within _____ (feet) Upstream End N/A *Cross-Section #* within _____ (feet)

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

Downstream End N/A *Cross-Section #* within _____ (feet) Upstream End N/A *Cross-Section #* within _____ (feet)

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

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

☒ Stream Name	☐ Community Name	☒ Corporate Limits labeled	☒ Study limits labeled
☒ Confluences labeled	☒ Channel Stationing	☒ Streambed profiled	☒ Cross Sections labeled
☐ Horizontal/Vertical Scales indicated		☒ 100-year elevs profiled*	
☒ Road Crossings	☐ Labeled	☐ Low Chord Elevations	☐ Top of Road Elevations

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

Floodway Data Table

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

Floodway Data Table Attached ☒ **Yes** ☐ **Not Required**

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

PUBLIC BURDEN DISCLOSURE NOTICE

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

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

Note: Fill out one form for each flooding source studied

Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

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

1. MAPPING CHANGES

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

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

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

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

City of Scottsdale, Photogrammetric Methods, Sept. Oct., Nov., 1993

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

Effective FIS	Scale	N/A	Contour Interval	N/A
Revision Request	Scale	1" = 200'	Contour Interval	2 ft.

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

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. EARTH FILL PLACEMENT

1. The fill is: ☐ Existing ☐ Proposed

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

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

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

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

      If Yes, justify steeper slopes _____

      _____

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

      ☐ Yes ☐ No

      If No, describe erosion protection provided _____

      _____

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

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

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

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

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

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

   ☐ Yes ☐ No

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

MT-2, Form 1, Page 1 of 2

Refer to Wash "B" Upstream of CAP-Zone A FDS
FEMA Case No.: 01-09-074P

MT-2, Form 4, Page 1 of 2

The floodplain has not previously been delineated. The model included is a new model; wb.prj.

MT-2, Form 5, Page 1 of 2

Item g: The effective 100-year floodplain and floodway boundaries from FIRM/FBFM do not exist, therefore will not be included.

Item h: Tie-ins between the effective and revised 100-, 500-year and floodway boundaries do not apply because this is a new study and there is no existing floodplain/floodway to tie into.

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

PUBLIC BURDEN DISCLOSURE NOTICE

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Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): Mountain View Road Bridge

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Sta 33+05 (RM = 0.6259)

3. This revision reflects (check one of the following):

   - [X] 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

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS bridge routine

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached [ ] **Yes** [ ] **No** [X] **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ 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
- ☐ Skew Angle
- ☐ Cross-Section Locations
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

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Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): 117th Way

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Sta 52+45 (RM = 0.9934)

3. This revision reflects (check one of the following):

   - [X] 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

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS culvert routine & HY 8

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached [ ] **Yes** [ ] **No** [X] **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ 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
- ☐ Skew Angle
- ☐ Cross-Section Locations
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

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Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): 118th Place

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Sta 61+88 (RM = 1.1720)

3. This revision reflects (check one of the following):

   ☒ 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

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS culvert routine & HY 8

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached ☐ **Yes** ☐ **No** ☒ **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ 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
- ☐ Skew Angle
- ☐ Cross-Section Locations
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

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Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): 120th Street

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Sta 71+07 (RM = 1.3460)

3. This revision reflects (check one of the following):

   - [X] 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

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS culvert routine & HY 8

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached [ ] **Yes** [ ] **No** [X] **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ 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
- ☐ Skew Angle
- ☐ Cross-Section Locations
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

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Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): C.A.P.

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Sta 85+57 (RM = 1.6206)

3. This revision reflects (check one of the following):

   - [x] 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

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS culvert routine & HY 8

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached ☐ **Yes** ☐ **No** ☒ **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ 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
- ☐ Skew Angle
- ☐ Cross-Section Locations
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

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Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): Shea Boulevard

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Sta 116+88 (RM = 2.2136)

3. This revision reflects (check one of the following):

   - [X] 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

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS culvert routine & HY 8

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached [ ] **Yes** [ ] **No** [X] **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ 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
- ☐ Skew Angle
- ☐ Cross-Section Locations
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE/CULVERT**	O.M.B. Burden No. 3067-0148 Expires April 30, 2001

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Community Name: Scottsdale, Arizona

Flooding Source: McDowell Mountains, North & East of Wash "B"

Project Name/Identifier: Wash "B"

1. IDENTIFIER

1. Name of structure (roadway, railroad, etc.): Via Linda

2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier):

   Sta 169+15 (RM = 3.2036)

3. This revision reflects (check one of the following):

   - [X] 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

4. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)*

   HEC-RAS culvert routine & HY 8

   If different than hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structure(s). *(Attach justification)*

   Justification attached [ ] **Yes** [ ] **No** [X] **N/A**

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

2. DRAWING CHECKLIST

Attach plans of the structure(s) certified by a registered professional engineer. The plan detail and information should include the following (check the boxes if the information has been provided):

- ☐ Dimensions (height, width, span, radius, length)
- ☐ Shape (culverts only)
- ☐ Material
- ☐ Beveling or Rounding
- ☐ Wing Wall Angle
- ☐ 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
- ☐ Skew Angle
- ☐ Cross-Section Locations
- ☐ Distances Between Cross Sections
- ☐ Erosion Protection

3. SEDIMENT TRANSPORT CONSIDERATIONS

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the 100-year (base flood) water-surface elevations; and/or based on the stream geomorphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including sewer and deposition) to affect the base flood elevations, then provide the following information **(Check the box if provided):**

- ☐ Estimated sediment load
- ☐ Method used to estimate sediment transport
- ☐ Method used to estimate scour and/or deposition
- ☐ Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport

Bridge/Culvert MT-2, Form 7

Plans for the structures crossing Wash "B" are no longer on record with the City of Scottsdale; therefore, they will not be included with the Bridge/Culvert Forms.

3.0 MAPPING & SURVEY INFORMATION

3.1 Description of Mapping

Topographic mapping used for the hydrologic analysis included the United States Geological Survey (USGS) 7.5-minute quadrangle map Sawik Mountain, Arizona, Photorevised 1982.

Other mapping used in the hydrologic and hydraulic analysis was 1" = 200' aerial topography with 2 foot contour intervals. The City of Scottsdale, based on photographs taken in November 1999, provided the mapping specifically for this floodplain delineation. The horizontal datum for this project is NAD 83, Arizona State Plane Coordinate System, Central Zone. Vertical elevations are based on the mean Sea Level Datum of 1929 as monumented by the United States National Geodetic Survey and the United States Geological Survey.

3.2 Watershed Maps

The hydrologic analysis maps for this floodplain delineation study are in the Technical Data Notebook Section 4, Hydrologic Analysis.

3.3 Survey Field Notes

JDS Associates, LLC, performed the structural survey for this floodplain delineation study. Survey data is included in Appendix C.

3.4 Hydraulic Analysis Maps

The floodplain delineation maps for this flood insurance study are in the Technical Data Notebook Section 5, Hydraulic Analysis.

3.5 FIRM Maps

The current regulatory Flood Insurance Rate Maps for the study area are: Maricopa County, Arizona and Incorporated Areas, Map numbers 04013C1705E and 04013C1710D. Map revised: September 30, 1995 and April 15, 1988 respectively. Refer to the appendix for a copy of the current regulatory Flood Insurance Rate Map.

3.6 Community Map

Refer to Figure 4 in Section 4, Hydrologic Analysis, for the community map.

3.7 Miscellaneous Maps

Other maps including drainage area maps, soils unit maps, and land use maps are included in the Technical Data Notebook Section 4, Hydrologic Analysis.

3.8 Elevation Reference Mark Data

The elevation reference mark data was supplied to the Flood Control District of Maricopa County by the City of Scottsdale. See Appendix C.

4.0 HYDROLOGIC ANALYSIS

The Technical Data Notebook Section 4, Hydrologic Analysis.

5.0 HYDRAULIC ANALYSIS

The Technical Data Notebook Section 5, Hydraulic Analysis.

WASH "B"
FLOODPLAIN DELINEATION

Between Shea Boulevard and Doubletree Ranch Road

FCDMC CONTRACT #99-10

TECHNICAL DATA NOTEBOOK
SECTION 4
HYDROLOGIC ANALYSIS

January 30, 2001
Revised: June 13, 2001

Prepared for:

Maricopa County Flood Control District
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CVL Project No.: 99-7002-01

CVL

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WASH B FLOODPLAIN DELINEATION

APPENDIX

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1.0 INTRODUCTION

1.1 Scope of Study

Coe & Van Loo Consultants, Inc., (CVL) has contracted with the Flood Control District Maricopa County (FCDMC) to perform a Floodplain Delineation for a portion of Wash B located in Maricopa County, Arizona.

The project consists of topographic mapping and floodway delineation of approximately 3.9 river miles of Wash B south of the Cactus Road alignment and north of Doubletree Ranch Road in the City of Scottsdale. The reaches under study consist of the main stem and one tributary, broken down into three segments (1a, 1b, and 2). Segments 1a and 1b are the main stem, with 1a (2.1 miles) being the reach south of Shea Boulevard. Segment 1b in the main stem of Wash B is north of Shea Boulevard, comprising approximately 1.5 miles to Cactus Road. Segment 2 is the tributary to the main stem and is roughly 0.3 miles terminating at Via Linda Road. In addition, the study includes topographic mapping and the establishment of ponding limits on the upstream side of the Central Arizona Project (CAP) Canal. The limits of the contributory watershed are from Section 13 of Township 3N Range 5E (on the north) to Section 25 of Township 3N Range 5E (on the south). CVL developed hydrology for the 2.5 square mile watershed using the US Army Corps of Engineer's HEC-1 computer model. Backwater analysis will be conducted using the HEC-RAS computer model to determine floodplain and floodway delineation for the 100-year peak flood.

The specific scope of this report is to analyze and document the hydrology of Wash B. The hydrologic computations documented in this report are in accordance with the methodology documented in the FCDMC's *Hydrologic Design Model* (Ref. 1).

1.2 Description of Watershed

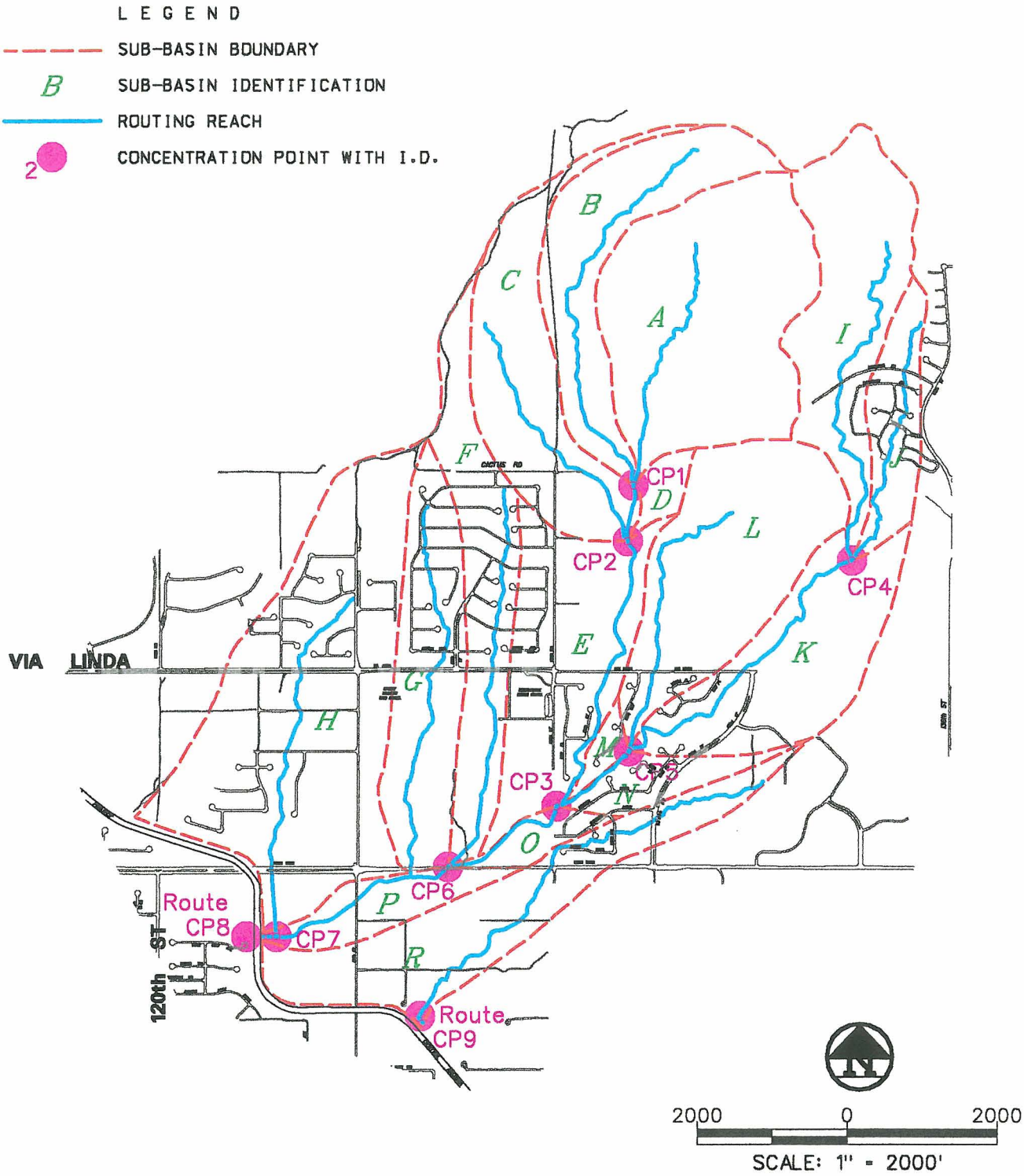
Hydrology is being analyzed for approximately 2.5 square miles of watershed that contributes stormwater runoff to Wash B. Wash B watershed extends approximately 2 miles north of the CAP Canal and Shea Boulevard crossing with the upper limit located within the McDowell Mountains. Numerous roads cross the watershed, including Cactus Road, Via Linda Road and Shea Boulevard with the southern boundary of the watershed being at the CAP Canal just south of Shea Boulevard. Refer to the **community** map (**Figure 4**) for the location of the Wash B Watershed Study Area.

The terrain within the watershed differs greatly with the mountains to the north having slopes ranging from 25 to 65 percent (%) and the rest of the watershed generally sloping to the southwest ranging from about 10% down to 2.5%. A large portion of the watershed is in a medium density residential condition with several roads, subdivisions and the CAP Canal. The soils within the watershed range from highly permeable sandy loam to less permeable clays and rock outcroppings.

1.3 Previous Studies and Reports

Wash B has not previously been analyzed for Floodplain Delineation. Hydrology is not available for the entire Wash B watershed. Information on the CAP overchute south of Shea Boulevard was gathered from the United States Bureau of Reclamation (USBR). The overchute structure, three, 72-inch-diameter pipes, is at CAP station 234+10. The Granite Reef Aqueduct (CAP Canal) Location Map (Reach 12) shows that the peak inflow is 1130 cfs, the storage capacity is 42 acre-feet and the peak outflow is 834 cfs for a 100-year 6-hour storm at this location. The input data for the overchute at station 234+10 (Hayden-Rhodes Data, Appendix VII) shows that the pipes were designed with the Soil Conservation Service (SCS) method to accommodate a drainage area of 2.42 square miles, a channel length of 2.50 miles with a centroid of 1.60 miles, a curve number of 80 and a slope of 480 feet/mile. The overchute was originally designed at an invert elevation of 1507.14 feet and a previous crest elevation of 1518.00 feet. See Appendix Section VII for details. No storage capacity data is available for the overchute.

A FEMA search was conducted to obtain any available historical data relating to the hydrologics and hydraulics in the area. The only information available for the entire Wash B area was a HEC-2 analysis, Glen Washburn FPMS, April 1976. A copy of this HEC-2 is included in the Appendix, Section VII. The HEC-2 appears to have been done prior to the construction of the CAP and does not provide any significant information.



WASH-B

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

ROUTING REACH WITH CONCENTRATION POINTS

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

JOB NO. 997002-01

FIGURE-2

DATE:- Mar. 01, 2000
TIME:- 13:08:36

WASH-B FLOODPLAIN DELINATION STUDY	STUDY AREA LOCATION MAP	JOB NO. 997002-01
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE-3

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2.0 METHOD DESCRIPTION

2.1 Hydrologic Model

A computerized rainfall/runoff model was developed for the Wash B watershed using the U.S. Army Corps of Engineers (CORPS) Flood Hydrograph Package, HEC-1 (Ref. 3). HEC-1 uses numerical parameters to describe the amount of temporal distribution of rainfall, the runoff characteristics of the watershed, and the hydraulic properties of channels and washes that collect and convey the direct runoff to concentration points. The computer output provides runoff hydrographs at user selected locations. A network of sub-basins and connecting channels was configured that simulates the natural drainage patterns of the watershed. See the Sub-Basin and Soils Delineation Map (Plate 1).

The September 1990 HEC-1 computer program was used to model the Wash B watershed. The HEC-1 version 4.0, as implemented by Dodson and Associates, Inc. in their April 1991 version of ProHEC-1 was used for this study.

2.2 Study Criteria

The criteria and guidelines to be used in this study were set forth by FCDMC prior to the commencement of work. The CORPS HEC-1 computer program was used to model the Wash B watershed, for the 100-year storm. Storm durations of 6 and 24 hours were evaluated to determine which duration storm results in the higher magnitude peak discharge.

The Phoenix Mountain S-Graph, the Phoenix Valley S-Graph, the Green-Ampt Loss Rate and the Normal Depth/Modified Puls Channel Routing options were used in the HEC-1 model for the Wash B watershed. The Maricopa County Unit Hydrograph Procedure 2 (MCUHP2) computer program within the new Drainage Design Management System (DDMSW), as provided by the FCDMC was used to generate the basic HEC-1 input file. The assumptions, procedures and methodologies used to develop the remainder of the HEC-1 data input sets are discussed in the following sections.

3.0 PARAMETER ESTIMATION

3.1 Drainage Area Boundaries

The study watershed encompasses approximately 2.5 square miles, extending from the McDowell Mountains to the CAP Canal. The sub-basins were delineated using detailed topographic mapping provided by the City of Scottsdale. The topographic mapping is at a 2-foot contour scale and is dated 1999.

The sub-basins were delineated such that concentration points were provided at meaningful locations, (confluences, roads, etc.). The sub-basin areas were all under 0.5 square miles. Refer to the Routing Reach with Concentration Points Map (Figure 2).

3.2 Physical Parameters

3.2.1 Unit Hydrograph Procedures

A large portion of the watershed was medium density residential with slopes ranging between 2.5% and 10%. The watershed was modeled with both the Phoenix Mountain S-Graph for the mountainous sub-basins and the Phoenix Valley S-Graph for the remainder, as implemented by the MCUHP2 computer program supplied by the FCDMC.

3.2.2 Loss Rate Estimation

Precipitation loss rates have been computed using the Green-Ampt Infiltration Equation option in HEC-1. The Green-Ampt Parameters XKSAT (hydraulic conductivity at natural saturation), PSIF (wetting front capillary suction), and DTHETA (volumetric soil moisture deficit at the start of rainfall) have been determined for each sub-basin. The area of each soil unit within each sub-basin was computed using maps from the Soil Conservation Service's Soil Survey of Aguila-Carefree Area, Parts of Maricopa and Pinal Counties, Arizona, then a log area-weighted set of Green-Ampt parameters for each sub-basin was calculated.

Given the Green-Ampt parameters based strictly on soil characteristics, the XKSAT and DTHETA parameters were then adjusted to account for vegetative cover and/or land use. To account for the impact of vegetative cover, the XKSAT parameters for each sub-basin were adjusted based on guidelines given in the FCDMC's *Hydrologic Design Manual*, aerial photographs and field observations. The DTHETA parameter is influenced by land use.

DTHETA (dry) was used in natural desert areas, due to the arid nature of the land. DTHETA (normal) was used for the medium density residential areas, since there is intermittent moisture due to watering landscaping. The DTHETA parameter was calculated as an area-weighted average based on the land use.

The percent vegetative cover within a sub-basin was based on guidelines from the City of Scottsdale (COS). The percent vegetative cover for natural mountain ranges, desert areas and medium density residential areas was restricted to 15%. The residential areas were further sub-divided into actual "developed" portions and "natural area" portions. These "natural areas" ranged from 25 to 35% of the total developed area in most of the sub-basins and are based on strict guidelines provided by the COS.

The COS has only minimal on-site storage (retention basins). The only on-site retention found in the entire Wash B drainage area was located at Anazi Elementary, Desert Mountain, and Mountain Middle Schools at 124th Street and Via Linda. Also, some parking lot retention is provided for a church located just south of Desert Mountain Middle School at 124th Street and Gail Street. Each facility has enough on-site storage to accommodate their own drainage areas. However, no off-site flows are retained. When the total on-site retention for these areas was accounted for in the HEC-1, it did not result in any significant impact to the original HEC-1 model. For this reason, no on-site retention of any kind has been included within the final HEC-1 model.

The "percent impervious" parameter (RTIMP) specifies the percentage of a sub-basin that is impervious. The "percent impervious" was computed for each sub-basin, as a function of natural rock features and land use. The percentage of impervious rock outcrops within each sub-basin was estimated from data provided in the SCS Soil Survey for each soil unit and was calculated within the MCHUP2 program.

The surface retention loss parameter (IA) is a function of land use and/or surface vegetative cover. IA values for each sub-basin have been calculated using guidelines given in the FCDMC's *Hydrologic Design Manual*. The IA values for natural desert areas have been weighted to reflect flat slopes, hill slopes or mountain slopes. Then the IA value has been area weighted to reflect the land use in the sub-basin.

The loss rate estimation parameters have been calculated using a computer spreadsheet program, Drainage Design Management System for Windows (DDMSW), provided by the FCDMC. The program uses the soil types, land use, vegetative cover and percent impervious to weight Green-Ampt parameters. The MCFCD provided semi-rectified aerial photographs dated 1999, which were used to determine land use parameters and vegetative cover percentages. See Section I in the appendix for loss rate parameters.

3.2.3 Lag Time

Lag time flow routes have been determined using detailed topographic maps. Lag times were calculated for each sub-basin using the following empirical equation per FCDMC guidelines.

$$Lag = C \frac{(L\ Lca)^m}{S^p}$$

where Lag = sub-basin lag time in hours

L = length of longest watercourse in miles

Lca= length along watercourse to a point opposite the centroid in miles

S = watercourse slope in feet

C = 24 Kn

Kn = estimated mean Manning's "n" for all channels in sub-basin

m = 0.38

p = 0.5

L, Lca and S were determined for each sub-basin based on topographic maps (see the Routing Reach Map, **Section XI,** Figure 2). The Kn values range from 0.035 to 0.09 and were based on aerial photography and field reconnaissance. The actual lag time calculation was done within DDMSW provided by the MCFCD. Refer to the appendix Section I for lag time calculation data.

3.2.4 Channel Routing

In this study, the Normal Depth Channel/Modified Puls method was used for all flow routings. Channel geometries, slopes and Manning's roughness coefficients were estimated from topographic maps, aerial photography and observations made during field

reconnaissance. The routing reach length and average slope were based on topographic mapping. The remaining channel parameters were estimated to represent an average cross-section for the reach.

The number of steps to be used in the channel routing (NSTPS) HEC-1 calculations was determined based on the guidelines given in the HEC-1 manual. The equation determining the NSTPS is as follows:

$$NSTPS = \frac{\text{Reach Length (ft)/Average Velocity (fps)}}{\text{Computational Time Interval (min) x 60 (sec/min)}}$$

The average velocity was initially estimated using Manning's Equation. After the initial HEC-1 runs, the reach length was divided by the difference in time to peak (due to the channel route) to better estimate the average velocity. After a few iterations, the results converged on a reasonable average velocity.

Transmission losses have not been applied to the channel routes.

3.2.5 Reservoir Routing

Reservoir routing was modeled in two locations in the ponding area behind the CAP Canal. The ponding and reservoir routing behind the CAP Canal was evaluated for the watershed based on topographic mapping. The outflow rating curves were based on inlet control using the HDS-5 culvert capacity charts (Ref. 10) for the 3, 72-inch-diameter culvert overchute and the 36-inch-diameter underchute and on weir flow over the canal. The CAP Canal bank was used as input into the HEC-1 model for weir flow calculations and the ponding limits were delineated based on 2-foot contour topographic mapping. Refer to the appendix Section IV for sample calculations of the ponding situation described in this section.

3.3 Statistical Parameters

The statistical parameters used in this analysis were obtained from the FCDMC's *Hydrologic Design Manual*. Extensive research and analysis went into the production of that manual. Refer to the Manual for the background of the statistical parameters.

3.3.1 Gage Data

There are no gage stations within this watershed. Therefore, a gage station analysis was not performed.

3.3.2 Calibration

Due to the lack of gage station data, calibration of the HEC-1 model was made using general statistical data. The FCDMC's Flood Frequency Analysis of U.S. Geological Survey (USGS) Gage Data Collected in Maricopa County was utilized for reasonableness of the HEC-1 model. Representative 100-year discharges for Wash B, as calculated in the HEC-1 model, were plotted on Peak Discharges versus Drainage Area Curves for the Maricopa County Area. The storm duration (6-hour or 24-hour) that produced the higher peak flow, at each selected location, was plotted on the curve. These plots indicated that the Hec-1 results appear to be of a reasonable magnitude. Refer to Appendix Section VIII for these curves and USGS's *Methods for Estimating Magnitude for Frequency of Floods in the Southwestern United States* (Reference 11) for the original empirical data.

3.4 Precipitation Parameters

3.4.1 Rainfall Distributions

The rainfall distributions used for the 6-hour storms are based on distributions documented in the FCDMC's *Hydrologic Design Manual* as implemented by the Maricopa County Unit Hydrograph Procedure 2 (MCUHP2) within DDMSW. The SCS Type II distribution was used for the 24-hour storm (see appendix **Sections IV**, Tables 5 & 6).

3.4.2 Precipitation Data

The point precipitation values used in this study were obtained from isopluvial maps for Maricopa County published in the FCDMC's *Hydrologic Design Manual.* The Wash B watershed was drawn on each isopluvial map and the precipitation was approximated at the centroid of the watershed. The point precipitation values are given in **Table 7** and copies of isopluvial maps are included in appendix **Section V**.

3.4.3 Aerial Reduction Factors

The point precipitation values used in this study were adjusted with aerial reduction factors to account for the natural spatial variability of rainfall. Reduction factors for the 6-hour duration storms were obtained from curves documented in the FCDMC's *Hydrologic Design Manual.* This data was based on depth-area reduction curves developed by the CORPS, for the historic storm of 1954 over the Queen Creek area. The 24-hour storm reduction factors were obtained from the *NOAA Technical Memorandum NWS HYDRO-40* (Ref. 4). These factors are given in the appendix **Section VI, Table 8**.

3.4.4 Computational Time Step Interval

The computational time step interval was chosen to be long enough such that the total storm would be covered by the 300 time increments, and short enough that it was no longer than the shortest lag time. A time step of 2 minutes was chosen for the 6-hour storm and a time step of 5 minutes was chosen for the 24-hour storm. With 300 time increments, the computations would cover 10 hours for the 6-hour storm and 25 hours for the 24-hour storm, which is sufficient for both.

4.0 PROBLEMS/DISCUSSIONS

The original model for the Wash B drainage area as found in the FEMA Flood Insurance Study (FIS) for Maricopa County, September 30, 1995, shows the peak 100-year discharge for Wash B to be approximately 1380 cfs at a point 4500 feet downstream of 124th Street, just south of the CAP Canal. The current HEC-1 model for Wash B developed in this study indicates a peak 100 year, 6-hour flow of 3115 cfs at the CAP Canal. This 3115 cfs flow results in overtopping of the CAP Canal at the 3, 72-inch-diameter culvert overchute, and overtopping of the berm south of the CAP Canal overchute. As a test, the model was adjusted by varying land-use types and changing all developed areas into their pre-developed natural conditions and still resulted in a large overtopping flow.

Due to the unavailability of any previous Wash B studies or any verification of the original FEMA FIS discharges, the model was set up to demonstrate that of the 3115 cfs that reaches the CAP Canal overchute, 1192 cfs is routed through the overchute, 1128 cfs is stored in the ponding area behind the CAP canal and the remaining 795 cfs overtops the CAP Canal and the berm south of the CAP Canal, 397 cfs and 397 cfs respectively. The flows routed through the overchute have been verified using the HY8 program. The floodplain delineation southwest of the CAP will use the 1192 cfs that is routed through the overchute. Of the 795 cfs that overtops the CAP and the berm south of the CAP, 397 will enter the CAP and 397 will contribute to the small drainage area south of the berm. The CAP at this location has been designed to be able to withstand an additional 600-cfs of flow without overtopping its banks. Additional calculations were performed at a cross-section of the CAP at the overchutes to determine the increase in the water level from the additional 397 cfs. The maximum increase in water level, assuming maximum capacity in the CAP of 3000 cfs, resulted in an elevation difference of 1.04 ft. Manning's Equation calculations and a sketch of the cross-section of the CAP can be found in Appendix Section IX. The HEC-1 models shows that the CAP south of the berm at the 36-inch-diameter underchute overtops approximately 0.15 feet from the additional 397 cfs. After many discussions with the FCDMC and the City of Scottsdale, it was decided that these overtopping flows accurately depict the flood scenario at the CAP Canal.

5.0 FINAL RESULTS

The HEC-1 hydrologic simulation model was used to compute 100-year discharges for Wash B. The 100-year discharges corresponding to both the 6-hour and 24-hour events were evaluated in the study. The results of the study are summarized in Table 9.

Wash B has a small watershed and small sub-basins, which resulted in a higher peak discharge for the 6-hour event as compared to the 24-hour event. It is recommended that the peak discharge for the 6-hour event be used in the floodplain delineation analysis.

The 6-hour peak flow is 3115 cfs. The routed flow of 1192 cfs will be used in the HEC-RAS model south of the CAP Canal for the Wash B Floodplain Delineation. South of the CAP, the downstream watershed conditions consist of moderately dense housing developments (subdivisions). Due to the topography and/or revised developments no additional contributions of flow occur south of the CAP Canal. The CAP Canal retains the entire runoff from the Wash B drainage area in the ponding areas that build up behind the Canal.

6.0 FINAL MODELING RESULTS

The enclosed disks contain the 100-year/6-hour and 100-year/24-hour HEC-1 input and output files.

Table 9

100-Year Peak Discharges on Wash B		6Hour			24Hour		
Location	**HEC-1 ID**	**Discharge (cfs)**	**Time to Peak (hrs)**	**Q/A (cfs/sm)**	**Discharge (cfs)**	**Time to Peak (hrs)**	**Q/A (cfs/sm)**
Concentration Point*	CP1	771	4.07	1606	794	12.00	1654
	CP2	1047	4.10	1517	1066	12.08	1545
	CP3	321	4.27	1459	306	12.17	1391
	CP4	326	4.13	1254	333	12.08	1281
	CP5	740	4.30	1088	739	12.25	1087
	CP3	2024	4.30	1242	2018	12.25	1238
	CP6	2565	4.33	1283	2509	12.25	1248
	CP7	3115	4.47	1261	3011	12.42	1214
CAP Canal	Route	2758	4.67	1117	2509	12.58	1012
Overchute	CP8	354	4.67	143.3	322	12.58	129.8
	CP9	498	4.67	186.5	467	12.58	174.3
CAP Canal	Route	296	4.97	110.9	227	13.00	84.7
Underchute							

* See Routing Map in appendix Section VIII for location of Concentration Points

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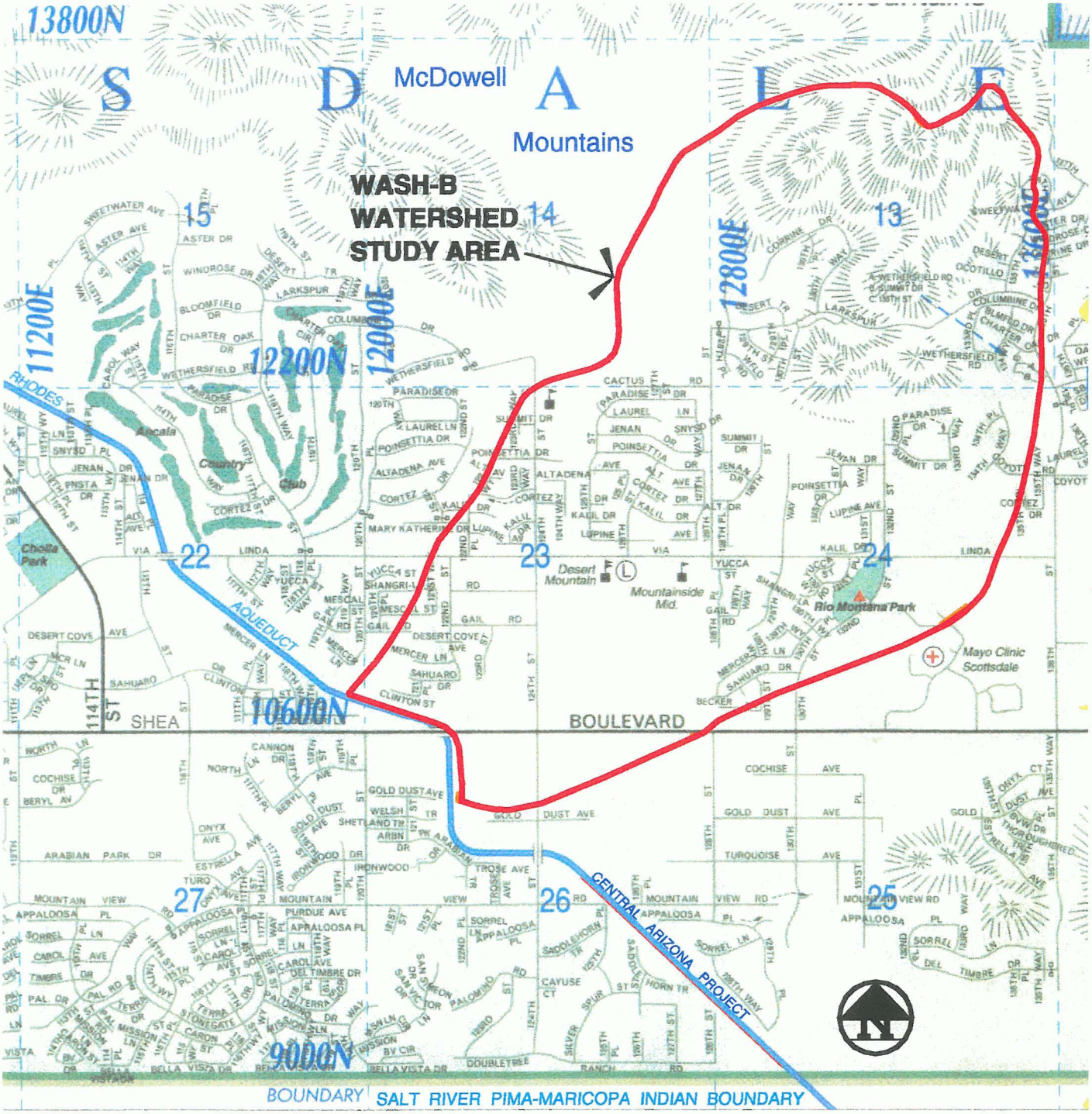

WASH-B FLOODPLAIN DELINATION STUDY	COMMUNITY MAP	JOB NO. 997002-01
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831	COE & VAN LOO PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE	FIGURE-4

DATE: March 2000
FILE: n:\llc\997002\land\fcd\exh-04.dgn

Table 9

100-Year Peak Discharges on Wash B

Location	HEC-1 ID	6Hour Discharge (cfs)	6Hour Time to Peak (hrs)	6Hour Q/A (cfs/sm)	24Hour Discharge (cfs)	24Hour Time to Peak (hrs)	24Hour Q/A (cfs/sm)
Concentration Point*	CP1	771	4.07	1606	794	12.00	1654
	CP2	1047	4.10	1517	1066	12.08	1545
	CP3	321	4.27	1459	306	12.17	1391
	CP4	326	4.13	1254	333	12.08	1281
	CP5	740	4.30	1088	739	12.25	1087
	CP3	2024	4.30	1242	2018	12.25	1238
	CP6	2565	4.33	1283	2509	12.25	1248
	CP7	3115	4.47	1261	3011	12.42	1214
CAP Canal	Route	2758	4.67	1117	2509	12.58	1012
Overchute	CP8	354	4.67	143.3	322	12.58	129.8
	CP9	498	4.67	186.5	467	12.58	174.3
CAP Canal	Route	296	4.97	110.9	227	13.00	84.7
Underchute							

* See Routing Map in appendix Section VIII for location of Concentration Points

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Section I: LOSS RATE PARAMETERS ESTIMATION

TABLE 1 SUB-BASIN DATA

TABLE 2 SOIL DATA

TABLE 3 LAND USE DATA

Flood Control District of Maricopa County
99700201 - Wash B

Sub Basin Data

5/15/00

Basin: 01 Storms: Single Duration: 6 Hour Loss Method: Green-Ampt Unit Hydrograph: S-Graph

	Sub Basin Parameters							Rainfall Losses				
Area ID	Area (sq mi)	Length (mi)	Slope (ft/mi)	S-Graph	Lca (mi)	Lag (min)	Kn	I (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)
A	0.31	0.80	175.0	Mountain	0.40	11	0.047	0.24	0.34	4.80	0.27	48
B	0.17	1.10	872.7	Valley	0.55	13	0.041	0.24	0.34	4.50	0.33	31
C	0.19	1.10	540.9	Valley	0.55	25	0.069	0.24	0.21	10.10	0.03	5
D	0.02	0.22	363.6	Valley	0.11	5	0.061	0.25	0.35	3.74	0.51	31
E	0.20	0.90	188.9	Valley	0.45	26	0.070	0.18	0.18	8.80	0.06	22
M	0.02	0.18	166.7	Valley	0.09	8	0.070	0.16	0.28	3.29	0.69	28
I	0.19	1.10	890.9	Mountain	0.55	18	0.054	0.25	0.35	3.95	0.44	53
J	0.07	0.95	505.3	Valley	0.48	23	0.070	0.19	0.31	2.89	0.92	17
K	0.18	1.10	163.6	Valley	0.55	32	0.070	0.23	0.33	3.50	0.59	6
L	0.23	1.10	400.0	Valley	0.55	25	0.066	0.20	0.31	3.71	0.52	27
N	0.04	0.60	100.0	Valley	0.30	22	0.070	0.21	0.32	3.29	0.69	12
F	0.16	1.11	252.3	Valley	0.56	29	0.070	0.19	0.17	10.10	0.03	18
O	0.03	0.18	166.7	Valley	0.09	8	0.070	0.18	0.29	3.29	0.69	22
H	0.41	1.11	180.2	Valley	0.56	31	0.070	0.21	0.18	10.10	0.03	13
P	0.06	0.75	53.3	Valley	0.35	28	0.070	0.23	0.33	4.00	0.43	5
G	0.20	1.10	200.0	Valley	0.55	30	0.070	0.19	0.17	10.10	0.03	18
R	0.20	1.30	107.7	Valley	0.65	39	0.070	0.21	0.31	3.71	0.52	12

Soil Data

Area Id	Soil Survey	Map Unit	Area	Area Pct (%)	XKSAT	Rock Outcrop (%)	Effective (%)
A	Aguila/Carefree	31	0.218	70.1	0.33	35.0	100
	Aguila/Carefree	44	0.047	15.1	0.03		
	Aguila/Carefree	68	0.046	14.8	0.63		
B	Aguila/Carefree	31	0.078	45.1	0.33	35.0	100
	Aguila/Carefree	68	0.069	39.9	0.63		
	Aguila/Carefree	44	0.026	15.0	0.03		
C	Aguila/Carefree	31	0.009	4.9	0.33	35.0	100
	Aguila/Carefree	44	0.176	95.1	0.03		
D	Aguila/Carefree	31	0.009	47.4	0.33	35.0	100
	Aguila/Carefree	68	0.010	52.6	0.63		
E	Aguila/Carefree	44	0.169	84.9	0.03		
	Aguila/Carefree	68	0.030	15.1	0.63		
M	Aguila/Carefree	68	0.015	100.0	0.63		
I	Aguila/Carefree	31	0.154	80.2	0.33	35.0	100
	Aguila/Carefree	91	0.029	15.1	0.93		
	Aguila/Carefree	68	0.009	4.7	0.63		
J	Aguila/Carefree	91	0.054	75.0	0.93		
	Aguila/Carefree	68	0.018	25.0	0.63		
K	Aguila/Carefree	68	0.175	95.1	0.63		
	Aguila/Carefree	44	0.009	4.9	0.03		
L	Aguila/Carefree	68	0.173	74.9	0.63		
	Aguila/Carefree	31	0.046	19.9	0.33	35.0	100
	Aguila/Carefree	44	0.012	5.2	0.03		
N	Aguila/Carefree	68	0.044	100.0	0.63		
F	Aguila/Carefree	44	0.160	100.0	0.03		
O	Aguila/Carefree	68	0.027	100.0	0.63		
H	Aguila/Carefree	44	0.408	100.0	0.03		
P	Aguila/Carefree	98	0.053	89.8	0.37		
	Aguila/Carefree	68	0.006	10.2	0.63		
G	Aguila/Carefree	44	0.196	100.0	0.03		
R	Aguila/Carefree	98	0.109	55.1	0.37		
	Aguila/Carefree	68	0.089	44.9	0.63		

* Custom Value (not default value)

Flood Control District of Maricopa County
99700201 - Wash B

Land Use Data

5/15/00

Area Id	Land Use Code	Area	Area Pct (%)	DTHETA Condition	Vegetation Cover (%)	RTIMP (%)	IA (in)	Kn
A	MOUNTAIN	0.220	70.7	Dry	15.0	30	0.25	0.050
	DESERT	0.071	22.8	Dry	15.0 *		0.25*	0.030
	M.D.R.	0.020	6.4	Normal	15.0 *	30	0.15*	0.070 *
B	MOUNTAIN	0.078	45.1	Dry	15.0	30	0.25	0.050
	DESERT	0.085	49.1	Dry	15.0 *		0.25*	0.030
	M.D.R.	0.010	5.8	Normal	15.0 *	30	0.15*	0.070 *
C	MOUNTAIN	0.009	4.9	Dry	15.0	30	0.25	0.050
	DESERT	0.165	89.2	Dry	15.0 *		0.25*	0.070 *
	M.D.R.	0.011	5.9	Normal	15.0 *	30	0.15*	0.070 *
D	MOUNTAIN	0.009	47.4	Dry	15.0	30	0.25	0.050
	DESERT	0.010	52.6	Dry	15.0 *		0.25*	0.070 *
E	M.D.R.	0.149	74.9	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.050	25.1	Dry	15.0 *		0.25*	0.070 *
M	M.D.R.	0.011	91.7	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.001	8.3	Dry	15.0 *		0.25*	0.070 *
I	MOUNTAIN	0.154	80.2	Dry	15.0	30	0.25	0.050
	M.D.R.	0.004	2.1	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.034	17.7	Dry	15.0 *		0.25*	0.070 *
J	M.D.R.	0.042	58.3	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.030	41.7	Dry	15.0 *		0.25*	0.070 *
K	M.D.R.	0.035	19.0	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.149	81.0	Dry	15.0 *		0.25*	0.070 *
L	MOUNTAIN	0.046	19.9	Dry	15.0	30	0.25	0.050
	M.D.R.	0.108	46.8	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.077	33.3	Dry	15.0 *		0.25*	0.070 *
N	M.D.R.	0.018	40.9	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.026	59.1	Dry	15.0 *		0.25*	0.070 *
F	M.D.R.	0.096	60.0	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.064	40.0	Dry	15.0 *		0.25*	0.070 *
O	M.D.R.	0.020	74.1	Normal	15.0 *	30	0.15*	0.070 *

* Custom Value (not default value)

Land Use Data

Area Id	Land Use Code	Area	Area Pct (%)	DTHETA Condition	Vegetation Cover (%)	RTIMP (%)	IA (in)	Kn
O	DESERT	0.007	25.9	Dry	15.0 *		0.25*	0.070 *
H	M.D.R.	0.179	43.9	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.229	56.1	Dry	15.0 *		0.25*	0.070 *
P	M.D.R.	0.009	15.3	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.050	84.7	Dry	15.0 *		0.25*	0.070 *
G	M.D.R.	0.119	60.7	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.077	39.3	Dry	15.0 *		0.25*	0.070 *
R	M.D.R.	0.082	41.4	Normal	15.0 *	30	0.15*	0.070 *
	DESERT	0.116	58.6	Dry	15.0 *		0.25*	0.070 *

SECTION II: CHANNEL ROUTING PARAMETERS

CHANNEL ROUTING COMPUTATION SHEETS

TABLE 4 CHANNEL ROUTING / NSTPS CALCULATIONS

TABLE 4

WASH B

CHANNEL ROUTING NSTPS CALCULATIONS

NSTPS = Number of steps to be used in the storage routing (reach length/average velocity)/(time interval, NMIN x 60)

ROUTE ID NUMBER	REACH LENGTH (ft)	APPROXIMATED VELOCITY (fps)	NMIN (min)	NSTPS (calc)	NSTPS (integer)
1-2	1100.0	2.83	5	1.297	1
2-3	4000.0	3.08	5	4.323	4
4-5	4000.0	2.03	5	6.582	7
3-6	2000.0	3.67	5	1.817	2
5-3	2000.0	2.04	5	3.277	3
6-7	3000.0	1.62	5	6.178	6

SECTION III: RESERVOIR ROUTING PARAMETERS

CAP CANAL ROUTING SAMPLE CALCULATIONS

CAP CANAL ROUTING CALCULATION

The 3, 72-inch-diameter culvert overchute and the 36-inch-diameter culvert underchute at the CAP Canal were modeled based on inlet control on the culverts using the HDS-5 culvert capacity charts (Ref. 9) and verified using the HY8 program. The culvert data was obtained from a field investigation. The capacity of each culvert was calculated separately and the results were combined to approximate the outflow rating curve for the overchute and underchute, respectively. The overchute was designed by the U.S Bureau of Reclamation (USBR). The 3, 72-inch-diameter pipes have a concrete outlet structure and exit into a wide trapezoidal channel downstream of the CAP. No tailwater condition exists. Therefore, no outlet condition analysis was performed.

Ponding areas were approximated based on topographic mapping and areas and volumes were calculated at various depths of ponding. This data, along with the outflow rating curve, top of bank elevation and length of weir were used as input for the HEC-1 model to determine the total discharge/storage capacity of the CAP Canal at these two locations.

RESERVOIR ROUTING

WASH B

CAP CANAL OVERCHUTE

DEPTH	1-72"	2-72"	3-72"	Q TOTAL (cfs)
0	0	0	0	0
1	14	14	14	42
2	31	31	31	93
3	65	65	65	195
4	110	110	110	330
5	155	155	155	465
6	210	210	210	630
7	250	250	250	750
8	295	295	295	885
9	320	320	320	960
10	365	365	365	1095
11	385	385	385	1155
12	410	410	410	1230
13	445	445	445	1335

HEC-1 INPUT TABLE:

RS	1	ELEV		1508						
SV*	0	1.5	8.0	20.0	35.0	53.0	63.0	72.0		
SE	1507	1510	1512	1514	1516	1518	1519	1520		
SQ	0	42	93	195	330	465	630	750	890	960
SQ	1095	1155	1230							
SE	1509	1510	1511	1512	1513	1514	1515	1516	1517	1518
SE	1519	1520	1521							
SS**	1509									
ST***	1519.5	500.0	3.0	1.5						

* Volumes calculated from ponding areas on topographic mapping

**Starting water elevation card, invert of culverts

***Top of bank elevation, length of weir, weir coefficients for weir flow. (HEC-1 automatically calculates and adds to rating table)

CURRENT DATE: 09-18-2000 FILE DATE: 09-18-2000
CURRENT TIME: 19:58:09 FILE NAME: WASHB

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULVERT NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1507.14	1505.00	170.01	3 CSP	6.00	6.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: WASHB DATE: 09-18-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1507.14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1510.13	200.0	200.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1511.65	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1513.49	600.0	600.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1514.78	800.0	800.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1516.64	1000.0	1000.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1518.62	1100.0	1100.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1519.80	1400.0	1166.8	0.0	0.0	0.0	0.0	0.0	219.76	5
1519.96	1600.0	1176.8	0.0	0.0	0.0	0.0	0.0	415.45	4
1520.09	1800.0	1184.7	0.0	0.0	0.0	0.0	0.0	610.57	4
1520.19	2000.0	1191.3	0.0	0.0	0.0	0.0	0.0	795.21	3
1519.50	1148.3	1148.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: WASHB DATE: 09-18-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1507.14	0.000	0.00	0.00	0.00
1510.13	0.000	200.00	0.00	0.00
1511.65	0.000	400.00	0.00	0.00
1513.49	0.000	600.00	0.00	0.00
1514.78	0.000	800.00	0.00	0.00
1516.64	0.000	1000.00	0.00	0.00
1518.62	0.000	1100.00	0.00	0.00
1519.80	-0.007	1400.00	13.41	0.96
1519.96	-0.004	1600.00	7.80	0.49
1520.09	-0.008	1800.00	4.77	0.26
1520.19	-0.005	2000.00	13.51	0.68

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 09-25-2000
CURRENT TIME: 09:43:11

FILE DATE: 09-25-2000
FILE NAME: ZA

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1503.00	1501.00	150.01	1 CSP	3.00	3.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: ZA DATE: 09-25-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1503.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1504.25	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1505.10	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1505.60	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
.10	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1506.38	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1507.15	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1508.70	56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1510.57	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1512.49	72.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1514.66	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: ZA DATE: 09-25-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1503.00	0.000	0.00	0.00	0.00
1504.25	0.000	8.00	0.00	0.00
1505.10	0.000	16.00	0.00	0.00
1505.60	0.000	24.00	0.00	0.00
1506.10	0.000	32.00	0.00	0.00
1506.38	0.000	37.00	0.00	0.00
1507.15	0.000	48.00	0.00	0.00
1508.70	0.000	56.00	0.00	0.00
1510.57	0.000	64.00	0.00	0.00
1512.49	0.000	72.00	0.00	0.00
1514.66	0.000	80.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 09-18-2000 FILE DATE: 09-18-2000
CURRENT TIME: 19:58:09 FILE NAME: WASHB

PERFORMANCE CURVE FOR CULVERT 1 - 3(6.00 (ft) BY 6.00 (ft)) CSP

DISCHARGE FLOW (cfs)	HEADWATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1507.14	0.00	-2.14	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
200.00	1510.13	2.99	2.21	1-S2n	2.07	2.16	1.96	0.00	8.28	0.00
400.00	1511.65	4.51	3.51	1-S2n	3.06	3.12	2.92	0.00	9.76	0.00
600.00	1513.49	5.92	6.35	2-M2c	3.97	3.85	3.85	0.00	10.44	0.00
800.00	1514.78	7.49	7.64	2-M2c	5.18	4.45	4.45	0.00	11.87	0.00
1000.00	1516.64	9.39	9.50	2-M2c	6.00	4.94	4.94	0.00	13.42	0.00
1100.00	1518.62	10.49	11.48	2-M2c	6.00	5.13	5.13	0.00	14.30	0.00
1166.83	1519.80	11.29	12.66	2-M2c	6.00	5.25	5.25	0.00	14.86	0.00
1176.76	1519.96	11.42	12.82	2-M2c	6.00	5.27	5.27	0.00	14.94	0.00
1184.66	1520.08	11.51	12.94	2-M2c	6.00	5.29	5.29	0.00	15.00	0.00
1191.27	1520.19	11.60	13.05	2-M2c	6.00	5.30	5.30	0.00	15.06	0.00

El. inlet face invert 1507.14 ft El. outlet invert 1505.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	1507.14 ft
OUTLET STATION	170.00 ft
OUTLET ELEVATION	1505.00 ft
NUMBER OF BARRELS	3
SLOPE (V/H)	0.0126
CULVERT LENGTH ALONG SLOPE	170.01 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	6.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 09-25-2000
CURRENT TIME: 09:43:11

FILE DATE: 09-25-2000
FILE NAME: ZA

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1503.00	0.00	-2.00	0-NF	0.00	0.00	0.00	-1.00	0.00	0.00
8.00	1504.25	1.25	0.05	1-S2n	0.89	0.89	0.79	-0.70	5.34	4.78
16.00	1505.10	1.86	2.10	2-M2c	1.29	1.27	1.27	-0.55	5.61	6.06
24.00	1505.60	2.35	2.60	2-M2c	1.63	1.57	1.57	-0.44	6.39	6.92
32.00	1506.10	2.85	3.10	2-M2c	1.97	1.83	1.83	-0.33	7.07	7.59
37.00	1506.38	3.20	3.38	2-M2c	2.20	1.97	1.97	-0.28	7.52	7.95
48.00	1507.15	4.15	3.00	2-M2c	3.00	2.25	2.25	-0.16	8.47	8.61
56.00	1508.70	5.01	5.70	2-M2c	3.00	2.42	2.42	-0.09	9.15	9.02
64.00	1510.57	5.99	7.57	2-M2c	3.00	2.55	2.55	-0.02	10.03	9.39
72.00	1512.49	7.07	9.49	2-M2c	3.00	2.68	2.68	0.05	10.82	9.72
80.00	1514.66	8.23	11.66	2-M2c	3.00	2.81	2.81	0.11	11.71	10.03

El. inlet face invert 1503.00 ft El. outlet invert 1501.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	1503.00 ft
OUTLET STATION	150.00 ft
OUTLET ELEVATION	1501.00 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0133
CULVERT LENGTH ALONG SLOPE	150.01 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	MITERED TO CONFORM TO SLOPE
INLET DEPRESSION	NONE

CURRENT DATE: 09-25-2000
C: T TIME: 09:43:11

FILE DATE: 09-25-2000
FILE NAME: ZA

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	5.00 ft
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (ft/ft)	0.055
MANNING'S n (.01-0.1)	0.030
CHANNEL INVERT ELEVATION	1500.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	1501.00 ft

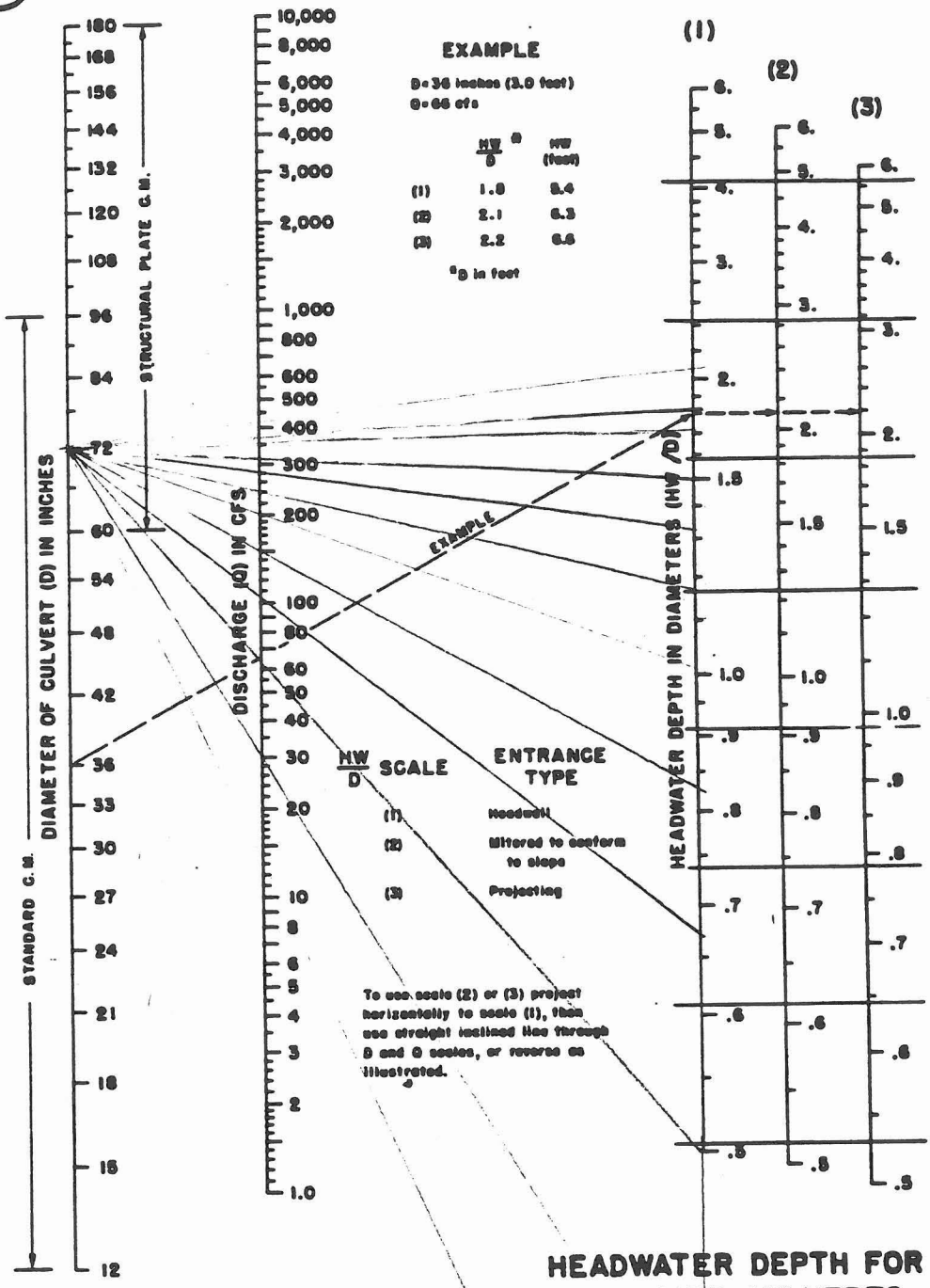
******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1500.00	0.000	0.00	0.00	0.00
8.00	1500.30	1.540	0.30	4.78	1.03
16.00	1500.45	1.595	0.45	6.06	1.54
24.00	1500.56	1.623	0.56	6.92	1.94
32.00	1500.67	1.639	0.67	7.59	2.29
37.00	1500.72	1.647	0.72	7.95	2.48
48.00	1500.84	1.660	0.84	8.61	2.87
56.00	1500.91	1.666	0.91	9.02	3.12
64.00	1500.98	1.672	0.98	9.39	3.36
72.00	1501.05	1.676	1.05	9.72	3.59
80.00	1501.11	1.680	1.11	10.03	3.80

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	50.00 ft
CREST LENGTH	500.00 ft
OVERTOPPING CREST ELEVATION	1510.00 ft

CHART 2



BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

SECTION IV: RAINFALL DISTRIBUTION

TABLE 5 6 HOUR DISTRIBUTION

TABLE 6 24 HOUR DISTRIBUTION

TABLE 5

6 HOUR STORM RAINFALL DISTRIBUTIONS

(Furnished by FCDMC's Maricopa County Unit Hydrograph Procedure 2)

Cumulative Rainfall Table

STORM TIME (hrs)	WATERSHED AREA (sm) ≤ 0.5	2.8
0.00	0.000	0.000
0.25	0.008	0.009
0.50	0.016	0.016
0.75	0.025	0.025
1.00	0.033	0.034
1.25	0.041	0.042
1.50	0.050	0.051
1.75	0.058	0.059
2.00	0.066	0.067
2.25	0.074	0.076
2.50	0.087	0.087
2.75	0.099	0.100
3.00	0.118	0.120
3.25	0.138	0.163
3.50	0.216	0.252
3.75	0.377	0.451
4.00	0.834	0.694
4.25	0.911	0.837
4.50	0.931	0.900
4.75	0.950	0.938
5.00	0.962	0.950
5.25	0.972	0.963
5.50	0.983	0.975
5.75	0.991	0.988
6.00	1.000	1.000

TABLE 6

24 HOUR RAINFALL DISTRIBUTION

Standard SCS 24-Hour, Type II Distribution

Cumulative Rainfall Table

STORM TIME (hrs)	PRECIPITATION RATIO	STORM TIME (hrs)	PRECIPITATION RATIO
0.0	0.000	12.5	0.735
0.5	0.005	13.0	0.772
1.0	0.011	13.5	0.799
1.5	0.016	14.0	0.820
2.0	0.022	14.5	0.838
2.5	0.028	15.0	0.854
3.0	0.035	15.5	0.868
3.5	0.041	16.0	0.880
4.0	0.048	16.5	0.891
4.5	0.056	17.0	0.902
5.0	0.063	17.5	0.912
5.5	0.071	18.0	0.921
6.0	0.080	18.5	0.929
6.5	0.089	19.0	0.937
7.0	0.098	19.5	0.945
7.5	0.109	20.0	0.952
8.0	0.120	20.5	0.959
8.5	0.133	21.0	0.965
9.0	0.147	21.5	0.972
9.5	0.163	22.0	0.978
10.0	0.181	22.5	0.984
10.5	0.204	23.0	0.989
11.0	0.235	23.5	0.995
11.5	0.283	24.0	1.000
12.0	0.663		

SECTION V: PRECIPITATION DATA

TABLE 7 POINT PRECIPITATION VALUES
ISOPLUVIAL MAPS

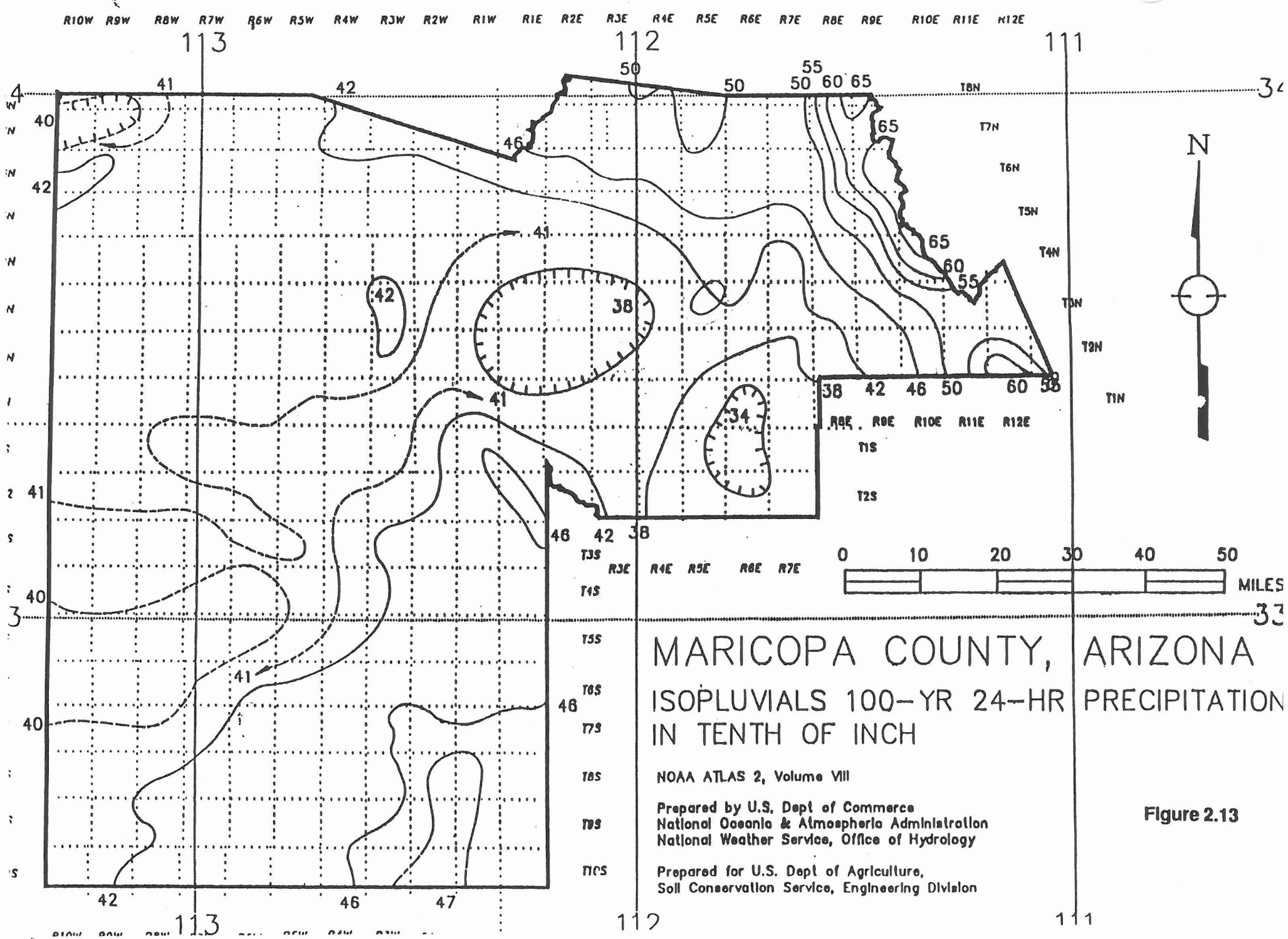
TABLE 7

POINT PRECIPITATION VALUES FOR WASH B

(inches)

RETURN PERIOD (years)	PRECIPITATION VALUES (inches) 6=Hour Duration Map	Adjusted	24-Hour Duration Map	Adjusted
2	1.20	1.2	1.42	1.4
5	1.70	1.7	2.07	2.1
10	2.06	2.1	2.50	2.5
25	2.56	2.5	3.20	3.2
50	2.90	2.9	3.60	3.6
100	3.30	3.3	4.10	4.1

Source: ***Hydrologic Design Manual for Maricopa County***, (Ref. 1)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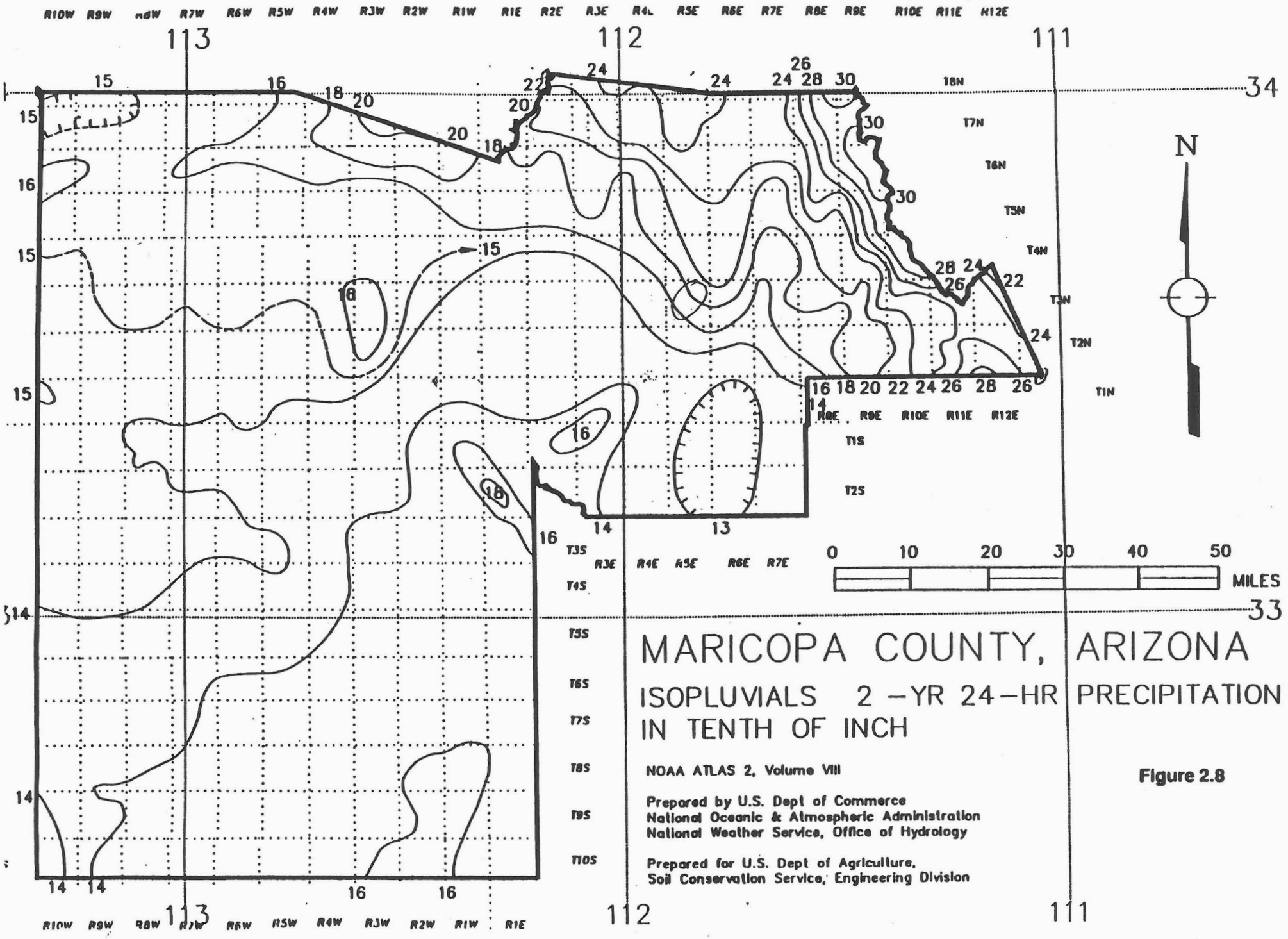
113
112
111
T8N
T7N
T6N
T5N
T4N
T3N
T2N
T1N
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
T9S
T10S
N
0 10 20 30 40 50
MILES
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 24-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.13



MARICOPA COUNTY, ARIZONA

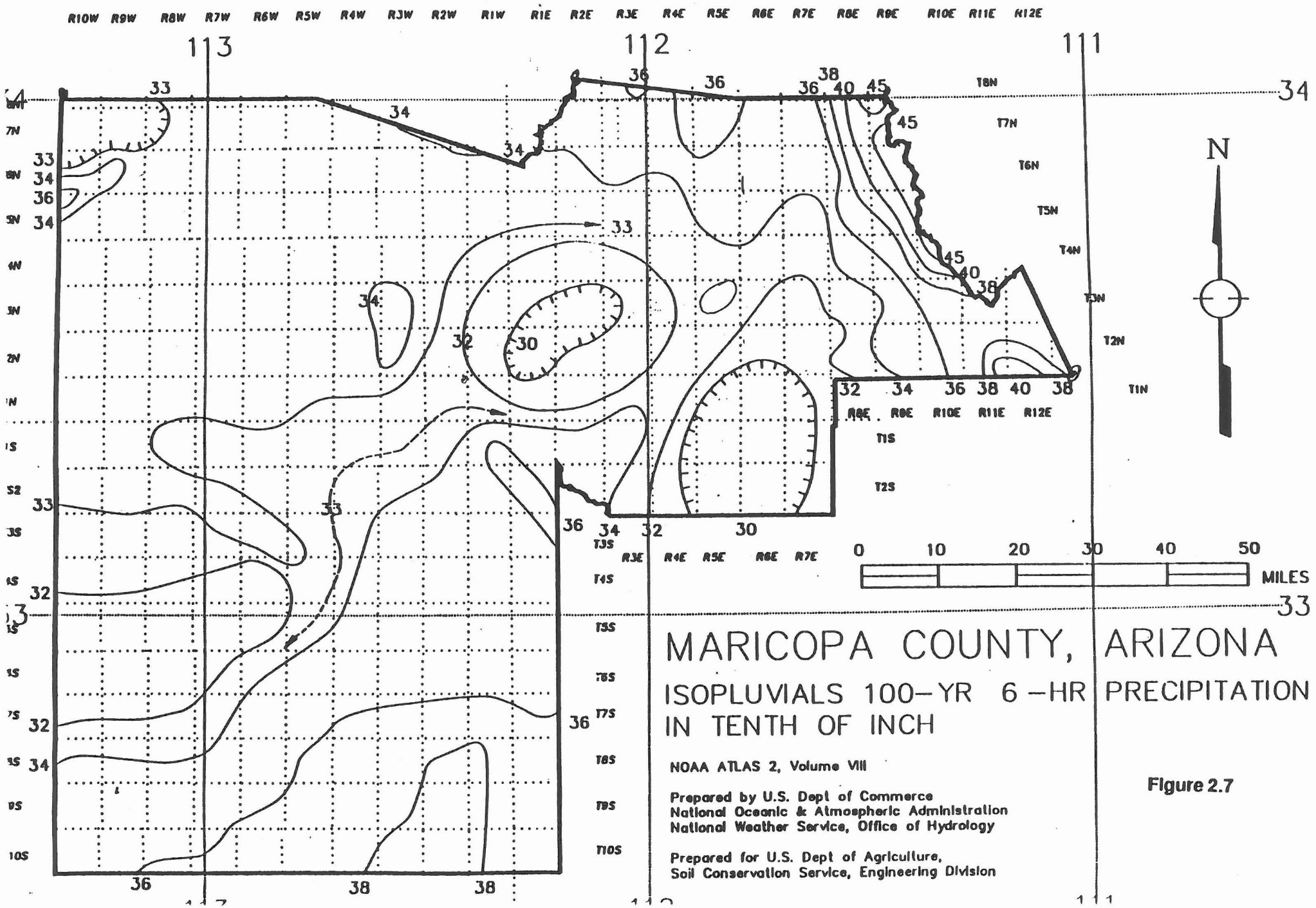
ISOPLUVIALS 2 –YR 24–HR PRECIPITATION IN TENTH OF INCH

NOAA ATLAS 2, Volume VIII

Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.8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113
112
111
T8N
T7N
T6N
T5N
T4N
T3N
T2N
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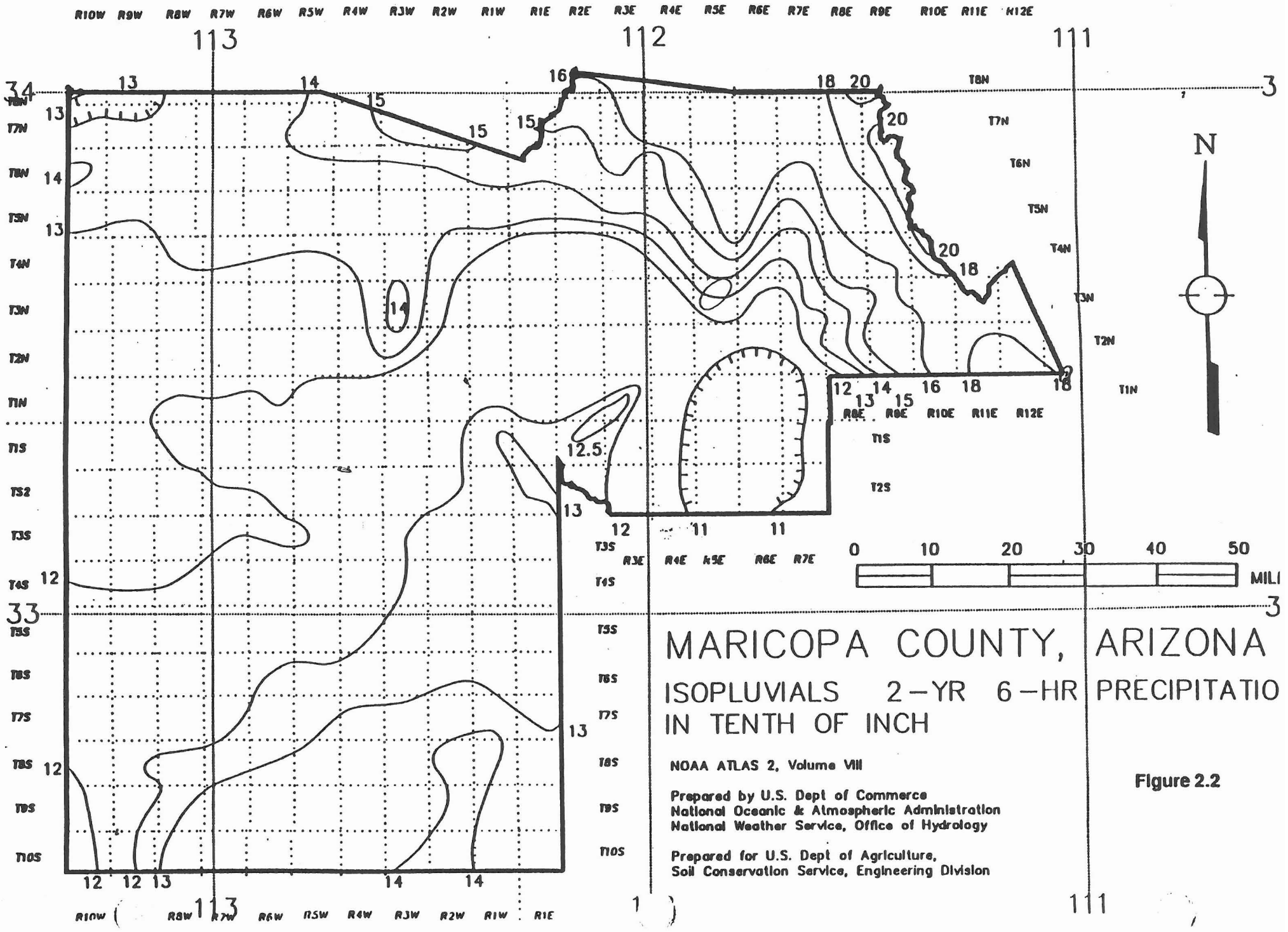
T7S
T8S
T9S
T10S
N
0 10 20 30 40 50
MILES
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 6-HR PRECIPITATION
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.7


R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
113
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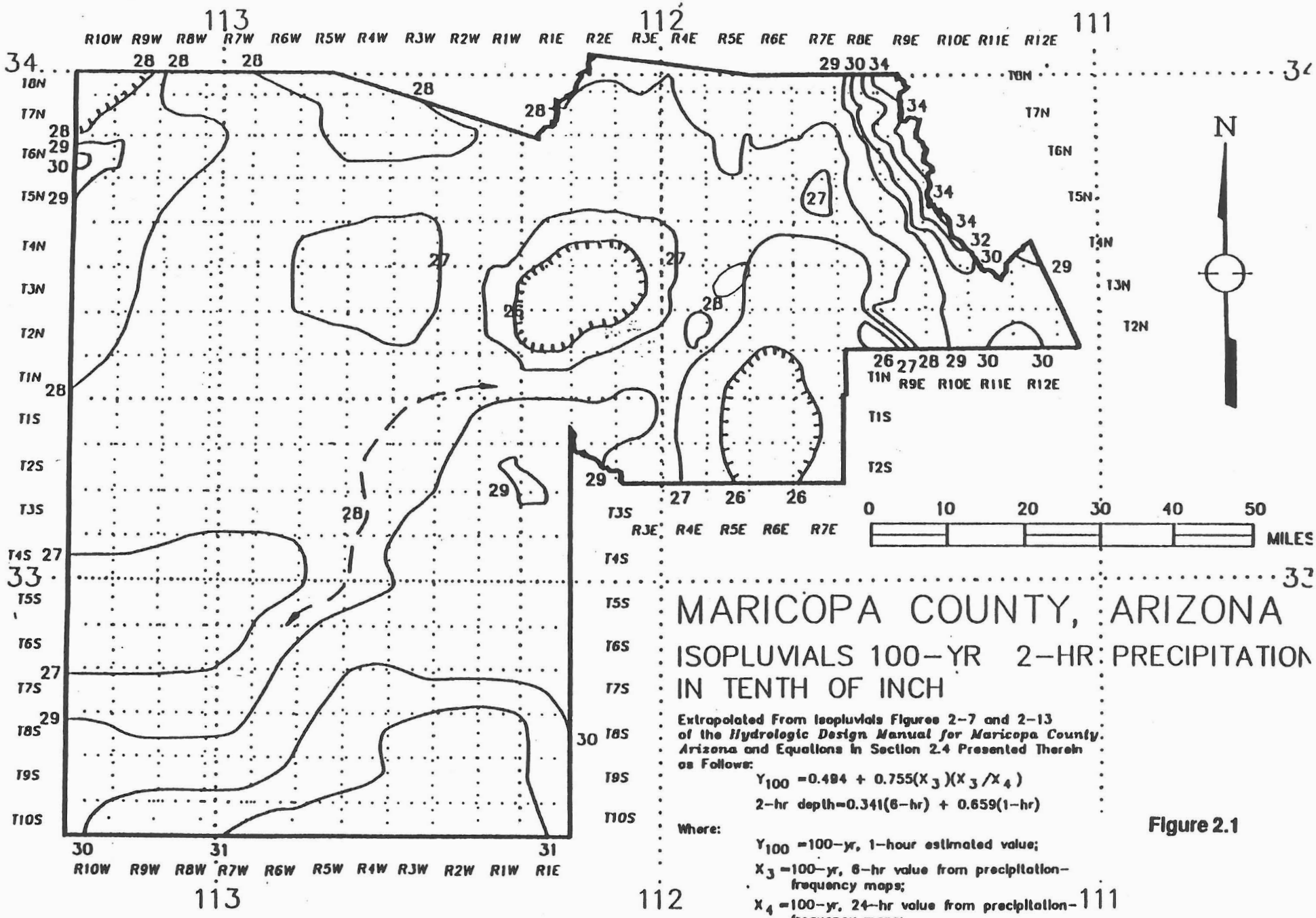
MILI
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 2-YR 6-HR PRECIPITATIO
IN TENTH OF INCH
NOAA ATLAS 2, Volume VIII
Prepared by U.S. Dept of Commerce
National Oceanic & Atmospheric Administration
National Weather Service, Office of Hydrology
Prepared for U.S. Dept of Agriculture,
Soil Conservation Service, Engineering Division

Figure 2.2


113
112
111
R10W R9W R8W R7W R6W R5W R4W R3W R2W R1W R1E R2E R3E R4E R5E R6E R7E R8E R9E R10E R11E R12E
34
33
T8N
T7N
T6N
T5N
T4N
T3N
T2N
T1N
T1S
T2S
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T4S
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T8S
T9S
T10S
28
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30
27
26
34
32
N
0 10 20 30 40 50
MILES
MARICOPA COUNTY, ARIZONA
ISOPLUVIALS 100-YR 2-HR PRECIPITATION
IN TENTH OF INCH
Extrapolated From Isopluvials Figures 2-7 and 2-13
of the Hydrologic Design Manual for Maricopa County,
Arizona and Equations in Section 2.4 Presented Therein
as Follows:
$Y_{100} = 0.484 + 0.755(X_3)(X_3/X_4)$
2-hr depth=0.341(6-hr) + 0.659(1-hr)
Where:
Y_{100} =100-yr, 1-hour estimated value;
X_3 =100-yr, 6-hr value from precipitation-frequency maps;
X_4 =100-yr, 24-hr value from precipitation-frequency maps;
6-hr=isopluvial values from figure 2.7;

Figure 2.1

SECTION VI: AERIAL REDUCTION FACTORS

TABLE 8 AERIAL REDUCTION FACTORS

TABLE 8

AERIAL PRECIPITATION REDUCTION DATA

WATERSHED AREA (sq. mi.)	STORM DURATION (hours) 6*	24**
0	1.00	1.00
1	0.99	~
3	~	0.98
5	0.96	0.98
10	0.94	~
20	0.91	0.92
30	0.89	0.90
40	0.87	0.89
50	0.86	0.88
100	0.80	0.85

* This data is based on depth-area reduction curves developed by the US Army Corps of Engineers in 1974 for the historic storm of 1954 over the Queen Creek area. The information was compiled from the *Hydrologic Design Manual for Maricopa County* (Ref. 1).

** This data is based on *NOAA Technical Memorandum NWS HYDRO-40, (Ref. 4), Depth-Area Ratio in the Semi-Arid Southwest United States*, August 1984.

SECTION VII: PREVIOUS STUDIES AND REPORTS

USBR DATA FOR CAP OVERCHUTE
FEMA STUDY- HEC-2 MODEL FOR WASH B

INPUT DATA FOR UNIT HYDROGRAPHS
HYDEN-RHODES AQUEDUCT - REACH 12

STATION	AREA Sq.Mi.	GRAPH SCS/PV	CHANNEL Miles	CENTROID Miles	SLOPE ft/mi.	CURVE No.	PRECIPITATION 100-yr	50-yr	3-hr
135+00	4.84	SCS	5.40	3.30	426	80	3.30	2.93	2.95
234+10	2.42	SCS	2.50	1.60	480	80	3.30	2.93	2.95
243+00	0.11	SCS	0.70	0.30	86	65	3.30	2.93	2.95
332+75	2.64	SCS	3.80	1.90	200	80	3.30	2.93	2.95
364+00	2.75	SCS	4.20	2.00	348	80	3.30	2.93	2.95
420+35	1.70	SCS	2.90	1.20	234	80	3.30	2.93	2.95
429+70	0.07	SCS	0.49	0.20	184	80	3.30	2.93	2.95
457+25	1.39	SCS	2.60	1.50	177	80	3.30	2.93	2.95
465+95	0.27	SCS	1.10	0.60	127	80	3.30	2.93	2.95
476+20	0.04	SCS	0.50	0.20	160	85	3.30	2.93	2.95
491+50	0.54	SCS	1.90	1.00	221	80	3.30	2.93	2.95
501+80	0.50	SCS	1.55	0.72	232	85	3.30	2.93	2.95
525+85									
541+80	0.43	SCS	1.10	0.50	218	85	3.30	2.93	2.95
558+60	0.24	SCS	0.90	0.50	267	85	3.30	2.93	2.95
573+50	0.26	SCS	1.40	1.10	250	80	3.30	2.93	2.95
586+40	1.70	SCS	2.50	0.80	192	80	3.30	2.93	2.95
618+90	0.06	SCS	0.25	0.11	700	85	3.30	2.93	2.95
626+40	0.60	SCS	1.38	0.66	290	83	3.30	2.93	2.95
650+40	0.21	SCS	1.10	0.70	1200	85	3.30	2.93	2.95

INPUT DATA FOR FLOOD ROUTING
HAYDEN-RHODES AQUEDUCT REACH 12

STATION	STRUCT. TYPE	SIZE	INVERT ELEV.	CREST ELEV.	STORAGE CAPACITY DATA ELEV.	AC.FT	ELEV.	AC.FT.
135+00	Culvert	48"	1470.0	1493.0	1470	0	1474	19
					1478	39	1482	71
					1486	117	1490	244
					1492	330		
234+10	Pipe OC	3-72"	1507.14	1518.0				
243+00	Culvert	36"	1495.10	1205.8	1500	0	1502	0.34
					1504	1.79	1506	6.16
					1508	15.32		
332+75	Pipe OC	2-66"	1506.71	1516.0	1507	0	1508	6
					1510	32	1512	75
					1514	133	1516	217
364+00	Pipe OC	3-72"	1506.91	1519.0				
420+35	Culvert	3-60"	1481.72	1504.0	1490	0	1492	1
					1494	4	1496	9.3
					1498	17.3	1500	28.1
					1502	42.9	1504	63.0
429+70	Culvert	42"	1477.86	1503.9				
457+25	Culvert	4-48"	1485.36	1503.7	1490	0	1492	1.0
					1494	4.0	1496	9.7
					1498	18.7	1500	31.0
					1502	47.3	1504	68.2
465+95	Culvert	48"	1488.97	1503.6	1490	0	1492	0.2
					1494	1.0	1496	2.9
					1498	6.7	1500	13.0
					1502	22.6	1504	36.2
476+20	Pipe OC	36"	1504.67	1511.0				
491+50	Box Cul	4'x4'	1479.39	1503.4	1480	0	1482	1.0
					1484	4.0	1486	9.5
					1488	17.8	1490	28.8
					1492	42.9	1494	60.5
					1496	81.7	1498	106.6
501+80	Box Cul	4'x4'	1473.44	1503.4	1474	0	1476	1.0
					1478	4.0	1480	9.0
					1482	16.7	1484	27.3
525+85	Culvert	36"	1475.70	1503.2				

CURRENT DATE: 09-18-2000 FILE DATE: 09-18-2000
CURRENT TIME: 19:58:09 FILE NAME: WASHB

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ TAILWATER ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
ÄÄ
ÄÄ

CONSTANT WATER SURFACE ELEVATION
1505.00

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ROADWAY OVERTOPPING DATA ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
ÄÄ

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	50.00 ft
CREST LENGTH	500.00 ft
OVERTOPPING CREST ELEVATION	1519.50 ft

ÄÄ

INPUT DATA FOR FLOOD ROUTING
HAYDEN-RHODES AQUEDUCT REACH 12

STATION	STRUCT. TYPE	SIZE	INVERT ELEV.	CREST ELEV.	STORAGE CAPACITY DATA ELEV.	AC.FT	ELEV.	AC.FT.
541+80	Box Cul	4'x4'	1475.49	1503.1	1476	0	1478	1.0
					1480	4.0	1482	10.0
					1484	21.2	1486	34.7
558+60	Culvert	48"	1485.23	1502.9	1492	0	1494	0.2
					1496	1.3	1498	5.5
					1500	12	1502	22.0
573+50	Culvert	48"	1487.34	1502.8	1493	0	1494	0.1
					1496	0.4	1498	0.9
					1500	1.7	1502	3.0
					1504	5.0	1506	7.9
586+40	Pipe OC	4-54"	1483.34	1502.7	1486	0	1488	2.0
					1490	8.5	1492	19.7
					1494	35.4	1496	56.1
618+90	Culvert	36"	1485.28	1502.4				
626+40	Culvert	4-42"	1488.97	1502.4	1491	0	1492	0.1
					1494	0.5	1496	1.5
					1498	2.9	1500	4.7
650+40	Culvert	42"	1481.65	1502.2	1496	0	1498	0.1
					1500	0.4	1502	1.0

CROSS DRAINAGE STRUCTURES

STATION	SIZE	PEAK Qin (cfs)	STORAGE CAPACITY (ac.ft)	PEAK Qout (cfs)	DESIGN STORM
135+00	48" DIA. CMP LINED CULVERT	1860	279	200	100yr. 6hr GENERAL STORM
234+10	72" DIA. 3BBL PIPE OVERCHUTE	1130	42	834	100yr. 6hr GENERAL STORM
243+00	36" DIA. PIPE CULVERT	37	0	37	100yr. 3hr THUNDERSTORM
332+75	66" DIA. 2BBL PIPE OVERCHUTE	1107	131	430	100yr. 6hr GENERAL STORM
364+00	72" DIA. 3BBL PIPE OVERCHUTE	1155	194	843	"
420+35	60" DIA. 3BBL PIPE CULVERT	790	35	546	"
429+70	42" DIA. PIPE CULVERT	94	0	94	100yr. 3hr THUNDERSTORM
457+25	48" DIA. 4BBL PIPE CULVERT	630	42	500	100yr. 6hr GENERAL STORM
465+95	48" DIA. PIPE CULVERT	149	11	125	"
476+20	36" DIA. PIPE OVERCHUTE	65	0	65	100yr. 3hr THUNDERSTORM
491+50	4 x 4 BOX CULVERT	269	39	165	100yr. 6hr GENERAL STORM
501+80	4'x4 BOX CULVERT	333	51	165	"
525+85	36" DIA. PIPE CULVERT	64	0	64	"
541+80	4'x4' BOX CULVERT	285	34	165	"
558+60	48" DIA. PIPE CULVERT	160	14	125	"
[illegible]	48" DIA. PIPE CULVERT	134	3	125	"
[illegible]	54" DIA. 4BBL PIPE CULVERT	827	27	604	"
+90	36" DIA. PIPE CULVERT	110	40	64	100yr. 3hr THUNDERSTORM
626+40	42" DIA. 4BBL PIPE CULVERT	380	57	83	100yr. 6hr GENERAL STORM
650+40	42" DIA. [illegible] CULVERT	154	23	83	"

EXPLANATION

- AQUEDUCT
- DIKE
- DRAINAGE DITCH
- SIPHON AND CHECK
- ABUTMENTS FOR FUTURE BRIDGE
- EQUESTRIAN CROSSING
- DRAINAGE INLET
- BRIDGE
- CULVERT
- OVERCHUTE
- CHECK STRUCTURE
- FLOAT WELL

NOTE

Arizona state plane coordinate system, central zone

2000 0 2000 4000 6000
SCALE OF FEET

6-20-90 330-	ADDED OVERCHUTE AND CULVERT TEXT
7-12-82 D-645	AS BUILT BY 330 ...
3-15-80 D-O.S.W.	REVISED STATIONS AT EXISTING SIPHON TO SUIT "AS BUILT" CONDITIONS. CORRECTED STATION AT EQUATION

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION-ARIZONA

GRANITE REEF AQUEDUCT
REACH 12
LOCATION MAP

PHOENIX, ARIZONA MARCH 8, 1979

344-330-803

PRECIPITATION FREQUENCY VALUES FOR GRANITE REEF AQUEDUCT REACH 12
ZONE NUMBER= 7

RETURN PERIOD DURATION	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR
5-MIN	.24	.37	.45	.56	.64	.72	.92
10-MIN	.38	.57	.69	.86	.99	1.12	1.43
15-MIN	.48	.72	.88	1.09	1.26	1.42	1.81
30-MIN	.66	1.00	1.22	1.51	1.75	1.97	2.50
1-HR	.84	1.26	1.54	1.92	2.21	2.50	3.17
2-HR	.96	1.42	1.72	2.14	2.46	2.77	3.50
3-HR	1.04	1.53	1.85	2.28	2.62	2.95	3.73
6-HR	1.20	1.73	2.08	2.56	2.93	3.30	4.15
12-HR	1.40	1.97	2.36	2.89	3.29	3.70	4.64
24-HR	1.60	2.22	2.64	3.21	3.66	4.10	5.12

HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,56,57,58
****

T1 SCOTTSDALE AZ. FLOOD INSURANCE STUDY TYPE 19
T2 GLEN MASHBURN FPMS APRIL 76 X-SEC LOOKING DOWNSTREAM
T3 UNNAMED WASH [illegible] Q=10 YR = [illegible] CFS

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	-0	2.	-0	-0	-0	-0	-0	-0	1440.000	-0
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	1.000	-0	-0	-0	-0	-0	-1.000	-0	-0	15.000
NC	.050	.050	.035	.100	.300	-0	-0	-0	[illegible]	[illegible]
QT	4,000	190,000	820,000	1300,000	3200,000	-0	-0	-0	-0	-0
X1	3100,000	23,000	570,000	630,000	0	0	0	-0	-0	-0
X3	-0	-0	-0	310,000	-0	-0	-0	[illegible]	[illegible]	[illegible]
GR	1449,300	0	1446,500	130,000	1446,000	170,000	1445,000	200,000	1445,000	250,000
GR	1447,500	310,000	1445,000	400,000	1444,500	450,000	1445,000	510,000	[illegible]	[illegible]
GR	1445,000	570,000	1442,000	590,000	1445,000	630,000	1445,500	665,000	[illegible]	[illegible]
GR	1445,500	765,000	1445,000	795,000	1445,000	960,000	1446,000	980,000	[illegible]	[illegible]
GR	1444,800	1095,000	1445,000	1135,000	1446,500	1400,000	-0	-0	-0	-0
X1	3700,000	16,000	1030,000	1070,000	500,000	550,000	600,000	-0	-0	-0
X3	-0	-0	-0	910,000	-0	-0	-0	-0	[illegible]	[illegible]
GR	1457,500	0	1456,500	500,000	1455,000	570,000	1454,000	610,000	1455,000	680,000
GR	1450,500	780,000	1455,000	850,000	1456,000	910,000	1455,000	970,000	[illegible]	[illegible]
GR	1451,700	1070,000	1453,000	1135,000	1452,500	1325,000	1455,000	1400,000	1455,000	1465,000
GR	1456,000	1500,000	-0	-0	-0	-0	-0	-0	[illegible]	[illegible]
X1	4170,000	20,000	1140,000	1115,000	385,000	475,000	485,000	-0	[illegible]	[illegible]
X3	-0	-0	-0	890,000	-0	-0	-0	-0	-0	-0
GR	1464,500	0	1461,500	550,000	1460,000	615,000	1460,000	715,000	[illegible]	[illegible]
GR	1460,000	800,000	1460,000	850,000	1461,000	890,000	1460,000	935,000	1457,000	960,000
GR	1460,000	995,000	1461,000	1025,000	1460,000	1050,000	1458,000	1090,000	[illegible]	[illegible]
GR	1457,000	1175,000	1460,000	1280,000	1457,000	1365,000	1460,000	1440,000	1461,000	1490,000
QT	4,000	300,000	1340,000	2300,000	5500,000	-0	-0	-0	[illegible]	[illegible]
X1	4730,000	28,000	1000,000	1085,000	530,000	485,000	540,000	-0	[illegible]	[illegible]
X3	-0	-0	-0	835,000	-0	1420,000	-0	-0	-0	-0
GR	1470,500	0	1471,000	580,000	1470,000	640,000	1465,000	680,000	[illegible]	[illegible]
GR	1465,000	710,000	1470,000	755,000	1474,600	835,000	1465,000	900,000	1464,000	925,000
GR	1465,000	945,000	1466,000	980,000	1465,000	1000,000	1462,500	1030,000	[illegible]	[illegible]
GR	1466,000	1080,000	1465,000	1115,000	1465,000	1140,000	1466,000	1215,000	[illegible]	[illegible]
GR	1465,000	1325,000	1467,000	1420,000	1465,000	1530,000	1465,000	1570,000	[illegible]	[illegible]
GR	1465,000	1645,000	1465,000	1705,000	1466,000	1770,000	-0	-0	-0	[illegible]
X1	5900,000	20,000	705,000	860,000	485,000	500,000	500,000	-0	[illegible]	-0
X3	[illegible]	[illegible]	-0	510,000	-0	1075,000	[illegible]	[illegible]	[illegible]	[illegible]
GR	1477,500	0	1476,000	155,000	1475,000	225,300	1474,000	255,000	[illegible]	[illegible]
GR	1475,500	335,000	1475,000	[illegible]	1475,000	610,000	1475,000	[illegible]	[illegible]	[illegible]
GR	1475,000	[illegible]	1474,000	510,000	1475,000	675,000	1470,000	745,000	[illegible]	[illegible]

	1470,800	860,000	1472,000	910,000	1470,000	950,000	1470,000	910,000	-0	-0	-0
	1472,500	1205,000	1470,600	1280,000	1473,000	1025,000	1475,000	1740,000	-0	-0	-0
	5700,000	21,000	935,000	980,000	880,000	500,000	890,000	-0	-0	-0	-0
	-0	-0	-0	730,000	-0	1235,000	-0	-0	-0	-0	-0
GR	1485,000	0	1482,000	875,000	1480,000	530,000	1479,000	570,000	1480,000	610,000	
GR	1480,000	960,000	1482,000	730,000	1480,000	815,000	1471,000	850,000	1481,000	885,000	
GR	1475,000	935,000	1480,000	965,000	1475,000	980,000	1475,000	1005,000	1480,000	1050,000	
GR	1475,000	1100,000	1478,000	1115,000	1480,000	1205,000	1481,000	1235,000	1481,000	1290,000	
GR	1482,000	1365,000	-0	-0	-0	-0	-0	-0	-0	-0	
X1	6200,000	18,000	840,000	920,000	450,000	535,000	500,000	-0	-0	-0	
X3	-0	-0	-0	700,000	-0	-0	-0	-0	-0	-0	
GR	1492,000	0	1491,000	250,000	1490,000	315,000	1489,000	370,000	1490,000	425,000	
GR	1486,500	595,000	1490,000	530,000	1491,000	700,000	1490,000	755,000	1491,000	805,000	
GR	1485,000	880,000	1480,000	885,000	1485,000	920,000	1485,000	1050,000	1481,700	1100,000	
GR	1480,000	1130,000	1490,000	1150,000	1492,000	1180,000	-0	-0	-0	-0	
X1	6700,000	16,000	1025,000	1010,000	450,000	550,000	490,000	-0	-0	-0	
X3	-0	-0	-0	700,000	-0	-0	-0	-0	-0	-0	
GR	1496,500	0	1490,000	430,000	1495,000	565,000	1495,000	605,000	1490,000	760,000	
GR	1490,000	755,000	1495,000	800,000	1490,000	820,000	1491,000	925,000	1490,000	960,000	
GR	1488,000	1015,000	1490,000	1040,000	1491,000	1095,000	1490,000	1130,000	1490,000	1155,000	
GR	1500,000	1180,000	-0	-0	-0	-0	-0	-0	-0	-0	
X1	7200,000	13,000	710,000	740,000	400,000	515,000	500,000	-0	-0	-0	
X3	-0	-0	-0	630,000	-0	-0	-0	-0	-0	-0	
GR	1502,000	0	1501,500	430,000	1500,000	580,000	1495,000	640,000	1497,000	670,000	
GR	1495,000	740,000	1491,500	750,000	1495,000	740,000	771,000	825,000	1491,000	885,000	
GR	1495,000	900,000	1500,000	915,000	1510,000	990,000	-0	-0	-0	-0	
X1	7800,000	23,000	890,000	915,000	835,000	560,000	600,000	-0	-0	-0	
X3	-0	-0	-0	390,000	-0	-0	-0	-0	-0	-0	
GR	1511,000	0	1511,000	390,000	1510,000	430,000	1509,000	485,000	1510,000	505,000	
GR	1520,000	620,000	1516,500	650,000	1510,000	675,000	1504,000	735,000	1510,000	820,000	
GR	1511,000	850,000	1510,000	865,000	1505,000	870,000	1500,000	890,000	1499,000	910,000	
GR	1500,000	915,000	1502,000	1000,000	1500,000	1100,000	1500,000	1125,000	1502,000	1200,000	
GR	1505,000	1300,000	1510,000	1305,000	1515,000	1410,000	-0	-0	-0	-0	
GR	6,000	200,000	1460,000	1025,000	4500,000	-0	-0	-0	-0	-0	
X1	8300,000	22,000	850,000	915,000	445,000	600,000	500,000	-0	-0	-0	
X3	-0	-0	-0	530,000	-0	-0	-0	-0	-0	-0	
GR	1517,000	0	1515,000	350,000	1514,000	390,000	1515,000	420,000	1517,000	530,000	
GR	1515,000	605,000	1510,000	625,000	1512,000	650,000	1510,000	670,000	1510,000	800,000	
GR	1506,500	850,000	1510,000	915,000	1507,000	985,000	1510,000	1135,000	1510,000	1085,000	
GR	1505,000	1125,000	1505,000	1140,000	1510,000	1180,000	1510,500	1195,000	1510,000	1200,000	
GR	1510,000	3250,000	1520,000	1280,000	-0	-0	-0	-0	-0	-0	
X1	8800,000	20,000	800,000	890,000	400,000	525,000	500,000	-0	-0	-0	
X3	-0	-0	-0	365,000	-0	-0	-0	-0	-0	-0	
GR	1523,000	0	1520,000	215,000	1517,500	250,000	1520,000	275,000	1521,000	385,000	
GR	1520,000	810,000	1520,000	870,000	1515,000	500,000	1514,700	555,000	1515,000	560,000	
GR	1516,000	615,000	1515,000	650,000	1511,500	660,000	1515,000	690,000	1516,000	715,000	
GR	1515,000	735,000	1515,000	775,000	1516,000	800,000	1515,000	825,000	1520,000	855,000	
X1	9300,000	10,000	870,000	580,000	500,000	485,000	500,000	-0	-0	-0	
X3	-0	-0	-0	365,000	-0	-0	-0	-0	-0	-0	
GR	1531,000	0	1530,000	35,000	1525,000	170,000	1527,000	305,000	1525,000	405,000	
GR	1520,000	479,000	1520,000	540,000	1525,000	590,000	1530,000	615,000	1535,000	655,000	
X1	[illegible]										
X3	-0	-0	-0	170,000	-0	-0	-0	-0	-0	-0	
GR	1530,500	0	1530,000	170,000	1525,000	280,000	1530,000	320,000	1530,000	405,000	
GR	1531,000	270,000	1510,000	390,000	1525,000	450,000	1527,000	500,000	1530,000	585,000	
GR	[illegible]										

X1	10300,000	11,000	10,000	455,000	350,000	380,000	400,000	-0	-0	-0	
X3	-0	-0	-0	475,000	-0	-0	-0	-0	-0	-0	
GR	1543,000	0	1548,000	190,000	1540,000	235,000	1541,000	475,000	1540,000	965,000	
GR	1535,000	610,000	1530,700	655,000	1535,000	730,000	1536,000	755,000	1535,000	765,000	
GA	1541,000	800,000	-0	-0	-0	-0	-0	-0	-0	-0	
EJ	-0	-0	-0	-0	-0	-0	-0	-0	-0	-0	

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HEC2 VERSION UPDATED JAN 1976
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 02,51,52,53,54,57,58
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T1    SCOTTSDALE AZ FLOOD INSURANCE STUDY TYPE 19
T2    GLEN MASHBURN FPMS          APRIL 76   X-SEC LOOKING DOWNSTREAM
T3    UNNAMED WASH REACH 6-50 YR = 820 CFS

J1  ICHECK    INQ    NINV    IDIR    STRT    METRIC    HVINS    Q    WSEL    STRT
        .0     3.      .0      .0      .0        .0       .0     .0  1445.460     .0

J2  NPROF   IPLOT   PRFVS   XSECV   XSECH      FN     ALLDC     IBW    CHNIM   ITRACE
    2.000      .0      .0      .0      .0      .0   -1.000      .0      .01   15.000
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**************************************************
HECR VERSION UPDATED JAN 197?
ERROR CORRECTIONS 01,02,03,04,05,06,07,08,09
MODIFICATIONS 52,53,54,55,[illegible]
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T1     SCOTTSDALE AZ, FLOOD INSURANCE STUDY TYPE 19
T2        GLEN WASHBURN FPMS        APRIL 76    X-SEC LOOKING DOWNSTREAM
T3        UNNAMED WASH [illegible] 2300 CFS

J1  ICHECK    INQ     NINV     IDIR     STRT    METRIC    HVINS      Q      WSEL     FQ
    [illegible]  [illegible]  -0  [illegible]  -0  [illegible]  -0  -0  [illegible]  -0

J2  NPROF    IPLOT    PRFVS    XSECV    XSECH     FN     ALLDC     IBW     CHNIM    ITRACE
    3.000    -0       -0       [illegible]  -0    -0     -1.000    -0      -0       15.000
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SUMMARY PRINTOUT FOR MULTIPLE PROFILES

UNNAMED NASH SBX 0-500

SECTION NUMBER	CHANNEL LENGTH	RIM EL TO ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRWS	EG	LOSS	LOSS	FR
3100.00		0	0	0	1442.00	190.00	1444.06	1443.85	1444.37	81.20	107.71
3100.00		0	0	0	1442.00	1300.00	1445.67	1445.61	1445.90	81.58	37.26
3100.00		0	0	0	1442.00	2300.00	1446.16	1446.04	1446.29	81.58	19.[illegible]
3700.00	600.00	0	0	0	1451.70	190.00	1452.00	1452.75	1452.96	81.58	21.[illegible]
3700.00	600.00	0	0	0	1451.70	820.00	1453.29	1453.29	1453.58	327.08	22.08
3700.00	600.00	0	0	0	1451.70	1300.00	1453.89	1453.89	1453.90	310.31	206.52
3700.00	600.00	0	0	0	1451.70	2300.00	1454.16	1454.16	1454.85	379.54	226.87
4170.00	485.00	0	0	0	1457.00	190.00	1458.27	1457.91	1458.33	105.36	71.49
4170.00	485.00	0	0	0	1457.00	820.00	1459.13	1458.63	1459.25	308.86	76.28
4170.00	485.00	0	0	0	1457.00	1300.00	1459.53	1458.94	1459.08	372.85	73.37
4170.00	485.00	0	0	0	1457.00	2300.00	1460.30	1459.73	1460.60	505.81	77.77
4700.00	530.00	0	0	0	1462.50	340.00	1464.86	1464.86	1465.38	81.58	164.14
4700.00	530.00	0	0	0	1462.50	1390.00	1465.97	1465.97	1466.38	409.32	90.50
4700.00	530.00	0	0	0	1462.50	2300.00	1466.26	1466.26	1466.81	493.81	113.51
4700.00	530.00	0	0	0	1462.50	5500.00	1467.08	1467.08	1467.86	538.10	127.72
5200.00	500.00	0	0	0	1470.00	340.00	1470.95	1470.67	1471.04	209.73	82.86
5200.00	500.00	0	0	0	1470.00	1390.00	1471.62	1471.41	1471.98	278.84	141.52
5200.00	500.00	0	0	0	1470.00	2300.00	1472.15	1471.85	1472.59	323.71	119.46
5200.00	500.00	0	0	0	1470.00	5500.00	1473.24	1472.97	1474.02	366.28	120.65
5700.00	500.00	0	0	0	1475.00	340.00	1476.23	1476.00	1476.42	121.30	147.08
5700.00	500.00	0	0	0	1475.00	1390.00	1477.54	1477.11	1477.82	247.65	97.70
5700.00	500.00	0	0	0	1475.00	2300.00	1478.01	1477.59	1478.41	276.32	115.56
5700.00	500.00	0	0	0	1475.00	5500.00	1479.26	1478.71	1479.92	346.56	117.65
6200.00	500.00	0	0	0	1480.00	340.00	1482.68	1482.57	1483.12	68.14	114.30
6200.00	500.00	0	0	0	1480.00	1390.00	1484.12	1484.12	1484.96	125.11	136.79
6200.00	500.00	0	0	0	1480.00	2300.00	1484.95	1484.95	1485.87	162.80	123.55
6200.00	500.00	0	0	0	1480.00	5500.00	1486.31	1486.51	1487.51	330.91	106.71
6700.00	500.00	0	0	0	1488.00	340.00	1490.14	1490.14	1490.53	121.67	162.91
6700.00	500.00	0	0	0	1488.00	1390.00	1491.15	1491.13	1491.60	342.49	129.67
6700.00	500.00	0	0	0	1488.00	2300.00	1491.57	1491.54	1492.10	348.27	126.65
6700.00	500.00	0	0	0	1488.00	5500.00	1492.60	1492.49	1493.44	351.96	131.20
7200.00	500.00	0	0	0	1492.50	340.00	1495.53	1495.50	1495.96	110.68	84.62
7200.00	500.00	0	0	0	1492.50	1390.00	1496.76	1496.76	1497.38	288.26	68.35
7200.00	500.00	0	0	0	1492.50	2300.00	1497.26	1497.26	1497.97	315.81	94.76
7200.00	500.00	0	0	0	1492.50	5500.00	1498.27	1498.27	1499.39	322.00	129.76
7800.00	600.00	0	0	0	1499.80	340.00	1501.05	1500.85	1501.21	81.58	82.[illegible]
7800.00	600.00	0	0	0	1499.80	1390.00	1502.07	1501.73	1502.34	321.00	80.66
7800.00	600.00	0	0	0	1499.80	2300.00	1502.59	1502.20	1502.92	334.93	71.07
7800.00	600.00	0	0	0	1499.80	5500.00	1503.96	1503.13	1504.05	390.92	84.40

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	[illegible]	[illegible]
8300.00	500.00	0	0	1505.00	290.00	1506.73	1506.70	1507.25	50.32	269.83	.40	10.03
8300.00	500.00	0	0	1505.00	1160.03	1508.11	1508.11	1508.73	161.87	217.73	.51	[illegible]
8300.00	500.00	0	0	1505.00	1925.00	1508.63	1508.63	1509.35	208.61	228.11	.27	30.76
8300.00	500.00	0	0	1505.00	4580.00	1509.80	1509.80	1510.75	312.46	218.98	[illegible]	[illegible]
8800.00	500.00	0	0	1511.50	290.04	1514.63	1514.29	1515.[illegible]	35.58	99.25	[illegible]	[illegible]
8800.00	500.00	0	0	1511.50	1160.00	1515.92	1515.92	1516.44	321.97	85.51	.38	30.25
8800.00	[illegible]	0	0	1511.50	1925.00	[illegible]	[illegible]	[illegible]	[illegible]	85.[illegible]	[illegible]	[illegible]
8800.00	500.00	0	0	1511.50	4580.00	1517.31	1517.18	1518.10	352.70	105.42	[illegible]	[illegible]
9300.00	500.00	0	0	1520.00	290.00	1520.84	1520.79	1521.16	89.30	151.74	[illegible]	[illegible]
9300.00	500.00	0	0	1520.00	1160.00	1521.90	1521.90	1522.72	113.30	117.53	[illegible]	[illegible]
9300.00	500.00	0	0	1520.00	1925.00	1522.60	1522.60	1523.67	129.71	123.67	[illegible]	59.91
9300.00	500.00	0	0	1520.00	4580.00	1524.34	1524.34	1525.99	169.76	103.44	[illegible]	[illegible]
9900.00	620.00	0	0	1525.00	290.00	1527.12	1526.74	1527.32	77.22	73.11	[illegible]	[illegible]
9900.00	620.00	0	0	1525.00	1160.00	1528.44	1528.06	1529.05	112.92	82.27	.38	43.53
9900.00	620.00	0	0	1525.00	1925.00	1529.13	1528.85	1530.04	131.51	90.96	[illegible]	[illegible]
9900.00	620.00	0	0	1525.00	4580.00	1530.86	1530.86	1532.21	234.71	85.28	.27	115.89
10300.00	400.00	0	0	1530.70	290.00	1532.66	1532.66	1533.16	54.80	251.04	.32	12.[illegible]
10300.00	400.00	0	0	1530.70	1160.00	1534.12	1534.12	1534.98	95.32	209.80	[illegible]	[illegible]
10300.00	400.00	0	0	1530.70	1925.00	1534.87	1534.87	1535.94	116.34	199.62	.35	[illegible]
10300.00	400.00	0	0	1530.70	4580.00	1536.58	1536.58	1538.00	197.37	135.50	[illegible]	[illegible]

SECTION NUMBER	DISCHARGE CFS	CWSEL	CWSEL DIFF EACH Q	CWSEL DIFF EACH SECTION	[illegible]	TOPWID	L.S. DIFF [illegible]	[illegible]
3100.000	[illegible]	1444.060	0	0	0	81.200	0	[illegible]
3100.000	820.000	1445.480	1.420	0	0	787.480	-706.280	0
3100.000	1300.000	1445.670	.190	0	0	826.336	-785.136	0
3100.000	3200.000	1446.043	.373	0	0	956.791	-915.591	0
3700.000	100.000	1452.800	0	8.740	0	214.335	0	600.000
3700.000	[illegible]	1453.205	.405	7.815	0	327.683	-113.348	[illegible]
3700.000	1300.000	1453.490	.195	7.820	0	339.384	-125.049	600.000
3700.000	3200.000	1454.159	[illegible]	8.116	0	379.538	-165.203	[illegible]
4170.000	[illegible]	1458.274	0	5.474	0	165.363	0	[illegible]
4170.000	820.000	1459.132	.858	5.837	0	306.876	-141.514	485.000
4170.000	1300.000	1459.520	.390	6.038	0	372.232	-206.869	[illegible]
4170.000	3200.000	1460.379	.851	6.220	0	505.812	-340.449	485.000
4700.000	300.000	1464.862	0	6.588	0	81.297	0	540.000
4700.000	1300.000	1465.968	1.106	6.836	0	469.321	-388.023	[illegible]
4700.000	2300.000	1466.264	.296	6.736	0	493.612	-412.315	540.000
4700.000	[illegible]	1467.083	[illegible]	6.704	0	534.100	-452.803	[illegible]
5200.000	[illegible]	1470.948	0	6.087	0	209.735	0	[illegible]
5200.000	1390.000	1471.625	.676	5.657	0	278.835	-69.103	500.000
5200.000	[illegible]	1472.153	.528	5.889	0	323.713	-113.980	[illegible]
5200.000	3500.000	1473.237	1.084	6.155	0	368.278	-158.545	[illegible]
5700.000	380.000	1476.233	0	5.285	0	121.103	0	500.000
5700.000	1300.000	1477.544	1.311	5.919	0	247.893	[illegible]	[illegible]
5700.000	2300.000	1478.006	.462	5.853	0	274.923	-153.820	500.000
5700.000	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]
6200.000	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]
6200.000	1300.000	1484.117	1.837	6.573	0	128.125	-50.988	[illegible]

6200,000	2300,000	1888,907	,830	6,081	0	162,808	[illegible]	500,000
6200,000	3500,000	1888,388	1,358	7,020	0	535,998	-262,731	500,000
6700,000	340,000	1890,143	0	7,463	0	121,678	0	490,000
6700,000	1390,000	1891,147	1,004	7,030	0	342,492	-220,822	490,000
6700,000	2300,000	1891,574	,427	6,626	0	345,278	-223,600	490,000
6700,000	3500,000	1892,601	1,027	6,295	0	351,957	-230,281	490,000
7200,000	340,000	1895,528	[illegible]	[illegible]	0	[illegible]	[illegible]	500,000
7200,000	1390,000	1896,764	1,236	5,617	0	282,262	-165,382	500,000
7200,000	2300,000	1897,259	,495	5,665	0	315,811	-198,132	500,000
7200,000	3500,000	1898,272	1,013	5,670	0	322,901	-206,221	500,000
7800,000	340,000	1501,046	0	5,517	0	189,845	0	600,000
7800,000	1390,000	1502,074	1,028	5,309	0	321,091	-131,155	600,000
7800,000	2300,000	1502,590	,516	5,331	0	330,993	-150,148	600,000
7800,000	3500,000	1503,958	1,368	5,687	0	390,910	-201,072	600,000
8300,000	290,000	1506,732	0	5,686	0	50,322	0	500,000
8300,000	1160,000	1508,108	1,376	6,034	0	161,868	-111,546	500,000
8300,000	1925,000	1508,634	,526	6,046	0	208,607	-158,285	500,000
8300,000	4530,000	1509,803	1,169	5,845	0	312,455	-262,133	500,000
8800,000	290,000	1514,632	0	7,900	0	35,676	0	500,000
8800,000	1160,000	1515,920	1,282	7,816	0	321,671	-286,295	500,000
8800,000	1925,000	1516,300	,560	7,750	0	341,610	-305,933	500,000
8800,000	4580,000	1517,210	,924	7,507	0	352,697	-317,021	500,000
9300,000	290,000	1520,838	0	6,206	0	89,305	0	500,000
9300,000	1160,000	1521,908	1,067	5,981	0	113,798	-24,490	500,000
9300,000	1925,000	1522,596	,692	6,212	0	129,713	-40,409	500,000
9300,000	4580,000	1524,337	1,741	7,028	0	169,761	-80,456	500,000
9900,000	290,000	1527,119	0	6,281	0	77,215	0	620,000
9900,000	1160,000	1528,441	1,322	6,537	0	112,917	-35,741	620,000
9900,000	1925,000	1529,130	,689	6,534	0	131,508	-54,293	620,000
9900,000	4580,000	1530,861	1,731	6,524	0	234,711	-157,496	620,000
10300,000	290,000	1532,664	0	5,545	0	54,805	0	800,000
10300,000	1160,000	1534,116	1,452	5,675	0	95,324	-40,519	800,000
10300,000	1925,000	1534,869	,753	5,739	0	116,363	-61,558	800,000
10300,000	4580,000	1536,579	1,710	5,717	0	197,368	-142,563	800,000

DATA FOR LAST CROSS SECTION

PROFILE	TYPE ENC	TARGET	TOP WIDTH AREA-ACRES	TOP WID AREA-DIFF
1	0	-475,000	18,259	0
2	0	-475,000	43,962	25,682
3	0	-475,000	48,655	30,396
4	0	-475,000	59,065	40,785

SECTION VIII: CALIBRATION

PEAK DISCHARGES VERSUS DRAINAGE AREA CURVE

TABLE 10: REPRESENTATIVE DISCHARGES FOR HEC-1 CALIBRATION

PEAK DISCHARGES VERSUS DRAINAGE AREA CURVE

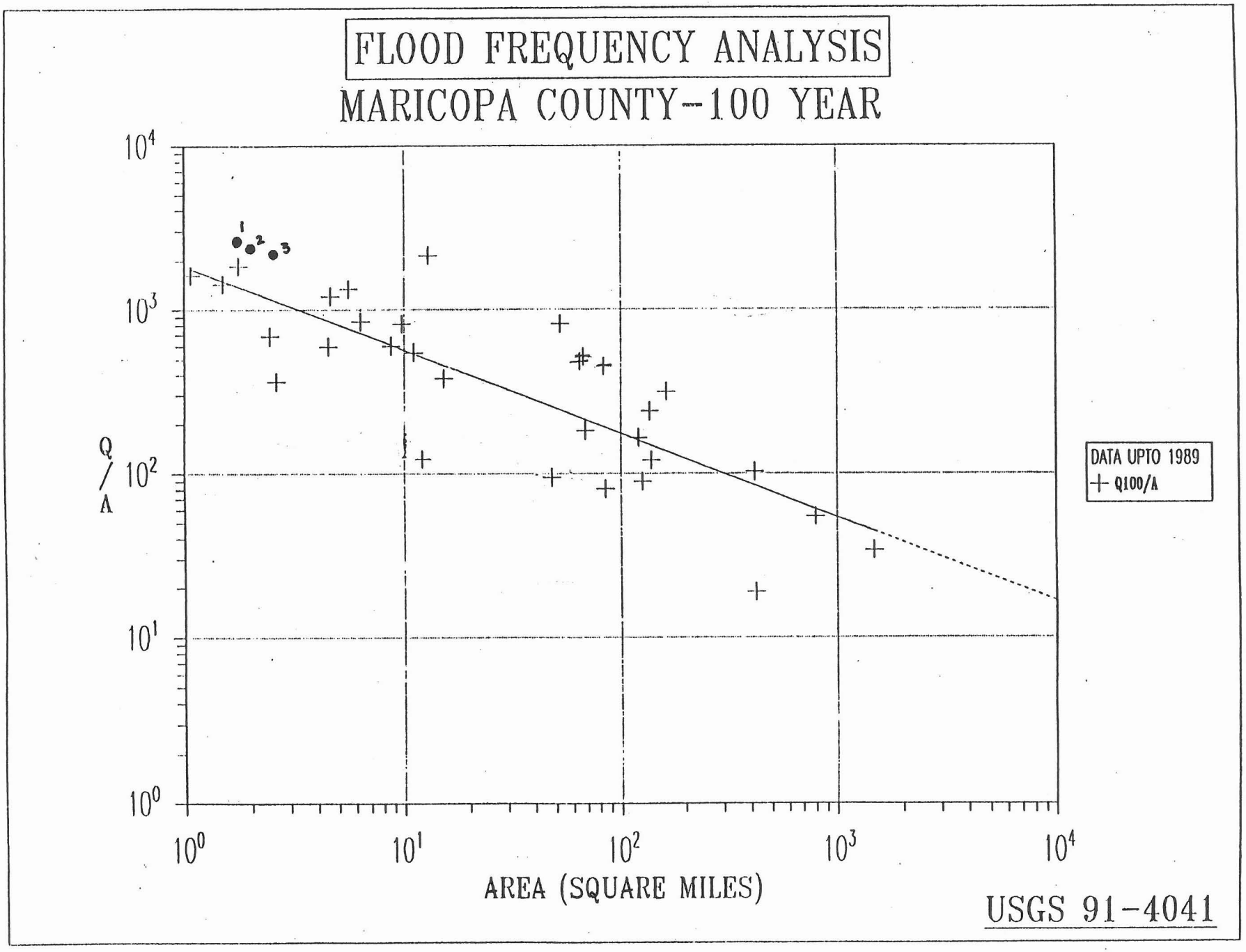


TABLE 10

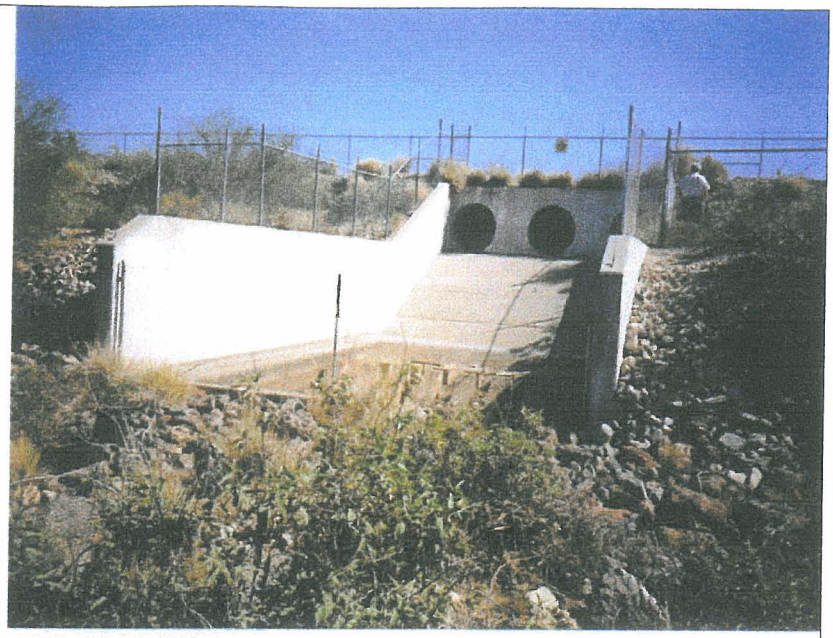
REPRESENTATIVE DISCHARGES FOR HEC-1 CALIBRATION

Item Number	Location	Contributing Area (sm)	100-Year Discharge 6-hr (cfs)	Q/A (cfs/sm)	24-hr (cfs)	Q/A (cfs/sm)
1	CP3	1.63	2024	1242	2018	1238
2	CP6	1.81	2565	1283	2509	1248
3	CP7	2.48	3115	1261	3011	1214

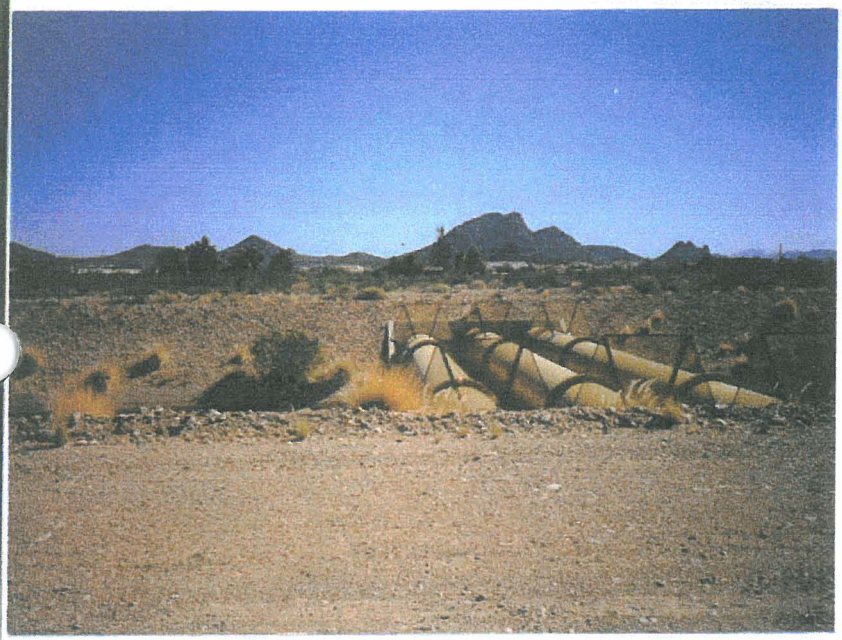
SECTION IX: CAP CROSS-SECTION

CALCULATIONS – MANNING'S EQUATION
CAP CROSS-SECTION AT OVERCHUTES

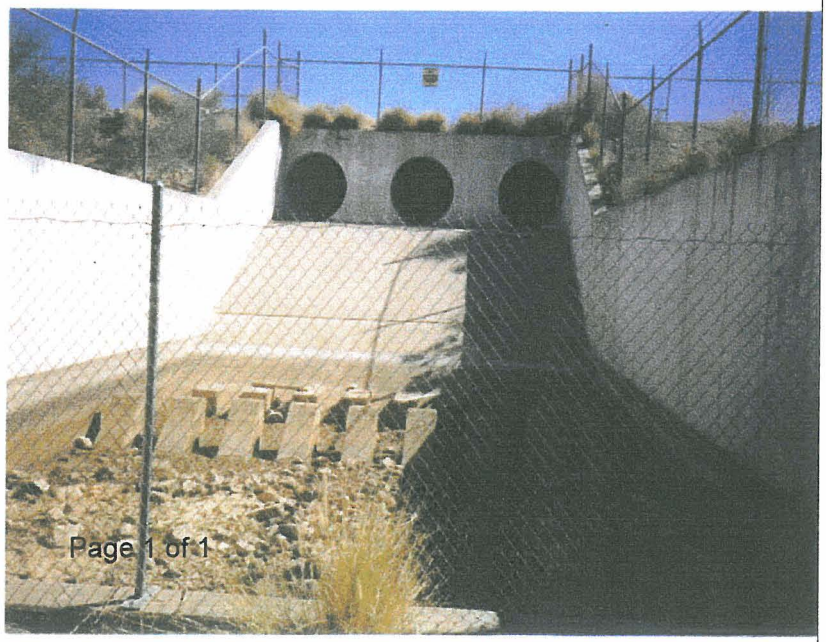
Wash B CAP Crossing



Outlet Structure



3, 72-inch CMP Pipes



Outlet Structure

Wash B at CAP with overflow
Worksheet for Trapezoidal Channel

Project Description	
Project File	n:\llc\997002\hydro\flowmaster\wbcap.fm2
Worksheet	Wash B at CAP
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coefficient	0.016	
Channel Slope	0.000080	ft/ft
Left Side Slope	1.500000	H : V
Right Side Slope	1.500000	H : V
Bottom Width	24.00	ft
Discharge	3,400.00	cfs

Results		
Depth	17.47	ft
Flow Area	877.03	ft²
Wetted Perimeter	86.99	ft
Top Width	76.41	ft
Critical Depth	7.29	ft
Critical Slope	0.002382	ft/ft
Velocity	3.88	ft/s
Velocity Head	0.23	ft
Specific Energy	17.70	ft
Froude Number	0.20	
Flow is subcritical.		

Wash B at CAP without overflow
Worksheet for Trapezoidal Channel

Project Description	
Project File	n:\llc\997002\hydro\flowmaster\wbcapwf.fm2
Worksheet	Wash B at CAP
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Channel Depth

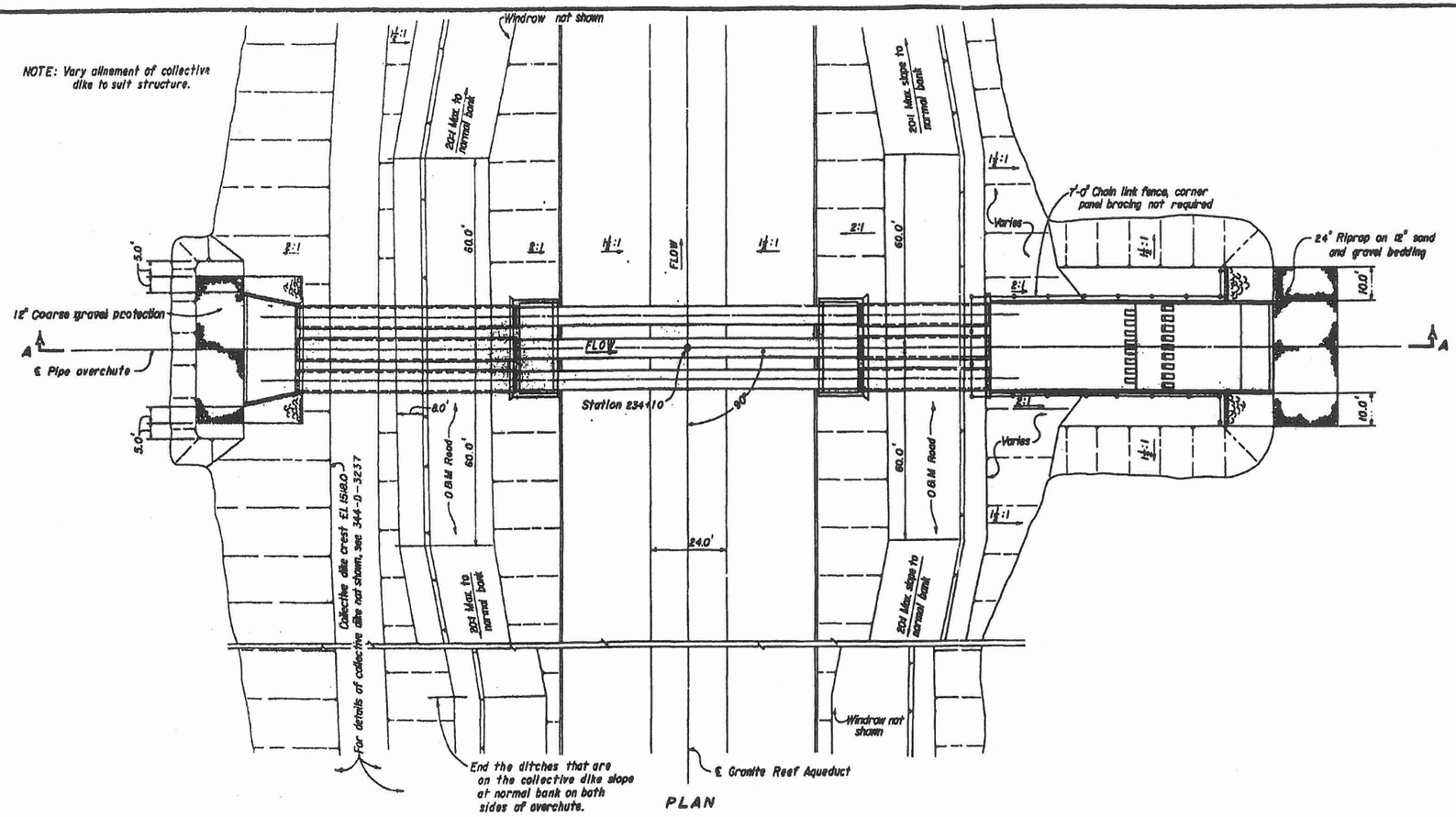
Input Data		
Mannings Coefficient	0.016	
Channel Slope	0.000080	ft/ft
Left Side Slope	1.500000	H : V
Right Side Slope	1.500000	H : V
Bottom Width	24.00	ft
Discharge	3,000.00	cfs

Results		
Depth	16.43	ft
Flow Area	799.41	ft²
Wetted Perimeter	83.25	ft
Top Width	73.30	ft
Critical Depth	6.78	ft
Critical Slope	0.002420	ft/ft
Velocity	3.75	ft/s
Velocity Head	0.22	ft
Specific Energy	16.65	ft
Froude Number	0.20	
Flow is subcritical.		

Hydraulic Characteristics of CAP
at Station of Wash "B" Overchutes

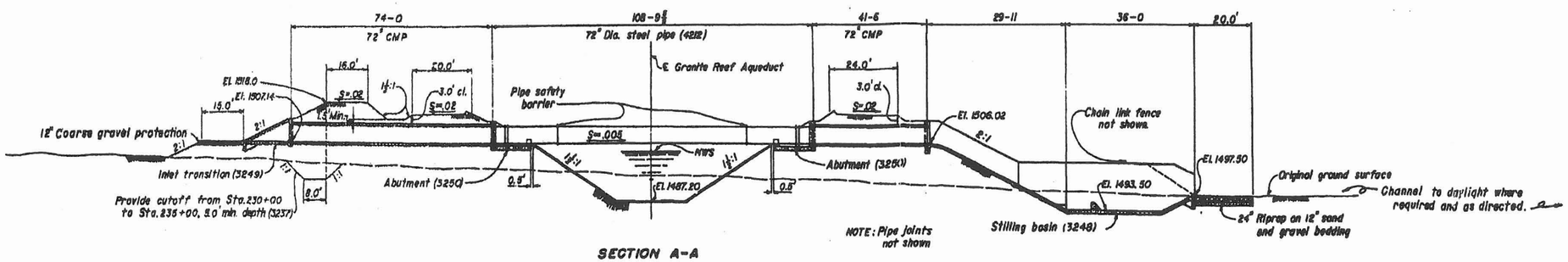
d	A	WP	R	V	Q
16.43	799.24	83.24	9.60	3.75	2999.29
16.50	804.38	83.49	9.63	3.76	3025.38
16.60	811.74	83.85	9.68	3.77	3062.87
16.70	819.14	84.21	9.73	3.79	3100.64
16.80	826.56	84.57	9.77	3.80	3138.67
16.90	834.02	84.93	9.82	3.81	3176.97
17.00	841.50	85.29	9.87	3.82	3215.54
17.10	849.02	85.65	9.91	3.83	3254.38
17.20	856.56	86.02	9.96	3.85	3293.49
17.30	864.14	86.38	10.00	3.86	3332.86
17.40	871.74	86.74	10.05	3.87	3372.51
17.42	873.26	86.81	10.06	3.87	3380.48
17.44	874.79	86.88	10.07	3.87	3388.45
17.46	876.32	86.95	10.08	3.88	3396.44
17.47	877.08	86.99	10.08	3.88	3400.43
17.48	877.85	87.03	10.09	3.88	3404.43
17.50	879.38	87.10	10.10	3.88	3412.44

NOTE: Vary alinement of collective dike to suit structure.



PLAN

SCALE OF FEET 20 0 20 40 60



SECTION A-A

NOTE: Pipe joints not shown

NOTES

For general notes, see 344-D-3241.
For chain link fencing details, see 40-D-6269, EXCEPT barbed wire supporting arms shall be oriented vertically.
For pipe safety barrier details, see 344-D-4211.
For typical aqueduct section details not shown, see 344-D-3237.

7-18-62 D-6.4.5. AS BUILT BY SSO, LTR. 6-6-62.

WORK THAN SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA

GRANITE REEF AQUEDUCT

REACH 12
STA. 234+10

72" DIA. THREE BARREL PIPE OVERCHUTE PLAN AND SECTION

DESIGNED J.F. Mehlig SUPERVISED J.F. Mehlig
DRAWN J.R. West SUBMITTED 20 Dec 61
CHECKED Bill Schatz APPROVED W.D. Lee
CHIEF, WATER CONSTRUCTION DIVISION
DENVER, COLORADO MARCH 28, 1962

344-D-3246

NOTES

For notes, see 344-330-474.
Flatten slopes on canal and collective dike embankments as directed.

SCALE OF FEET
CONTOUR INTERVAL OF 5 FEET

STATIONS

ELEVATION

Original ground surface

Finished bottom grade.

1-11-68	AS BUILT BY SRS, DH. 6-5-68
6-6-67	

RIGHTS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION—ARIZONA

GRANITE REEF AQUEDUCT
REACH 2
STA. 200+00 TO STA. 238+00
PLAN AND PROFILE

DESIGNED ..... SUBMITTED .....
DRAWN ..... RECOMMENDED .....
TRACED ..... APPROVED .....

PHOENIX, ARIZONA SEPTEMBER 1970 344-330-473

USE OVERLAY - INFORMATION

SECTION X: FINAL RESULTS

100-YEAR, 6-HOUR HEC-1 MODEL
100-YEAR, 24-HOUR HEC-1 MODEL

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*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             MAY   1991                *
*          VERSION 4.0.1E               *
*     Lahey F77L-EM/32 version 5.01     *
*       Dodson & Associates, Inc.       *
*  RUN DATE  10/31/00  TIME  11:04:21   *
*****************************************
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	A	521.	12.00	66.	21.	21.	0.31		
HYDROGRAPH AT	B	275.	12.00	30.	9.	9.	0.17		
2 COMBINED AT	CP1	794.	12.00	97.	31.	29.	0.48		
ROUTED TO	CH1	784.	12.08	97.	31.	29.	0.48		
HYDROGRAPH AT	C	285.	12.17	44.	11.	11.	0.19		
HYDROGRAPH AT	D	30.	12.00	3.	1.	1.	0.02		
3 COMBINED AT	CP2	1066.	12.08	143.	43.	41.	0.69		
ROUTED TO	CH2	1025.	12.17	143.	43.	41.	0.69		
HYDROGRAPH AT	E	299.	12.17	46.	13.	12.	0.20		
HYDROGRAPH AT	M	23.	12.00	2.	1.	1.	0.01		
2 COMBINED AT	CP3	306.	12.17	49.	14.	13.	0.22		
HYDROGRAPH AT	I	269.	12.08	41.	13.	13.	0.19		
HYDROGRAPH AT	J	69.	12.17	8.	2.	2.	0.07		
2 COMBINED AT	CP4	333.	12.08	49.	16.	15.	0.26		
ROUTED TO	CH4	320.	12.25	49.	16.	15.	0.26		
HYDROGRAPH AT	K	159.	12.33	20.	5.	5.	0.18		
HYDROGRAPH AT	L	273.	12.17	37.	11.	11.	0.23		
3 COMBINED AT	CP5	739.	12.25	106.	32.	31.	0.68		
ROUTED TO	CH5	729.	12.33	106.	32.	31.	0.68		
HYDROGRAPH AT	N	47.	12.17	5.	1.	1.	0.04		
4 COMBINED AT	CP3	2018.	12.25	301.	90.	86.	1.63		
ROUTED TO	CH6	1990.	12.25	301.	90.	86.	1.63		
HYDROGRAPH AT	F	234.	12.25	41.	11.	11.	0.16		
HYDROGRAPH AT	O	40.	12.00	4.	1.	1.	0.03		
HYDROGRAPH AT	G	287.	12.25	51.	14.	14.	0.20		
4 COMBINED AT	CP6	2509.	12.25	395.	116.	111.	2.01		
ROUTED TO	CH7	2435.	12.42	395.	115.	111.	2.01		
HYDROGRAPH AT	H	570.	12.33	102.	27.	26.	0.41		
HYDROGRAPH AT	P	62.	12.25	7.	2.	2.	0.06		
3 COMBINED AT	CP7	3011.	12.42	502.	144.	139.	2.48		
ROUTED TO	ROUTE	2509.	12.58	500.	144.	139.	2.48		
DIVERSION TO	DI1	2187.	12.58	436.	125.	121.	2.48		
HYDROGRAPH AT	CP8	322.	12.58	64.	18.	18.	2.48		
HYDROGRAPH AT	R	166.	12.42	26.	7.	7.	0.20		
2 COMBINED AT	CP9	467.	12.58	89.	25.	25.	2.68		

ROUTED TO	ROUT	227.	13.00	64.	25.	24.	2.68

WASH B 100YR-24HR

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION ROUTE
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1507.14	1507.20	1519.50
STORAGE	0.	0.	68.
OUTFLOW	2.	3.	1125.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1520.49	0.99	76.	2659.	0.58	12.58	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1507.14	1507.20	1519.50
STORAGE	0.	0.	68.
OUTFLOW	2.	3.	1125.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1520.42	0.92	76.	2504.	0.58	12.58	0.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1507.14	1507.20	1519.50
STORAGE	0.	0.	68.
OUTFLOW	2.	3.	1125.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1520.34	0.84	75.	2334.	0.58	12.67	0.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION ROUT
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1503.00	1503.00	1510.00
STORAGE	0.	0.	21.
OUTFLOW	0.	0.	48.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1510.12	0.12	22.	230.	1.83	13.00	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1503.00	1503.00	1510.00
STORAGE	0.	0.	21.
OUTFLOW	0.	0.	48.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1510.12	0.12	22.	227.	1.83	13.00	0.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1503.00	1503.00	1510.00
STORAGE	0.	0.	21.
OUTFLOW	0.	0.	48.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1510.10	0.10	22.	191.	1.67	13.08	0.00

*** NORMAL END OF HEC-1 ***

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*             MAY   1991                *
*          VERSION 4.0.1E               *
*     Lahey F77L-EM/32 version 5.01     *
*       Dodson & Associates, Inc.       *
*  RUN DATE  10/31/00  TIME  11:05:51   *
*                                       *
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*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
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XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
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X     X  XXXXXXX   XXXXX           XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	A	506.	4.03	76.	46.	46.	0.31		
HYDROGRAPH AT	B	267.	4.07	35.	21.	21.	0.17		
2 COMBINED AT	CP1	771.	4.07	112.	67.	67.	0.48		
ROUTED TO	CH1	763.	4.07	111.	67.	67.	0.48		
HYDROGRAPH AT	C	293.	4.23	47.	29.	29.	0.19		
HYDROGRAPH AT	D	29.	4.00	4.	2.	2.	0.02		
3 COMBINED AT	CP2	1047.	4.10	162.	98.	98.	0.69		
ROUTED TO	CH2	1023.	4.23	161.	98.	98.	0.69		
HYDROGRAPH AT	E	311.	4.27	52.	31.	31.	0.20		
HYDROGRAPH AT	M	22.	4.00	3.	2.	2.	0.01		
2 COMBINED AT	CP3	321.	4.27	55.	33.	33.	0.21		
HYDROGRAPH AT	I	266.	4.13	46.	28.	28.	0.19		
HYDROGRAPH AT	J	65.	4.23	9.	5.	5.	0.07		
2 COMBINED AT	CP4	326.	4.13	55.	33.	33.	0.26		
ROUTED TO	CH4	319.	4.30	55.	33.	33.	0.26		
HYDROGRAPH AT	K	159.	4.37	22.	13.	13.	0.18		
HYDROGRAPH AT	L	274.	4.27	41.	25.	25.	0.23		
3 COMBINED AT	CP5	740.	4.30	117.	71.	71.	0.67		
ROUTED TO	CH5	732.	4.40	117.	71.	71.	0.67		
HYDROGRAPH AT	N	44.	4.23	6.	3.	3.	0.04		
4 COMBINED AT	CP3	2024.	4.30	335.	203.	203.	1.61		
ROUTED TO	CH6	2015.	4.33	334.	203.	203.	1.61		
HYDROGRAPH AT	F	249.	4.30	45.	27.	27.	0.16		
HYDROGRAPH AT	O	37.	4.00	4.	3.	3.	0.03		
HYDROGRAPH AT	G	301.	4.33	54.	33.	33.	0.20		
4 COMBINED AT	CP6	2565.	4.33	434.	263.	263.	2.00		
ROUTED TO	CH7	2518.	4.50	434.	263.	263.	2.00		
HYDROGRAPH AT	H	615.	4.37	110.	66.	66.	0.41		
HYDROGRAPH AT	P	61.	4.33	8.	5.	5.	0.06		
3 COMBINED AT	CP7	3115.	4.47	548.	332.	332.	2.47		
ROUTED TO	ROUTE	2758.	4.67	548.	333.	333.	2.47		
DIVERSION TO	DI1	2404.	4.67	478.	290.	290.	2.47		
HYDROGRAPH AT	CP8	354.	4.67	70.	43.	43.	2.47		
HYDROGRAPH AT	R	173.	4.50	28.	17.	17.	0.20		
2 COMBINED AT	CP9	498.	4.67	97.	59.	59.	2.67		

ROUTED TO	ROUT	296.	4.97	82.	52.	52.	2.67

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION ROUTE
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1507.14	1507.20	1519.50
STORAGE	0.	0.	68.
OUTFLOW	9.	13.	1164.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1520.46	0.96	76.	2875.	0.73	4.63	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1507.14	1507.20	1519.50
STORAGE	0.	0.	68.
OUTFLOW	9.	13.	1164.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1520.45	0.95	76.	2841.	0.73	4.67	0.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1507.14	1507.20	1519.50
STORAGE	0.	0.	68.
OUTFLOW	9.	13.	1164.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1520.42	0.92	76.	2752.	0.70	4.67	0.00

SUMMARY OF DAM OVERTOPPING/BREACH ANALYSIS FOR STATION ROUT
(PEAKS SHOWN ARE FOR INTERNAL TIME STEP USED DURING BREACH FORMATION)

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1503.00	1503.00	1510.00
STORAGE	0.	0.	21.
OUTFLOW	0.	0.	64.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1510.16	0.16	22.	333.	1.77	4.93	0.00

PLAN 2 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1503.00	1503.00	1510.00
STORAGE	0.	0.	21.
OUTFLOW	0.	0.	64.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1510.16	0.16	22.	322.	1.77	4.93	0.00

PLAN 3 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1503.00	1503.00	1510.00
STORAGE	0.	0.	21.
OUTFLOW	0.	0.	64.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1510.14	0.14	22.	296.	1.73	4.97	0.00

*** NORMAL END OF HEC-1 ***

SECTION XI: FIGURES & PLATES

FIGURE 1 STORAGE CAPACITY AT THE CAP CANAL

FIGURE 2 ROUTING REACH WITH CONCENTRATION POINTS

PLATE 1 SUB-BASIN AND SOILS DELINEATION MAP

LEGEND

SOILS BOUNDARY

WATERSHED & SUB-BASIN BOUNDARY

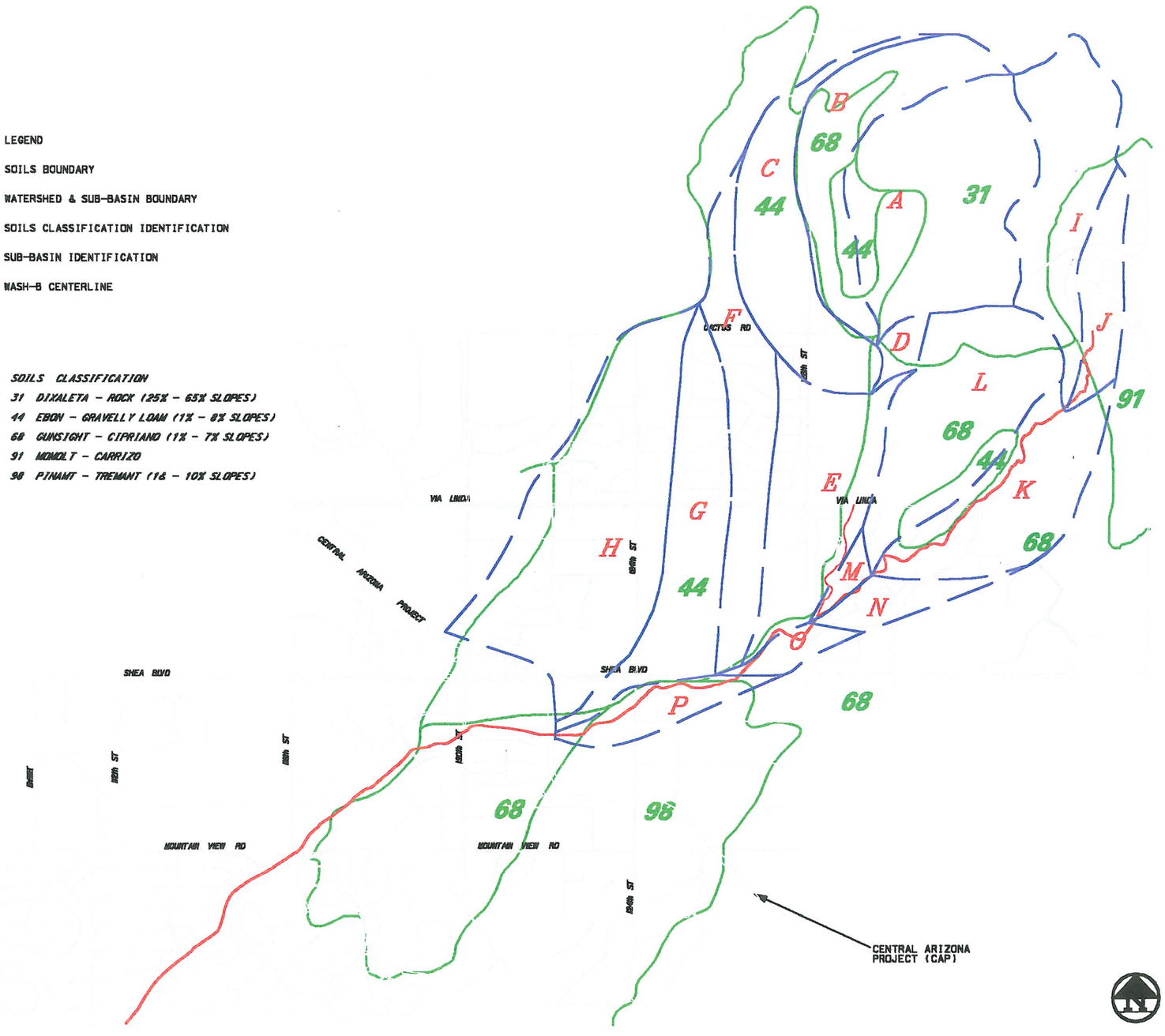
31 SOILS CLASSIFICATION IDENTIFICATION

F SUB-BASIN IDENTIFICATION

WASH-B CENTERLINE

SOILS CLASSIFICATION

31 DIXALETA - ROCK (25% - 65% SLOPES)
44 EBON - GRAVELLY LOAM (1% - 8% SLOPES)
68 GUNSIGHT - CIPRIANO (1% - 7% SLOPES)
91 MOMOLT - CARRIZO
96 PINAMT - TREMANT (1& - 10% SLOPES)



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TIME:- 12:52:47
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WASH-B

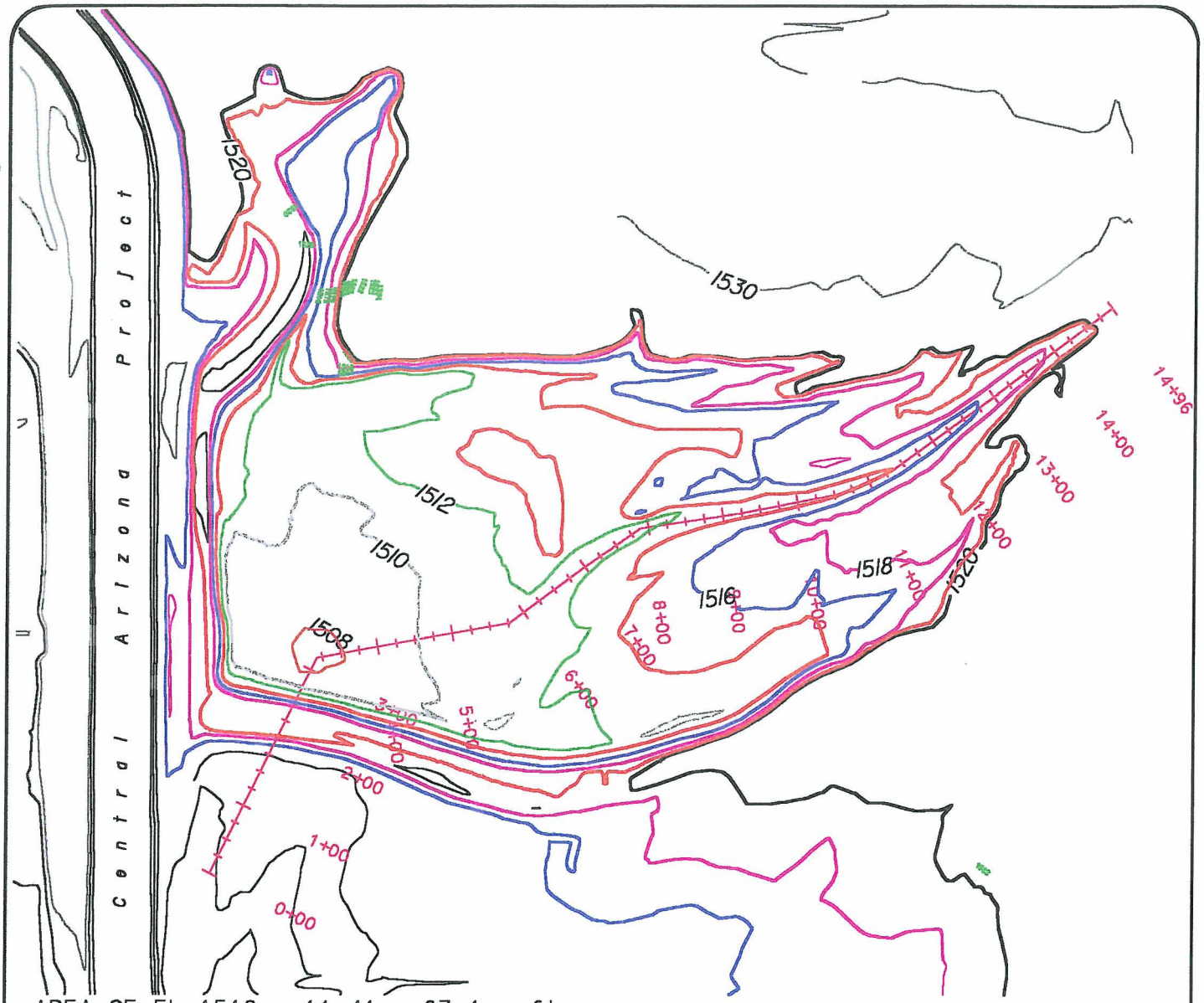
COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

SUB-BASIN & SOILS DELINEATION MAP

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

JOB NO. 997002-01

PLATE - 1



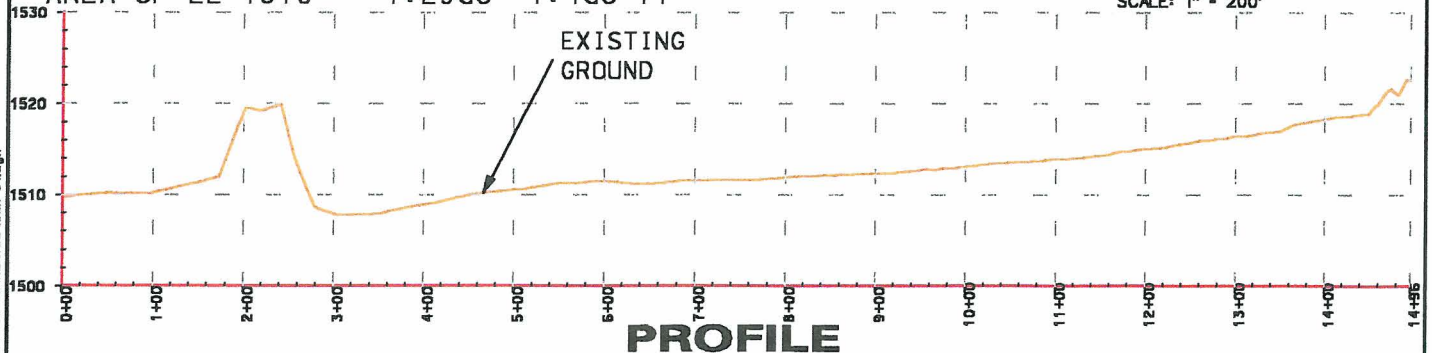
PLAN

AREA OF EL 1519 = 11.41ac 63.1ac ft
AREA OF EL 1518 = 10.97ac 52.2ac ft
AREA OF EL 1516 = 8.53ac 34.5ac ft
AREA OF EL 1514 = 6.50ac 19.7ac ft
AREA OF EL 1512 = 3.64ac 7.4ac ft
AREA OF EL 1510 = 1.29ac 1.4ac ft

N

200' 100' 0 200'

SCALE: 1" = 200'



PROFILE

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WASH–B

STORAGE CAPACITY AT C. A. P. & WASH–B

JOB NO 997002

4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE

FIGURE 1

WASH "B"
FLOODPLAIN DELINEATION

Between Shea Boulevard and Doubletree Ranch Road

FCDMC CONTRACT #99-10

TECHNICAL DATA NOTEBOOK
SECTION 5
HYDRAULIC ANALYSIS

June 13, 2001
Revised: June 13, 2001

Prepared for:

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

Prepared by:

Coe & Van Loo Consultants, Inc.
4550 N. 12th Street
Phoenix, AZ 85014
(602) 264-6831

CVL #99-7002-01

CVL

WASH "B"
HYDRAULIC ANALYSIS

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APPENDIX

Appendix A Wash "B" HEC-RAS and Output Cross Section Plots
Appendix B Flood Profiles
Appendix C Local Ponding Behind CAP Canal (Zone A LOMR)
Appendix D HY8 Output
Appendix E Floodplain Delineation Maps

1.0 INTRODUCTION

1.1 Scope of Study

Coe & Van Loo Consultants, Inc., (CVL) has contracted with the Flood Control District Maricopa County (FCDMC) to perform a Floodplain Delineation for a portion of Wash B located in Maricopa County, Arizona.

The project consists of topographic mapping and floodway delineation of approximately 3.9 river miles of Wash "B" south of the Cactus Road alignment and north of Doubletree Ranch Road in the City of Scottsdale. The reaches under study consist of the main stem and one tributary, broken down into three segments (1a, 1b, and 2). Segments 1a and 1b are the main stem, with 1a (2.1 miles) being the reach south of Shea Boulevard. Segment 1b in the main stem of Wash "B" is north of Shea Boulevard, comprising approximately 1.5 miles to Cactus Road. Segment 2 is the tributary to the main stem and is roughly 0.3 miles terminating at Via Linda Road. In addition, the study includes topographic mapping and the establishment of ponding limits on the upstream side of the Central Arizona Project (CAP) Canal. The limits of the contributory watershed are from Section 13 of Township 3N Range 5E (on the north) to Section 25 of Township 3N Range 5E (on the south). CVL developed hydrology for the 2.5 square mile watershed using the US Army Corps of Engineer's HEC-1 computer model. Backwater analysis was conducted using the HEC-RAS computer model to determine floodplain and floodway delineation for the 100-year peak flood.

The specific scope of this report is to evaluate the existence and severity of flood hazards for Wash B. The hydraulic computations documented in this report are in accordance with the methodology documented in the FCDMC Hydrologic Design Model (Ref. 1), and Guidelines and Specifications for Study Contractors; FEMA 37 (Ref. 3).

1.2 Description of Watershed

Hydrology is being analyzed for approximately 2.5 square miles of watershed that contributes stormwater runoff to Wash "B". Wash "B" watershed extends approximately 2 miles north of the CAP Canal and Shea Boulevard crossing with the upper limit located within the McDowell Mountains. Numerous roads cross the watershed, including Cactus Road, Via Linda Road and Shea Boulevard with the southern boundary of the watershed being at the CAP Canal just south of Shea Boulevard.

The terrain within the watershed differs greatly with the mountains to the north having slopes ranging from 25 to 65 percent (%) and the rest of the watershed generally sloping to the southwest ranging from about 10% down to 2.5%. A large portion of the watershed is in a medium density residential condition with several roads, subdivisions and the CAP Canal. The vegetation is primarily desert weeds and brush with some smaller trees.

1.3 Previous Studies and Reports

Wash "B" has not been analyzed previously for floodplain delineation. Hydrology is not available for the entire Wash B watershed. Information on the CAP overchute south of Shea Boulevard was gathered from the United States Bureau of Reclamation (USBR). The overchute structure, three, 72-inch-diameter pipes, is at CAP station 234+10. The Granite Reef Aqueduct (CAP Canal) Location Map (Reach 12) shows that the peak inflow is 1130 cfs, the storage capacity is 42 acre-feet and the peak outflow is 834 cfs for a 100-year 6-hour storm at this location. The input data for the overchute at station 234+10 (Hayden-Rhodes Data, Appendix VII, Ref. 2, under separate cover) shows that the pipes were designed with the Soil Conservation Service (SCS) method to accommodate a drainage area of 2.42 square miles, a channel length of 2.50 miles with a centroid of 1.60 miles, a curve number of 80 and a slope of 480 feet/mile. The overchute was originally designed at an invert elevation of 1507.14 feet and a previous crest elevation of 1518.00 feet. No storage capacity data is available for the overchute.

1.4 Coordination and Acknowledgements

CVL and the FCDMC have been in close coordination throughout the project. This coordination was typically meetings or telephone conversations to discuss the aspects of the FIS. The methodology used in preparing this FIS have been agreed upon by the FCDMC and CVL.

The Flood Control District of Maricopa County was not represented at the "N" value field investigation; however, they provided guidance in the determination of "N" values for the entire study area. See the N Value Determination Report (Appendix G, of TDN).

1.5 Location of Data

Survey, hydrologic, "N" value, and other pertinent data used in this study may be obtained from the Flood Control District of Maricopa County, 2801 West Durango Street, Phoenix, AZ 85009.

2.0 ENGINEERING METHODS

2.1 Hydrologic Analysis

A computerized rainfall/runoff model was developed for the Wash "B" watershed using the U.S. Army Corps of Engineers (CORPS) Flood Hydrograph Package (HEC-1). The September 1990 HEC-1 computer program was used to model the Wash "B" Watershed. The HEC-1 version 4.0, as implemented by Dodson and Associates, Inc. in their April 1991 version of ProHEC-1 was used for this study.

The assumptions and parameters used in the preparation of the HEC-1 model have been documented in the Technical Data Notebook Section 4 for this study. The 100-year, 6-hour and 24-hour storms were modeled. The floodplain delineation was based on the storm event that produced the higher peak flow. Refer to Table 1 for a list of the peak discharges that were used for the floodplain delineation.

Table 1
Peak Discharges Used for Floodplain Delineation

Wash Name	Location Section-Section	HEC-1 ID	Controlling Storm	Peak Flow (cfs) 100-yr
Wash "B"	1.160-1.404	CP4	24-HR.	333
	1.449-1.819	CP5	24-HR.	739
	1.839-2.197	CP3	24-HR.	2018
	2.294-2.682	CP6	24-HR.	2509
Tributary	0.389-0.723	CP2	24-HR.	1066

2.2 Hydraulic Analysis

The study reach is 3.9 miles of Wash "B" and one minor tributary south of the Cactus Road Alignment to Doubletree Ranch Road. For most of the study reach Wash "B" and its tributaries are in their natural condition. There are, however, some road and structure crossings, including the CAP Canal.

The existing condition 100-year frequency flood was analyzed for the hydraulics of the entire study reach. The resultant 100-year flood limits were delineated for FEMA regulatory purposes. Refer to the floodplain delineation maps in the Appendix E for the location of the floodplain boundary.

The National Flood Insurance Program was established to encourage state and local governments to adopt sound floodplain management programs to reduce future flood losses. Flood insurance has been made available to communities meeting the standards of this program as defined in reference 1. This study, therefore, has been performed to meet these standards and includes a flood boundary map designed to assist the FCDMC and the local communities in developing sound floodplain management measures.

The 100-year flood has been adopted by the Federal Emergency Management Agency (FEMA) as the base flood for purposes of floodplain management measures. The boundary of the 100-year flood (shown in Appendix E) has been delineated from flood elevations computed at each cross section. The boundaries were then interpolated between each cross section using topographic maps at a scale of 1" = 200' with a contour interval of 2 feet.

The CORPS HEC-RAS computer program was used to model the study reaches. The September 1998 HEC-RAS version 2.2 was used in the study. The study reaches were modeled as sub-critical profiles. The computer runs were started based on the slope area method. In some areas, the encroachment and ineffective flow options were used to model dead or non-effective flow areas. Consequently "Enc Sta L" and "Enc Sta R" do not represent the actual flooding limits, and the delineation was established based on the cross-section point elevations and the topography. In some cases "Top Width" does not represent the full width of the floodplain due to ineffective flow areas or low islands within the floodplain. These considerations were accounted for in the modeling and the delineation process.

3.0 PARAMETER ESTIMATION

3.1 Manning's "N" Value

The roughness factors ("N" values) for Wash "B" and its tributary were established based on field investigations, topographic mapping, and photographs of the area. These values were coordinated with the FCDMC. For complete description of assumptions made regarding "N" value determination, refer to the "N" Value Determination Report for the Wash "B" Floodplain Delineation Study dated March, 2000 (Appendix G, of TDN).

Table 2
`N' Values Used for Wash "B" FIS

WASH "B" BELOW CAP CANAL	
"N" value for the channel =	0.045 to 0.065
"N" value for the overbanks =	0.04 to 0.09
WASH "B" ABOVE CAP CROSSING	
"N" value for the channel =	0.046 to 0.058
"N" value for the overbanks =	0.065 to 0.08
TRIBUTARY	
"N" value for the channel =	0.061
"N" value for the overbanks =	0.066

3.2 Expansion and Contraction Coefficients

Expansion and contraction coefficients were used to model the energy losses within a reach due to the changes in shape of river cross-sections (or effective flow areas). The contraction and expansion coefficients used for Wash "B" and its tributary are 0.1 and 0.3 respectively (for gradual transitions). In the vicinity of the bridge, a contraction coefficient of 0.3 and an expansion coefficient of 0.5 was used.

3.3 Hydraulic Jump/Drop Analysis

There are no significant hydraulic jumps or drops that occur in Wash "B" or its tributaries within the study area. Therefore, a hydraulic jump or drop analysis was not performed.

4.0 CROSS SECTION DESCRIPTION

4.1 Channel and Overbank

All cross-sections are stationed from left to right looking downstream with the control line set at station 10,000. Cross-section numbers for Wash "B" are stationed in river miles upstream from the border of the Salt River/Pima Indian Reservation border. Cross-section numbers for the unnamed tributary are stationed in river miles upstream from the confluence with Wash "B".

Cross-sections are located at intervals along the washes to define the flow carrying capability of the wash and its adjacent floodplain. The cross sections are generally situated perpendicular to the direction of flow and typically extend over the banks across the entire floodplain. Cross sections are spaced at various distances ranging from 200 to 500 feet apart or they are located where changes in discharge occur, or where there are changes in slope, shape, or roughness.

Bank stations at each cross section were offset from the channel thalweg based on 1" = 200' topographic maps and field investigation. The location of these bank stations on the cross sections affect the HEC-RAS model computations due to differing 'N' values with respect to these bank stations.

4.2 Bridge and Constriction

Cross sections are located near the concrete culverts in the manner described in the Corps of Engineers' HEC-RAS manual (Ref. 4). To represent the contraction of flow entering the box culverts, one cross section is located upstream a distance approximately equal to the width of the flow contraction. Cross sections are also located adjacent to the upstream and downstream ends of the culverts. Another cross section is located downstream of the culverts approximately four times the width of the expansion to model the flow as it leaves the culverts. The culverts and bridge were modeled using the bridge culvert data editor in HEC-RAS.

5.0 CALIBRATION

For the Wash "B" Floodplain Delineation Study, calibration was performed for the hydraulics of the steel overchute pipes at the CAP Canal. The FHWA Culvert Analysis Program, HY8, version 6.0 was used for this calibration and verified the performance of the culvert routine of HEC-RAS.

6.0 SPECIAL PROBLEMS

6.1 Wash "B" Crossing of 120th Street

Wash "B" crosses under 120th Street through 4 barrel concrete box culverts. The upstream side of the crossing has 4-14'x3' box culverts, while the downstream side has 4-8'x3' box culverts. The 4-8'x3' box culverts were modeled for the purpose of analyzing the crossing. There is also a bend in the crossing, therefore a higher "n" value, 0.025, was used in the culvert editor.

The floodplain breaks out on the southeast side of the crossing. There is a small swale that continues to decrease in elevation at this location. The floodplain boundary was truncated due to the insignificant amount of flow that could be conveyed in the swale (see sheet 3, Appendix E).

6.2 Wash "B" Crossing of the CAP Canal

There are 3-72" overchute pipes crossing the CAP Canal; however, the pipes do not have the capacity to convey all of the 100-year flow, therefore some flow will overtop the canal bank. This will also create a large ponding area behind the canal. A Letter of Map Revision has been processed to establish the ponding limits for Wash "B" east of the canal (Appendix C). The flow that overtops the east canal bank will weir into the CAP Canal and be carried downstream in the C.A.P Canal, thus the flow in the overchute pipes is the only flow used in determining water surface elevations downstream of the CAP Canal. Analysis of the CAP capacity indicates the canal can carry at least 600 cfs within the freeboard designed into the canal. This capacity is more than adequate to handle the weir flow, which is 397 cfs. Refer to Section 4, Problems/Discussions, of Hydrology Report (Section 4 of TDN).

6.3 Wash "B" Crossing of Shea Boulevard

Wash "B" crosses under Shea Boulevard through 5-barrel 10'x6' concrete box culverts. The 100-year storm will cause ponding north of the culverts of Shea Boulevard. The culverts convey the entire flow under the road without any overtopping. Flood boundaries were then plotted on the 1" = 200' topographic maps based on the water surface elevations.

7.0 FLOOD HAZARD ZONES

The National Flood Insurance Program provides for the delineation of different flood hazard zones. These zones can be used as a tool to assist local communities in providing good floodplain management.

100-year floodplains have been determined for Wash "B" and its tributary as described previously in this report. Much of the 100-year flow is channelized with velocities varying from 2 ft/s to 10 ft/s. Based on this, the FCDMC and CVL concluded that a floodway would equal floodplain for most of the study area. Therefore, a floodway was only delineated for the sections of Wash "B" that were encroachable. The FCDMC and CVL recommend that Wash "B" and its tributary be designated as a Zone "AE".

Stormwater ponding upstream of the CAP Canal has been delineated for the 100-year storm. This is described in Section 6.2 and Appendix C. The FCDMC and CVL recommend that this area be designated as a Zone "A" on the Flood Insurance Rate Maps.

8.0 FINAL RESULTS

8.1 Computer Runs

The HEC-RAS computer model was used to compute the 100-year floodplain and floodway boundaries for Wash "B" and its tributary. The results of this computer run were used to complete the Floodplain Maps as previously described. Water surface elevations, top widths, etc. have been taken directly from the output of the runs, which are included in the appendix of this report.

8.2 Insurance Applications

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A: Zone A is the flood insurance rate zone that corresponds to 100-year floodplains that are determined in the FIS by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone.

Zone AE Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH Zone AH is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding with a constant water-surface elevation (usually areas of ponding) where average depths are between 1 and 3 feet. The BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 and 3 feet. The depth should be averaged along the cross-section and then along the direction of flow to determine the extent of the zone. Average depths derived from the detailed hydraulic analyses are shown within this zone.

Zone A99 Zone A99 is the flood insurance rate zone that corresponds to areas of the 100-year floodplain that will be protected by a Federal flood protection system where construction has reached specified statutory milestones. No BFEs or depths are shown within this zone.

Zone V Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Because approximate hydraulic analyses are performed for such areas, no BFEs are shown within this zone.

Zone VE Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, and areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.]

Zone D Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible

9.0 DISKETTES OF RUNS

The enclosed floppy diskettes contain each of the floodplain runs and are named as follows:

Wash Name	Input File Name	Output File Name
Wash "B"	WB.Prj	WB.txt

REFERENCES

1. Flood Control District of Maricopa County, Special Projects Branch, Hydrology Division, *Hydrologic Design Manual for Maricopa County, Arizona,* September 1, 1990.

2. Coe & Van Loo Consultants, Inc., *Wash "B" Floodplain Delineation, Between Shea Boulevard and Doubletree Ranch Road, Technical Data Notebook Section 4, Hydrologic Analysis*, November 8, 2000.

3. Federal Emergency Management Agency, *Flood Insurance Study Guidelines and Specifications for Study Contractors,* September 1985.

4. U.S. Army Corps of Engineers, The Hydrologic Engineering Center, *HEC-RAS River Analysis System Manual*, April 1997.

APPENDICES

APPENDIX A

Wash "B" HEC-RAS
And Output Cross Section Plots

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOW REACH	2.5294	2018.00	1564.60	1569.48	1568.70	1570.14	0.015594	6.53	314.91	106.33	0.65
LOW REACH	2.5294	2018.00	1564.60	1569.48	1568.70	1570.14	0.015594	6.53	314.91	106.33	0.65
LOW REACH	2.4973	2018.00	1563.59	1567.77		1568.12	0.008652	4.75	425.35	152.75	0.50
LOW REACH	2.4973	2018.00	1563.59	1567.77		1568.12	0.008652	4.75	425.35	152.75	0.50
LOW REACH	2.4576	2018.00	1558.55	1564.99	1564.60	1565.54	0.018449	6.29	382.92	217.90	0.70
LOW REACH	2.4576	2018.00	1558.55	1564.99	1564.60	1565.54	0.018449	6.29	382.92	217.90	0.70
LOW REACH	2.428	2018.00	1557.64	1562.48		1562.91	0.015056	5.31	382.62	176.64	0.63
LOW REACH	2.428	2018.00	1557.64	1562.48		1562.91	0.015056	5.31	382.62	176.64	0.63
LOW REACH	2.4044	2018.00	1556.60	1561.56		1561.81	0.005329	4.46	600.20	248.42	0.41
LOW REACH	2.4044	2018.00	1556.60	1561.56		1561.81	0.005329	4.46	600.20	248.42	0.41
LOW REACH	2.3748	2018.00	1552.57	1559.22	1559.08	1560.31	0.018629	8.94	296.10	137.75	0.76
LOW REACH	2.3748	2018.00	1552.57	1559.22	1559.08	1560.31	0.018629	8.94	296.10	137.75	0.76
LOW REACH	2.3087	2018.00	1548.22	1553.33		1554.09	0.016511	7.03	288.93	94.85	0.70
LOW REACH	2.3087	2018.00	1548.22	1553.33		1554.09	0.016511	7.03	288.93	94.85	0.70
LOW REACH	2.2413	2018.00	1545.00	1550.60		1550.86	0.005314	4.62	596.33	260.97	0.41
LOW REACH	2.2413	2018.00	1545.00	1550.60		1550.86	0.005314	4.62	596.33	260.97	0.41
LOW REACH	2.2138	2018.00	1542.80	1549.49	1548.45	1549.95	0.007314	5.87	452.10	673.83	0.49
LOW REACH	2.2138	2018.00	1542.80	1549.49	1548.45	1549.95	0.007314	5.87	452.10	673.83	0.49
LOW REACH	2.2136	Culvert									
LOW REACH	2.1945	2509.00	1542.11	1548.40	1547.89	1549.45	0.024383	8.23	304.86	94.96	0.81
LOW REACH	2.1945	2509.00	1542.11	1548.40	1547.89	1549.45	0.024383	8.23	304.86	94.96	0.81
LOW REACH	2.1174	2509.00	1537.10	1541.79		1542.45	0.012401	6.99	407.44	165.35	0.75
LOW REACH	2.1174	2509.00	1537.10	1541.79		1542.45	0.012401	6.99	407.44	165.35	0.75
LOW REACH	2.0244	2509.00	1529.96	1535.62	1535.35	1536.38	0.012290	8.09	429.06	189.23	0.77

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOW REACH	2.0244	2509.00	1529.96	1535.62	1535.35	1536.38	0.012290	8.09	429.06	189.23	0.77
LOW REACH	1.9278	2509.00	1525.31	1529.78		1530.54	0.010795	7.57	432.04	212.67	0.72
LOW REACH	1.9278	2509.00	1525.31	1529.78		1530.54	0.010795	7.57	432.04	212.67	0.72
LOW REACH	1.872	2509.00	1521.43	1525.58		1526.46	0.018080	7.54	334.03	148.96	0.88
LOW REACH	1.872	2509.00	1521.43	1525.58		1526.46	0.018080	7.54	334.03	148.96	0.88
LOW REACH	1.8329	2509.00	1516.32	1521.48	1521.48	1522.59	0.019213	8.85	328.85	168.75	0.93
LOW REACH	1.8329	2509.00	1516.32	1521.48	1521.48	1522.59	0.019213	8.85	328.85	168.75	0.93
LOW REACH	1.7892	2509.00	1513.60	1520.89		1520.95	0.000803	2.17	1350.57	413.72	0.20
LOW REACH	1.7892	2509.00	1513.60	1520.89		1520.95	0.000803	2.17	1350.57	413.72	0.20
LOW REACH	1.7383	2509.00	1511.66	1520.89		1520.90	0.000052	0.85	3534.66	543.69	0.06
LOW REACH	1.7383	2509.00	1511.66	1520.89		1520.90	0.000052	0.85	3534.66	543.69	0.06
LOW REACH	1.6445	2509.00	1507.65	1520.88		1520.88	0.000010	0.48	5925.06	662.46	0.03
LOW REACH	1.6445	2509.00	1507.65	1520.88		1520.88	0.000010	0.48	5925.06	662.46	0.03
LOW REACH	1.6233	2509.00	1508.54	1520.87	1510.84	1520.88	0.000033	0.85	3706.69	443.23	0.04
LOW REACH	1.6233	2509.00	1508.54	1520.87	1510.84	1520.88	0.000033	0.85	3706.69	443.23	0.04
LOW REACH	1.6206	Culvert									
LOW REACH	1.5767	1192.00	1507.20	1511.28	1511.28	1513.11	0.001888	10.86	109.75	30.04	1.00
LOW REACH	1.5767	1192.00	1507.20	1511.28	1511.28	1513.11	0.001888	10.86	109.75	30.04	1.00
LOW REACH	1.5651	1192.00	1499.73	1503.32	1503.19	1504.28	0.024600	7.85	151.84	68.67	0.93
LOW REACH	1.5651	1192.00	1499.73	1503.32	1503.19	1504.28	0.024600	7.85	151.84	68.67	0.93
LOW REACH	1.5401	1192.00	1496.25	1499.27	1499.27	1500.16	0.041220	9.18	179.96	123.78	1.17
LOW REACH	1.5401	1192.00	1496.25	1499.27	1499.27	1500.16	0.041220	9.18	179.96	123.78	1.17
LOW REACH	1.5097	1192.00	1495.13	1498.42	1494.15	1498.49	0.002028	2.34	548.85	164.23	0.27
LOW REACH	1.5097	1192.00	1495.13	1498.42	1494.15	1498.49	0.002028	2.34	548.85	164.23	0.27

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOW REACH	1.4792	1192.00	1492.94	1497.75		1497.96	0.005871	4.53	414.50	193.67	0.47
LOW REACH	1.4792	1192.00	1492.94	1497.75		1497.96	0.005871	4.53	414.50	193.67	0.47
LOW REACH	1.4195	1192.00	1490.58	1493.62	1493.62	1494.44	0.027554	7.30	174.43	146.74	0.96
LOW REACH	1.4195	1192.00	1490.58	1493.62	1493.62	1494.44	0.027554	7.30	174.43	146.74	0.96
LOW REACH	1.3462	1192.00	1486.92	1492.79	1489.80	1492.83	0.000477	1.64	735.40	190.56	0.14
LOW REACH	1.3462	1192.00	1486.92	1492.79	1489.80	1492.83	0.000477	1.64	735.40	190.56	0.14
LOW REACH	1.346	Culvert									
LOW REACH	1.3242	1192.00	1485.62	1488.92		1489.35	0.011756	5.82	270.32	195.12	0.81
LOW REACH	1.3242	1192.00	1485.62	1488.92		1489.35	0.011756	5.82	270.32	195.12	0.81
LOW REACH	1.3076	1192.00	1485.10	1487.92		1488.26	0.012131	4.94	280.09	248.63	0.78
LOW REACH	1.3076	1192.00	1485.10	1487.92		1488.26	0.012131	4.94	280.09	248.63	0.78
LOW REACH	1.2775	1192.00	1482.76	1485.98		1486.24	0.013111	4.63	330.06	321.91	0.79
LOW REACH	1.2775	1192.00	1482.76	1485.98		1486.24	0.013111	4.63	330.06	321.91	0.79
LOW REACH	1.2311	1192.00	1479.51	1482.62	1482.62	1483.10	0.012513	7.04	335.35	307.53	0.86
LOW REACH	1.2311	1192.00	1479.51	1482.62	1482.62	1483.10	0.012513	7.04	335.35	307.53	0.86
LOW REACH	1.1788	1192.00	1475.65	1479.54		1479.77	0.004167	5.00	419.26	206.28	0.53
LOW REACH	1.1788	1192.00	1475.65	1479.54		1479.77	0.004167	5.00	419.26	206.28	0.53
LOW REACH	1.1722	1192.00	1476.00	1478.90	1478.60	1479.45	0.023438	8.05	234.14	206.85	1.10
LOW REACH	1.1722	1192.00	1476.00	1478.90	1478.60	1479.45	0.023438	8.05	234.14	206.85	1.10
LOW REACH	1.172	Culvert									
LOW REACH	1.161	1192.00	1475.48	1478.31		1478.56	0.006588	4.02	299.02	222.12	0.59
LOW REACH	1.161	1192.00	1475.48	1478.31		1478.56	0.006588	4.02	299.02	222.12	0.59
LOW REACH	1.1362	1192.00	1474.30	1477.10		1477.45	0.011058	4.71	254.15	214.96	0.75

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOW REACH	1.1362	1192.00	1474.30	1477.10		1477.45	0.011058	4.71	254.15	214.96	0.75
LOW REACH	1.0822	1192.00	1469.52	1472.73	1472.73	1473.28	0.020653	5.94	203.51	190.72	1.00
LOW REACH	1.0822	1192.00	1469.52	1472.73	1472.73	1473.28	0.020653	5.94	203.51	190.72	1.00
LOW REACH	1.0024	1192.00	1462.90	1468.35	1465.94	1468.41	0.000575	2.09	739.83	354.18	0.20
LOW REACH	1.0024	1192.00	1462.90	1468.35	1465.94	1468.41	0.000575	2.09	739.83	354.18	0.20
LOW REACH	0.9936	1192.00	1463.52	1468.34	1465.66	1468.38	0.000398	2.00	1133.45	535.09	0.17
LOW REACH	0.9936	1192.00	1463.52	1468.34	1465.66	1468.38	0.000398	2.00	1133.45	535.09	0.17
LOW REACH	0.9934	Culvert									
LOW REACH	0.9712	1192.00	1459.80	1462.61	1462.61	1463.51	0.018842	8.02	173.13	103.77	1.04
LOW REACH	0.9712	1192.00	1459.80	1462.61	1462.61	1463.51	0.018842	8.02	173.13	103.77	1.04
LOW REACH	0.9454	1192.00	1458.12	1461.04		1461.71	0.008621	6.63	192.73	92.58	0.74
LOW REACH	0.9454	1192.00	1458.12	1461.04		1461.71	0.008621	6.63	192.73	92.58	0.74
LOW REACH	0.8884	1192.00	1454.50	1457.16	1457.16	1458.09	0.017630	7.75	153.82	84.01	1.01
LOW REACH	0.8884	1192.00	1454.50	1457.16	1457.16	1458.09	0.017630	7.75	153.82	84.01	1.01
LOW REACH	0.8216	1192.00	1448.93	1452.27	1451.05	1452.47	0.002334	3.65	360.79	165.43	0.39
LOW REACH	0.8216	1192.00	1448.93	1452.27	1451.05	1452.47	0.002334	3.65	360.79	165.43	0.39
LOW REACH	0.7947	1192.00	1448.24	1451.16		1451.84	0.008919	6.64	181.62	77.99	0.75
LOW REACH	0.7947	1192.00	1448.24	1451.16		1451.84	0.008919	6.64	181.62	77.99	0.75
LOW REACH	0.7002	1192.00	1442.43	1444.91	1444.91	1445.89	0.016574	7.93	152.75	82.05	0.99
LOW REACH	0.7002	1192.00	1442.43	1444.91	1444.91	1445.89	0.016574	7.93	152.75	82.05	0.99
LOW REACH	0.6384	1192.00	1438.62	1443.15		1443.30	0.001398	3.23	457.47	257.56	0.31
LOW REACH	0.6384	1192.00	1438.62	1443.15		1443.30	0.001398	3.23	457.47	257.56	0.31
LOW REACH	0.6261	1192.00	1437.41	1441.33	1441.33	1442.72	0.013475	9.54	136.29	57.95	0.93
LOW REACH	0.6261	1192.00	1437.41	1441.33	1441.33	1442.72	0.013475	9.54	136.29	57.95	0.93

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOW REACH	0.6259	Bridge									
LOW REACH	0.5964	1192.00	1436.56	1438.83	1438.83	1439.76	0.017472	7.73	154.34	85.02	1.00
LOW REACH	0.5964	1192.00	1436.56	1438.83	1438.83	1439.76	0.017472	7.73	154.34	85.02	1.00
LOW REACH	0.5559	1192.00	1432.81	1435.84		1436.57	0.009552	6.89	175.52	76.65	0.78
LOW REACH	0.5559	1192.00	1432.81	1435.84		1436.57	0.009552	6.89	175.52	76.65	0.78
LOW REACH	0.5114	1192.00	1430.30	1432.70	1432.68	1433.66	0.016494	7.86	153.01	82.04	0.99
LOW REACH	0.5114	1192.00	1430.30	1432.70	1432.68	1433.66	0.016494	7.86	153.01	82.04	0.99
LOW REACH	0.464	1192.00	1426.60	1429.13		1429.93	0.013347	7.19	165.88	82.22	0.89
LOW REACH	0.464	1192.00	1426.60	1429.13		1429.93	0.013347	7.19	165.88	82.22	0.89
LOW REACH	0.4167	1192.00	1422.96	1426.19		1426.86	0.011096	6.58	181.19	89.41	0.81
LOW REACH	0.4167	1192.00	1422.96	1426.19		1426.86	0.011096	6.58	181.19	89.41	0.81
LOW REACH	0.3735	1192.00	1419.99	1422.85	1422.80	1423.91	0.014828	8.32	147.07	68.48	0.96
LOW REACH	0.3735	1192.00	1419.99	1422.85	1422.80	1423.91	0.014828	8.32	147.07	68.48	0.96
LOW REACH	0.322	1192.00	1416.92	1420.49		1421.02	0.007280	5.89	207.06	109.46	0.68
LOW REACH	0.322	1192.00	1416.92	1420.49		1421.02	0.007280	5.89	207.06	109.46	0.68
LOW REACH	0.2615	1192.00	1414.80	1417.29		1418.05	0.012265	7.01	170.65	87.28	0.86
LOW REACH	0.2615	1192.00	1414.80	1417.29		1418.05	0.012265	7.01	170.65	87.28	0.86
LOW REACH	0.2271	1192.00	1413.02	1415.78	1415.27	1416.31	0.007134	5.81	205.29	95.00	0.70
LOW REACH	0.2271	1192.00	1413.02	1415.78	1415.27	1416.31	0.007134	5.81	205.29	95.00	0.70
LOW REACH	0.1324	1192.00	1409.39	1412.45	1411.81	1412.94	0.006353	5.61	212.34	94.86	0.66
LOW REACH	0.1324	1192.00	1409.39	1412.45	1411.81	1412.94	0.006353	5.61	212.34	94.86	0.66
LOW REACH	0.0377	1192.00	1404.97	1407.32	1407.32	1408.28	0.014623	7.88	153.01	81.29	0.98
LOW REACH	0.0377	1192.00	1404.97	1407.32	1407.32	1408.28	0.014623	7.88	153.01	81.29	0.98

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
LOW REACH	0.0015	1192.00	1403.50	1404.58	1404.28	1404.94	0.012003	3.91	252.06	171.58	0.77
LOW REACH	0.0015	1192.00	1403.50	1404.58	1404.28	1404.94	0.012003	3.91	252.06	171.58	0.77

HEC-RAS Plan: Imported Pla River: WASH B Reach: UPPER REACH

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
UPPER REACH	3.8799	333.00	1779.41	1782.73	1782.73	1783.70	0.041731	7.91	42.11	22.16	1.01
UPPER REACH	3.8799	333.00	1779.41	1782.73	1782.73	1783.70	0.041731	7.91	42.11	22.16	1.01
UPPER REACH	3.8174	333.00	1765.41	1767.79	1767.79	1768.37	0.046091	6.13	54.32	47.10	1.01
UPPER REACH	3.8174	333.00	1765.41	1767.79	1767.79	1768.37	0.046091	6.13	54.32	47.10	1.01
UPPER REACH	3.7235	333.00	1741.14	1744.07	1744.07	1744.85	0.042241	7.08	47.02	30.28	1.00
UPPER REACH	3.7235	333.00	1741.14	1744.07	1744.07	1744.85	0.042241	7.08	47.02	30.28	1.00
UPPER REACH	3.6294	333.00	1717.05	1720.74	1720.74	1721.75	0.040949	8.04	41.39	20.61	1.00
UPPER REACH	3.6294	333.00	1717.05	1720.74	1720.74	1721.75	0.040949	8.04	41.39	20.61	1.00
UPPER REACH	3.5932	333.00	1706.70	1709.04	1708.81	1709.66	0.028530	6.32	52.68	29.80	0.84
UPPER REACH	3.5932	333.00	1706.70	1709.04	1708.81	1709.66	0.028530	6.32	52.68	29.80	0.84
UPPER REACH	3.5347	333.00	1697.16	1700.09		1700.77	0.028918	6.63	50.26	26.52	0.85
UPPER REACH	3.5347	333.00	1697.16	1700.09		1700.77	0.028918	6.63	50.26	26.52	0.85
UPPER REACH	3.4405	333.00	1680.00	1682.84	1682.84	1683.74	0.041204	7.59	43.88	24.56	1.00
UPPER REACH	3.4405	333.00	1680.00	1682.84	1682.84	1683.74	0.041204	7.59	43.88	24.56	1.00
UPPER REACH	3.3466	333.00	1663.63	1666.53		1667.09	0.020987	6.03	55.22	26.25	0.73
UPPER REACH	3.3466	333.00	1663.63	1666.53		1667.09	0.020987	6.03	55.22	26.25	0.73
UPPER REACH	3.2524	333.00	1649.30	1652.01	1652.01	1652.90	0.040979	7.61	43.94	25.42	1.00
UPPER REACH	3.2524	333.00	1649.30	1652.01	1652.01	1652.90	0.040979	7.61	43.94	25.42	1.00
UPPER REACH	3.2038	333.00	1643.43	1647.97	1646.49	1648.24	0.005898	4.25	85.07	33.66	0.42
UPPER REACH	3.2038	333.00	1643.43	1647.97	1646.49	1648.24	0.005898	4.25	85.07	33.66	0.42
UPPER REACH	3.2036	Culvert									
UPPER REACH	3.1483	333.00	1634.65	1638.07		1638.59	0.019270	5.79	57.52	26.14	0.69
UPPER REACH	3.1483	333.00	1634.65	1638.07		1638.59	0.019270	5.79	57.52	26.14	0.69
UPPER REACH	3.0634	333.00	1624.00	1626.35		1626.96	0.036735	6.26	53.47	38.55	0.92
UPPER REACH	3.0634	333.00	1624.00	1626.35		1626.96	0.036735	6.26	53.47	38.55	0.92

HEC-RAS Plan: Imported Pla River: WASH B Reach: UPPER REACH (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
UPPER REACH	2.9691	333.00	1611.30	1613.21	1612.88	1613.51	0.020409	4.33	76.93	59.48	0.67
UPPER REACH	2.9691	333.00	1611.30	1613.21	1612.88	1613.51	0.020409	4.33	76.93	59.48	0.67
UPPER REACH	2.9258	333.00	1604.71	1606.15	1606.15	1606.60	0.049222	5.41	61.53	90.03	0.99
UPPER REACH	2.9258	333.00	1604.71	1606.15	1606.15	1606.60	0.049222	5.41	61.53	90.03	0.99
UPPER REACH	2.8845	333.00	1598.05	1600.89	1600.46	1601.06	0.013475	3.35	100.23	84.33	0.54
UPPER REACH	2.8845	333.00	1598.05	1600.89	1600.46	1601.06	0.013475	3.35	100.23	84.33	0.54
UPPER REACH	2.7809	333.00	1586.50	1588.89	1588.79	1589.44	0.038148	5.95	57.68	73.68	0.91
UPPER REACH	2.7809	333.00	1586.50	1588.89	1588.79	1589.44	0.038148	5.95	57.68	73.68	0.91
UPPER REACH	2.7418	739.00	1581.53	1585.37		1585.75	0.013478	4.94	150.72	71.17	0.59
UPPER REACH	2.7418	739.00	1581.53	1585.37		1585.75	0.013478	4.94	150.72	71.17	0.59
UPPER REACH	2.6803	739.00	1576.70	1580.44		1580.78	0.017297	4.72	157.76	95.21	0.64
UPPER REACH	2.6803	739.00	1576.70	1580.44		1580.78	0.017297	4.72	157.76	95.21	0.64
UPPER REACH	2.6574	739.00	1574.57	1577.78		1578.24	0.025931	5.46	135.61	89.37	0.78
UPPER REACH	2.6574	739.00	1574.57	1577.78		1578.24	0.025931	5.46	135.61	89.37	0.78
UPPER REACH	2.5918	739.00	1569.86	1573.86	1572.79	1574.06	0.006749	3.60	206.82	95.65	0.42
UPPER REACH	2.5918	739.00	1569.86	1573.86	1572.79	1574.06	0.006749	3.60	206.82	95.65	0.42

HEC-RAS Plan: Imported Pla River: WASH B Reach: TRIBUTARY

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
TRIBUTARY	0.3748	1066.00	1597.40	1601.92		1602.73	0.017765	7.23	147.39	42.35	0.68
TRIBUTARY	0.3748	1066.00	1597.40	1601.92		1602.73	0.017765	7.23	147.39	42.35	0.68
TRIBUTARY	0.3057	1066.00	1589.93	1594.54	1593.97	1595.25	0.023694	6.77	157.38	63.35	0.76
TRIBUTARY	0.3057	1066.00	1589.93	1594.54	1593.97	1595.25	0.023694	6.77	157.38	63.35	0.76
TRIBUTARY	0.2473	1066.00	1585.90	1590.32		1590.59	0.010055	4.21	253.19	110.23	0.49
TRIBUTARY	0.2473	1066.00	1585.90	1590.32		1590.59	0.010055	4.21	253.19	110.23	0.49
TRIBUTARY	0.1922	1066.00	1581.33	1585.86		1586.30	0.023293	5.56	208.25	150.72	0.72
TRIBUTARY	0.1922	1066.00	1581.33	1585.86		1586.30	0.023293	5.56	208.25	150.72	0.72
TRIBUTARY	0.1386	1066.00	1575.85	1581.15	1580.37	1581.43	0.012459	4.29	249.60	127.56	0.53
TRIBUTARY	0.1386	1066.00	1575.85	1581.15	1580.37	1581.43	0.012459	4.29	249.60	127.56	0.53
TRIBUTARY	0.0587	1066.00	1571.48	1574.76	1574.21	1575.26	0.018184	5.74	193.30	95.45	0.66
TRIBUTARY	0.0587	1066.00	1571.48	1574.76	1574.21	1575.26	0.018184	5.74	193.30	95.45	0.66

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH

Reach	River Sta	Top Wdth Act	Area	Vel Total	W.S. Elev	Base WS	Prof Delta WS
		(ft)	(sq ft)	(ft/s)	(ft)	(ft)	(ft)
LOW REACH	2.5294	106.33	314.91	6.41	1569.48	1569.48	
LOW REACH	2.5294	106.33	314.91	6.41	1569.48	1569.48	0.00
LOW REACH	2.4973	152.75	425.35	4.74	1567.77	1567.77	
LOW REACH	2.4973	152.75	425.35	4.74	1567.77	1567.77	0.00
LOW REACH	2.4576	217.90	382.92	5.27	1564.99	1564.99	
LOW REACH	2.4576	217.90	382.92	5.27	1564.99	1564.99	0.00
LOW REACH	2.428	176.64	382.62	5.27	1562.48	1562.48	
LOW REACH	2.428	176.64	382.62	5.27	1562.48	1562.48	0.00
LOW REACH	2.4044	248.42	600.20	3.36	1561.56	1561.56	
LOW REACH	2.4044	248.42	600.20	3.36	1561.56	1561.56	0.00
LOW REACH	2.3748	137.75	296.10	6.82	1559.22	1559.22	
LOW REACH	2.3748	137.75	296.10	6.82	1559.22	1559.22	0.00
LOW REACH	2.3087	94.85	288.93	6.98	1553.33	1553.33	
LOW REACH	2.3087	94.85	288.93	6.98	1553.33	1553.33	0.00
LOW REACH	2.2413	260.97	596.33	3.38	1550.60	1550.60	
LOW REACH	2.2413	260.97	596.33	3.38	1550.60	1550.60	0.00
LOW REACH	2.2138	197.21	3538.60	4.46	1549.49	1549.49	
LOW REACH	2.2138	197.21	3538.60	4.46	1549.49	1549.49	0.00
LOW REACH	2.2136	Culvert					
LOW REACH	2.1945	94.96	304.86	8.23	1548.40	1548.40	
LOW REACH	2.1945	94.96	304.86	8.23	1548.40	1548.40	0.00
LOW REACH	2.1174	165.35	407.44	6.16	1541.79	1541.79	
LOW REACH	2.1174	165.35	407.44	6.16	1541.79	1541.79	0.00
LOW REACH	2.0244	189.23	429.06	5.85	1535.62	1535.62	

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Top Wdth Act	Area	Vel Total	W.S. Elev	Base WS	Prof Delta WS
		(ft)	(sq ft)	(ft/s)	(ft)	(ft)	(ft)
LOW REACH	2.0244	189.23	429.06	5.85	1535.62	1535.62	0.00
LOW REACH	1.9278	212.67	432.04	5.81	1529.78	1529.78	
LOW REACH	1.9278	212.67	432.04	5.81	1529.78	1529.78	0.00
LOW REACH	1.872	148.96	334.03	7.51	1525.58	1525.58	
LOW REACH	1.872	148.96	334.03	7.51	1525.58	1525.58	0.00
LOW REACH	1.8329	168.75	328.85	7.63	1521.48	1521.48	
LOW REACH	1.8329	168.75	328.85	7.63	1521.48	1521.48	0.00
LOW REACH	1.7892	413.72	1350.57	1.86	1520.89	1520.89	
LOW REACH	1.7892	413.72	1350.57	1.86	1520.89	1520.89	0.00
LOW REACH	1.7383	543.69	3534.66	0.71	1520.89	1520.89	
LOW REACH	1.7383	543.69	3534.66	0.71	1520.89	1520.89	0.00
LOW REACH	1.6445	662.46	5925.06	0.42	1520.88	1520.88	
LOW REACH	1.6445	662.46	5925.06	0.42	1520.88	1520.88	0.00
LOW REACH	1.6233	443.23	3706.69	0.68	1520.87	1520.87	
LOW REACH	1.6233	443.23	3706.69	0.68	1520.87	1520.87	0.00
LOW REACH	1.6206	Culvert					
LOW REACH	1.5767	30.04	109.75	10.86	1511.28	1511.28	
LOW REACH	1.5767	30.04	109.75	10.86	1511.28	1511.28	0.00
LOW REACH	1.5651	68.67	151.84	7.85	1503.32	1503.32	
LOW REACH	1.5651	68.67	151.84	7.85	1503.32	1503.32	0.00
LOW REACH	1.5401	96.98	193.80	6.62	1499.27	1499.27	
LOW REACH	1.5401	96.98	193.80	6.62	1499.27	1499.27	0.00
LOW REACH	1.5097	134.41	580.39	2.17	1498.42	1498.42	
LOW REACH	1.5097	134.41	580.39	2.17	1498.42	1498.42	0.00

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Top Wdth Act (ft)	Area (sq ft)	Vel Total (ft/s)	W.S. Elev (ft)	Base WS (ft)	Prof Delta WS (ft)
LOW REACH	1.4792	193.67	414.50	2.88	1497.75	1497.75	
LOW REACH	1.4792	193.67	414.50	2.88	1497.75	1497.75	0.00
LOW REACH	1.4195	146.74	174.43	6.83	1493.62	1493.62	
LOW REACH	1.4195	146.74	174.43	6.83	1493.62	1493.62	0.00
LOW REACH	1.3462	190.56	735.40	1.62	1492.79	1492.79	
LOW REACH	1.3462	190.56	735.40	1.62	1492.79	1492.79	0.00
LOW REACH	1.346	Culvert					
LOW REACH	1.3242	195.12	270.32	4.41	1488.92	1488.92	
LOW REACH	1.3242	195.12	270.32	4.41	1488.92	1488.92	0.00
LOW REACH	1.3076	248.63	280.09	4.26	1487.92	1487.92	
LOW REACH	1.3076	248.63	280.09	4.26	1487.92	1487.92	0.00
LOW REACH	1.2775	321.91	330.06	3.61	1485.98	1485.98	
LOW REACH	1.2775	321.91	330.06	3.61	1485.98	1485.98	0.00
LOW REACH	1.2311	307.53	335.35	3.55	1482.62	1482.62	
LOW REACH	1.2311	307.53	335.35	3.55	1482.62	1482.62	0.00
LOW REACH	1.1788	206.28	419.26	2.84	1479.54	1479.54	
LOW REACH	1.1788	206.28	419.26	2.84	1479.54	1479.54	0.00
LOW REACH	1.1722	206.85	234.14	5.09	1478.90	1478.90	
LOW REACH	1.1722	206.85	234.14	5.09	1478.90	1478.90	0.00
LOW REACH	1.172	Culvert					
LOW REACH	1.161	222.12	299.02	3.99	1478.31	1478.31	
LOW REACH	1.161	222.12	299.02	3.99	1478.31	1478.31	0.00
LOW REACH	1.1362	214.96	254.15	4.69	1477.10	1477.10	

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Top Wdth Act	Area	Vel Total	W.S. Elev	Base WS	Prof Delta WS
		(ft)	(sq ft)	(ft/s)	(ft)	(ft)	(ft)
LOW REACH	1.1362	214.96	254.15	4.69	1477.10	1477.10	0.00
LOW REACH	1.0822	190.72	203.51	5.86	1472.73	1472.73	
LOW REACH	1.0822	190.72	203.51	5.86	1472.73	1472.73	0.00
LOW REACH	1.0024	354.18	739.83	1.61	1468.35	1468.35	
LOW REACH	1.0024	354.18	739.83	1.61	1468.35	1468.35	0.00
LOW REACH	0.9936	535.09	1133.45	1.05	1468.34	1468.34	
LOW REACH	0.9936	535.09	1133.45	1.05	1468.34	1468.34	0.00
LOW REACH	0.9934	Culvert					
LOW REACH	0.9712	103.77	173.13	6.89	1462.61	1462.61	
LOW REACH	0.9712	103.77	173.13	6.89	1462.61	1462.61	0.00
LOW REACH	0.9454	92.58	192.73	6.18	1461.04	1461.04	
LOW REACH	0.9454	92.58	192.73	6.18	1461.04	1461.04	0.00
LOW REACH	0.8884	84.01	153.82	7.75	1457.16	1457.16	
LOW REACH	0.8884	84.01	153.82	7.75	1457.16	1457.16	0.00
LOW REACH	0.8216	165.43	360.79	3.30	1452.27	1452.27	
LOW REACH	0.8216	165.43	360.79	3.30	1452.27	1452.27	0.00
LOW REACH	0.7947	77.99	181.62	6.56	1451.16	1451.16	
LOW REACH	0.7947	77.99	181.62	6.56	1451.16	1451.16	0.00
LOW REACH	0.7002	82.05	152.75	7.80	1444.91	1444.91	
LOW REACH	0.7002	82.05	152.75	7.80	1444.91	1444.91	0.00
LOW REACH	0.6384	257.56	457.47	2.61	1443.15	1443.15	
LOW REACH	0.6384	257.56	457.47	2.61	1443.15	1443.15	0.00
LOW REACH	0.6261	57.95	136.29	8.75	1441.33	1441.33	
LOW REACH	0.6261	57.95	136.29	8.75	1441.33	1441.33	0.00

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Top Wdth Act (ft)	Area (sq ft)	Vel Total (ft/s)	W.S. Elev (ft)	Base WS (ft)	Prof Delta WS (ft)
LOW REACH	0.6259 BR U	59.55	138.47	8.61	1440.13	1440.13	
LOW REACH	0.6259 BR U	59.55	138.47	8.61	1440.13	1440.13	0.00
LOW REACH	0.6259 BR D	59.62	183.69	6.49	1439.35	1439.35	
LOW REACH	0.6259 BR D	59.62	183.69	6.49	1439.35	1439.35	0.00
LOW REACH	0.5964	85.02	154.34	7.72	1438.83	1438.83	
LOW REACH	0.5964	85.02	154.34	7.72	1438.83	1438.83	0.00
LOW REACH	0.5559	76.65	175.52	6.79	1435.84	1435.84	
LOW REACH	0.5559	76.65	175.52	6.79	1435.84	1435.84	0.00
LOW REACH	0.5114	82.04	153.01	7.79	1432.70	1432.70	
LOW REACH	0.5114	82.04	153.01	7.79	1432.70	1432.70	0.00
LOW REACH	0.464	82.22	165.88	7.19	1429.13	1429.13	
LOW REACH	0.464	82.22	165.88	7.19	1429.13	1429.13	0.00
LOW REACH	0.4167	89.41	181.19	6.58	1426.19	1426.19	
LOW REACH	0.4167	89.41	181.19	6.58	1426.19	1426.19	0.00
LOW REACH	0.3735	68.48	147.07	8.11	1422.85	1422.85	
LOW REACH	0.3735	68.48	147.07	8.11	1422.85	1422.85	0.00
LOW REACH	0.322	109.46	207.06	5.76	1420.49	1420.49	
LOW REACH	0.322	109.46	207.06	5.76	1420.49	1420.49	0.00
LOW REACH	0.2615	87.28	170.65	6.99	1417.29	1417.29	
LOW REACH	0.2615	87.28	170.65	6.99	1417.29	1417.29	0.00
LOW REACH	0.2271	95.00	205.29	5.81	1415.78	1415.78	
LOW REACH	0.2271	95.00	205.29	5.81	1415.78	1415.78	0.00
LOW REACH	0.1324	94.86	212.34	5.61	1412.45	1412.45	
LOW REACH	0.1324	94.86	212.34	5.61	1412.45	1412.45	0.00

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	Top Wdth Act	Area	Vel Total	W.S. Elev	Base WS	Prof Delta WS
		(ft)	(sq ft)	(ft/s)	(ft)	(ft)	(ft)
LOW REACH	0.0377	81.29	153.01	7.79	1407.32	1407.32	
LOW REACH	0.0377	81.29	153.01	7.79	1407.32	1407.32	0.00
LOW REACH	0.0015	171.58	252.06	4.73	1404.58	1404.58	
LOW REACH	0.0015	171.58	252.06	4.73	1404.58	1404.58	0.00

HEC-RAS Plan: Imported Pla River: WASH B Reach: UPPER REACH

Reach	River Sta	Top Wdth Act	Area	Vel Total	W.S. Elev	Base WS	Prof Delta WS
		(ft)	(sq ft)	(ft/s)	(ft)	(ft)	(ft)
UPPER REACH	3.8799	22.16	42.11	7.91	1782.73	1782.73	
UPPER REACH	3.8799	22.16	42.11	7.91	1782.73	1782.73	0.00
UPPER REACH	3.8174	47.10	54.32	6.13	1767.79	1767.79	
UPPER REACH	3.8174	47.10	54.32	6.13	1767.79	1767.79	0.00
UPPER REACH	3.7235	30.28	47.02	7.08	1744.07	1744.07	
UPPER REACH	3.7235	30.28	47.02	7.08	1744.07	1744.07	0.00
UPPER REACH	3.6294	20.61	41.39	8.04	1720.74	1720.74	
UPPER REACH	3.6294	20.61	41.39	8.04	1720.74	1720.74	0.00
UPPER REACH	3.5932	29.80	52.68	6.32	1709.04	1709.04	
UPPER REACH	3.5932	29.80	52.68	6.32	1709.04	1709.04	0.00
UPPER REACH	3.5347	26.52	50.26	6.63	1700.09	1700.09	
UPPER REACH	3.5347	26.52	50.26	6.63	1700.09	1700.09	0.00
UPPER REACH	3.4405	24.56	43.88	7.59	1682.84	1682.84	
UPPER REACH	3.4405	24.56	43.88	7.59	1682.84	1682.84	0.00
UPPER REACH	3.3466	26.25	55.22	6.03	1666.53	1666.53	
UPPER REACH	3.3466	26.25	55.22	6.03	1666.53	1666.53	0.00
UPPER REACH	3.2524	25.42	43.94	7.58	1652.01	1652.01	
UPPER REACH	3.2524	25.42	43.94	7.58	1652.01	1652.01	0.00
UPPER REACH	3.2038	33.66	85.07	3.91	1647.97	1647.97	
UPPER REACH	3.2038	33.66	85.07	3.91	1647.97	1647.97	0.00
UPPER REACH	3.2036	Culvert					
UPPER REACH	3.1483	26.14	57.52	5.79	1638.07	1638.07	
UPPER REACH	3.1483	26.14	57.52	5.79	1638.07	1638.07	0.00
UPPER REACH	3.0634	38.55	53.47	6.23	1626.35	1626.35	

HEC-RAS Plan: Imported Pla River: WASH B Reach: UPPER REACH (Continued)

Reach	River Sta	Top Wdth Act	Area	Vel Total	W.S. Elev	Base WS	Prof Delta WS
		(ft)	(sq ft)	(ft/s)	(ft)	(ft)	(ft)
UPPER REACH	3.0634	38.55	53.47	6.23	1626.35	1626.35	0.00
UPPER REACH	2.9691	59.48	76.93	4.33	1613.21	1613.21	
UPPER REACH	2.9691	59.48	76.93	4.33	1613.21	1613.21	0.00
UPPER REACH	2.9258	66.09	73.24	5.41	1606.15	1606.15	
UPPER REACH	2.9258	66.09	73.24	5.41	1606.15	1606.15	0.00
UPPER REACH	2.8845	84.33	100.23	3.32	1600.89	1600.89	
UPPER REACH	2.8845	84.33	100.23	3.32	1600.89	1600.89	0.00
UPPER REACH	2.7809	73.68	57.68	5.77	1588.89	1588.89	
UPPER REACH	2.7809	73.68	57.68	5.77	1588.89	1588.89	0.00
UPPER REACH	2.7418	71.17	150.72	4.90	1585.37	1585.37	
UPPER REACH	2.7418	71.17	150.72	4.90	1585.37	1585.37	0.00
UPPER REACH	2.6803	95.21	157.76	4.68	1580.44	1580.44	
UPPER REACH	2.6803	95.21	157.76	4.68	1580.44	1580.44	0.00
UPPER REACH	2.6574	89.37	135.61	5.45	1577.78	1577.78	
UPPER REACH	2.6574	89.37	135.61	5.45	1577.78	1577.78	0.00
UPPER REACH	2.5918	95.65	206.82	3.57	1573.86	1573.86	
UPPER REACH	2.5918	95.65	206.82	3.57	1573.86	1573.86	0.00

HEC-RAS Plan: Imported Pla River: WASH B Reach: TRIBUTARY

Reach	River Sta	Top Wdth Act (ft)	Area (sq ft)	Vel Total (ft/s)	W.S. Elev (ft)	Base WS (ft)	Prof Delta WS (ft)
TRIBUTARY	0.3748	42.35	147.39	7.23	1601.92	1601.92	
TRIBUTARY	0.3748	42.35	147.39	7.23	1601.92	1601.92	0.00
TRIBUTARY	0.3057	63.35	157.38	6.77	1594.54	1594.54	
TRIBUTARY	0.3057	63.35	157.38	6.77	1594.54	1594.54	0.00
TRIBUTARY	0.2473	110.23	253.19	4.21	1590.32	1590.32	
TRIBUTARY	0.2473	110.23	253.19	4.21	1590.32	1590.32	0.00
TRIBUTARY	0.1922	150.72	208.25	5.12	1585.86	1585.86	
TRIBUTARY	0.1922	150.72	208.25	5.12	1585.86	1585.86	0.00
TRIBUTARY	0.1386	127.56	249.60	4.27	1581.15	1581.15	
TRIBUTARY	0.1386	127.56	249.60	4.27	1581.15	1581.15	0.00
TRIBUTARY	0.0587	95.45	193.30	5.51	1574.76	1574.76	
TRIBUTARY	0.0587	95.45	193.30	5.51	1574.76	1574.76	0.00

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
LOW REACH	2.5294	1569.48		1570.14	106.33	26.68	1991.32			9940.03	10043.12	
LOW REACH	2.5294	1569.48	0.00	1570.14	106.33	26.68	1991.32			9940.03	10043.12	
LOW REACH	2.4973	1567.77		1568.12	152.75	0.42	2017.58			9973.76	10128.63	
LOW REACH	2.4973	1567.77	0.00	1568.12	152.75	0.42	2017.58			9973.76	10128.63	
LOW REACH	2.4576	1564.99		1565.54	217.90		1756.12	261.88		9991.83	10105.80	
LOW REACH	2.4576	1564.99	0.00	1565.54	217.90		1756.12	261.88		9991.83	10105.80	
LOW REACH	2.428	1562.48		1562.91	176.64	7.06	2010.92	0.03		9981.56	10152.32	
LOW REACH	2.428	1562.48	0.00	1562.91	176.64	7.06	2010.92	0.03		9981.56	10152.32	
LOW REACH	2.4044	1561.56		1561.81	248.42	177.33	1452.99	387.68		9969.24	10057.25	
LOW REACH	2.4044	1561.56	0.00	1561.81	248.42	177.33	1452.99	387.68		9969.24	10057.25	
LOW REACH	2.3748	1559.22		1560.31	137.75	269.61	1748.39			9968.42	10015.04	
LOW REACH	2.3748	1559.22	0.00	1560.31	137.75	269.61	1748.39			9968.42	10015.04	
LOW REACH	2.3087	1553.33		1554.09	94.85	3.93	2014.07			9957.25	10048.70	
LOW REACH	2.3087	1553.33	0.00	1554.09	94.85	3.93	2014.07			9957.25	10048.70	
LOW REACH	2.2413	1550.60		1550.86	260.97	42.76	1546.46	428.78		9969.12	10054.59	
LOW REACH	2.2413	1550.60	0.00	1550.86	260.97	42.76	1546.46	428.78		9969.12	10054.59	
LOW REACH	2.2138	1549.49		1549.95	197.21	6.85	1681.47	329.68		9987.68	10052.11	
LOW REACH	2.2138	1549.49	0.00	1549.95	197.21	6.85	1681.47	329.68		9987.68	10052.11	
LOW REACH	2.2136	Culvert										
LOW REACH	2.1945	1548.40		1549.45	94.96		2509.00			9964.39	10067.43	
LOW REACH	2.1945	1548.40	0.00	1549.45	94.96		2509.00			9964.39	10067.43	
LOW REACH	2.1174	1541.79		1542.45	165.35	456.54	2052.46			9978.49	10093.45	
LOW REACH	2.1174	1541.79	0.00	1542.45	165.35	456.54	2052.46			9978.49	10093.45	
LOW REACH	2.0244	1535.62		1536.38	189.23	785.01	1722.82	1.17		9963.81	10025.56	
LOW REACH	2.0244	1535.62	0.00	1536.38	189.23	785.01	1722.82	1.17		9963.81	10025.56	
LOW REACH	1.9278	1529.78		1530.54	212.67	408.53	2100.47			9944.77	10028.44	
LOW REACH	1.9278	1529.78	0.00	1530.54	212.67	408.53	2100.47			9944.77	10028.44	
LOW REACH	1.872	1525.58		1526.46	148.96	1.34	2506.14	1.52		9926.20	10070.42	

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
LOW REACH	1.872	1525.58	0.00	1526.46	148.96	1.34	2506.14	1.52		9926.20	10070.42	
LOW REACH	1.8329	1521.48		1522.59	168.75	83.49	2254.06	171.44		9963.05	10054.13	
LOW REACH	1.8329	1521.48	0.00	1522.59	168.75	83.49	2254.06	171.44		9963.05	10054.13	
LOW REACH	1.7892	1520.89		1520.95	413.72	586.40	1920.00	2.60		9948.32	10190.23	
LOW REACH	1.7892	1520.89	0.00	1520.95	413.72	586.40	1920.00	2.60		9948.32	10190.23	
LOW REACH	1.7383	1520.89		1520.90	543.69	700.83	1643.63	164.54		9904.27	10178.14	
LOW REACH	1.7383	1520.89	0.00	1520.90	543.69	700.83	1643.63	164.54		9904.27	10178.14	
LOW REACH	1.6445	1520.88		1520.88	662.46	131.20	2363.23	14.57		9917.17	10359.30	
LOW REACH	1.6445	1520.88	0.00	1520.88	662.46	131.20	2363.23	14.57		9917.17	10359.30	
LOW REACH	1.6233	1520.87		1520.88	443.23	51.80	2177.52	279.68		9963.92	10189.20	
LOW REACH	1.6233	1520.87	0.00	1520.88	443.23	51.80	2177.52	279.68		9963.92	10189.20	
LOW REACH	1.6206	Culvert										
LOW REACH	1.5767	1511.28		1513.11	30.04		1192.00			9979.24	10014.53	
LOW REACH	1.5767	1511.28	0.00	1513.11	30.04		1192.00			9979.24	10014.53	
LOW REACH	1.5651	1503.32		1504.28	68.67		1192.00			9956.07	10043.73	
LOW REACH	1.5651	1503.32	0.00	1504.28	68.67		1192.00			9956.07	10043.73	
LOW REACH	1.5401	1499.27		1500.16	96.98		653.09	538.91		9986.98	10033.90	
LOW REACH	1.5401	1499.27	0.00	1500.16	96.98		653.09	538.91		9986.98	10033.90	
LOW REACH	1.5097	1498.42		1498.49	134.41	0.06	240.22	951.72		9985.75	10032.69	
LOW REACH	1.5097	1498.42	0.00	1498.49	134.41	0.06	240.22	951.72		9985.75	10032.69	
LOW REACH	1.4792	1497.75		1497.96	193.67	0.44	685.22	506.34		9980.19	10035.48	
LOW REACH	1.4792	1497.75	0.00	1497.96	193.67	0.44	685.22	506.34		9980.19	10035.48	
LOW REACH	1.4195	1493.62		1494.44	146.74	1.08	1178.81	12.11		9969.74	10058.99	
LOW REACH	1.4195	1493.62	0.00	1494.44	146.74	1.08	1178.81	12.11		9969.74	10058.99	
LOW REACH	1.3462	1492.79		1492.83	190.56	2.10	1188.13	1.78		9988.33	10168.07	
LOW REACH	1.3462	1492.79	0.00	1492.83	190.56	2.10	1188.13	1.78		9988.33	10168.07	
LOW REACH	1.346	Culvert										

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
LOW REACH	1.3242	1488.92		1489.35	195.12		932.94	259.06		9950.02	10060.81	
LOW REACH	1.3242	1488.92	0.00	1489.35	195.12		932.94	259.06		9950.02	10060.81	
LOW REACH	1.3076	1487.92		1488.26	248.63		1062.54	129.46		9907.22	10099.54	
LOW REACH	1.3076	1487.92	0.00	1488.26	248.63		1062.54	129.46		9907.22	10099.54	
LOW REACH	1.2775	1485.98		1486.24	321.91	7.55	874.04	310.41		9979.16	10158.65	
LOW REACH	1.2775	1485.98	0.00	1486.24	321.91	7.55	874.04	310.41		9979.16	10158.65	
LOW REACH	1.2311	1482.62		1483.10	307.53		704.26	487.74		9967.01	10024.82	
LOW REACH	1.2311	1482.62	0.00	1483.10	307.53		704.26	487.74		9967.01	10024.82	
LOW REACH	1.1788	1479.54		1479.77	206.28	13.08	629.96	548.96		9978.83	10023.64	
LOW REACH	1.1788	1479.54	0.00	1479.77	206.28	13.08	629.96	548.96		9978.83	10023.64	
LOW REACH	1.1722	1478.90		1479.45	206.85	6.11	455.86	730.03		9974.51	10008.90	
LOW REACH	1.1722	1478.90	0.00	1479.45	206.85	6.11	455.86	730.03		9974.51	10008.90	
LOW REACH	1.172	Culvert										
LOW REACH	1.161	1478.31		1478.56	222.12	1.49	1190.51			9968.32	10184.21	
LOW REACH	1.161	1478.31	0.00	1478.56	222.12	1.49	1190.51			9968.32	10184.21	
LOW REACH	1.1362	1477.10		1477.45	214.96		1191.08	0.92		9940.58	10153.76	
LOW REACH	1.1362	1477.10	0.00	1477.45	214.96		1191.08	0.92		9940.58	10153.76	
LOW REACH	1.0822	1472.73		1473.28	190.72	7.32	1184.68			9983.88	10176.16	
LOW REACH	1.0822	1472.73	0.00	1473.28	190.72	7.32	1184.68			9983.88	10176.16	
LOW REACH	1.0024	1468.35		1468.41	354.18		1076.80	115.20		9951.69	10113.14	
LOW REACH	1.0024	1468.35	0.00	1468.41	354.18		1076.80	115.20		9951.69	10113.14	
LOW REACH	0.9936	1468.34		1468.38	535.09	137.78	771.03	283.20		9955.26	10048.95	
LOW REACH	0.9936	1468.34	0.00	1468.38	535.09	137.78	771.03	283.20		9955.26	10048.95	
LOW REACH	0.9934	Culvert										
LOW REACH	0.9712	1462.61		1463.51	103.77		1062.76	129.24		9969.50	10049.48	
LOW REACH	0.9712	1462.61	0.00	1463.51	103.77		1062.76	129.24		9969.50	10049.48	
LOW REACH	0.9454	1461.04		1461.71	92.58	14.11	1165.13	12.77		9976.05	10047.22	
LOW REACH	0.9454	1461.04	0.00	1461.71	92.58	14.11	1165.13	12.77		9976.05	10047.22	

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	W.S. Elev (ft)	Prof Delta WS (ft)	E.G. Elev (ft)	Top Wdth Act (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
LOW REACH	0.8884	1457.16		1458.09	84.01		1192.00			9952.22	10065.96	
LOW REACH	0.8884	1457.16	0.00	1458.09	84.01		1192.00			9952.22	10065.96	
LOW REACH	0.8216	1452.27		1452.47	165.43	6.89	1150.80	34.31		9925.35	10042.78	
LOW REACH	0.8216	1452.27	0.00	1452.47	165.43	6.89	1150.80	34.31		9925.35	10042.78	
LOW REACH	0.7947	1451.16		1451.84	77.99	3.51	1188.49			9977.39	10057.91	
LOW REACH	0.7947	1451.16	0.00	1451.84	77.99	3.51	1188.49			9977.39	10057.91	
LOW REACH	0.7002	1444.91		1445.89	82.05	4.51	1187.49			9956.53	10040.09	
LOW REACH	0.7002	1444.91	0.00	1445.89	82.05	4.51	1187.49			9956.53	10040.09	
LOW REACH	0.6384	1443.15		1443.30	257.56		1127.78	64.22		9934.58	10045.45	
LOW REACH	0.6384	1443.15	0.00	1443.30	257.56		1127.78	64.22		9934.58	10045.45	
LOW REACH	0.6261	1441.33		1442.72	57.95		1167.70	24.30		9977.76	10016.59	
LOW REACH	0.6261	1441.33	0.00	1442.72	57.95		1167.70	24.30		9977.76	10016.59	
LOW REACH	0.6259 BR U	1440.13		1441.32	59.55	35.89	1125.41	30.71		9974.00	10026.00	
LOW REACH	0.6259 BR U	1440.13	0.00	1441.32	59.55	35.89	1125.41	30.71		9974.00	10026.00	
LOW REACH	0.6259 BR D	1439.35		1440.03	59.62	32.55	1126.91	32.55		9974.00	10026.00	
LOW REACH	0.6259 BR D	1439.35	0.00	1440.03	59.62	32.55	1126.91	32.55		9974.00	10026.00	
LOW REACH	0.5964	1438.83		1439.76	85.02		1191.77	0.23		9961.89	10048.09	
LOW REACH	0.5964	1438.83	0.00	1439.76	85.02		1191.77	0.23		9961.89	10048.09	
LOW REACH	0.5559	1435.84		1436.57	76.65	5.51	1186.49			9964.23	10046.53	
LOW REACH	0.5559	1435.84	0.00	1436.57	76.65	5.51	1186.49			9964.23	10046.53	
LOW REACH	0.5114	1432.70		1433.66	82.04	2.82	1189.18			9967.71	10050.29	
LOW REACH	0.5114	1432.70	0.00	1433.66	82.04	2.82	1189.18			9967.71	10050.29	
LOW REACH	0.464	1429.13		1429.93	82.22		1192.00			9965.65	10064.16	
LOW REACH	0.464	1429.13	0.00	1429.93	82.22		1192.00			9965.65	10064.16	
LOW REACH	0.4167	1426.19		1426.86	89.41		1192.00			9957.94	10057.00	
LOW REACH	0.4167	1426.19	0.00	1426.86	89.41		1192.00			9957.94	10057.00	
LOW REACH	0.3735	1422.85		1423.91	68.48		1178.74	13.26		9960.47	10024.87	
LOW REACH	0.3735	1422.85	0.00	1423.91	68.48		1178.74	13.26		9960.47	10024.87	

HEC-RAS Plan: Imported Pla River: WASH B Reach: LOW REACH (Continued)

Reach	River Sta	W.S. Elev (ft)	Prof Delta WS (ft)	E.G. Elev (ft)	Top Wdth Act (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
LOW REACH	0.322	1420.49		1421.02	109.46	17.95	1174.05			9944.64	10029.24	
LOW REACH	0.322	1420.49	0.00	1421.02	109.46	17.95	1174.05			9944.64	10029.24	
LOW REACH	0.2615	1417.29		1418.05	87.28	60.95	1131.05			9972.48	10056.48	
LOW REACH	0.2615	1417.29	0.00	1418.05	87.28	60.95	1131.05			9972.48	10056.48	
LOW REACH	0.2271	1415.78		1416.31	95.00		1192.00			9940.95	10051.93	
LOW REACH	0.2271	1415.78	0.00	1416.31	95.00		1192.00			9940.95	10051.93	
LOW REACH	0.1324	1412.45		1412.94	94.86		1192.00			9960.00	10070.39	
LOW REACH	0.1324	1412.45	0.00	1412.94	94.86		1192.00			9960.00	10070.39	
LOW REACH	0.0377	1407.32		1408.28	81.29	4.23	1187.77			9964.62	10045.79	
LOW REACH	0.0377	1407.32	0.00	1408.28	81.29	4.23	1187.77			9964.62	10045.79	
LOW REACH	0.0015	1404.58		1404.94	171.58	946.05	245.95			9952.02	10050.66	
LOW REACH	0.0015	1404.58	0.00	1404.94	171.58	946.05	245.95			9952.02	10050.66	

HEC-RAS Plan: Imported Pla River: WASH B Reach: UPPER REACH

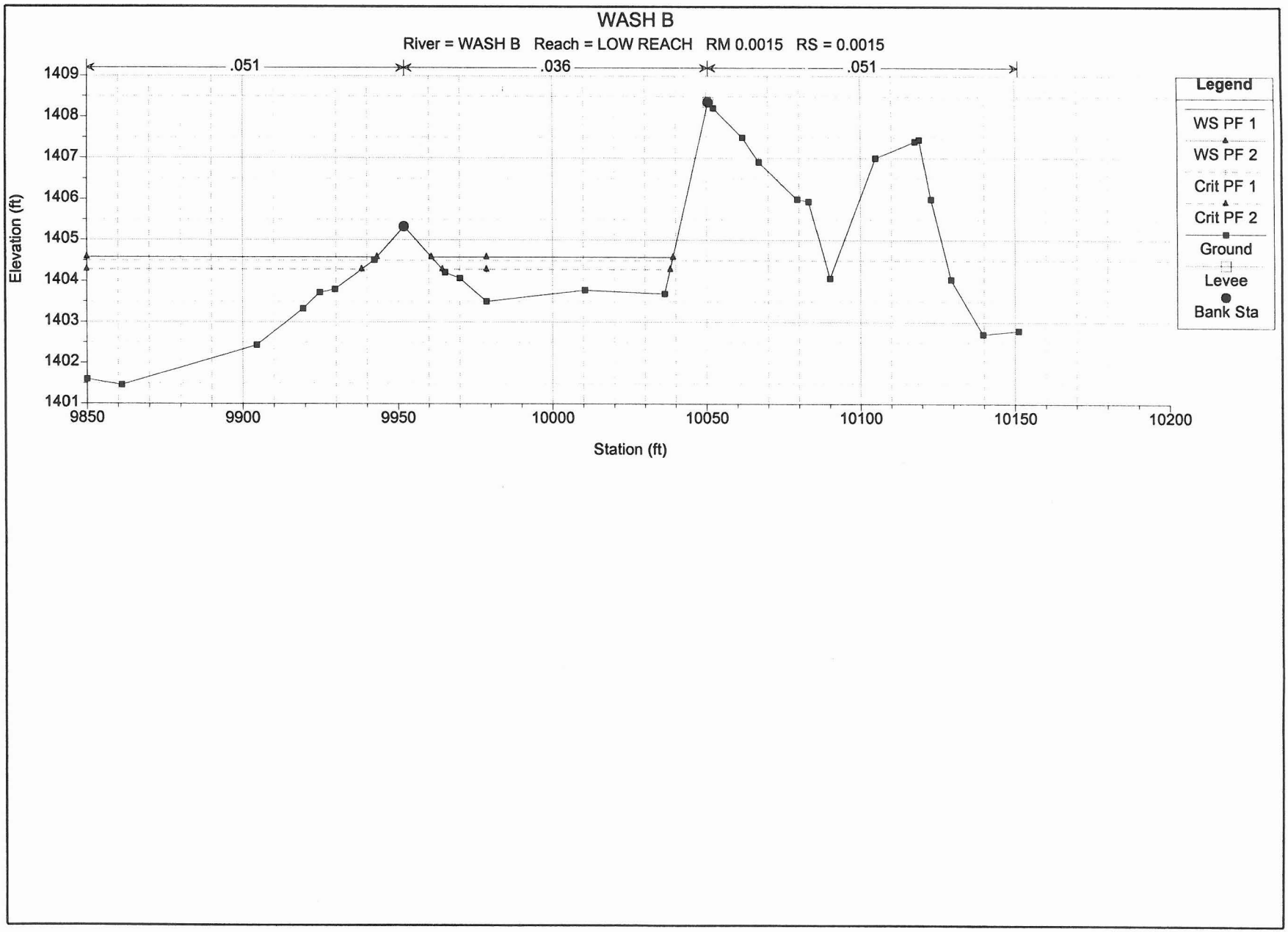
Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
UPPER REACH	3.8799	1782.73		1783.70	22.16		333.00			9978.36	10023.56	
UPPER REACH	3.8799	1782.73	0.00	1783.70	22.16		333.00			9978.36	10023.56	
UPPER REACH	3.8174	1767.79		1768.37	47.10		333.00			9960.28	10022.31	
UPPER REACH	3.8174	1767.79	0.00	1768.37	47.10		333.00			9960.28	10022.31	
UPPER REACH	3.7235	1744.07		1744.85	30.28		333.00			9983.18	10027.07	
UPPER REACH	3.7235	1744.07	0.00	1744.85	30.28		333.00			9983.18	10027.07	
UPPER REACH	3.6294	1720.74		1721.75	20.61		333.00			9977.40	10025.58	
UPPER REACH	3.6294	1720.74	0.00	1721.75	20.61		333.00			9977.40	10025.58	
UPPER REACH	3.5932	1709.04		1709.66	29.80		333.00			9984.03	10018.39	
UPPER REACH	3.5932	1709.04	0.00	1709.66	29.80		333.00			9984.03	10018.39	
UPPER REACH	3.5347	1700.09		1700.77	26.52		333.00			9967.23	10028.06	
UPPER REACH	3.5347	1700.09	0.00	1700.77	26.52		333.00			9967.23	10028.06	
UPPER REACH	3.4405	1682.84		1683.74	24.56		333.00			9977.43	10014.69	
UPPER REACH	3.4405	1682.84	0.00	1683.74	24.56		333.00			9977.43	10014.69	
UPPER REACH	3.3466	1666.53		1667.09	26.25		333.00			9973.29	10014.38	
UPPER REACH	3.3466	1666.53	0.00	1667.09	26.25		333.00			9973.29	10014.38	
UPPER REACH	3.2524	1652.01		1652.90	25.42	0.37	332.63			9982.34	10009.74	
UPPER REACH	3.2524	1652.01	0.00	1652.90	25.42	0.37	332.63			9982.34	10009.74	
UPPER REACH	3.2038	1647.97		1648.24	33.66	4.27	321.15	7.58		9982.21	10005.39	
UPPER REACH	3.2038	1647.97	0.00	1648.24	33.66	4.27	321.15	7.58		9982.21	10005.39	
UPPER REACH	3.2036	Culvert										
UPPER REACH	3.1483	1638.07		1638.59	26.14		333.00			9980.83	10015.27	
UPPER REACH	3.1483	1638.07	0.00	1638.59	26.14		333.00			9980.83	10015.27	
UPPER REACH	3.0634	1626.35		1626.96	38.55	0.40	332.60			9979.48	10028.93	
UPPER REACH	3.0634	1626.35	0.00	1626.96	38.55	0.40	332.60			9979.48	10028.93	
UPPER REACH	2.9691	1613.21		1613.51	59.48		333.00			9953.54	10026.66	

HEC-RAS Plan: Imported Pla River: WASH B Reach: UPPER REACH (Continued)

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
UPPER REACH	2.9691	1613.21	0.00	1613.51	59.48		333.00			9953.54	10026.66	
UPPER REACH	2.9258	1606.15		1606.60	66.09		333.00			9934.85	10018.39	
UPPER REACH	2.9258	1606.15	0.00	1606.60	66.09		333.00			9934.85	10018.39	
UPPER REACH	2.8845	1600.89		1601.06	84.33	2.10	330.90			9990.77	10077.14	
UPPER REACH	2.8845	1600.89	0.00	1601.06	84.33	2.10	330.90			9990.77	10077.14	
UPPER REACH	2.7809	1588.89		1589.44	73.68		331.88	1.12		9979.53	10024.41	
UPPER REACH	2.7809	1588.89	0.00	1589.44	73.68		331.88	1.12		9979.53	10024.41	
UPPER REACH	2.7418	1585.37		1585.75	71.17		736.68	2.32		9981.81	10050.95	
UPPER REACH	2.7418	1585.37	0.00	1585.75	71.17		736.68	2.32		9981.81	10050.95	
UPPER REACH	2.6803	1580.44		1580.78	95.21	3.17	735.83			9980.49	10077.91	
UPPER REACH	2.6803	1580.44	0.00	1580.78	95.21	3.17	735.83			9980.49	10077.91	
UPPER REACH	2.6574	1577.78		1578.24	89.37	0.58	738.42			9969.36	10063.32	
UPPER REACH	2.6574	1577.78	0.00	1578.24	89.37	0.58	738.42			9969.36	10063.32	
UPPER REACH	2.5918	1573.86		1574.06	95.65	1.73	737.26	0.01		9955.84	10047.07	
UPPER REACH	2.5918	1573.86	0.00	1574.06	95.65	1.73	737.26	0.01		9955.84	10047.07	

HEC-RAS Plan: Imported Pla River: WASH B Reach: TRIBUTARY

Reach	River Sta	W.S. Elev	Prof Delta WS	E.G. Elev	Top Wdth Act	Q Left	Q Channel	Q Right	Enc Sta L	Ch Sta L	Ch Sta R	Enc Sta R
		(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)	(ft)	(ft)
TRIBUTARY	0.3748	1601.92		1602.73	42.35		1066.00			9982.09	10032.54	
TRIBUTARY	0.3748	1601.92	0.00	1602.73	42.35		1066.00			9982.09	10032.54	
TRIBUTARY	0.3057	1594.54		1595.25	63.35		1066.00			9954.70	10025.89	
TRIBUTARY	0.3057	1594.54	0.00	1595.25	63.35		1066.00			9954.70	10025.89	
TRIBUTARY	0.2473	1590.32		1590.59	110.23		1066.00			9980.36	10110.75	
TRIBUTARY	0.2473	1590.32	0.00	1590.59	110.23		1066.00			9980.36	10110.75	
TRIBUTARY	0.1922	1585.86		1586.30	150.72	132.37	931.86	1.77		9937.64	10028.51	
TRIBUTARY	0.1922	1585.86	0.00	1586.30	150.72	132.37	931.86	1.77		9937.64	10028.51	
TRIBUTARY	0.1386	1581.15		1581.43	127.56	0.00	1062.35	3.65		9889.29	10012.28	
TRIBUTARY	0.1386	1581.15	0.00	1581.43	127.56	0.00	1062.35	3.65		9889.29	10012.28	
TRIBUTARY	0.0587	1574.76		1575.26	95.45	32.21	1033.79			9951.41	10031.84	
TRIBUTARY	0.0587	1574.76	0.00	1575.26	95.45	32.21	1033.79			9951.41	10031.84	


WASH B
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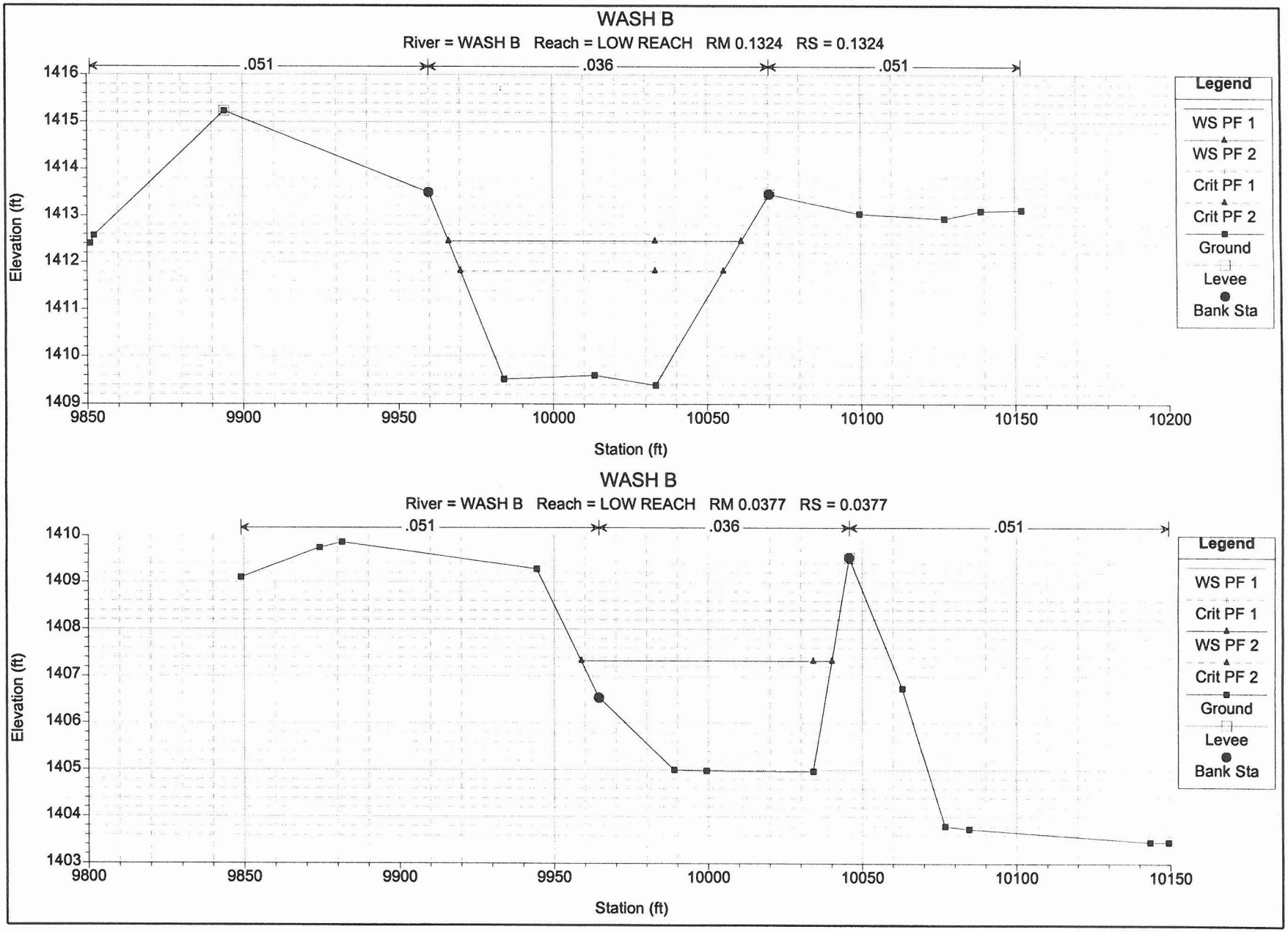
.051
.036
.051
Elevation (ft)
1409
1408
1407
1406
1405
1404
1403
1402
1401
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta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River = WASH B Reach = LOW REACH RM 0.1324 RS = 0.1324
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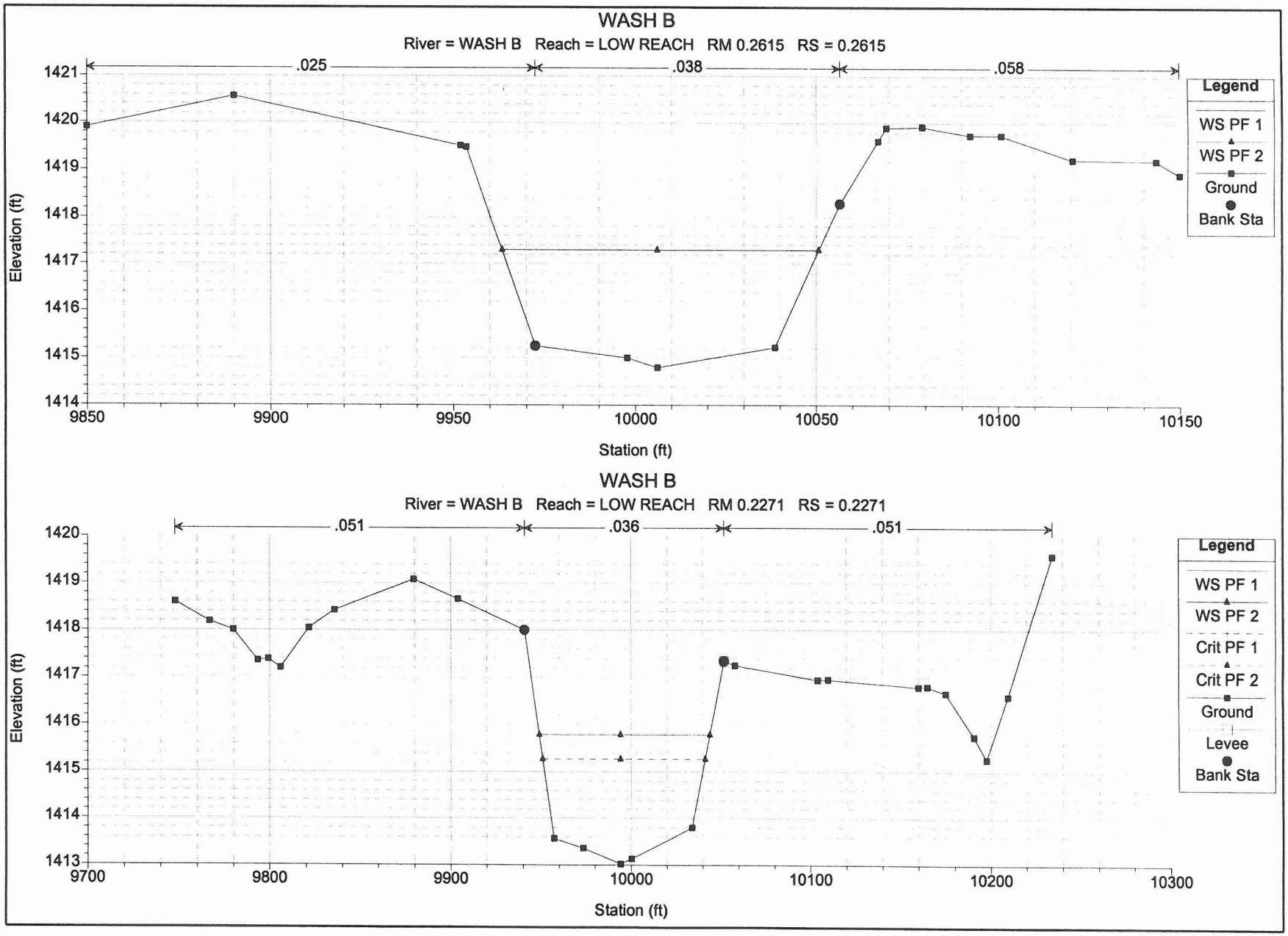
.036
.051
Elevation (ft)
1416
1415
1414
1413
1412
1411
1410
1409
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 0.0377 RS = 0.0377
.051
.036
.051
Elevation (ft)
1410
1409
1408
1407
1406
1405
1404
1403
9800
9850
9900
9950
10000
10050
10100
10150
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Levee
Bank Sta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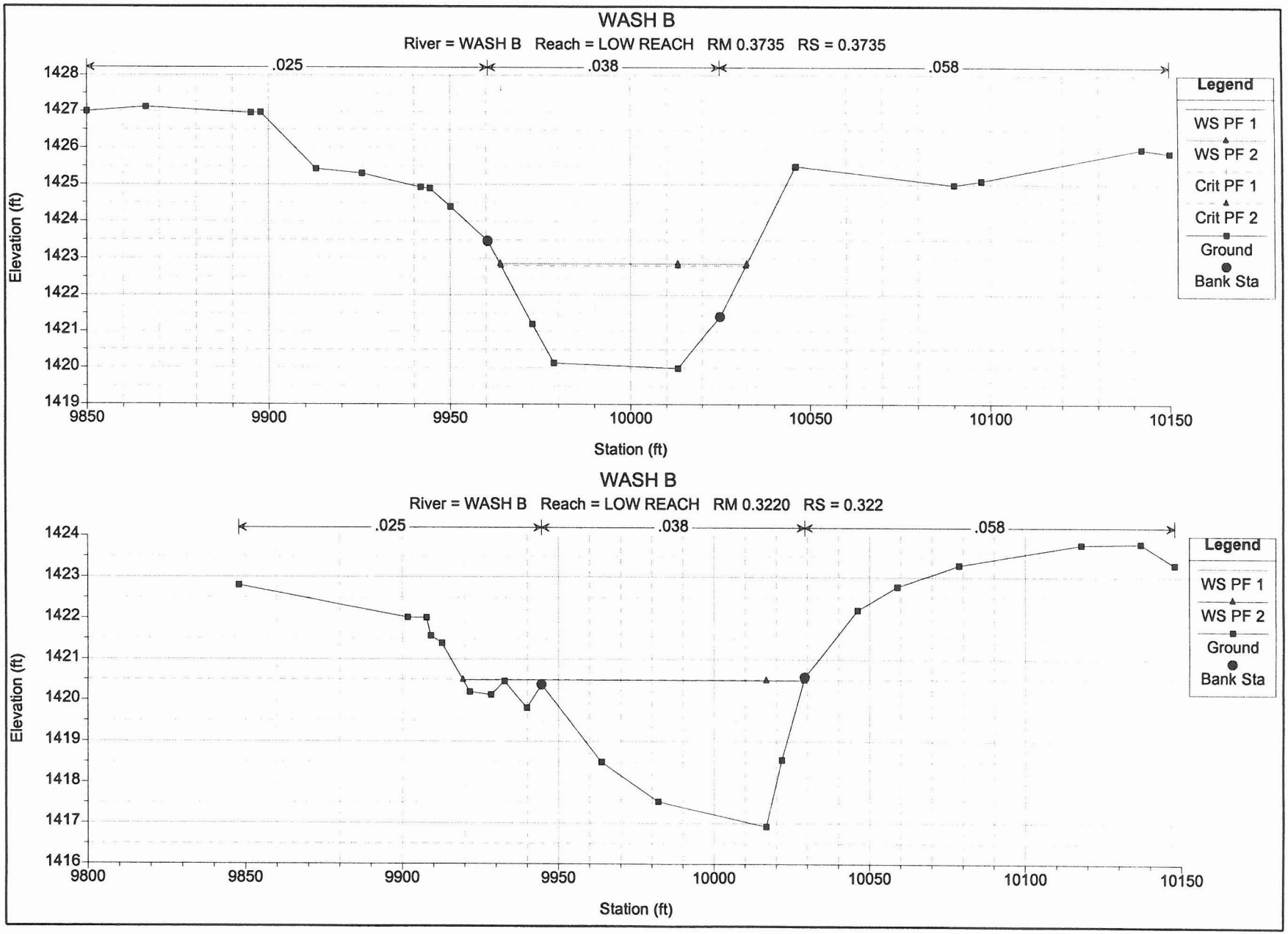
.038
.058
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1421
1420
1419
1418
1417
1416
1415
1414
9850
9900
9950
10000
10050
10100
10150
WASH B
River = WASH B Reach = LOW REACH RM 0.2271 RS = 0.2271
.051
.036
.051
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1420
1419
1418
1417
1416
1415
1414
1413
9700
9800
9900
10000
10100
10200
10300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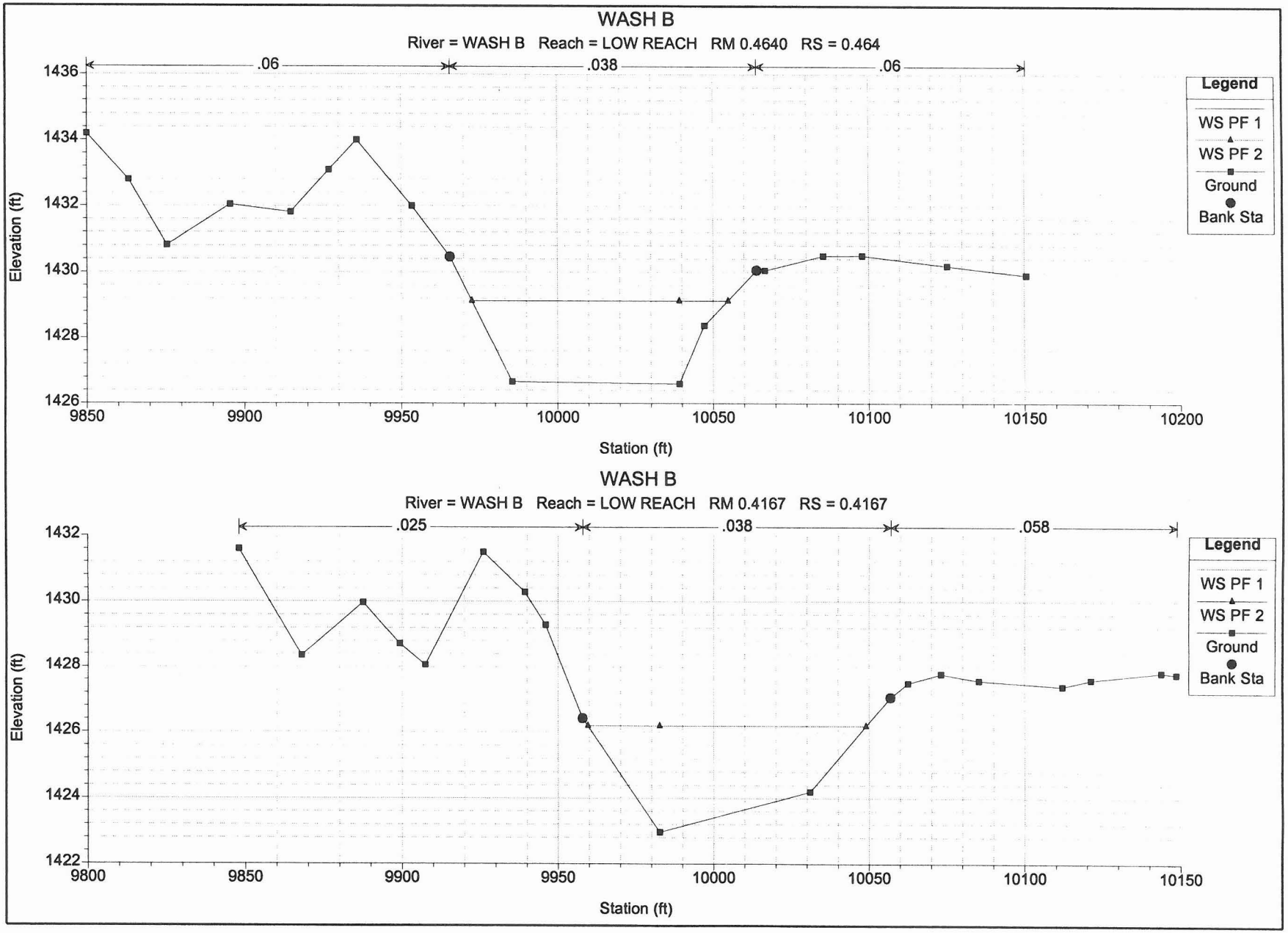
.038
.058
Elevation (ft)
1428
1427
1426
1425
1424
1423
1422
1421
1420
1419
9850
9900
9950
10000
10050
10100
10150
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 0.3220 RS = 0.322
.025
.038
.058
Elevation (ft)
1424
1423
1422
1421
1420
1419
1418
1417
1416
9800
9850
9900
9950
10000
10050
10100
10150
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta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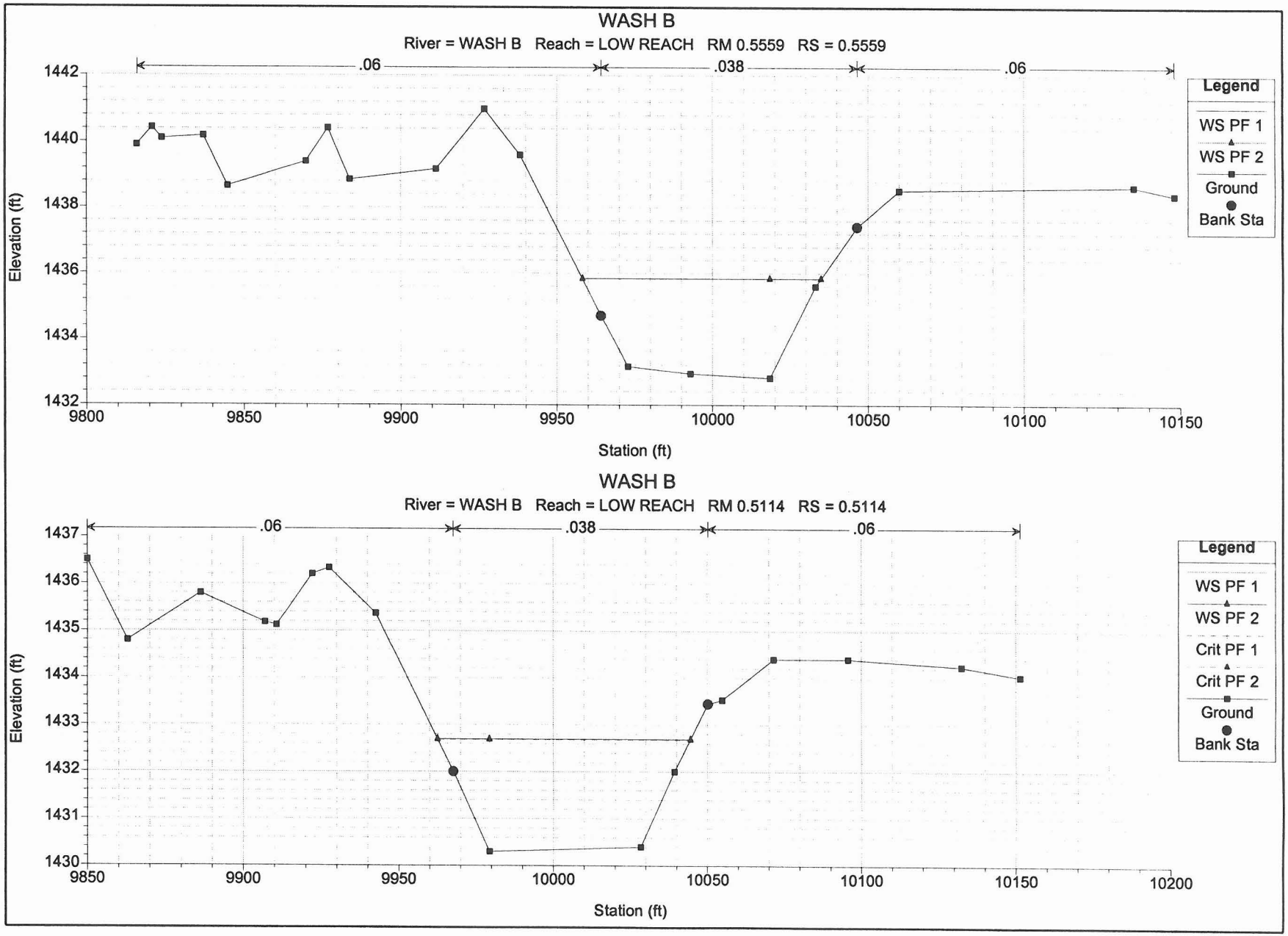
.038
.06
1436
1434
1432
1430
1428
1426
Elevation (ft)
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 0.4167 RS = 0.4167
.025
.038
.058
1432
1430
1428
1426
1424
1422
Elevation (ft)
9800
9850
9900
9950
10000
10050
10100
10150
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta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River = WASH B Reach = LOW REACH RM 0.5559 RS = 0.5559
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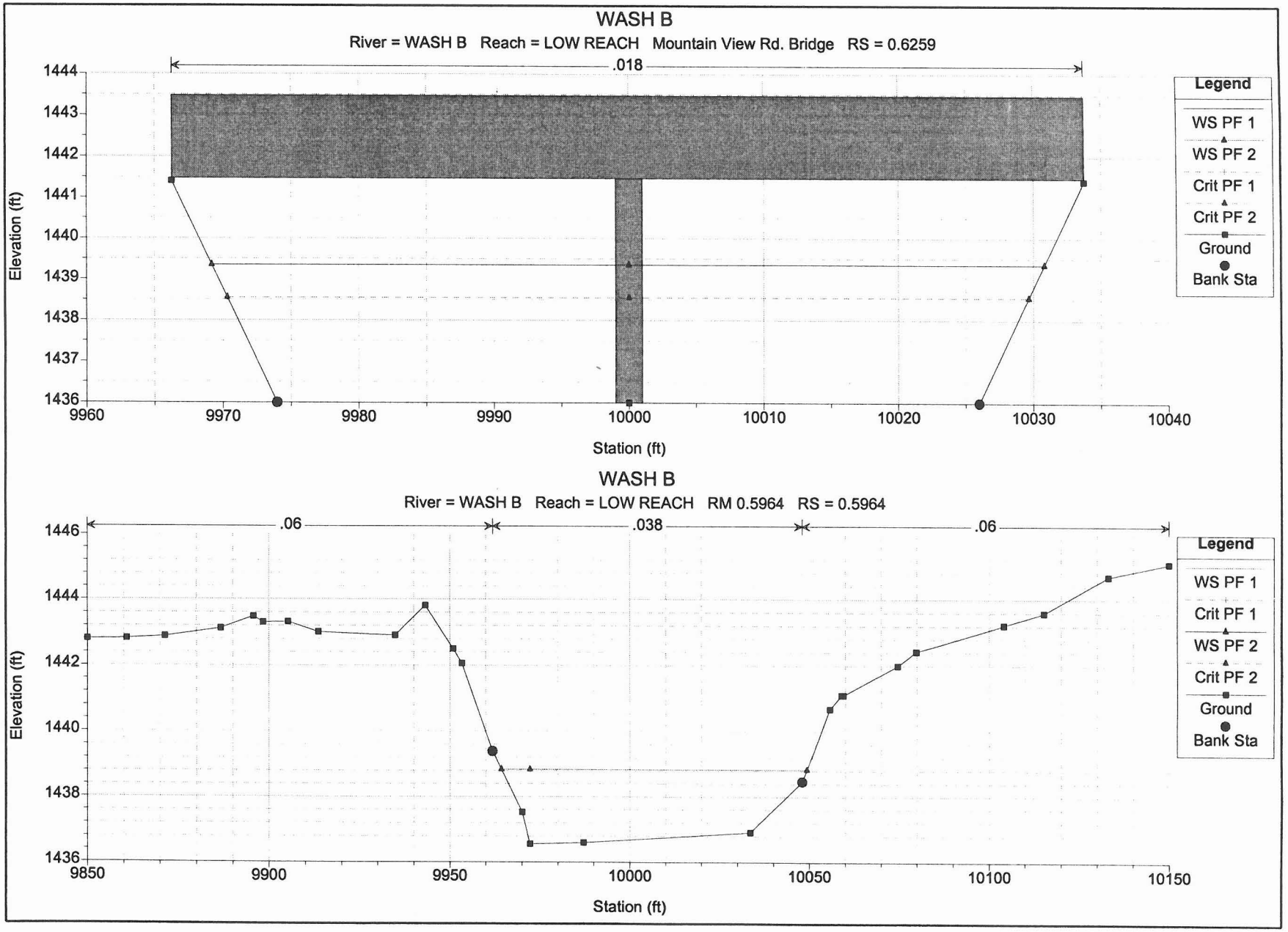
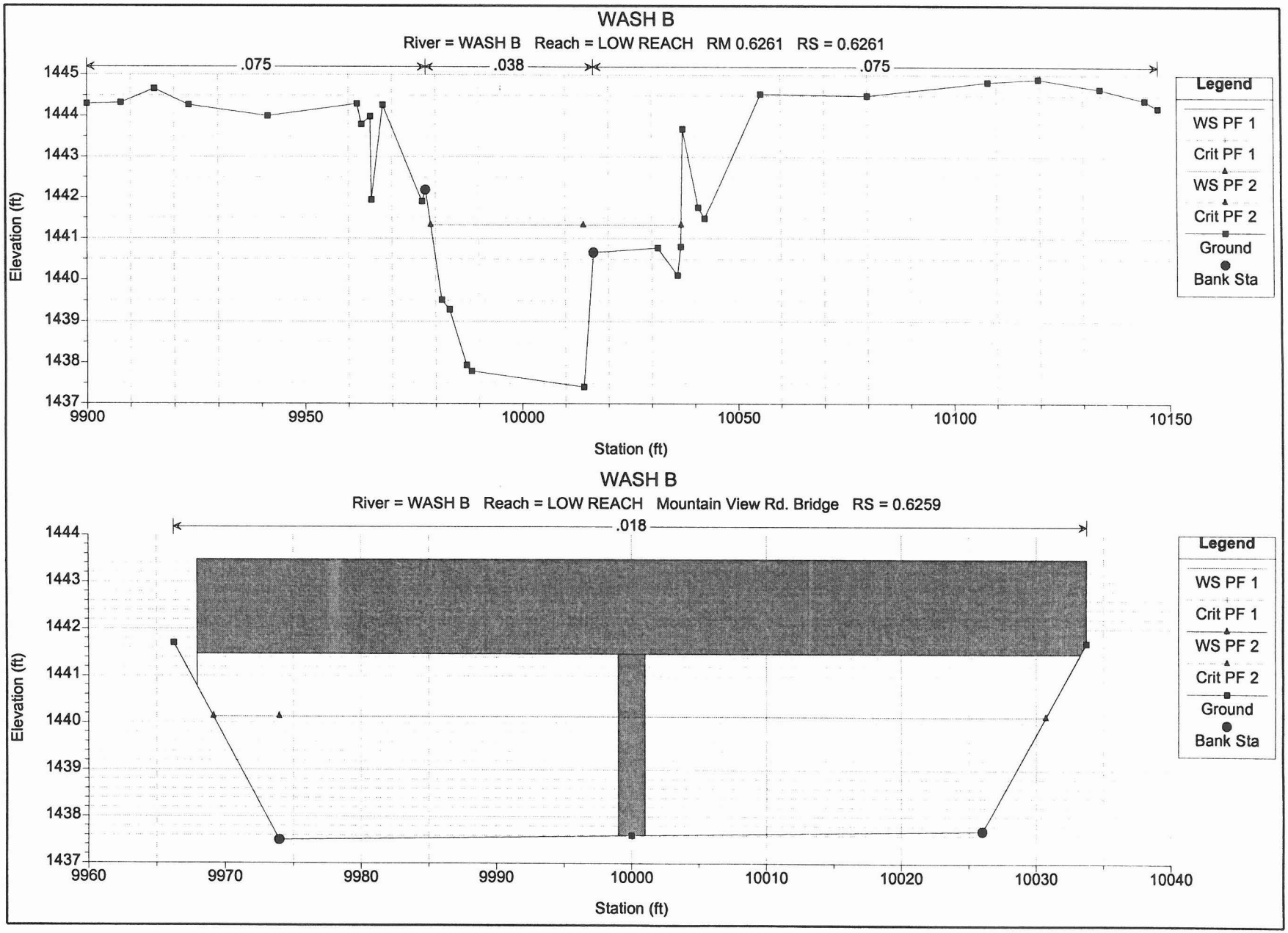
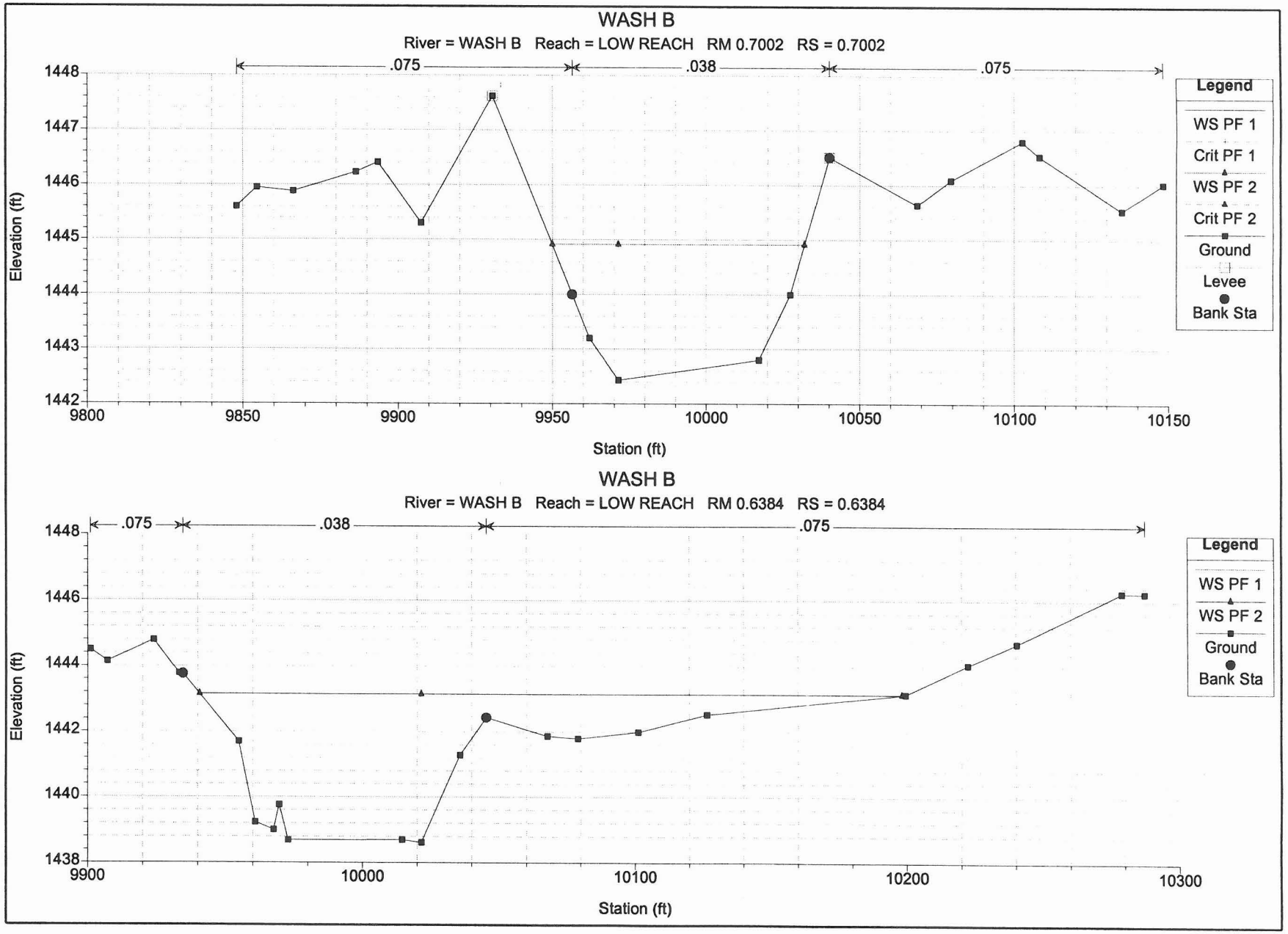
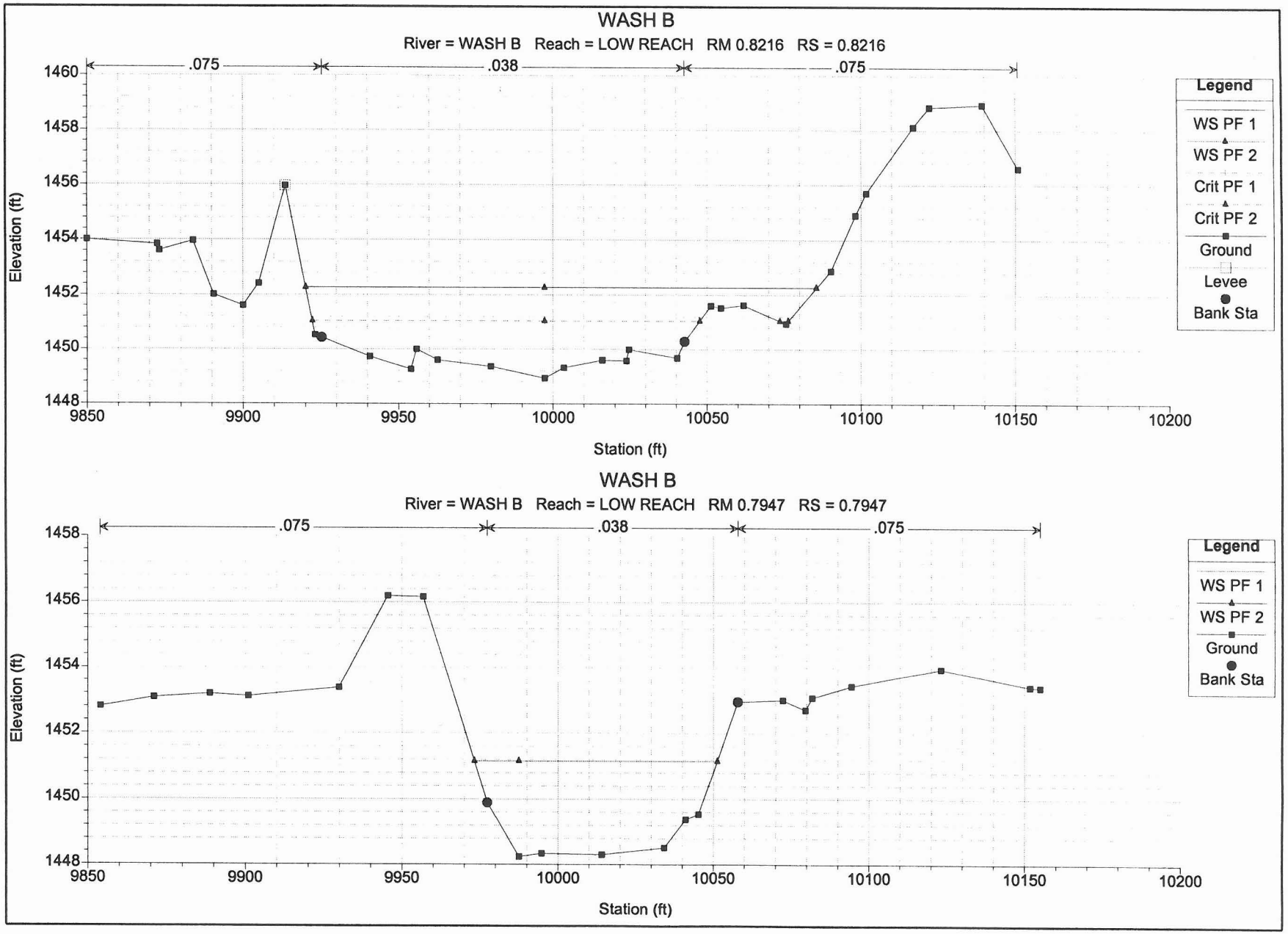
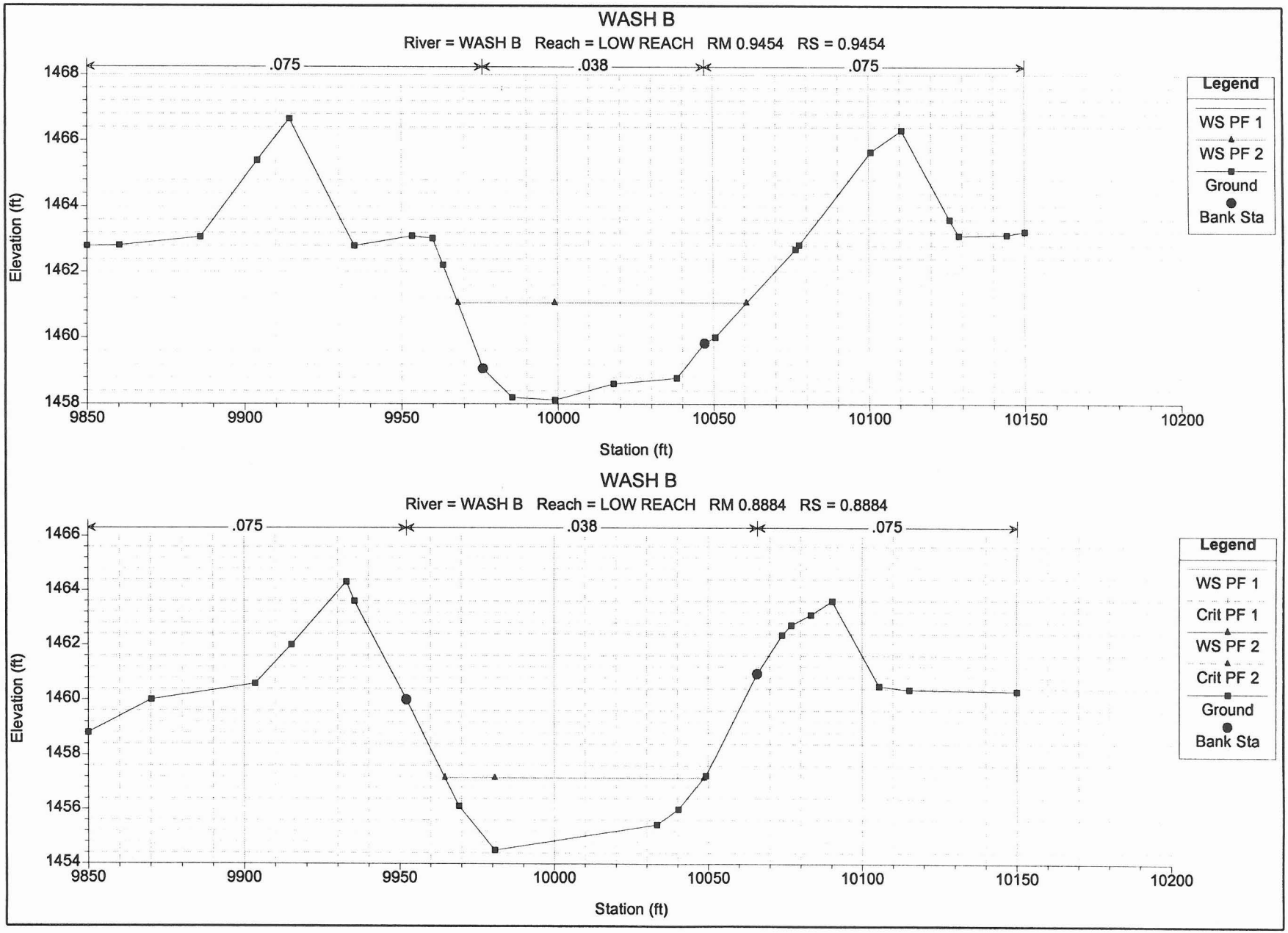
.038
.06
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
1442
1440
1438
1436
1434
1432
9800
9850
9900
9950
10000
10050
10100
10150
Station (ft)
WASH B
River = WASH B Reach = LOW REACH RM 0.5114 RS = 0.5114
.06
.038
.06
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
1437
1436
1435
1434
1433
1432
1431
1430
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)

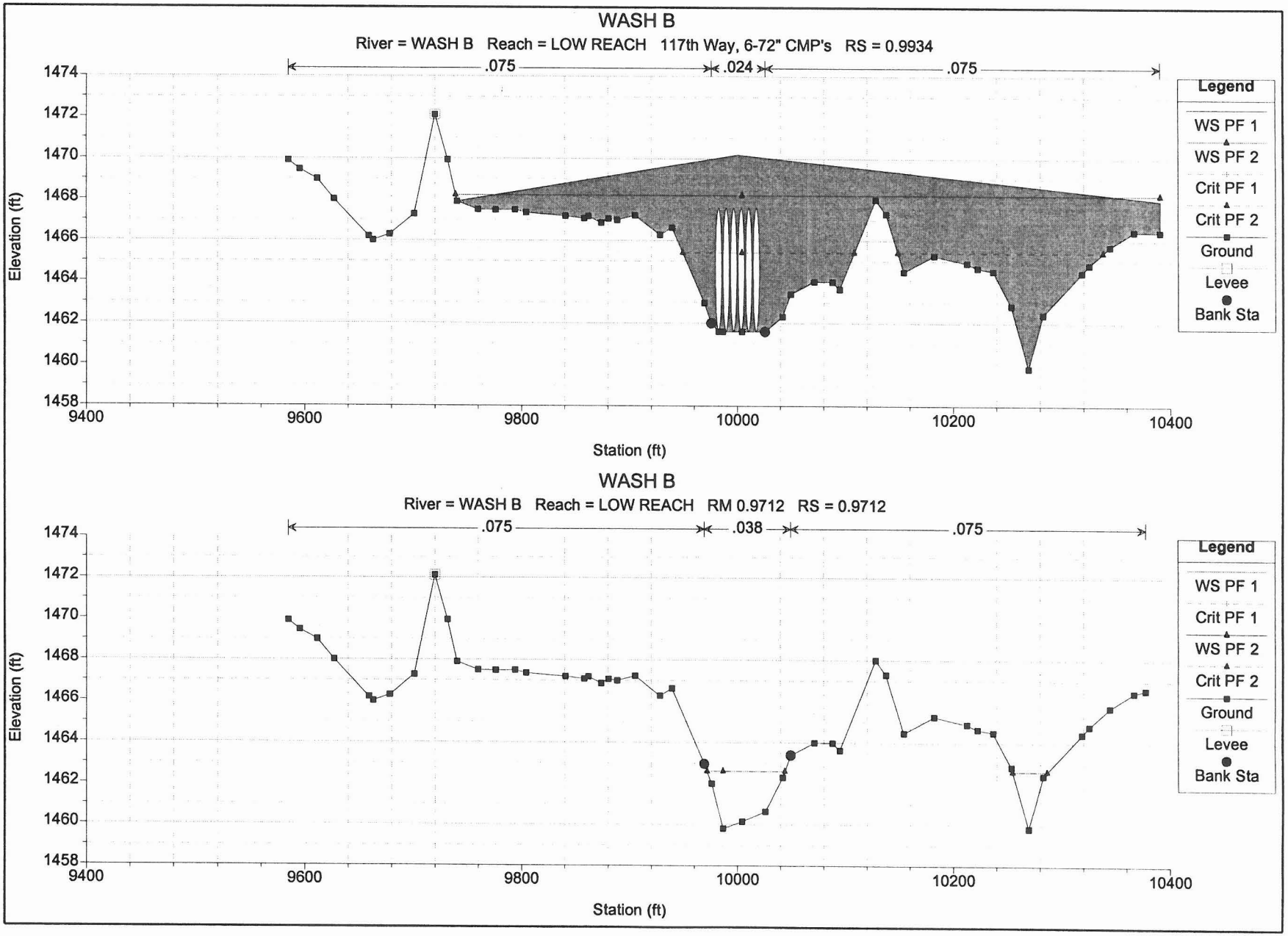

WASH B
River = WASH B Reach = LOW REACH Mountain View Rd. Bridge RS = 0.6259
.018
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
1444
1443
1442
1441
1440
1439
1438
1437
1436
9960
9970
9980
9990
10000
10010
10020
10030
10040
Station (ft)
WASH B
River = WASH B Reach = LOW REACH RM 0.5964 RS = 0.5964
.06
.038
.06
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
1446
1444
1442
1440
1438
1436
9850
9900
9950
10000
10050
10100
10150
Station (ft)

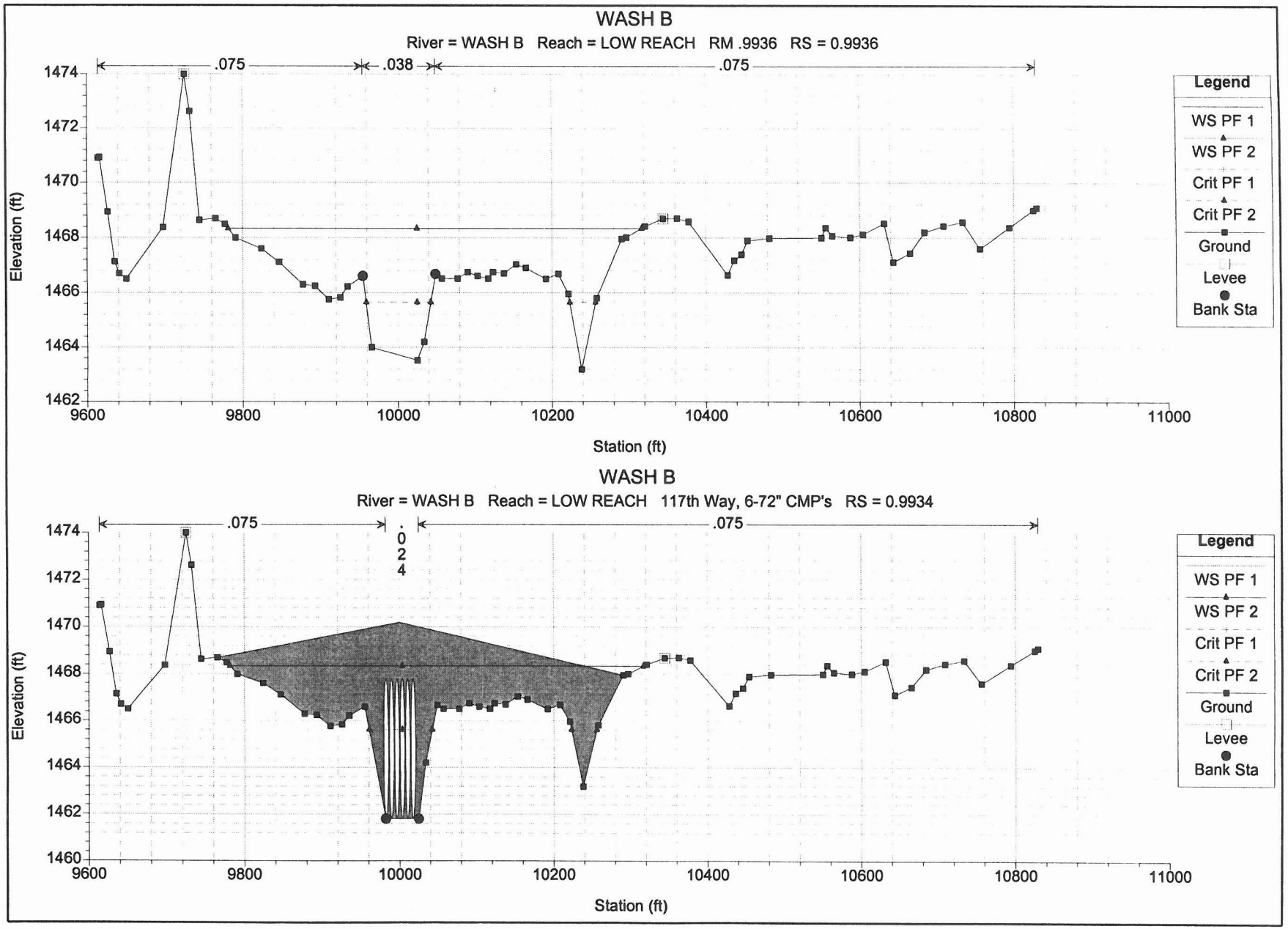

WASH B
River = WASH B Reach = LOW REACH RM 0.6261 RS = 0.6261
.075
.038
.075
Elevation (ft)
1445
1444
1443
1442
1441
1440
1439
1438
1437
9900
9950
10000
10050
10100
10150
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH Mountain View Rd. Bridge RS = 0.6259
.018
Elevation (ft)
1444
1443
1442
1441
1440
1439
1438
1437
9960
9970
9980
9990
10000
10010
10020
10030
10040
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta

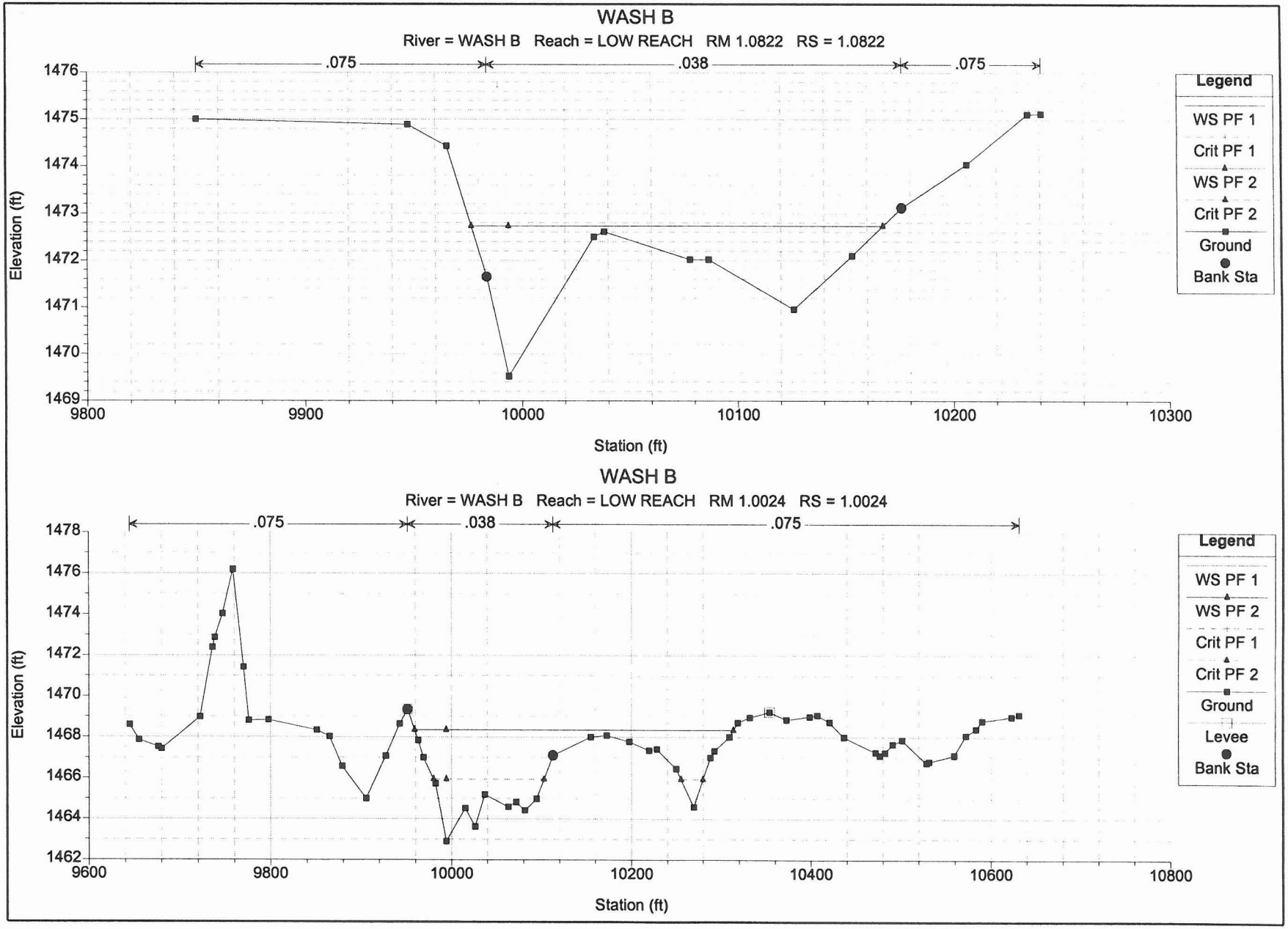

WASH B
River = WASH B Reach = LOW REACH RM 0.7002 RS = 0.7002
.075
.038
.075
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1448
1447
1446
1445
1444
1443
1442
9800
9850
9900
9950
10000
10050
10100
10150
WASH B
River = WASH B Reach = LOW REACH RM 0.6384 RS = 0.6384
.075
.038
.075
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1448
1446
1444
1442
1440
1438
9900
10000
10100
10200
10300

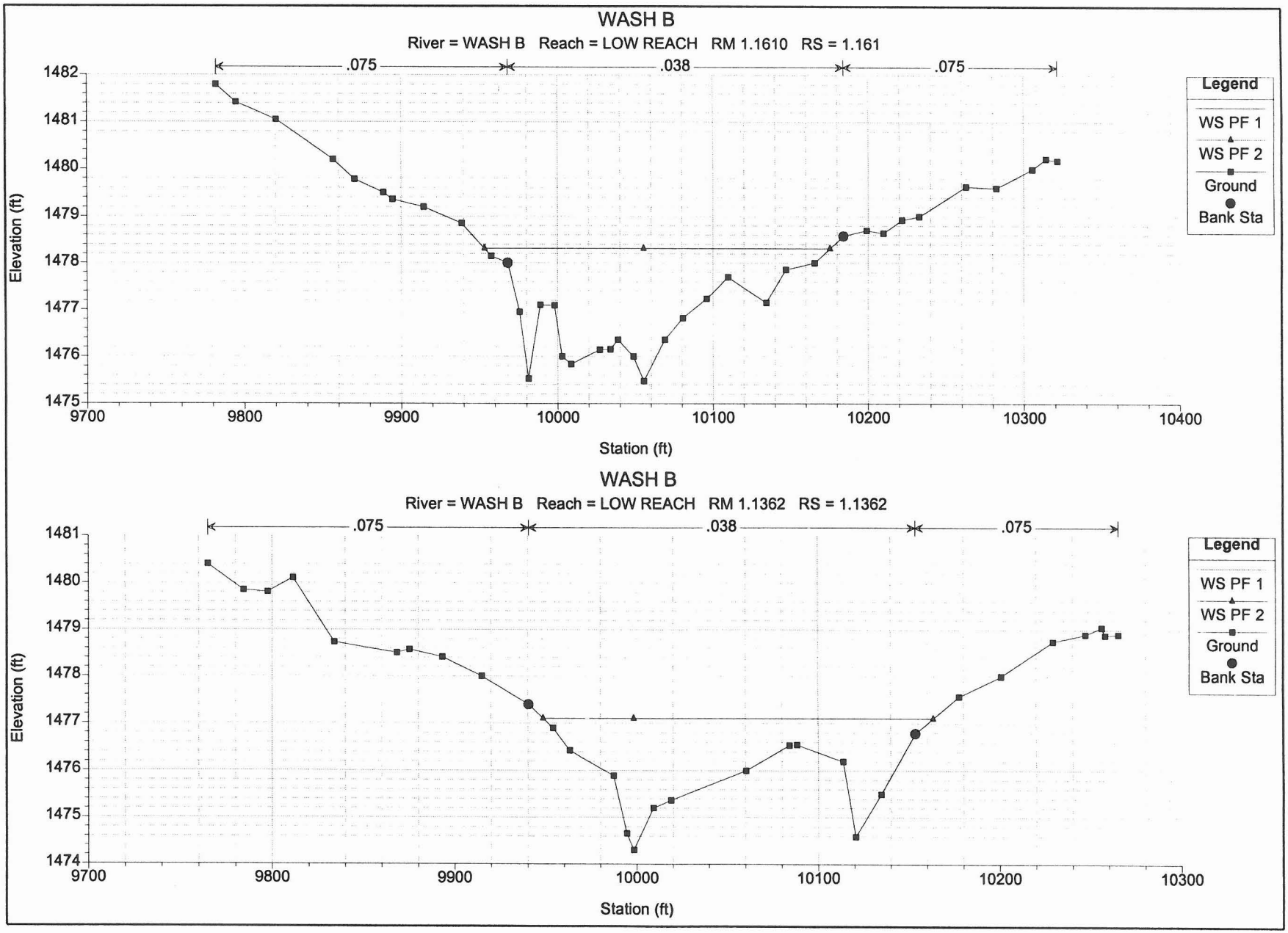

WASH B
River = WASH B Reach = LOW REACH RM 0.8216 RS = 0.8216
.075
.038
.075
Elevation (ft)
1460
1458
1456
1454
1452
1450
1448
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 0.7947 RS = 0.7947
.075
.038
.075
Elevation (ft)
1458
1456
1454
1452
1450
1448
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta

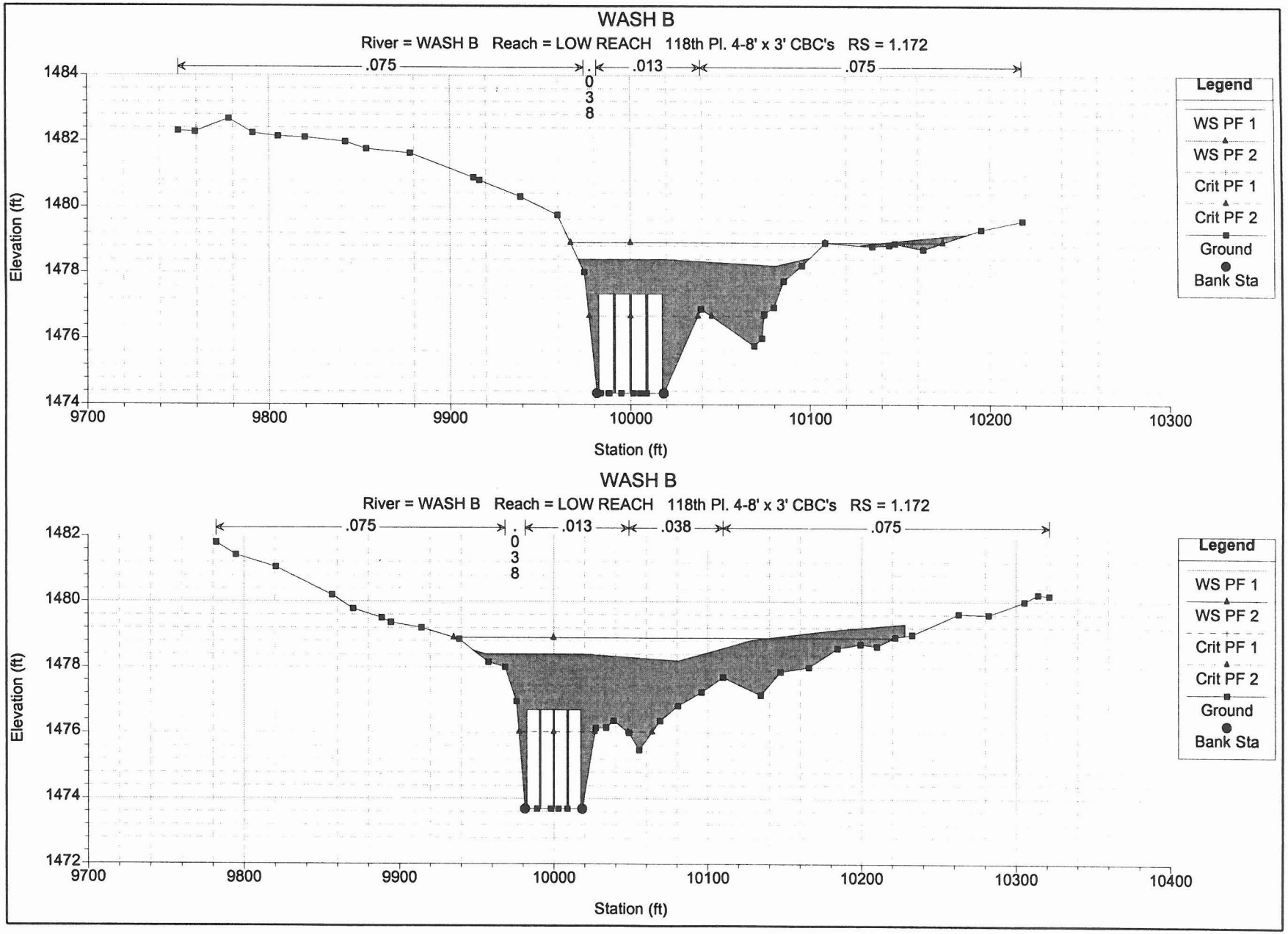

WASH B
River = WASH B Reach = LOW REACH RM 0.9454 RS = 0.9454
.075
.038
.075
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
1468
1466
1464
1462
1460
1458
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
WASH B
River = WASH B Reach = LOW REACH RM 0.8884 RS = 0.8884
.075
.038
.075
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
1466
1464
1462
1460
1458
1456
1454
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)

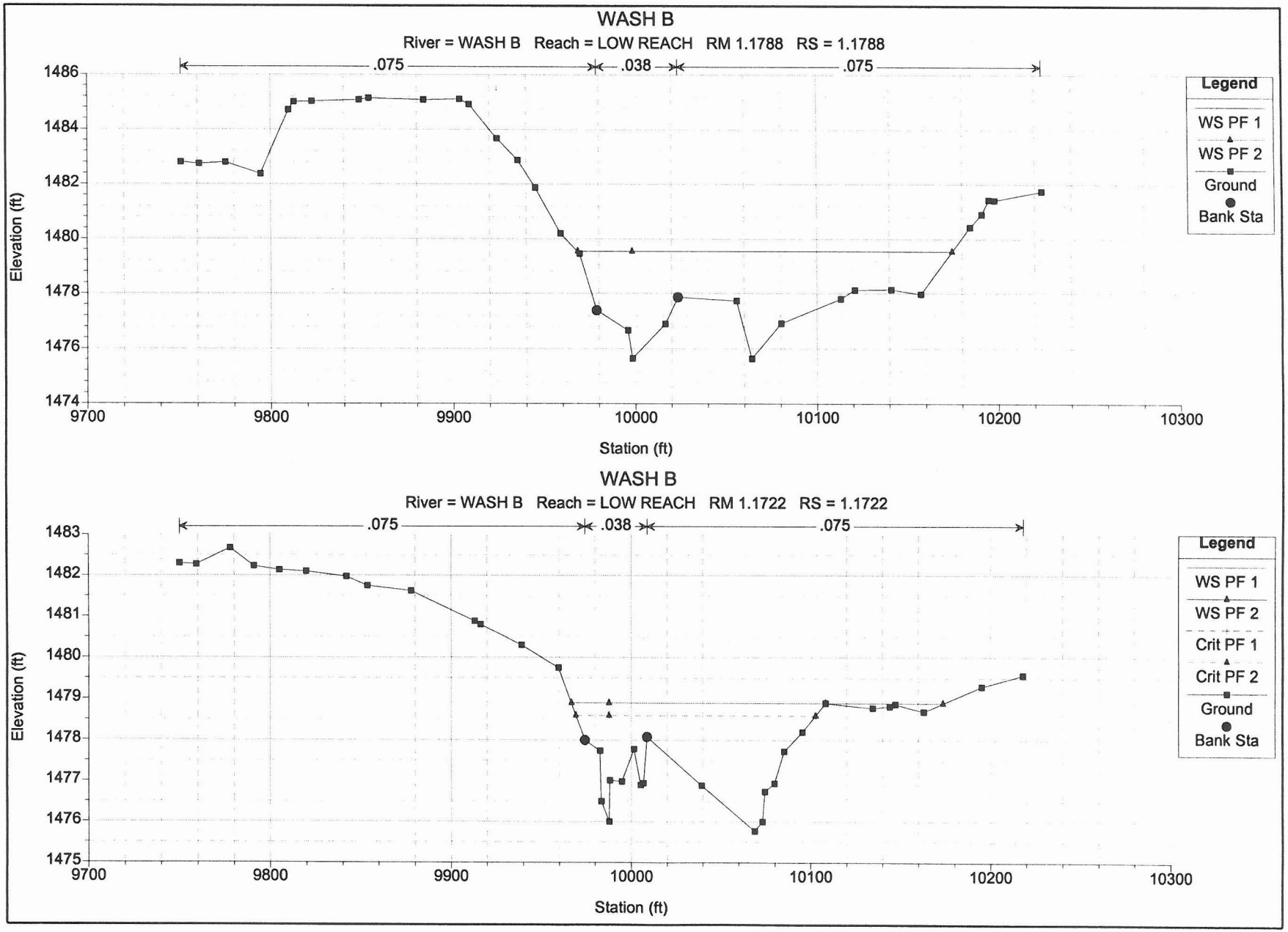

WASH B
River = WASH B Reach = LOW REACH 117th Way, 6-72" CMP's RS = 0.9934
.075
.024
.075
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
Elevation (ft)
1474
1472
1470
1468
1466
1464
1462
1460
1458
9400
9600
9800
10000
10200
10400
Station (ft)
WASH B
River = WASH B Reach = LOW REACH RM 0.9712 RS = 0.9712
.075
.038
.075
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Levee
Bank Sta
Elevation (ft)
1474
1472
1470
1468
1466
1464
1462
1460
1458
9400
9600
9800
10000
10200
10400
Station (ft)

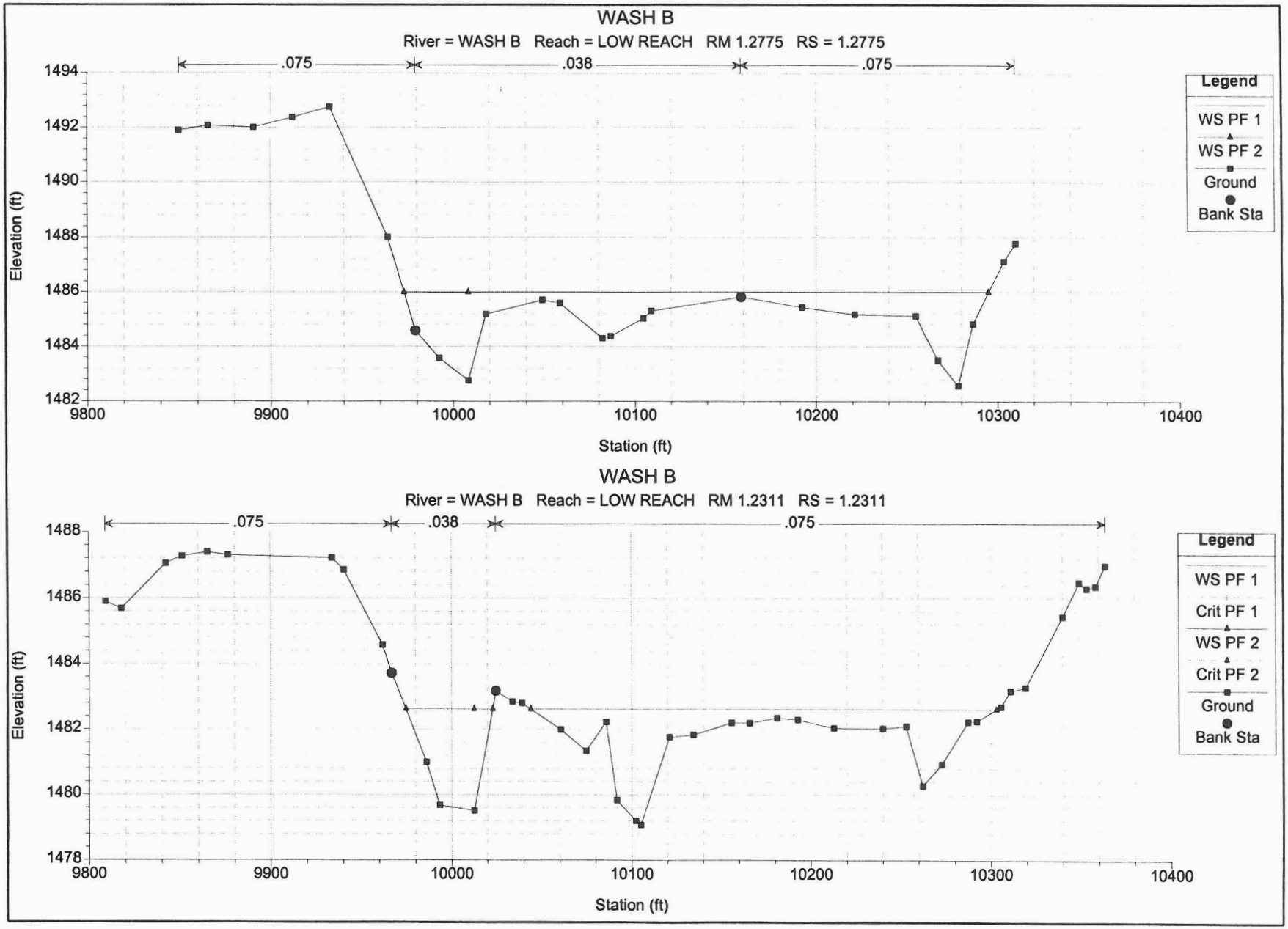

WASH B
River = WASH B Reach = LOW REACH RM .9936 RS = 0.9936
.075
.038
.075
Elevation (ft)
1474
1472
1470
1468
1466
1464
1462
9600
9800
10000
10200
10400
10600
10800
11000
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
WASH B
River = WASH B Reach = LOW REACH 117th Way, 6-72" CMP's RS = 0.9934
.075
.024
.075
Elevation (ft)
1474
1472
1470
1468
1466
1464
1462
1460
9600
9800
10000
10200
10400
10600
10800
11000
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta

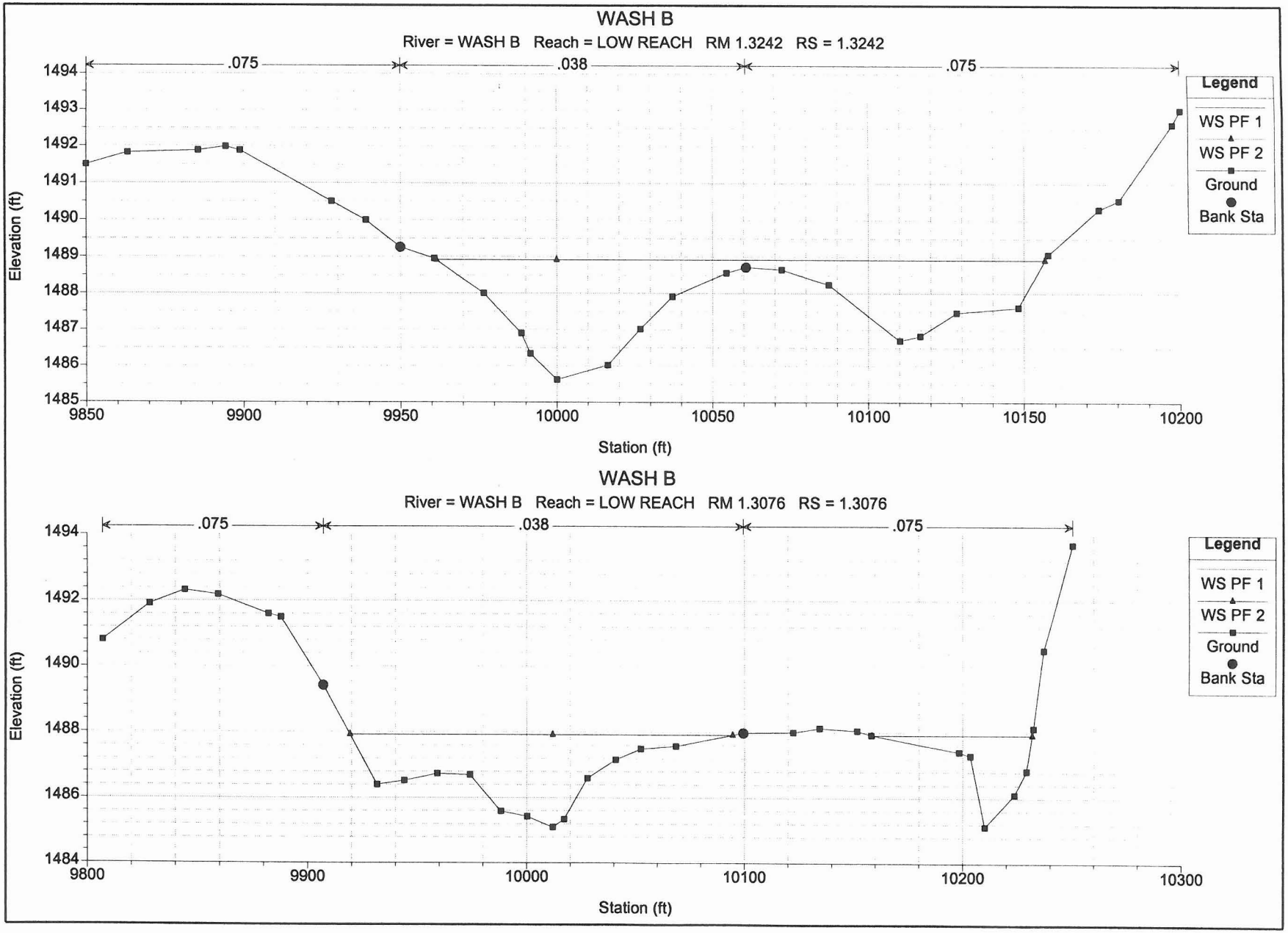

WASH B
River = WASH B Reach = LOW REACH RM 1.0822 RS = 1.0822
.075
.038
.075
Elevation (ft)
1476
1475
1474
1473
1472
1471
1470
1469
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 1.0024 RS = 1.0024
.075
.038
.075
Elevation (ft)
1478
1476
1474
1472
1470
1468
1466
1464
1462
9600
9800
10000
10200
10400
10600
10800
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta

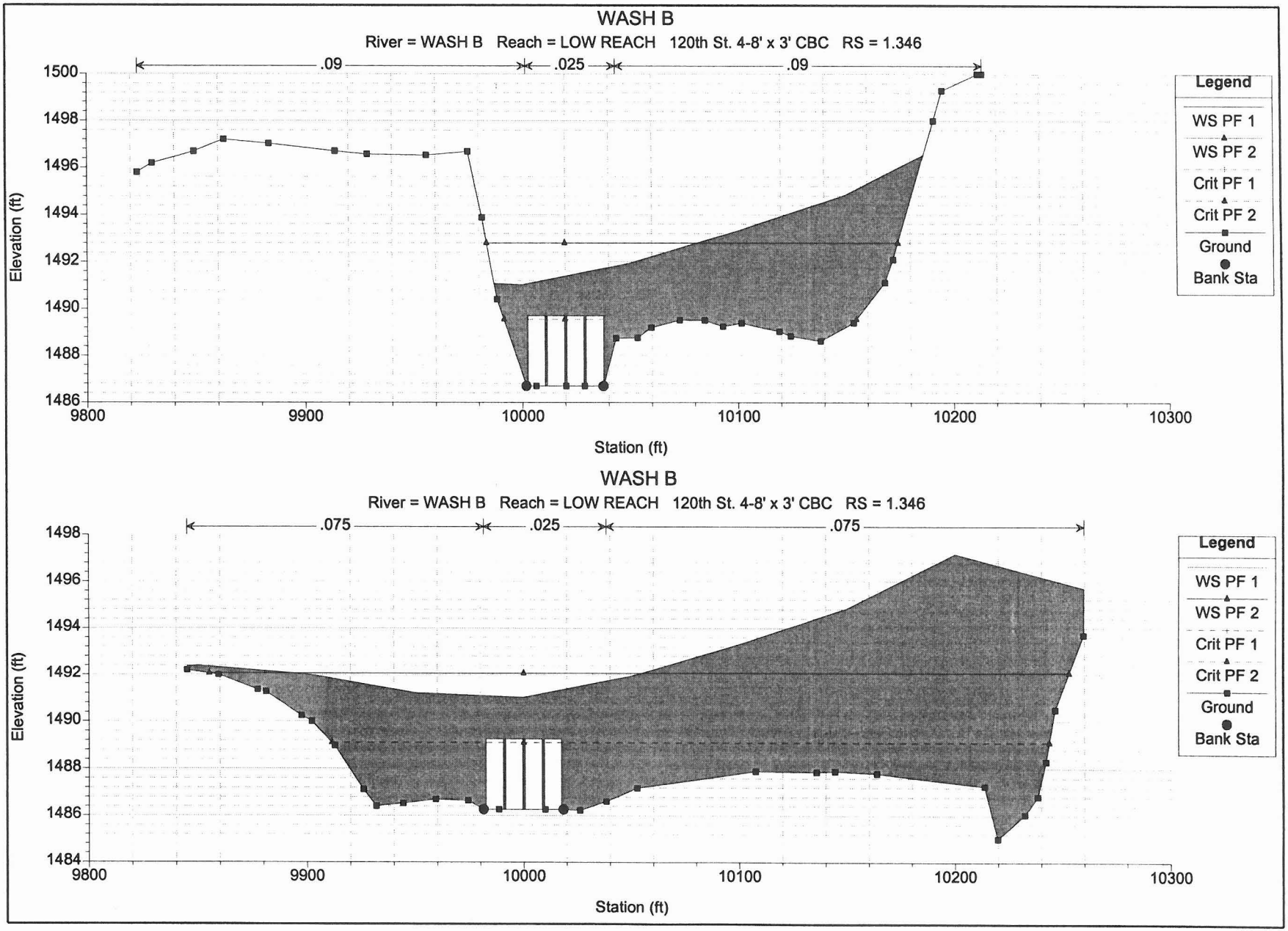

WASH B
River = WASH B Reach = LOW REACH RM 1.1610 RS = 1.161
.075
.038
.075
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1482
1481
1480
1479
1478
1477
1476
1475
9700
9800
9900
10000
10100
10200
10300
10400
WASH B
River = WASH B Reach = LOW REACH RM 1.1362 RS = 1.1362
.075
.038
.075
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1481
1480
1479
1478
1477
1476
1475
1474
9700
9800
9900
10000
10100
10200
10300

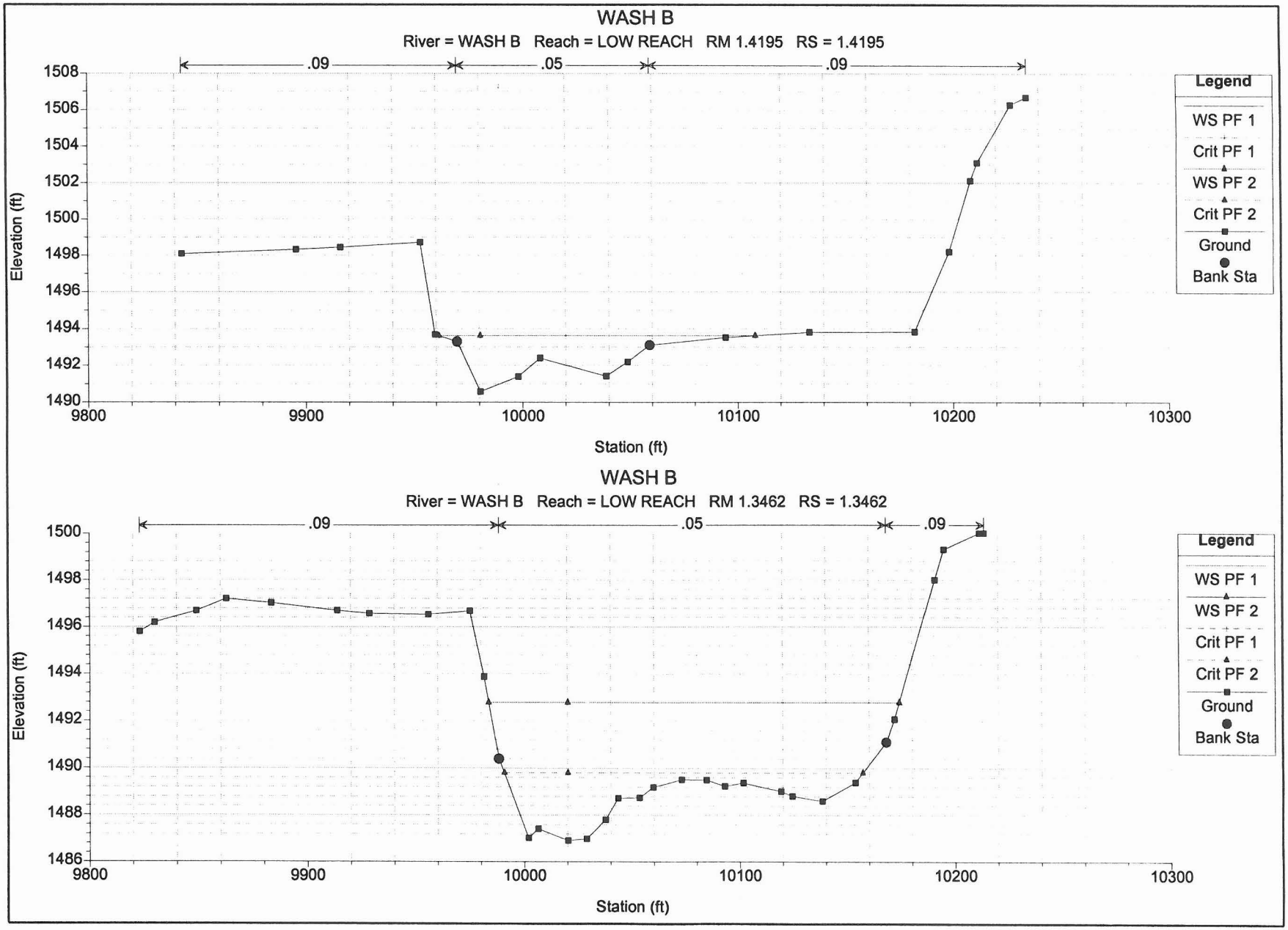

WASH B
River = WASH B Reach = LOW REACH 118th Pl. 4-8' x 3' CBC's RS = 1.172
.075
.038
.013
.075
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1484
1482
1480
1478
1476
1474
9700
9800
9900
10000
10100
10200
10300
WASH B
River = WASH B Reach = LOW REACH 118th Pl. 4-8' x 3' CBC's RS = 1.172
.075
.038
.013
.038
.075
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1482
1480
1478
1476
1474
1472
9700
9800
9900
10000
10100
10200
10300
10400

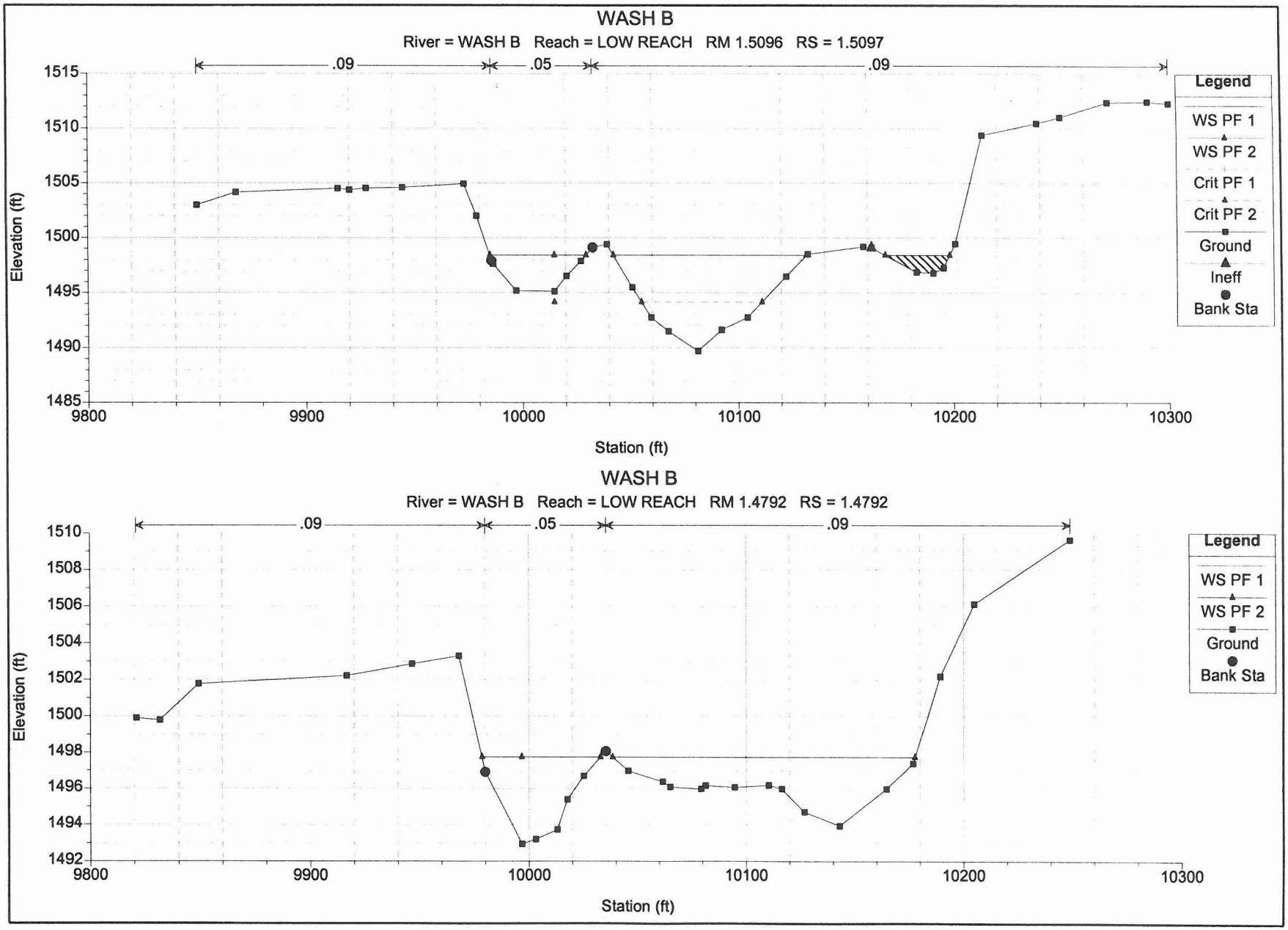

WASH B
River = WASH B Reach = LOW REACH RM 1.1788 RS = 1.1788
.075
.038
.075
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1486
1484
1482
1480
1478
1476
1474
9700
9800
9900
10000
10100
10200
10300
WASH B
River = WASH B Reach = LOW REACH RM 1.1722 RS = 1.1722
.075
.038
.075
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1483
1482
1481
1480
1479
1478
1477
1476
1475
9700
9800
9900
10000
10100
10200
10300

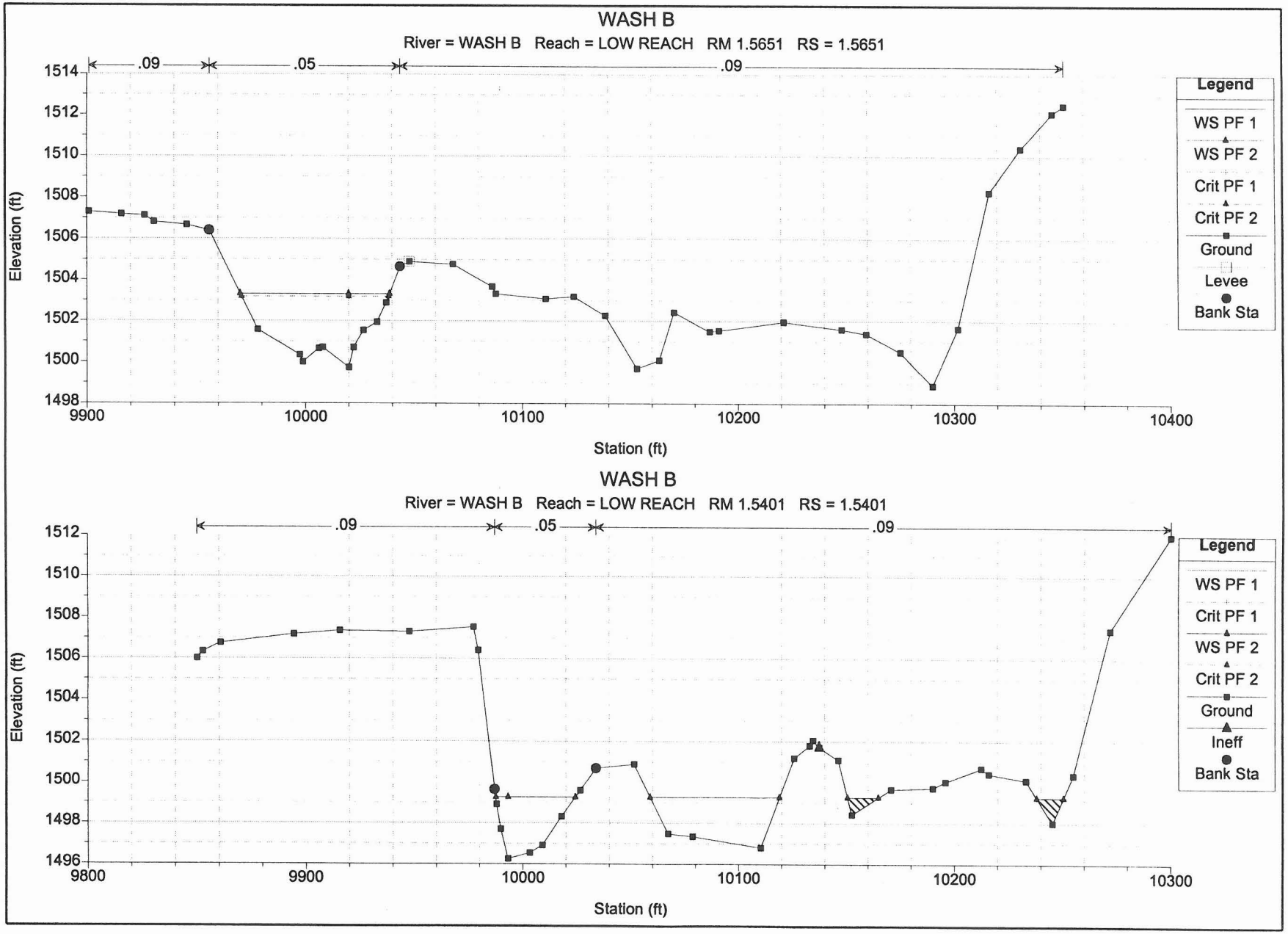

WASH B
River = WASH B Reach = LOW REACH RM 1.2775 RS = 1.2775
.075
.038
.075
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
1494
1492
1490
1488
1486
1484
1482
9800
9900
10000
10100
10200
10300
10400
Station (ft)
WASH B
River = WASH B Reach = LOW REACH RM 1.2311 RS = 1.2311
.075
.038
.075
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
1488
1486
1484
1482
1480
1478
9800
9900
10000
10100
10200
10300
10400
Station (ft)

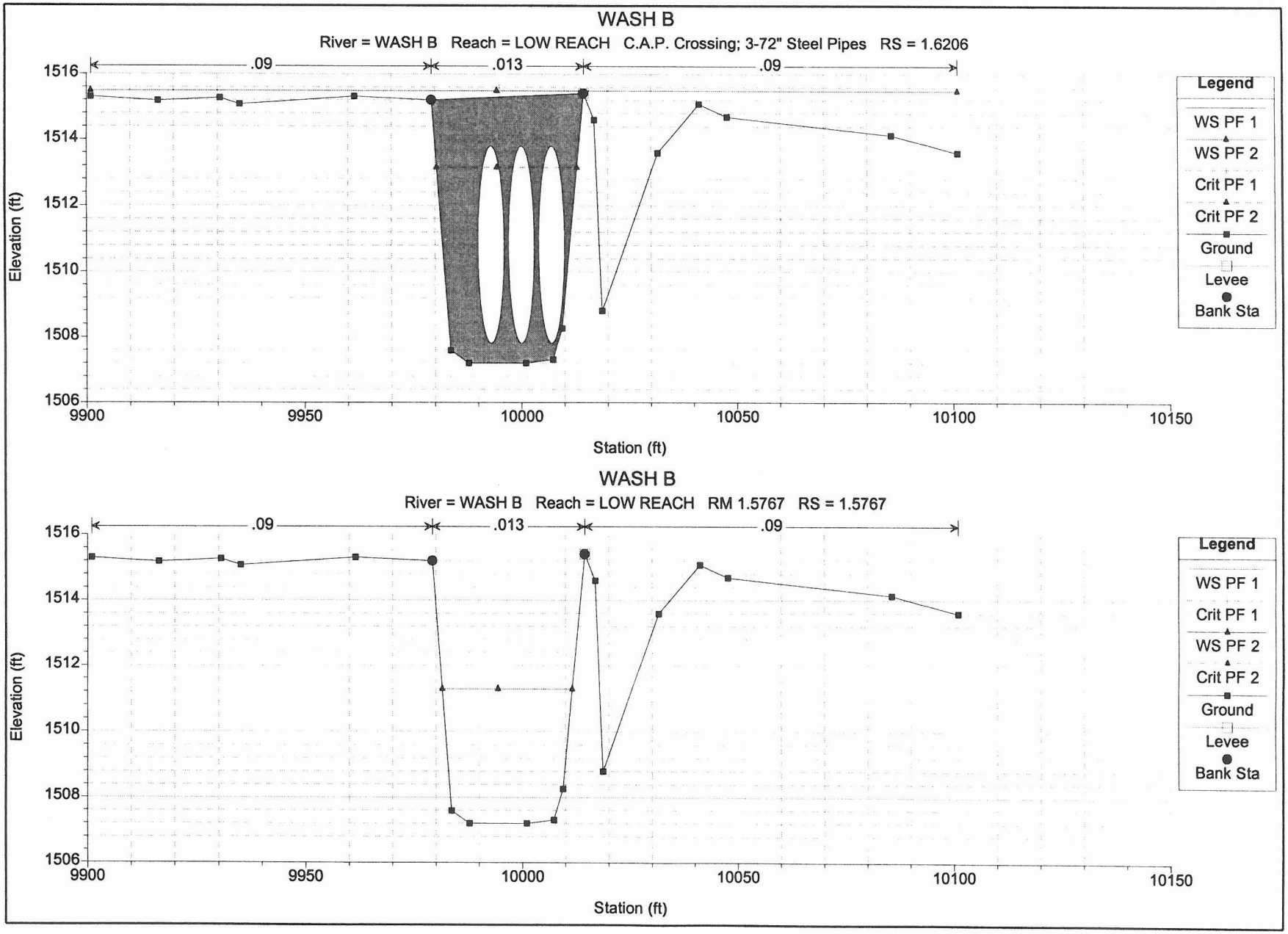

WASH B
River = WASH B Reach = LOW REACH RM 1.3242 RS = 1.3242
.075
.038
.075
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1494
1493
1492
1491
1490
1489
1488
1487
1486
1485
9850
9900
9950
10000
10050
10100
10150
10200
WASH B
River = WASH B Reach = LOW REACH RM 1.3076 RS = 1.3076
.075
.038
.075
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1494
1492
1490
1488
1486
1484
9800
9900
10000
10100
10200
10300

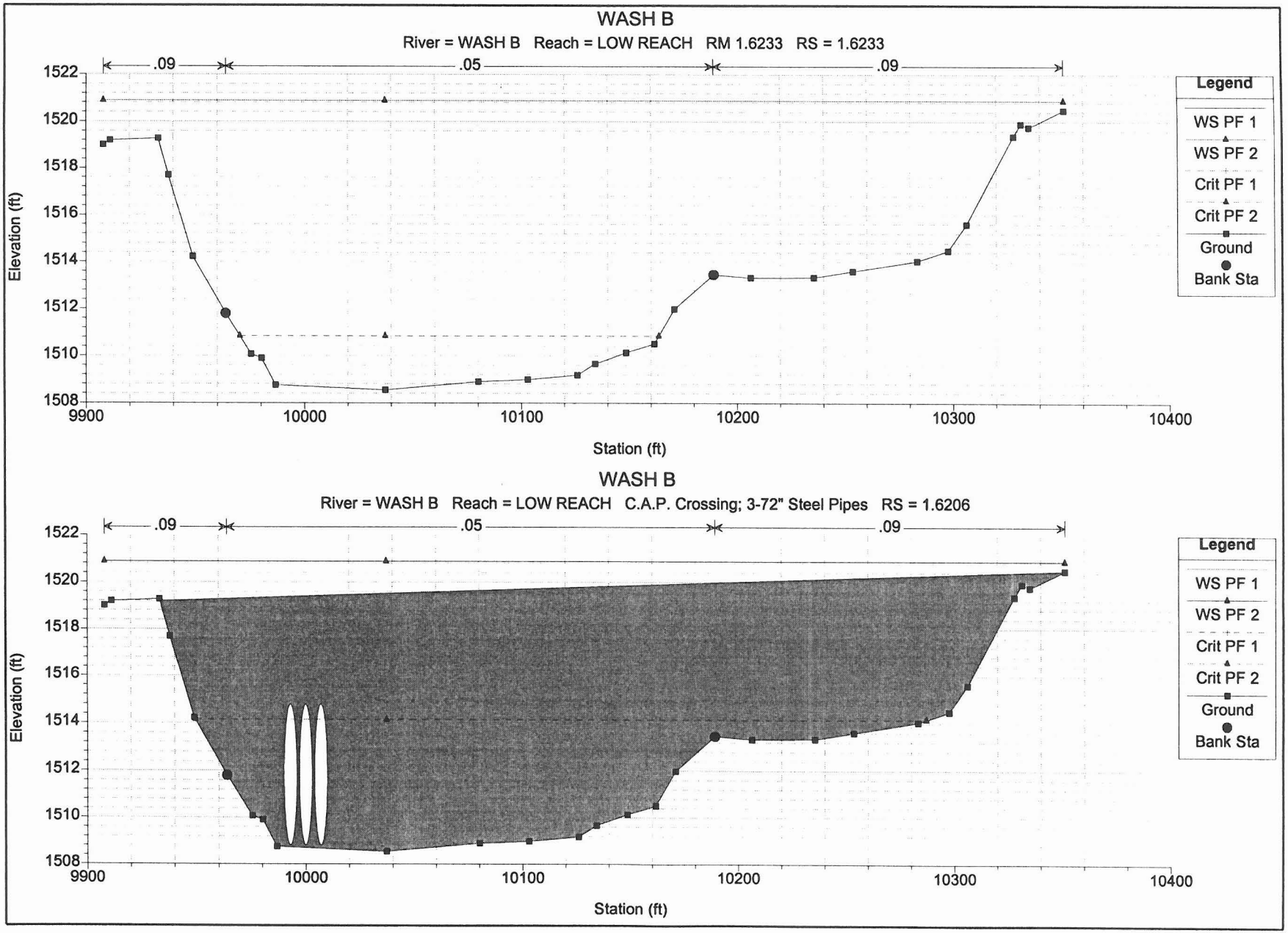

WASH B
River = WASH B Reach = LOW REACH 120th St. 4-8' x 3' CBC RS = 1.346
.09
.025
.09
1500
1498
1496
1494
1492
1490
1488
1486
Elevation (ft)
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH 120th St. 4-8' x 3' CBC RS = 1.346
.075
.025
.075
1498
1496
1494
1492
1490
1488
1486
1484
Elevation (ft)
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta

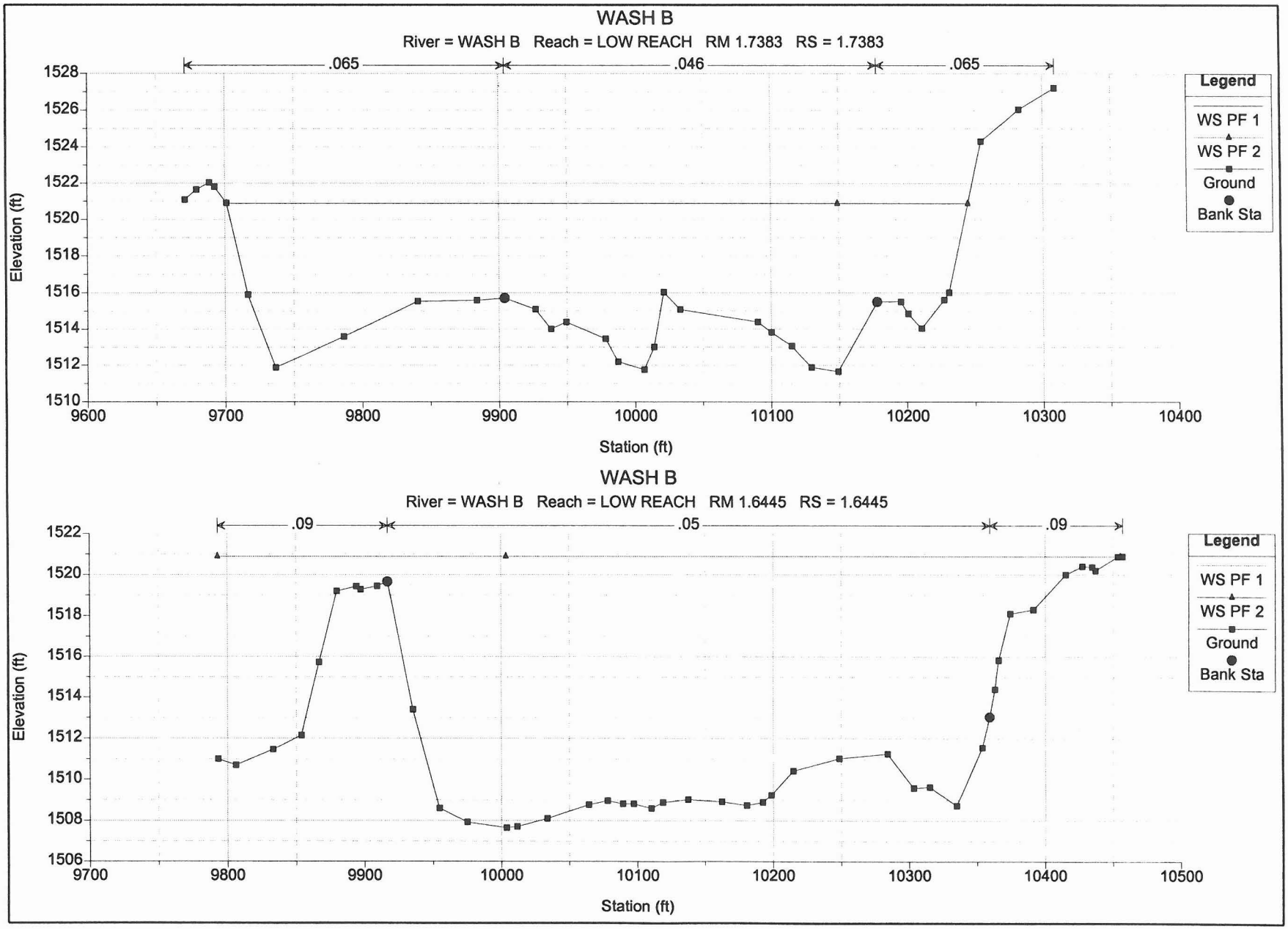

WASH B
River = WASH B Reach = LOW REACH RM 1.4195 RS = 1.4195
.09
.05
.09
Elevation (ft)
1508
1506
1504
1502
1500
1498
1496
1494
1492
1490
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 1.3462 RS = 1.3462
.09
.05
.09
Elevation (ft)
1500
1498
1496
1494
1492
1490
1488
1486
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta

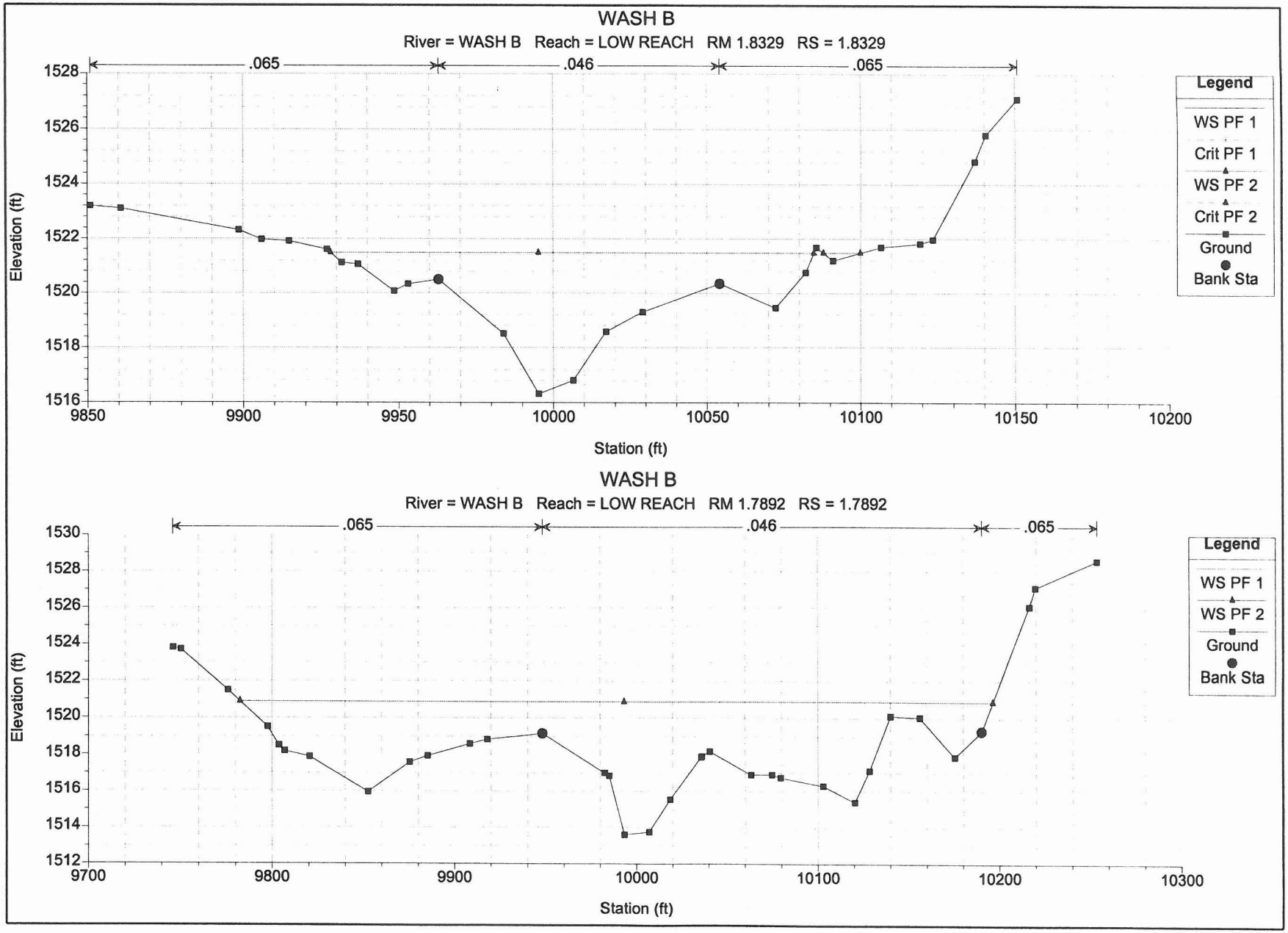

WASH B
River = WASH B Reach = LOW REACH RM 1.5096 RS = 1.5097
.09
.05
.09
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Ineff
Bank Sta
Elevation (ft)
1515
1510
1505
1500
1495
1490
1485
9800
9900
10000
10100
10200
10300
Station (ft)
WASH B
River = WASH B Reach = LOW REACH RM 1.4792 RS = 1.4792
.09
.05
.09
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
1510
1508
1506
1504
1502
1500
1498
1496
1494
1492
9800
9900
10000
10100
10200
10300
Station (ft)

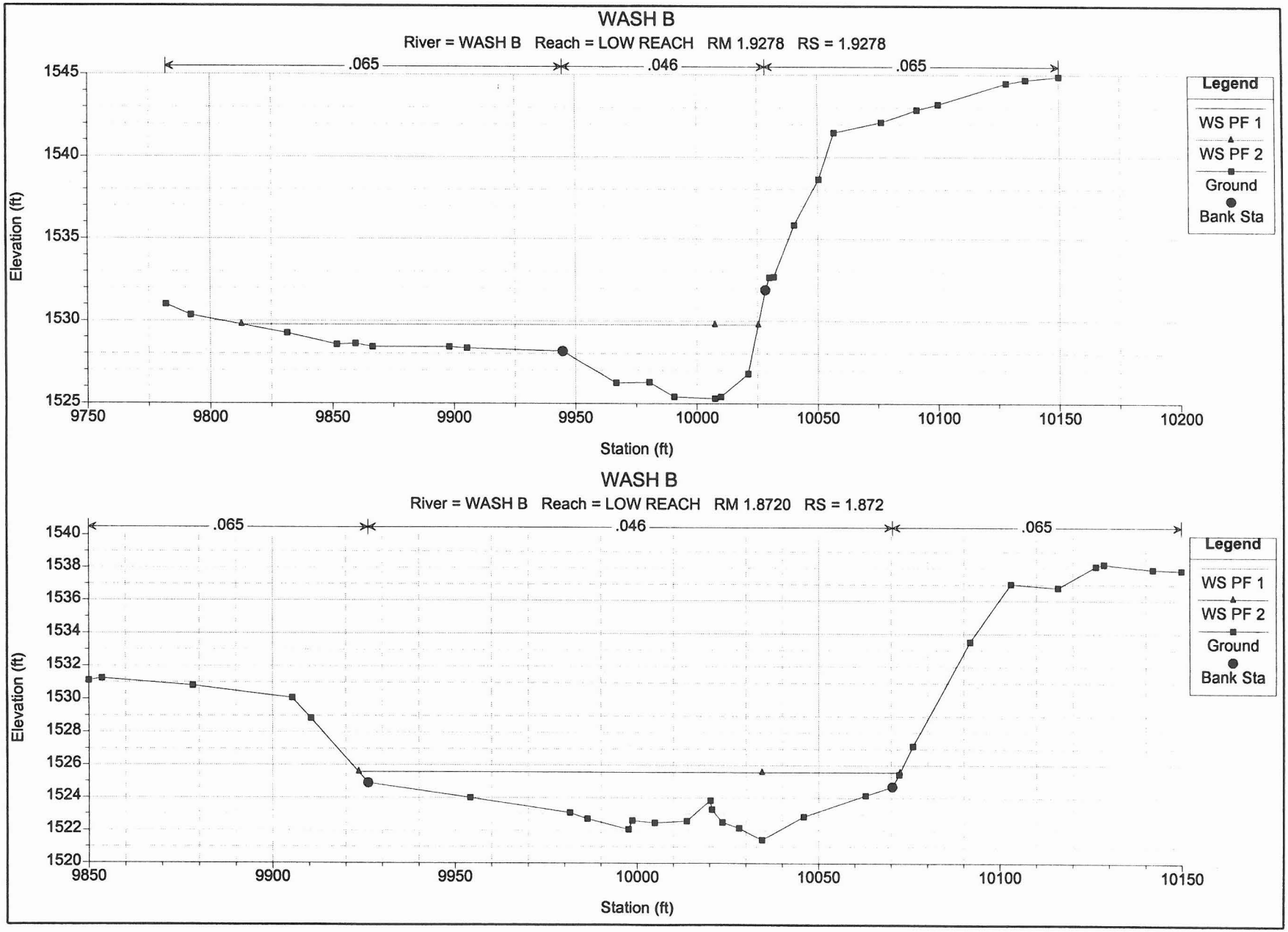

WASH B
River = WASH B Reach = LOW REACH RM 1.5651 RS = 1.5651
.09
.05
.09
1514
1512
1510
1508
1506
1504
1502
1500
1498
Elevation (ft)
9900
10000
10100
10200
10300
10400
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 1.5401 RS = 1.5401
.09
.05
.09
1512
1510
1508
1506
1504
1502
1500
1498
1496
Elevation (ft)
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Ineff
Bank Sta

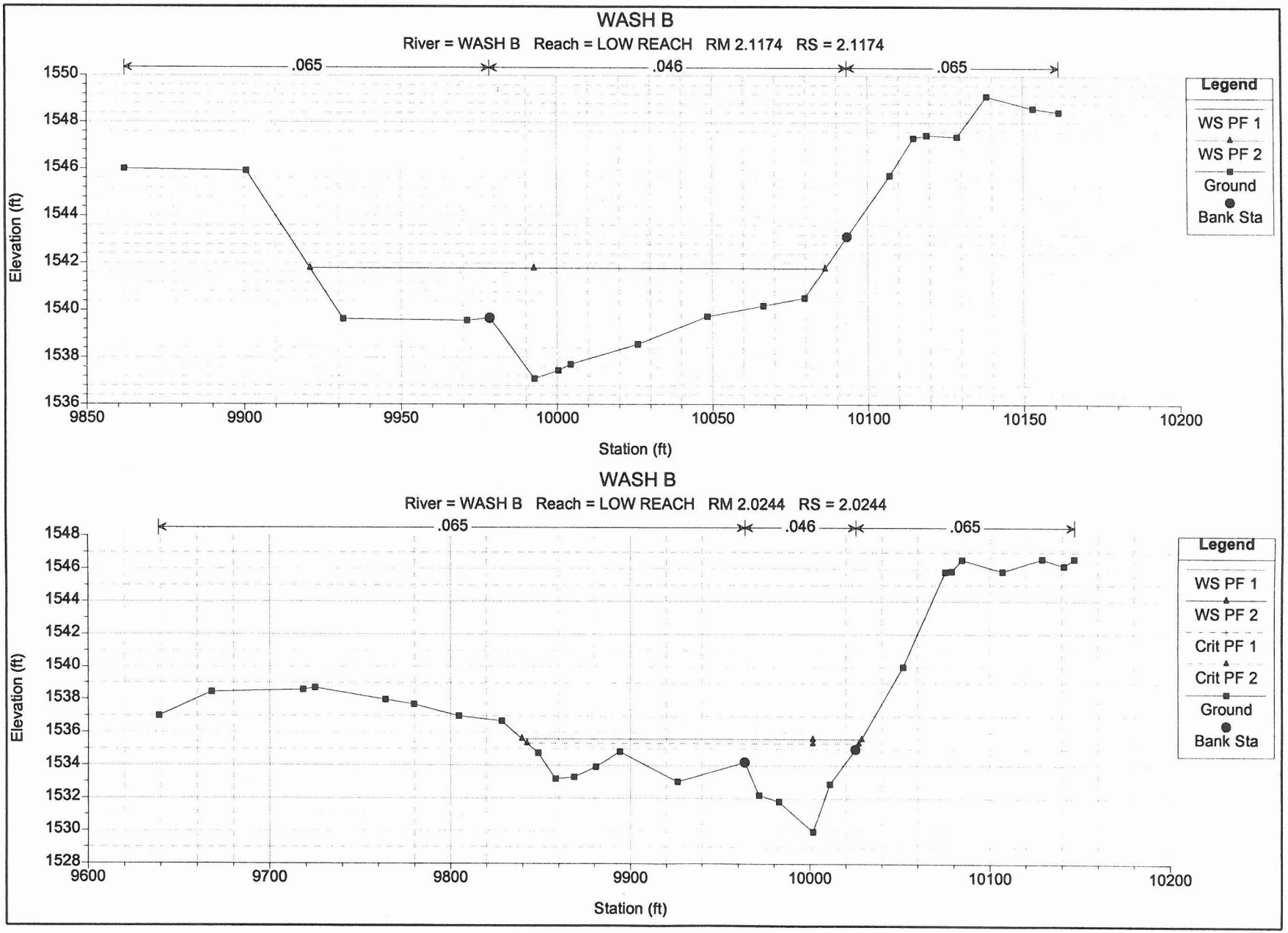

WASH B
River = WASH B Reach = LOW REACH C.A.P. Crossing; 3-72" Steel Pipes RS = 1.6206
.09
.013
.09
1516
1514
1512
1510
1508
1506
Elevation (ft)
9900
9950
10000
10050
10100
10150
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 1.5767 RS = 1.5767
.09
.013
.09
1516
1514
1512
1510
1508
1506
Elevation (ft)
9900
9950
10000
10050
10100
10150
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Levee
Bank Sta

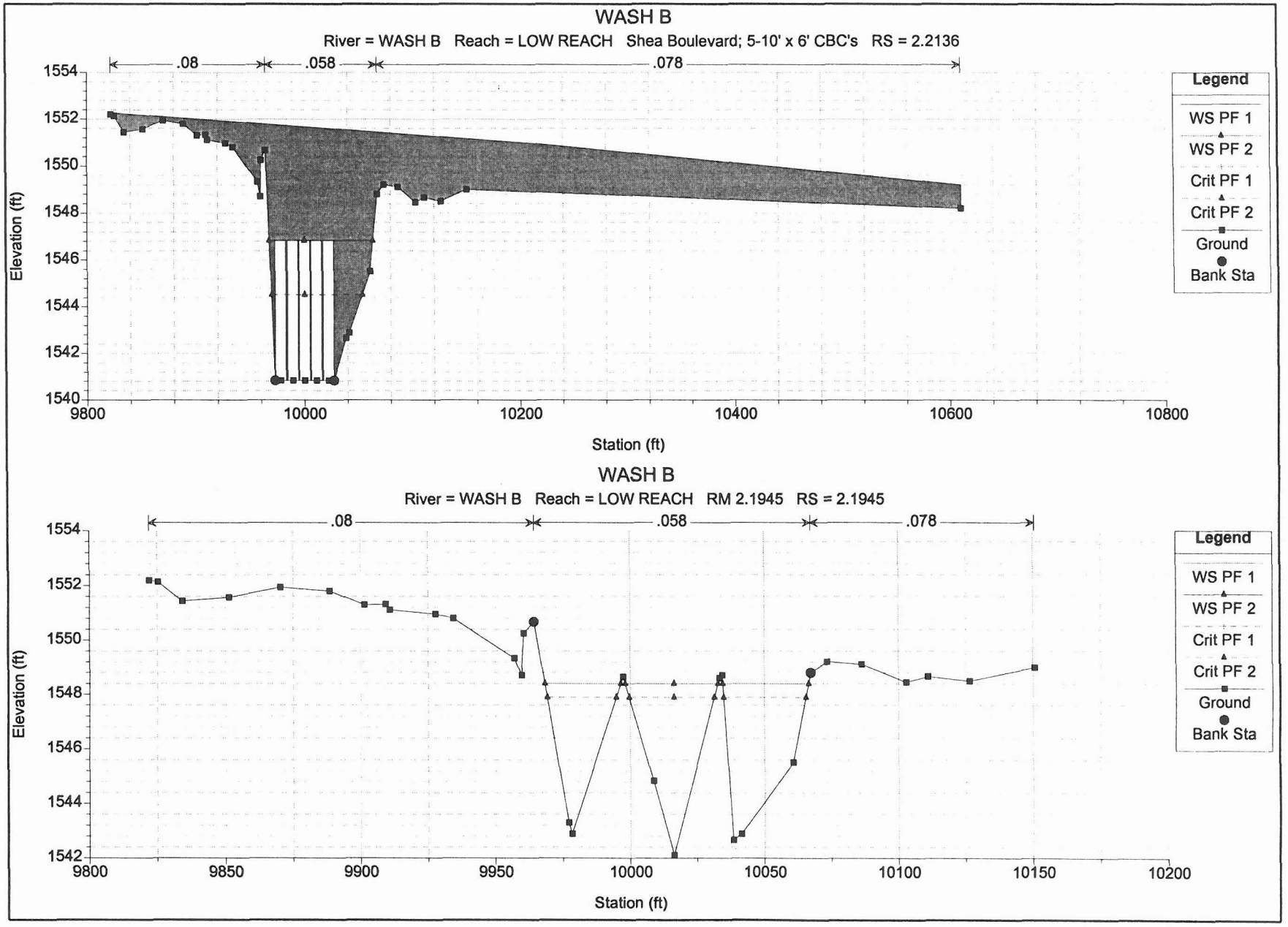

WASH B
River = WASH B Reach = LOW REACH RM 1.6233 RS = 1.6233
.09
.05
.09
Elevation (ft)
1522
1520
1518
1516
1514
1512
1510
1508
9900
10000
10100
10200
10300
10400
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH C.A.P. Crossing; 3-72" Steel Pipes RS = 1.6206
.09
.05
.09
Elevation (ft)
1522
1520
1518
1516
1514
1512
1510
1508
9900
10000
10100
10200
10300
10400
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta

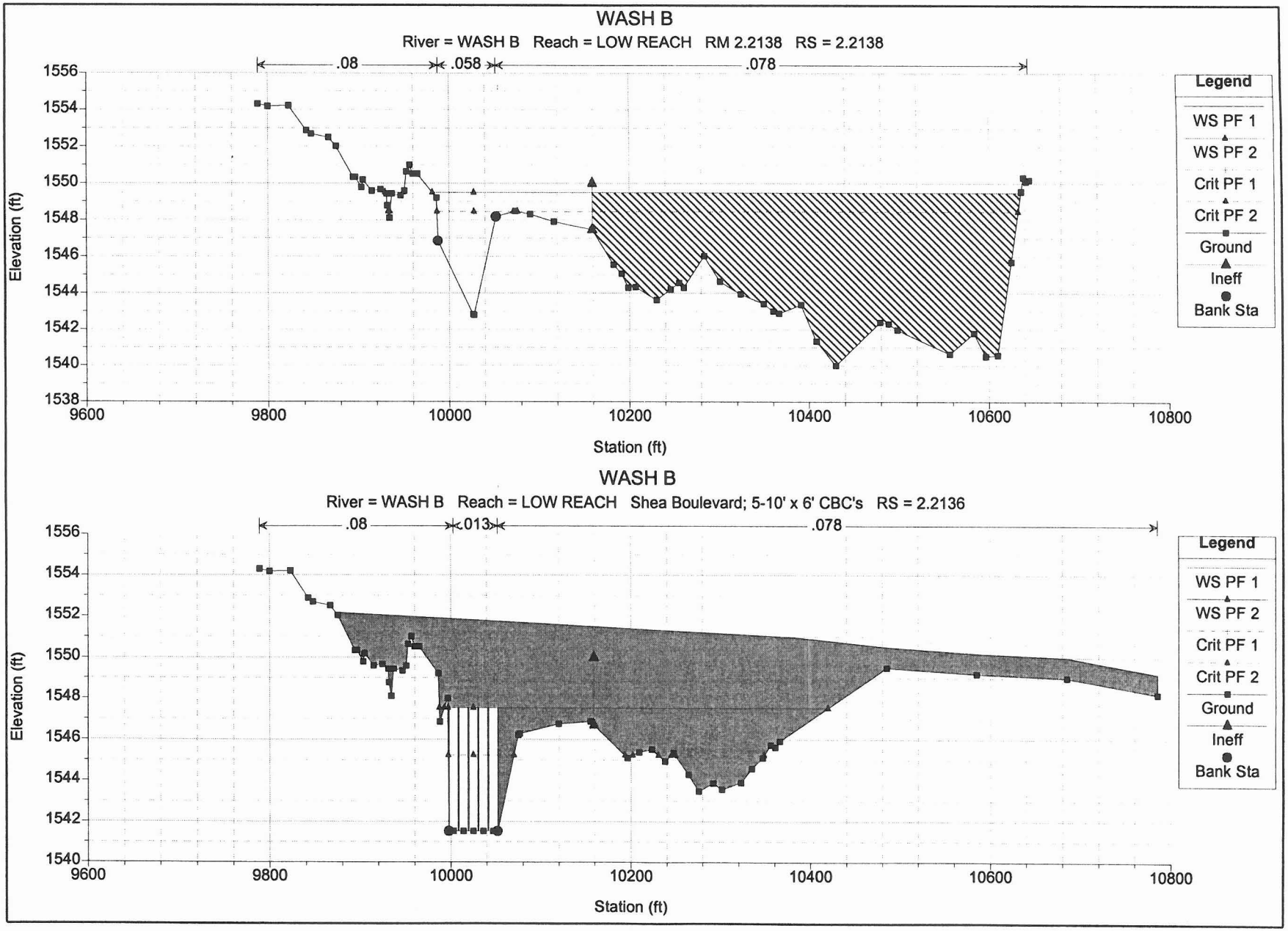

WASH B
River = WASH B Reach = LOW REACH RM 1.7383 RS = 1.7383
.065
.046
.065
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1528
1526
1524
1522
1520
1518
1516
1514
1512
1510
9600
9700
9800
9900
10000
10100
10200
10300
10400
WASH B
River = WASH B Reach = LOW REACH RM 1.6445 RS = 1.6445
.09
.05
.09
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1522
1520
1518
1516
1514
1512
1510
1508
1506
9700
9800
9900
10000
10100
10200
10300
10400
10500

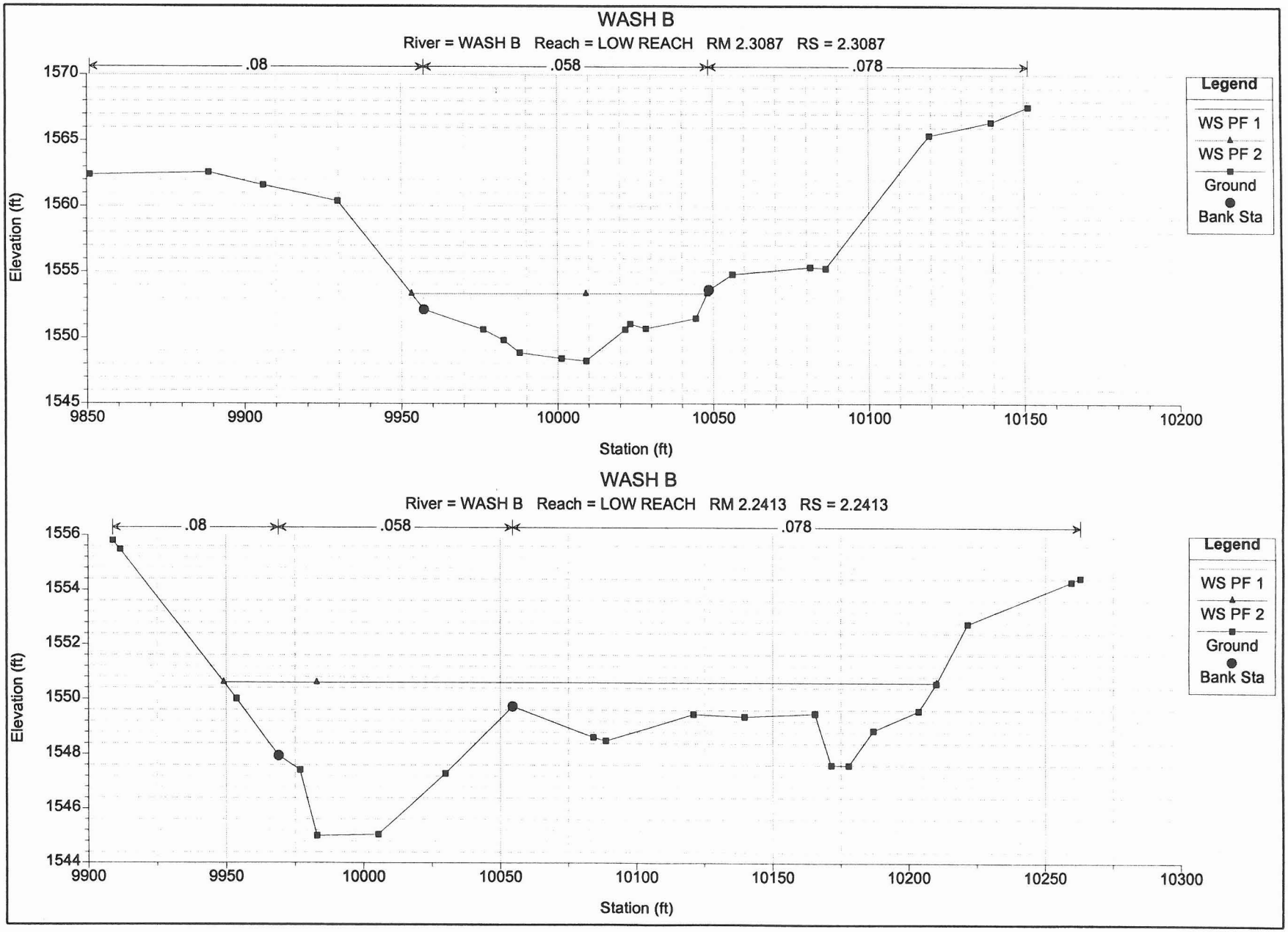

WASH B
River = WASH B Reach = LOW REACH RM 1.8329 RS = 1.8329
.065
.046
.065
1528
1526
1524
1522
1520
1518
1516
Elevation (ft)
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 1.7892 RS = 1.7892
.065
.046
.065
1530
1528
1526
1524
1522
1520
1518
1516
1514
1512
Elevation (ft)
9700
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta

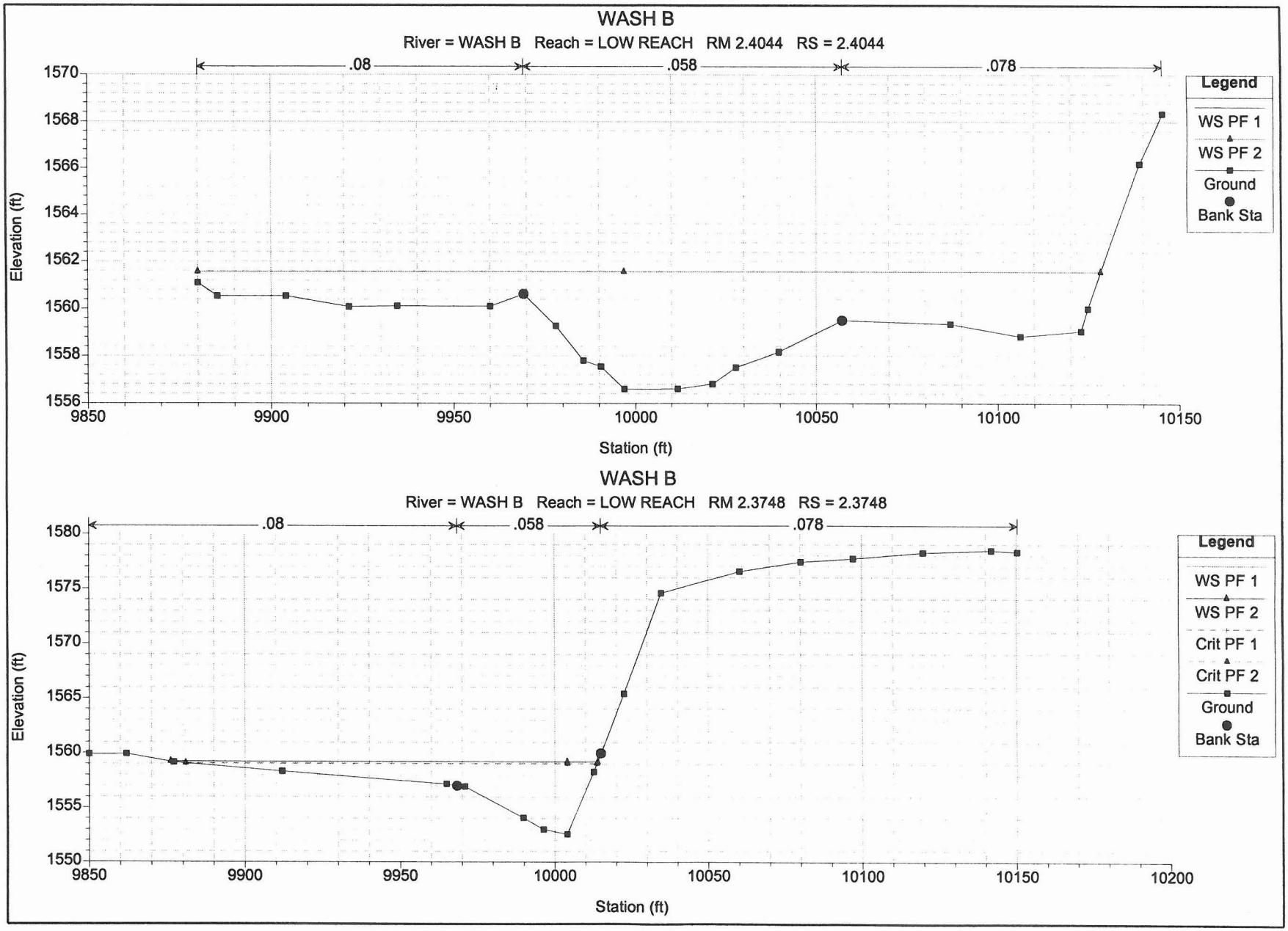

WASH B
River = WASH B Reach = LOW REACH RM 1.9278 RS = 1.9278
.065
.046
.065
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1545
1540
1535
1530
1525
9750
9800
9850
9900
9950
10000
10050
10100
10150
10200
WASH B
River = WASH B Reach = LOW REACH RM 1.8720 RS = 1.872
.065
.046
.065
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1540
1538
1536
1534
1532
1530
1528
1526
1524
1522
1520
9850
9900
9950
10000
10050
10100
10150

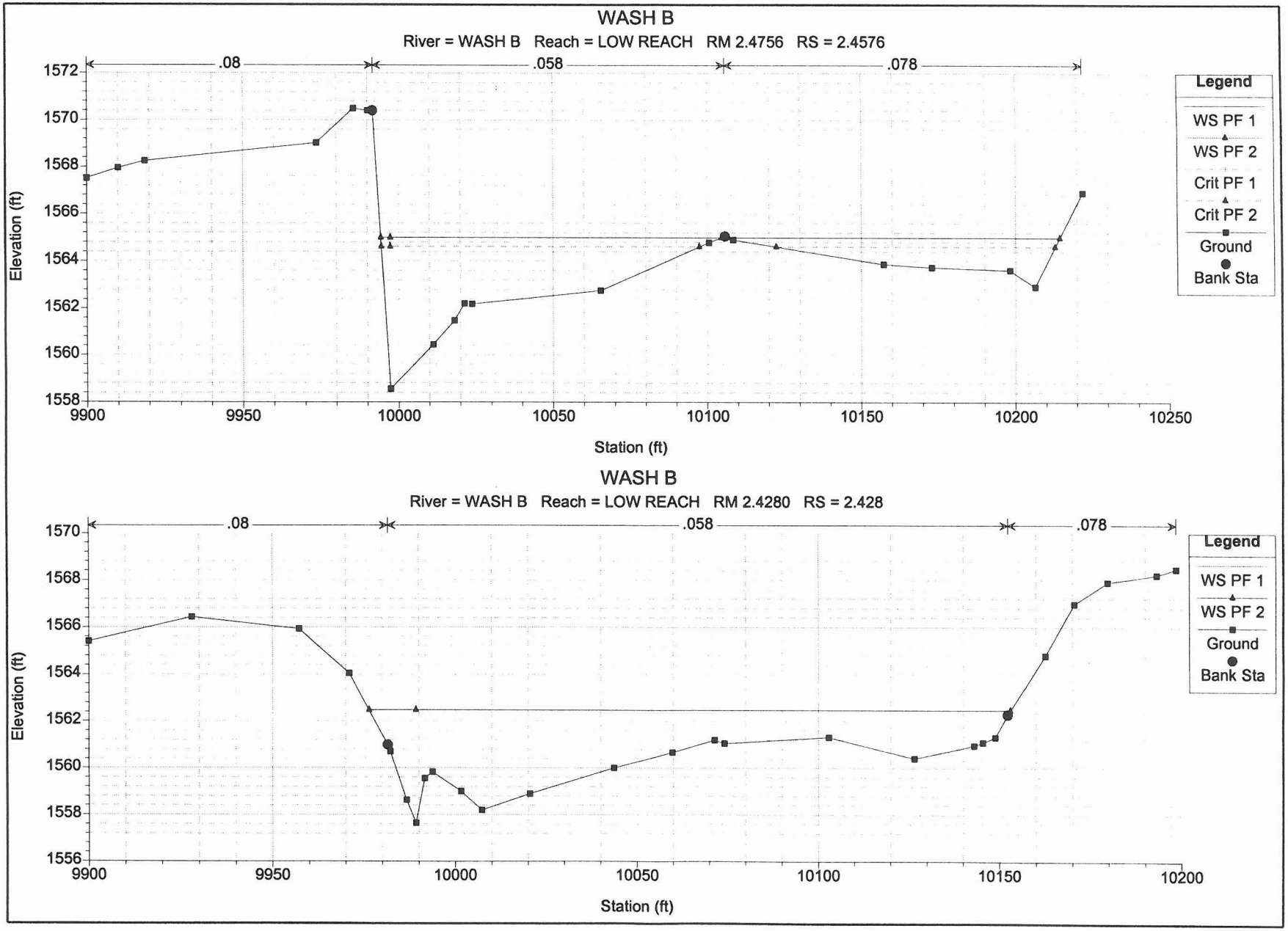

WASH B
River = WASH B Reach = LOW REACH RM 2.1174 RS = 2.1174
.065
.046
.065
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
1550
1548
1546
1544
1542
1540
1538
1536
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
WASH B
River = WASH B Reach = LOW REACH RM 2.0244 RS = 2.0244
.065
.046
.065
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
1548
1546
1544
1542
1540
1538
1536
1534
1532
1530
1528
9600
9700
9800
9900
10000
10100
10200
Station (ft)

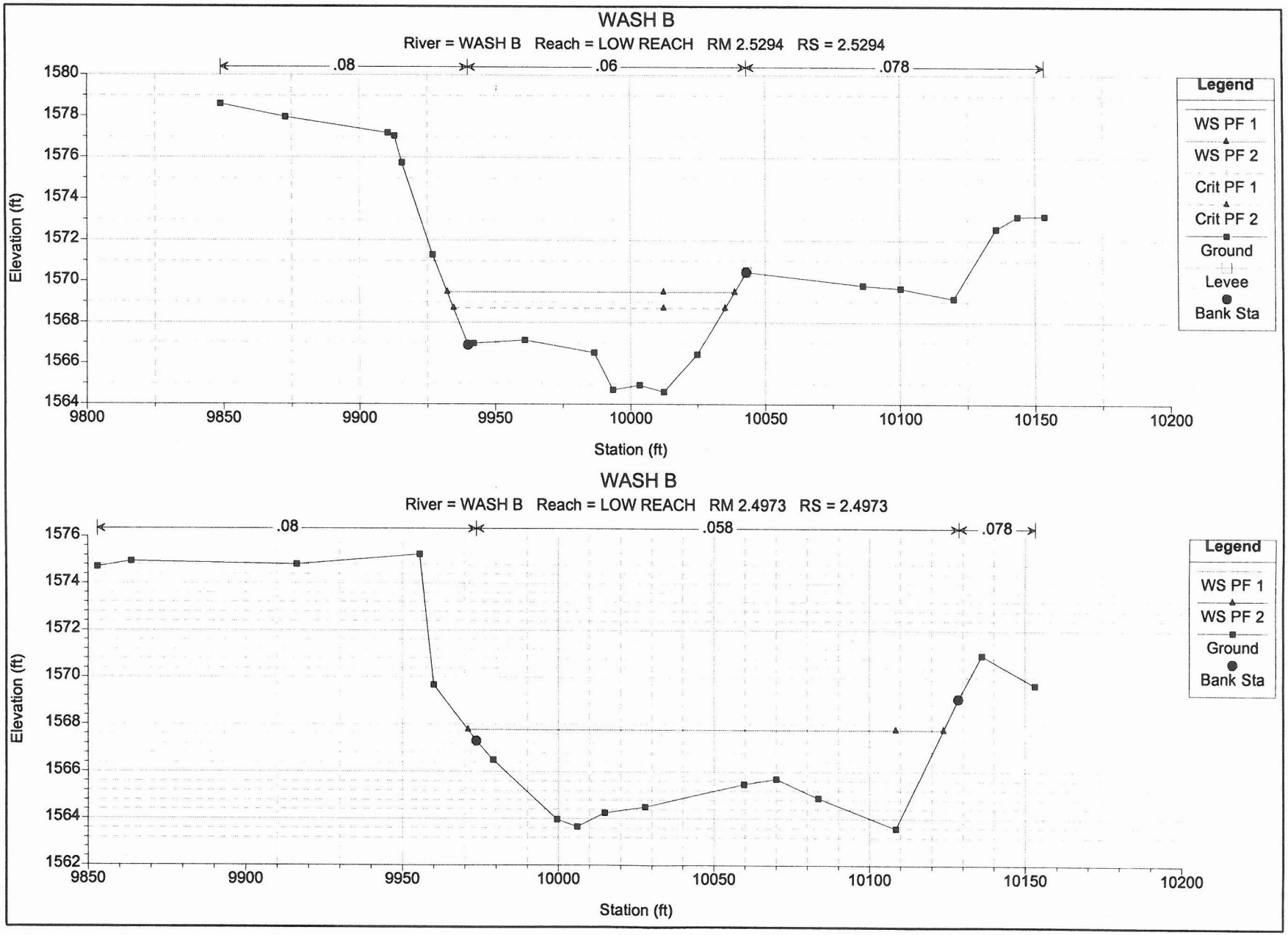

WASH B
River = WASH B Reach = LOW REACH Shea Boulevard; 5-10' x 6' CBC's RS = 2.2136
.08
.058
.078
Elevation (ft)
1554
1552
1550
1548
1546
1544
1542
1540
9800
10000
10200
10400
10600
10800
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = LOW REACH RM 2.1945 RS = 2.1945
.08
.058
.078
Elevation (ft)
1554
1552
1550
1548
1546
1544
1542
9800
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta

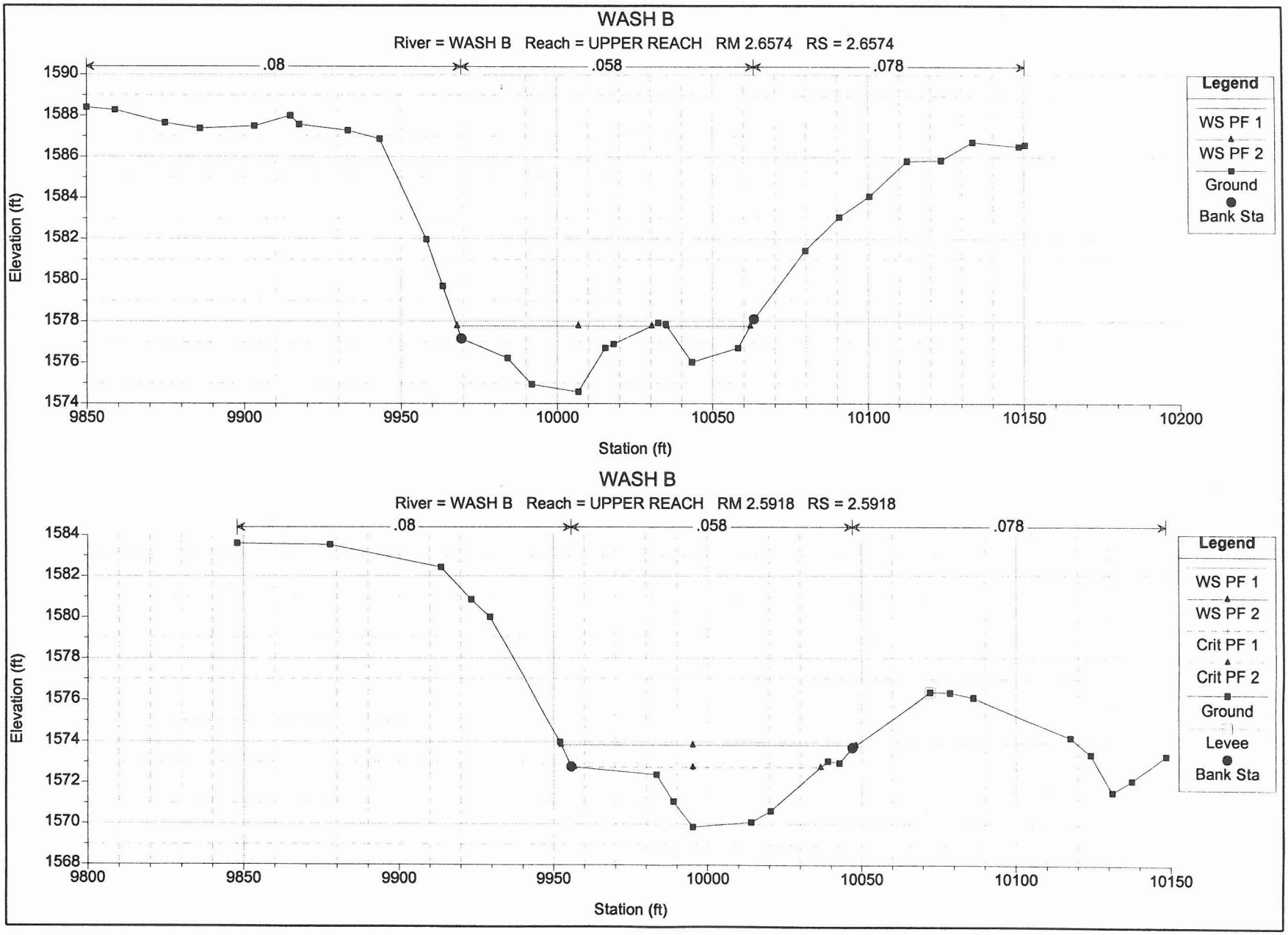

WASH B
River = WASH B Reach = LOW REACH RM 2.2138 RS = 2.2138
.08
.058
.078
Elevation (ft)
1556
1554
1552
1550
1548
1546
1544
1542
1540
1538
9600
9800
10000
10200
10400
10600
10800
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Ineff
Bank Sta
WASH B
River = WASH B Reach = LOW REACH Shea Boulevard; 5-10' x 6' CBC's RS = 2.2136
.08
.013
.078
Elevation (ft)
1556
1554
1552
1550
1548
1546
1544
1542
1540
9600
9800
10000
10200
10400
10600
10800
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Ineff
Bank Sta

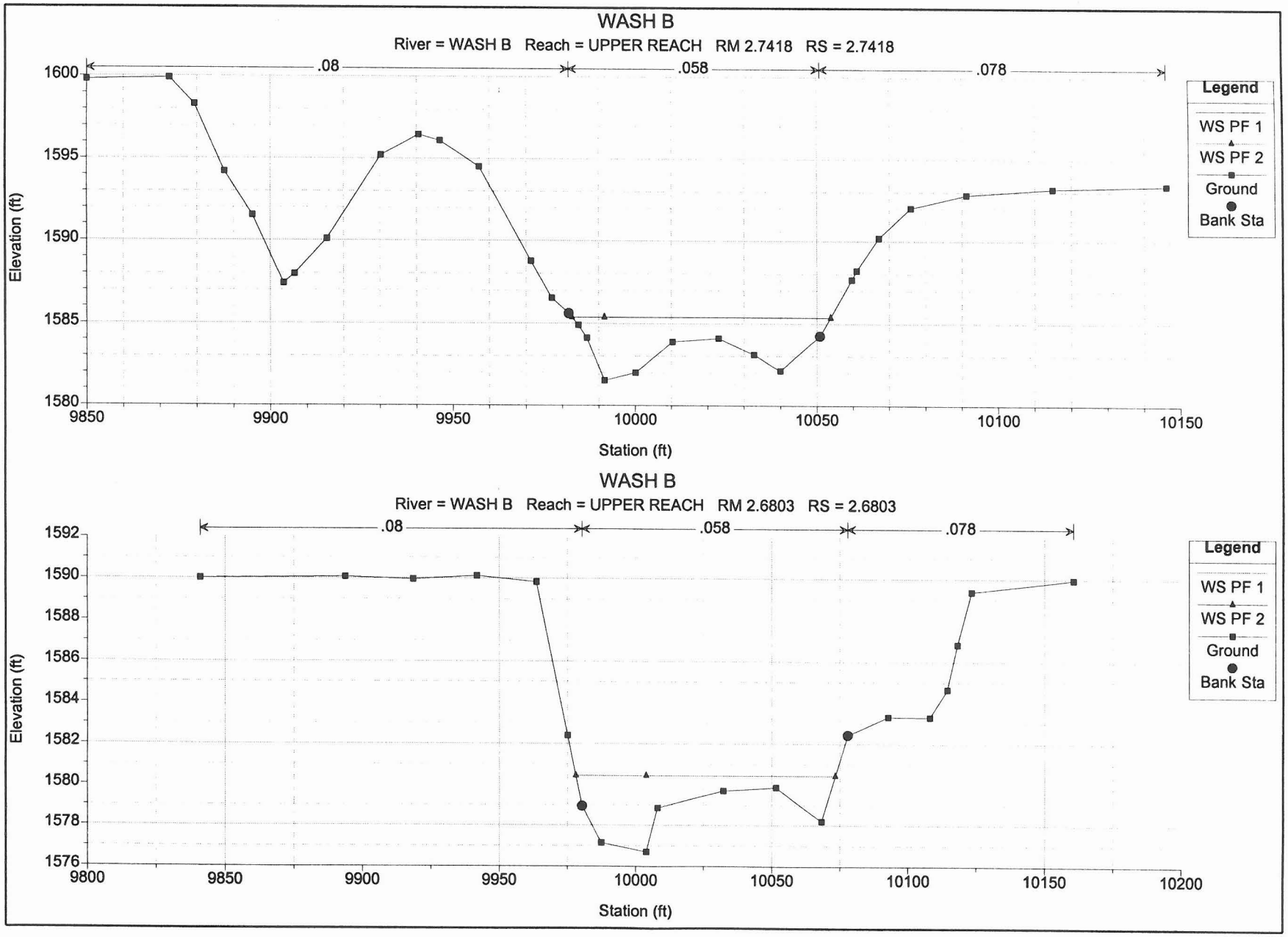

WASH B
River = WASH B Reach = LOW REACH RM 2.3087 RS = 2.3087
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1570
1565
1560
1555
1550
1545
9850
9900
9950
10000
10050
10100
10150
10200
WASH B
River = WASH B Reach = LOW REACH RM 2.2413 RS = 2.2413
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1556
1554
1552
1550
1548
1546
1544
9900
9950
10000
10050
10100
10150
10200
10250
10300

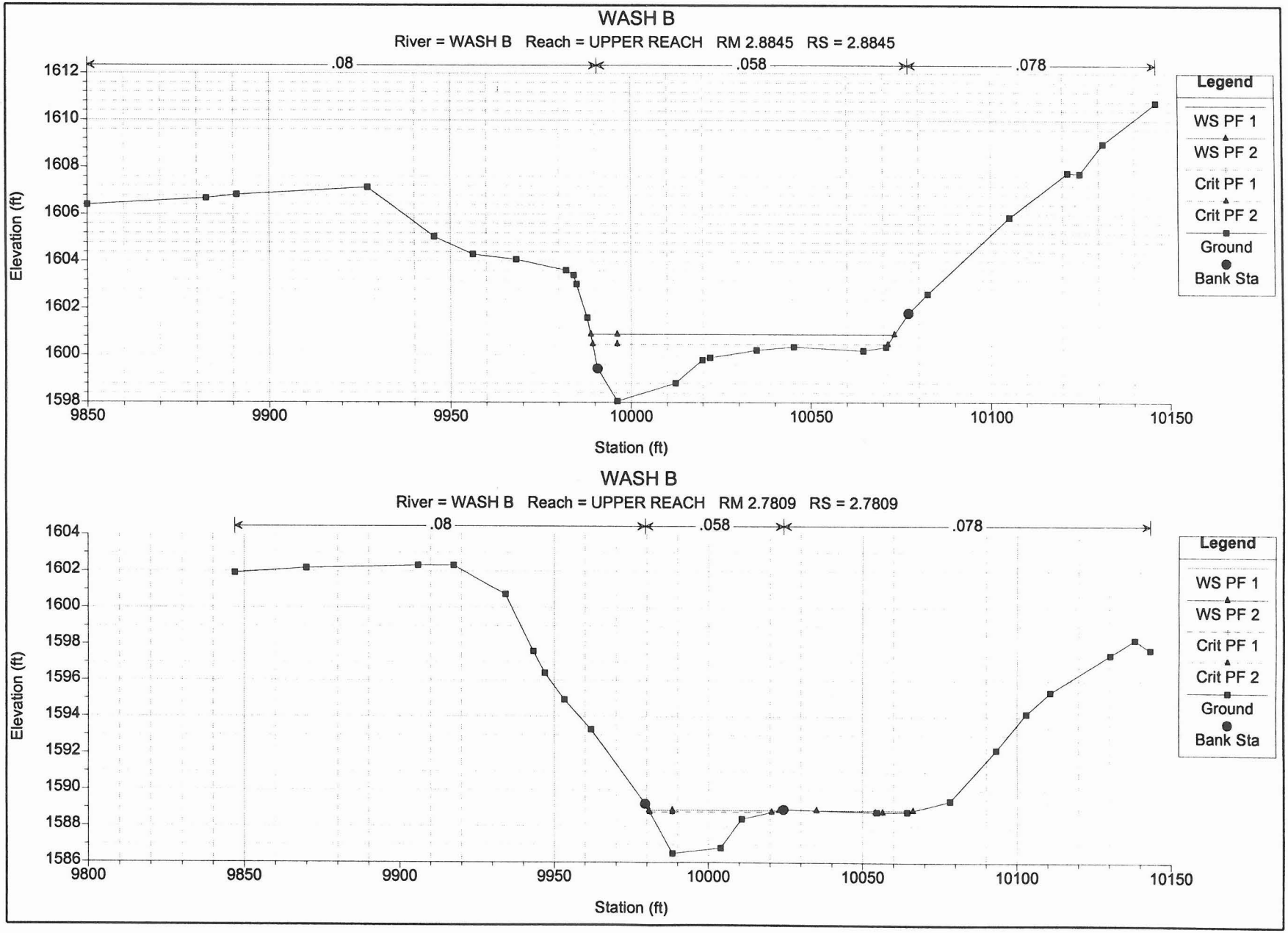

WASH B
River = WASH B Reach = LOW REACH RM 2.4044 RS = 2.4044
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
WASH B
River = WASH B Reach = LOW REACH RM 2.3748 RS = 2.3748
.08
.058
.078
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)

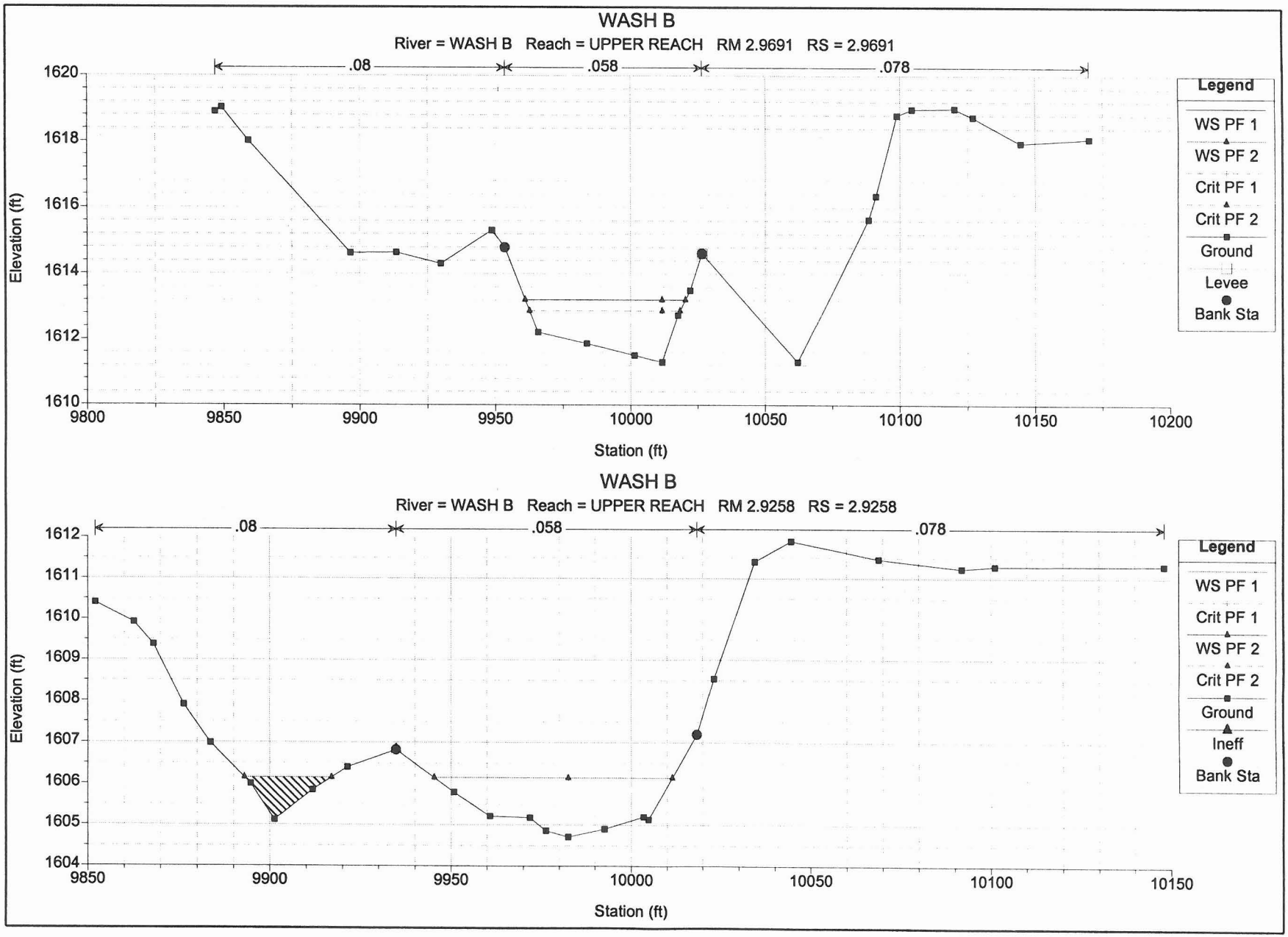

WASH B
River = WASH B Reach = LOW REACH RM 2.4756 RS = 2.4576
.08
.058
.078
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1572
1570
1568
1566
1564
1562
1560
1558
9900
9950
10000
10050
10100
10150
10200
10250
WASH B
River = WASH B Reach = LOW REACH RM 2.4280 RS = 2.428
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1570
1568
1566
1564
1562
1560
1558
1556
9900
9950
10000
10050
10100
10150
10200

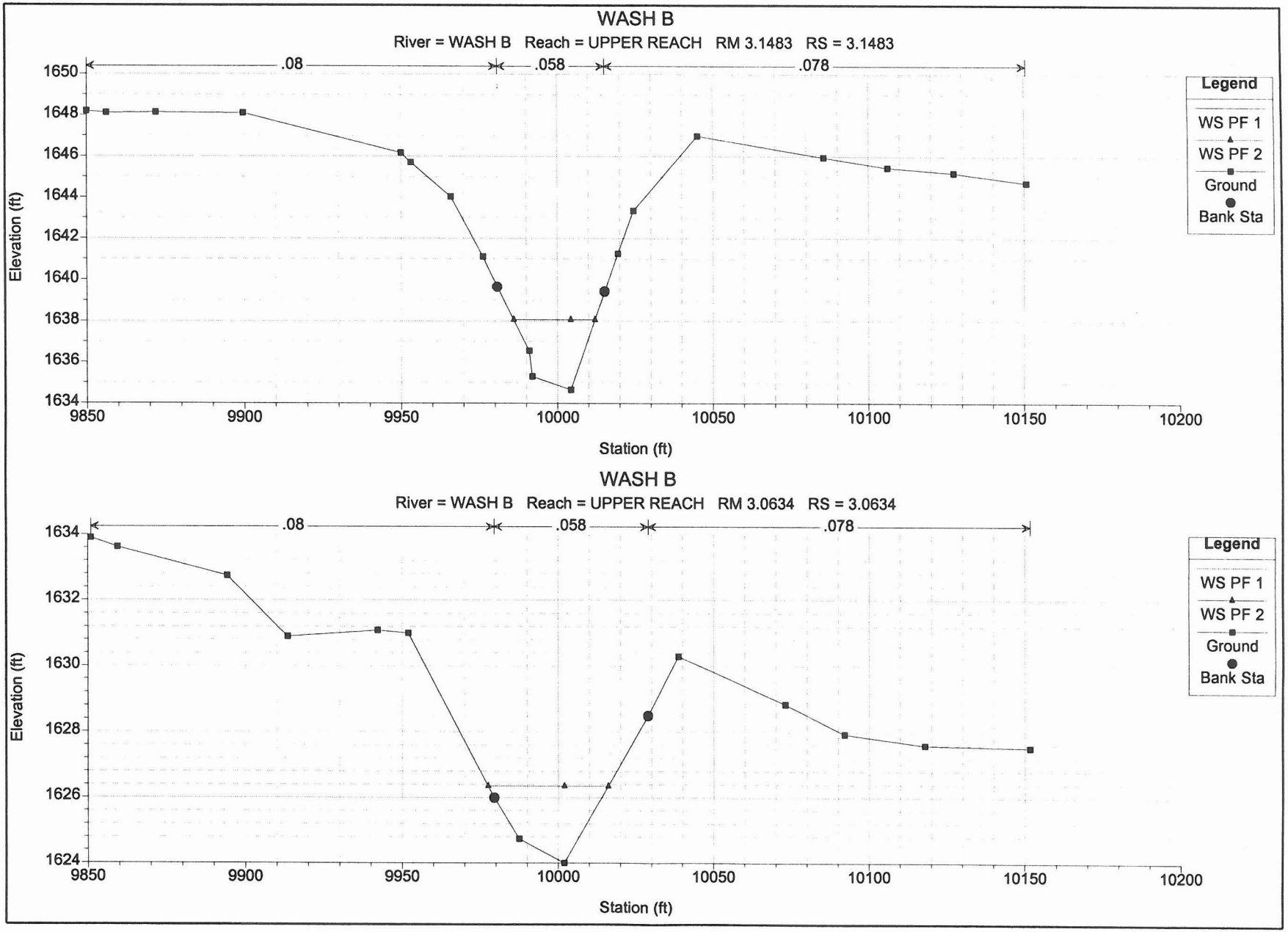

WASH B
River = WASH B Reach = LOW REACH RM 2.5294 RS = 2.5294
.08
.06
.078
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
1580
1578
1576
1574
1572
1570
1568
1566
1564
9800
9850
9900
9950
10000
10050
10100
10150
10200
WASH B
River = WASH B Reach = LOW REACH RM 2.4973 RS = 2.4973
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1576
1574
1572
1570
1568
1566
1564
1562
9850
9900
9950
10000
10050
10100
10150
10200

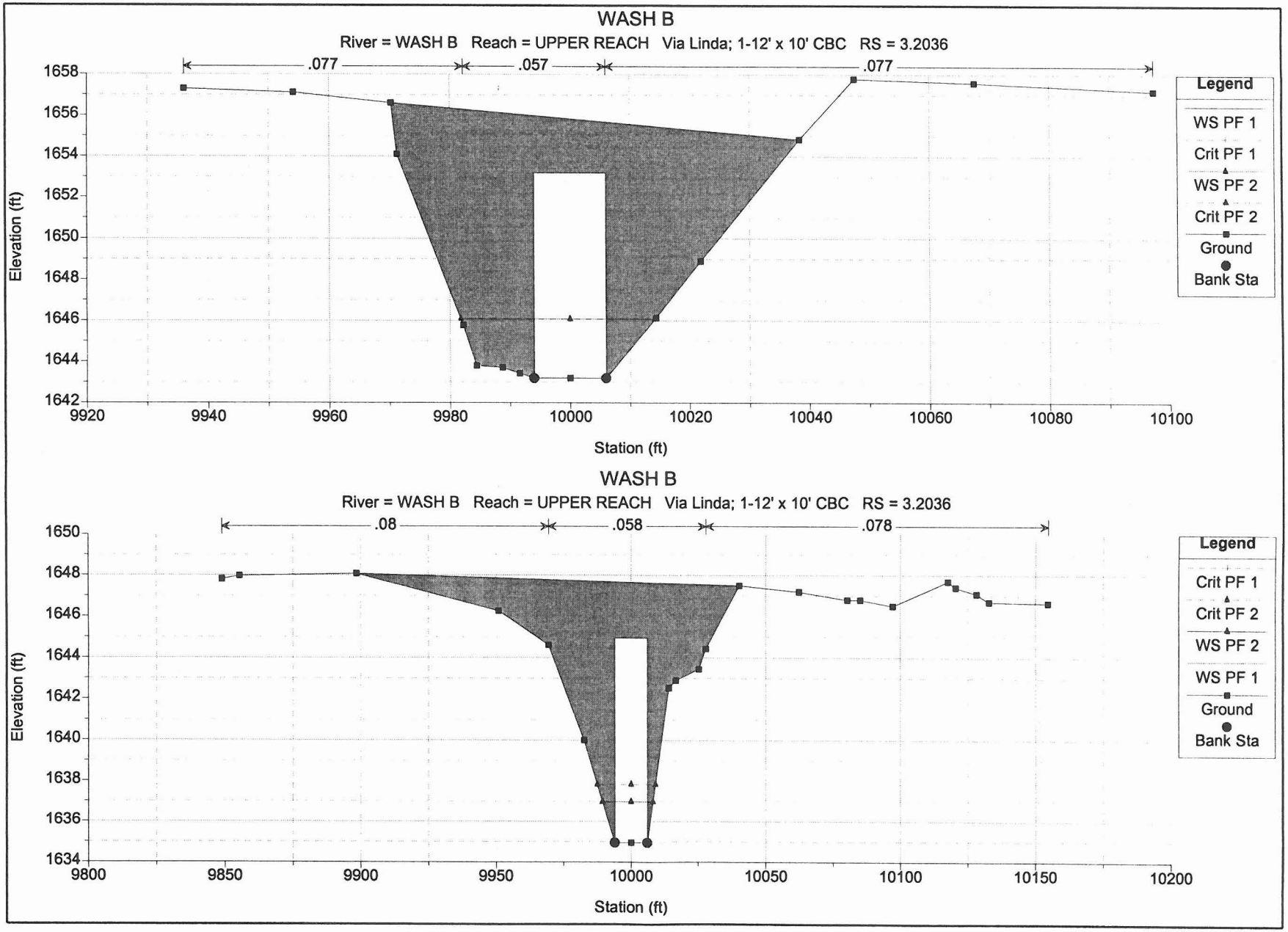

WASH B
River = WASH B Reach = UPPER REACH RM 2.6574 RS = 2.6574
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
WASH B
River = WASH B Reach = UPPER REACH RM 2.5918 RS = 2.5918
.08
.058
.078
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

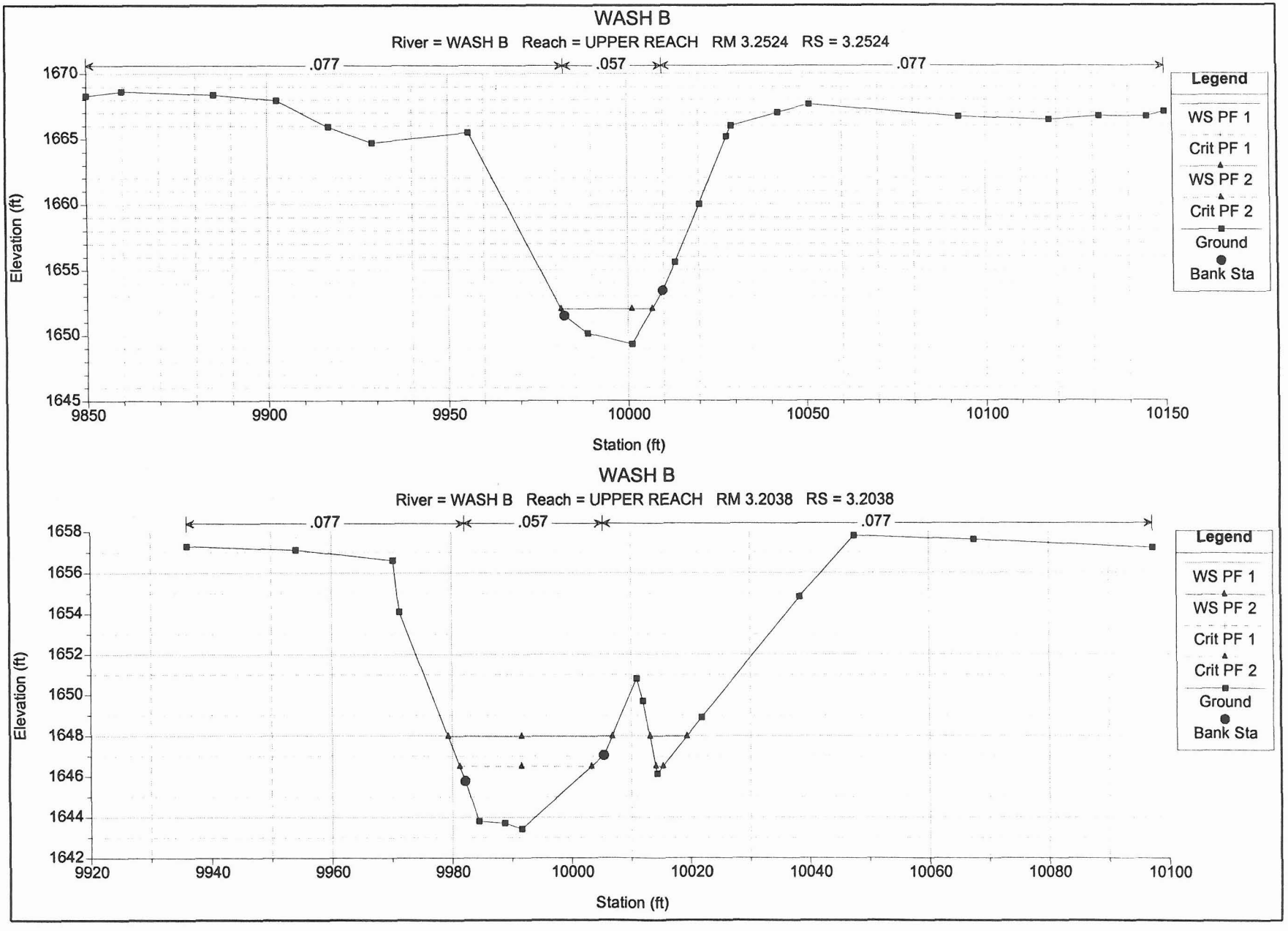

WASH B
River = WASH B Reach = UPPER REACH RM 2.7418 RS = 2.7418
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1600
1595
1590
1585
1580
9850
9900
9950
10000
10050
10100
10150
WASH B
River = WASH B Reach = UPPER REACH RM 2.6803 RS = 2.6803
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1592
1590
1588
1586
1584
1582
1580
1578
1576
9800
9850
9900
9950
10000
10050
10100
10150
10200

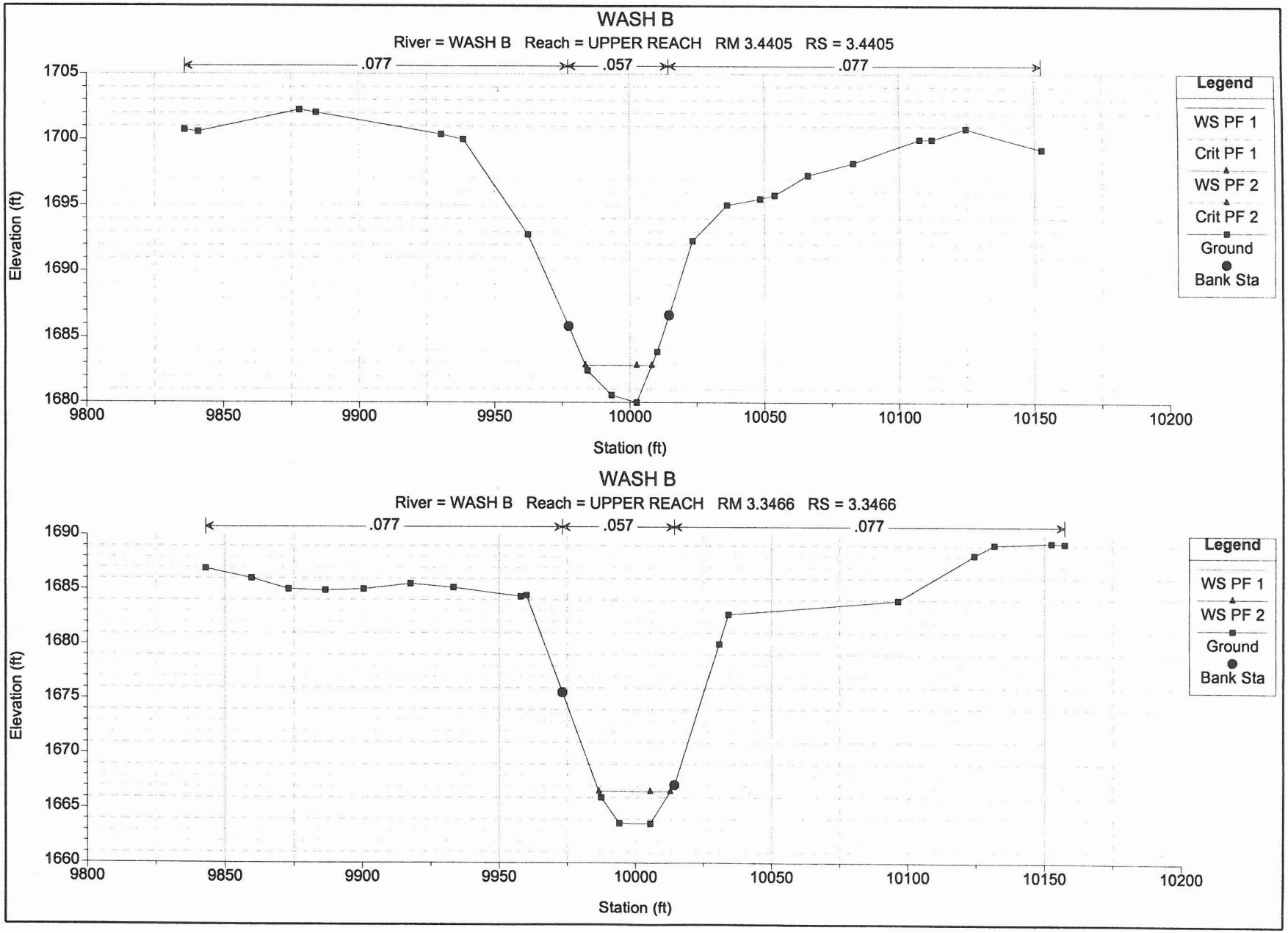

WASH B
River = WASH B Reach = UPPER REACH RM 2.8845 RS = 2.8845
.08
.058
.078
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1612
1610
1608
1606
1604
1602
1600
1598
9850
9900
9950
10000
10050
10100
10150
WASH B
River = WASH B Reach = UPPER REACH RM 2.7809 RS = 2.7809
.08
.058
.078
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1604
1602
1600
1598
1596
1594
1592
1590
1588
1586
9800
9850
9900
9950
10000
10050
10100
10150

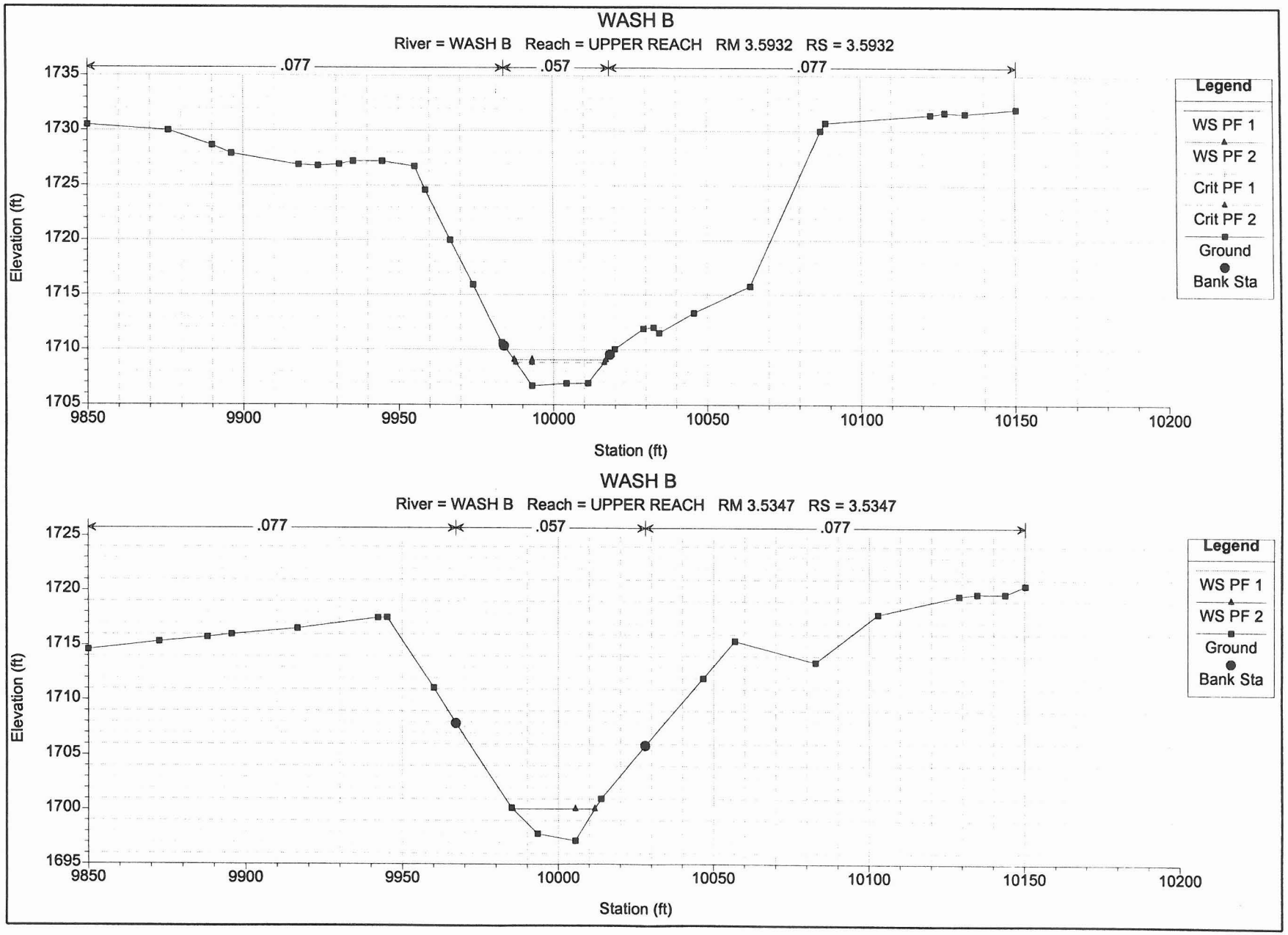

WASH B
River = WASH B Reach = UPPER REACH RM 2.9691 RS = 2.9691
.08
.058
.078
Elevation (ft)
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta
WASH B
River = WASH B Reach = UPPER REACH RM 2.9258 RS = 2.9258
.08
.058
.078
Elevation (ft)
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Ineff
Bank Sta

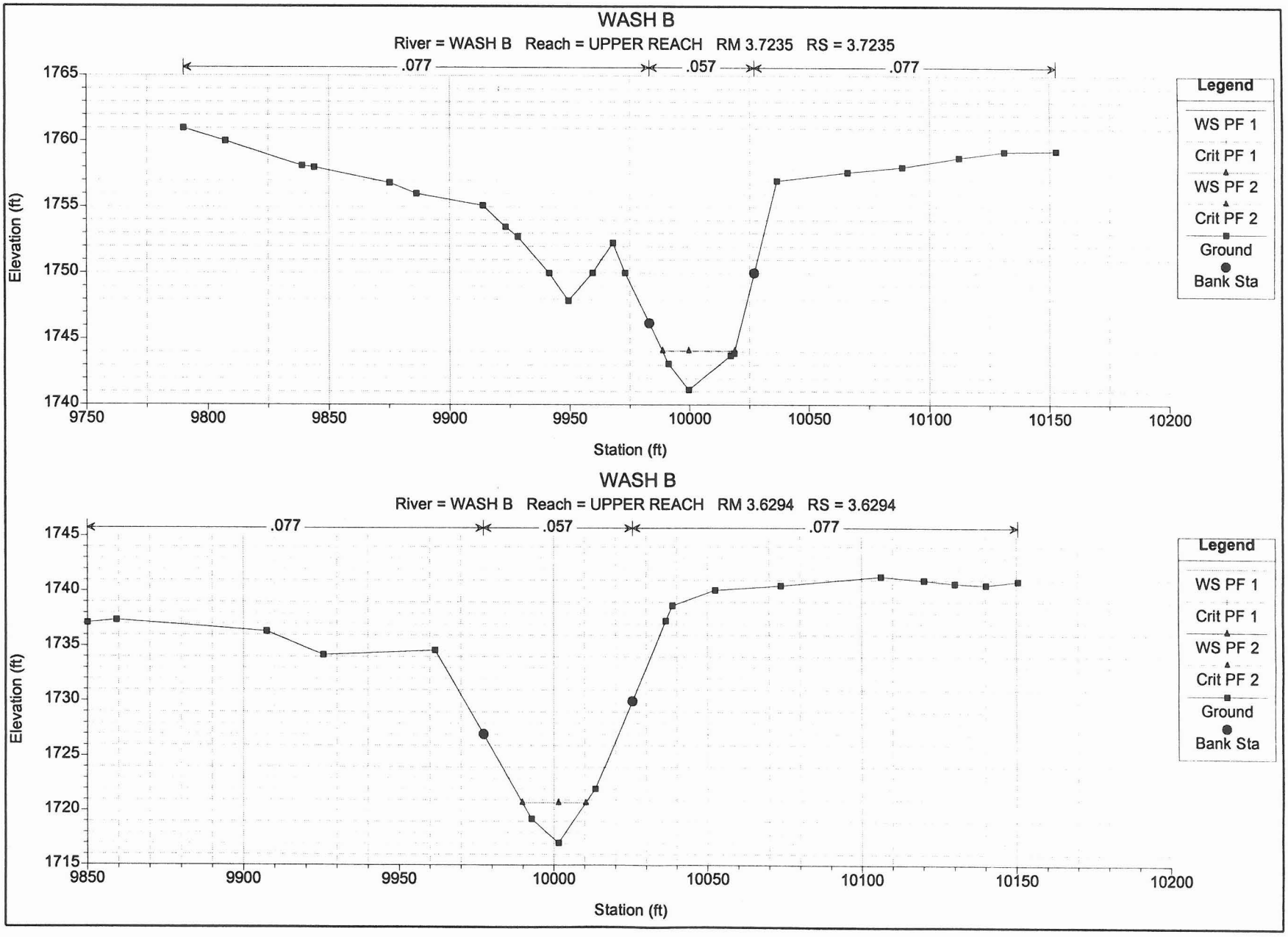

WASH B
River = WASH B Reach = UPPER REACH RM 3.1483 RS = 3.1483
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
1650
1648
1646
1644
1642
1640
1638
1636
1634
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
WASH B
River = WASH B Reach = UPPER REACH RM 3.0634 RS = 3.0634
.08
.058
.078
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
1634
1632
1630
1628
1626
1624
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)

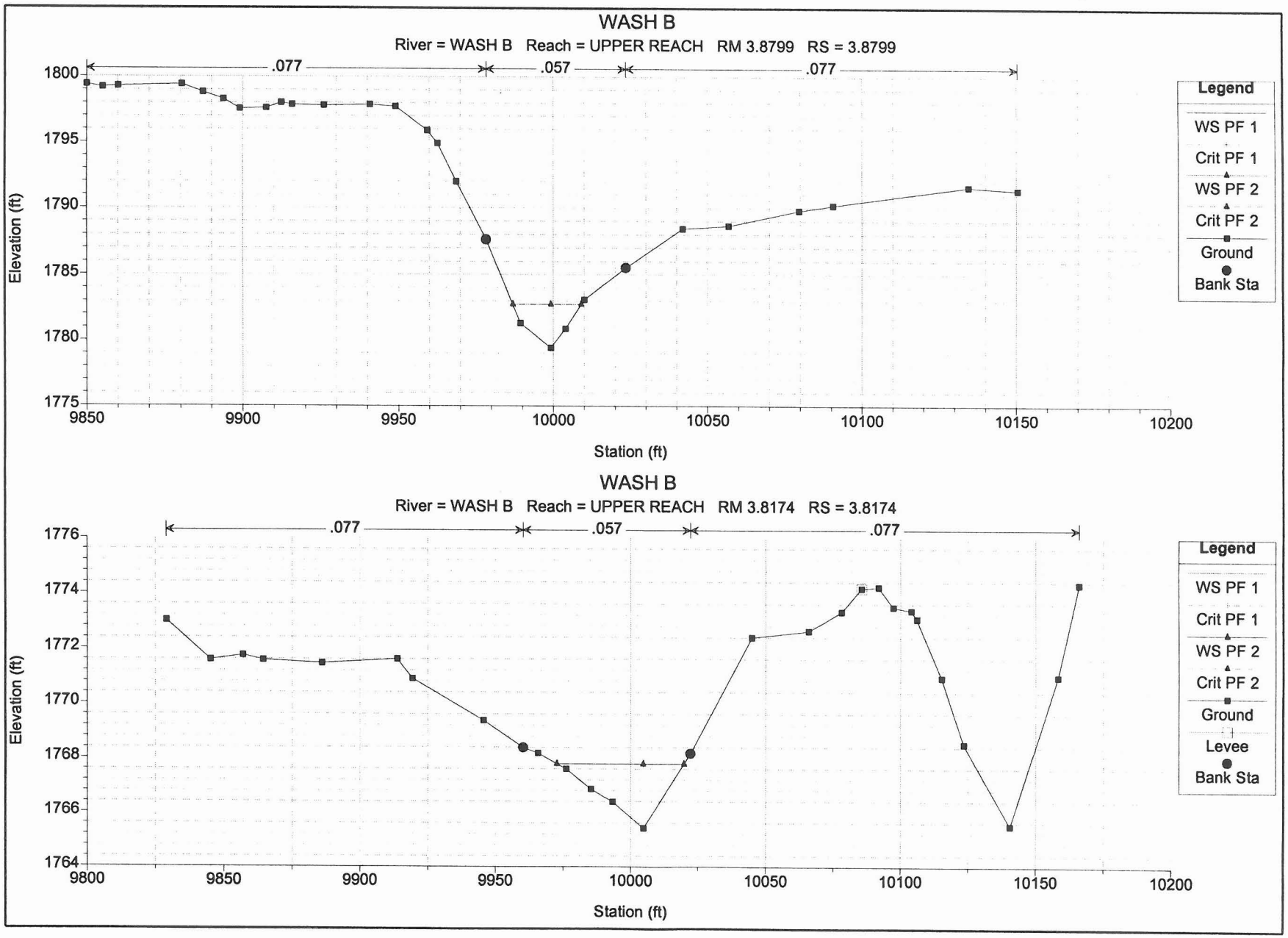

WASH B
River = WASH B Reach = UPPER REACH Via Linda; 1-12' x 10' CBC RS = 3.2036
.077
.057
.077
Elevation (ft)
1658
1656
1654
1652
1650
1648
1646
1644
1642
9920
9940
9960
9980
10000
10020
10040
10060
10080
10100
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = UPPER REACH Via Linda; 1-12' x 10' CBC RS = 3.2036
.08
.058
.078
Elevation (ft)
1650
1648
1646
1644
1642
1640
1638
1636
1634
9800
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
Crit PF 1
Crit PF 2
WS PF 2
WS PF 1
Ground
Bank Sta

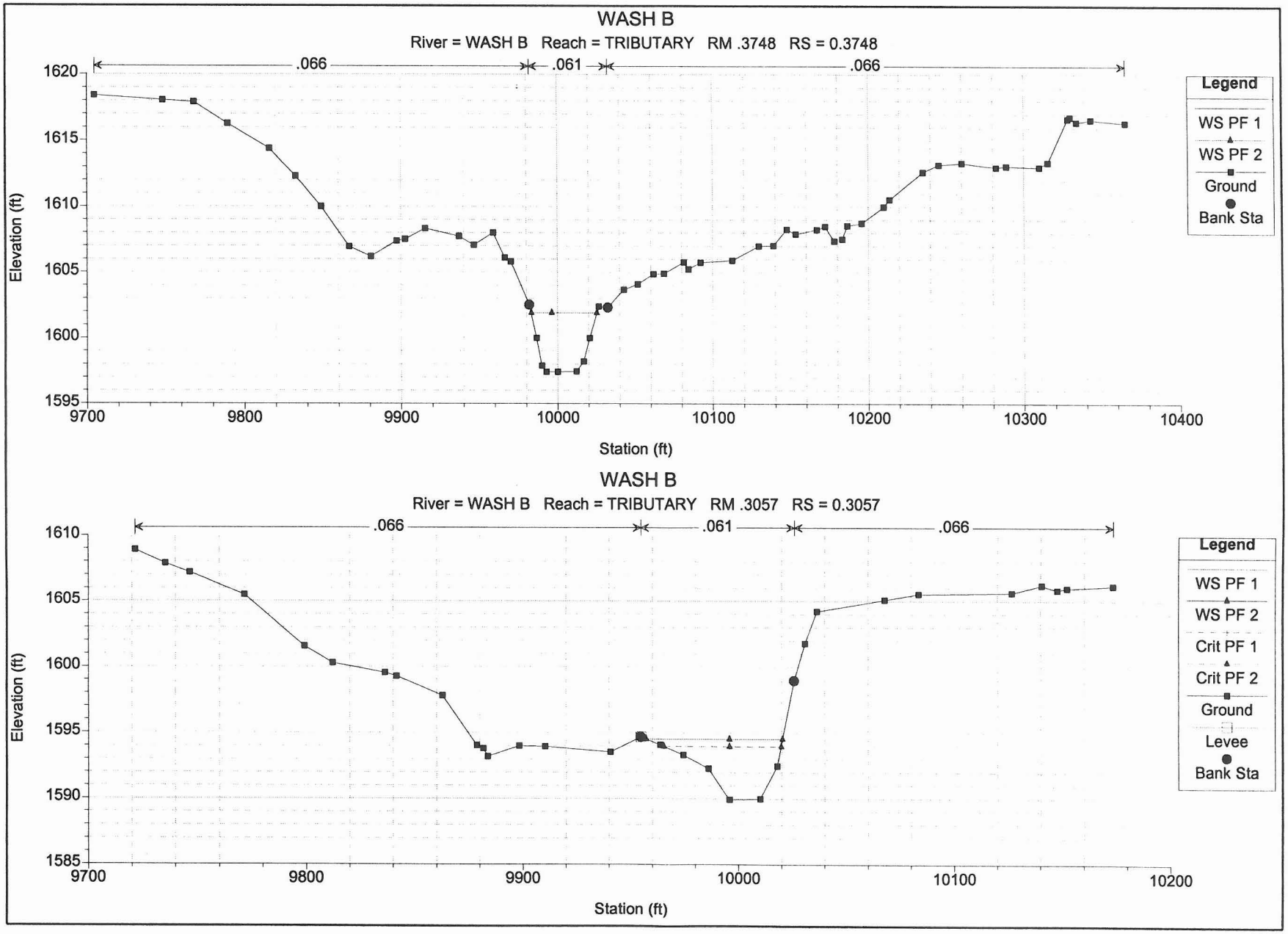

WASH B
River = WASH B Reach = UPPER REACH RM 3.2524 RS = 3.2524
.077
.057
.077
Elevation (ft)
1670
1665
1660
1655
1650
1645
9850
9900
9950
10000
10050
10100
10150
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = UPPER REACH RM 3.2038 RS = 3.2038
.077
.057
.077
Elevation (ft)
1658
1656
1654
1652
1650
1648
1646
1644
1642
9920
9940
9960
9980
10000
10020
10040
10060
10080
10100
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta

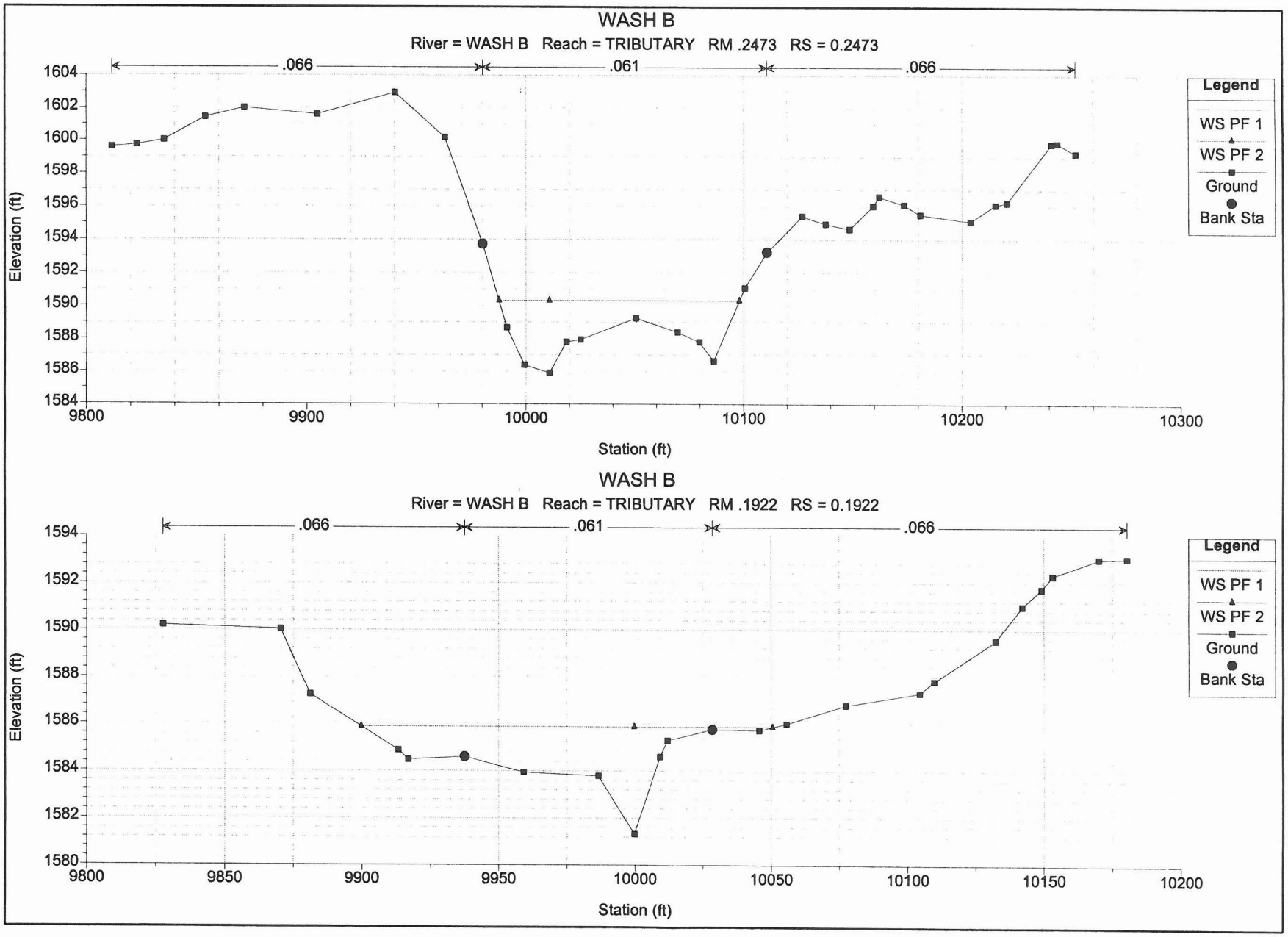

WASH B
River = WASH B Reach = UPPER REACH RM 3.4405 RS = 3.4405
.077
.057
.077
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1705
1700
1695
1690
1685
1680
9800
9850
9900
9950
10000
10050
10100
10150
10200
WASH B
River = WASH B Reach = UPPER REACH RM 3.3466 RS = 3.3466
.077
.057
.077
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
Elevation (ft)
Station (ft)
1690
1685
1680
1675
1670
1665
1660
9800
9850
9900
9950
10000
10050
10100
10150
10200

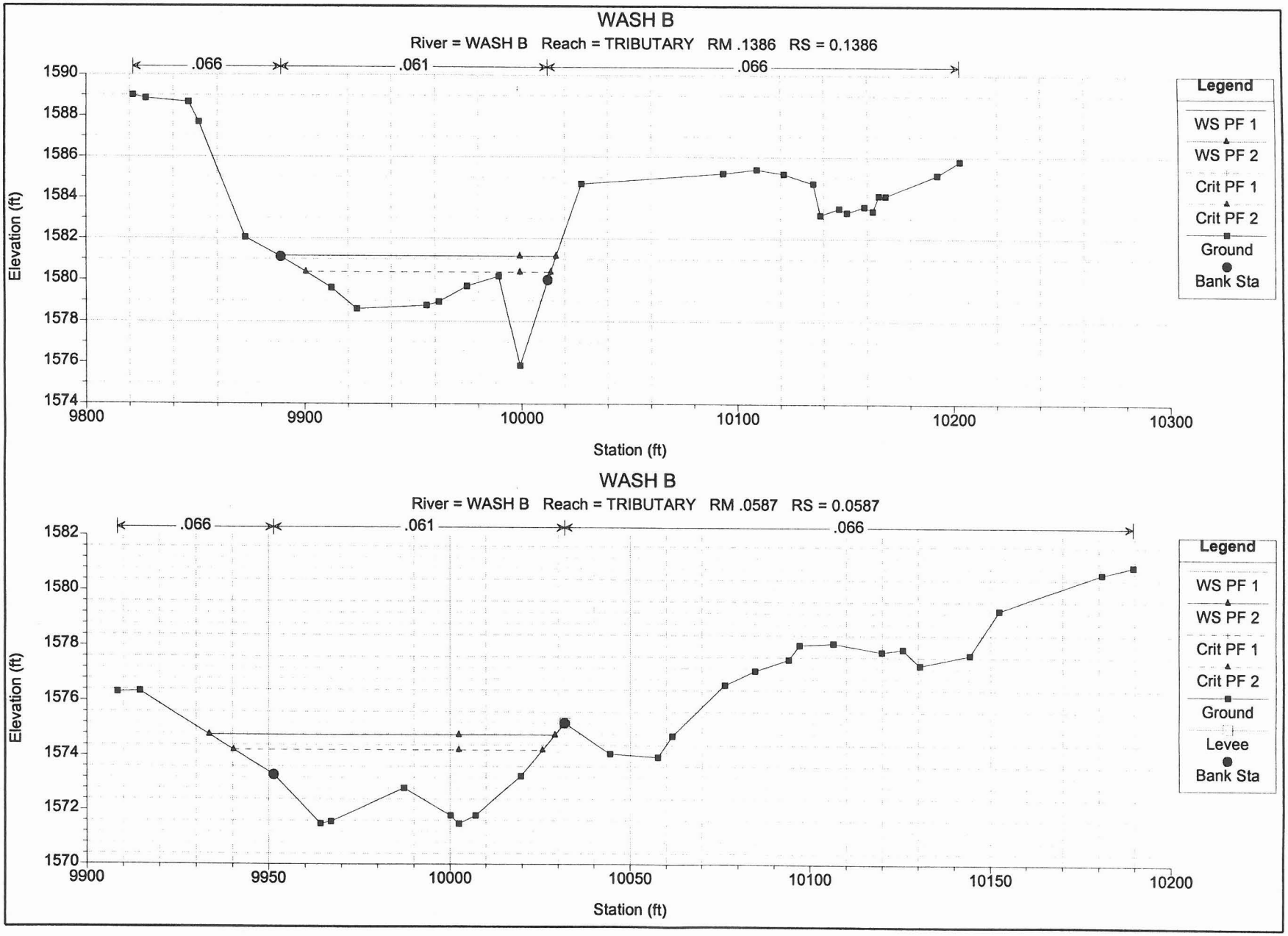

WASH B
River = WASH B Reach = UPPER REACH RM 3.5932 RS = 3.5932
.077
.057
.077
Elevation (ft)
1735
1730
1725
1720
1715
1710
1705
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = UPPER REACH RM 3.5347 RS = 3.5347
.077
.057
.077
Elevation (ft)
1725
1720
1715
1710
1705
1700
1695
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta


WASH B
River = WASH B Reach = UPPER REACH RM 3.7235 RS = 3.7235
.077
.057
.077
Elevation (ft)
1765
1760
1755
1750
1745
1740
9750
9800
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = UPPER REACH RM 3.6294 RS = 3.6294
.077
.057
.077
Elevation (ft)
1745
1740
1735
1730
1725
1720
1715
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta


WASH B
River = WASH B Reach = UPPER REACH RM 3.8799 RS = 3.8799
.077
.057
.077
Elevation (ft)
1800
1795
1790
1785
1780
1775
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = UPPER REACH RM 3.8174 RS = 3.8174
.077
.057
.077
Elevation (ft)
1776
1774
1772
1770
1768
1766
1764
9800
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
Crit PF 1
WS PF 2
Crit PF 2
Ground
Levee
Bank Sta

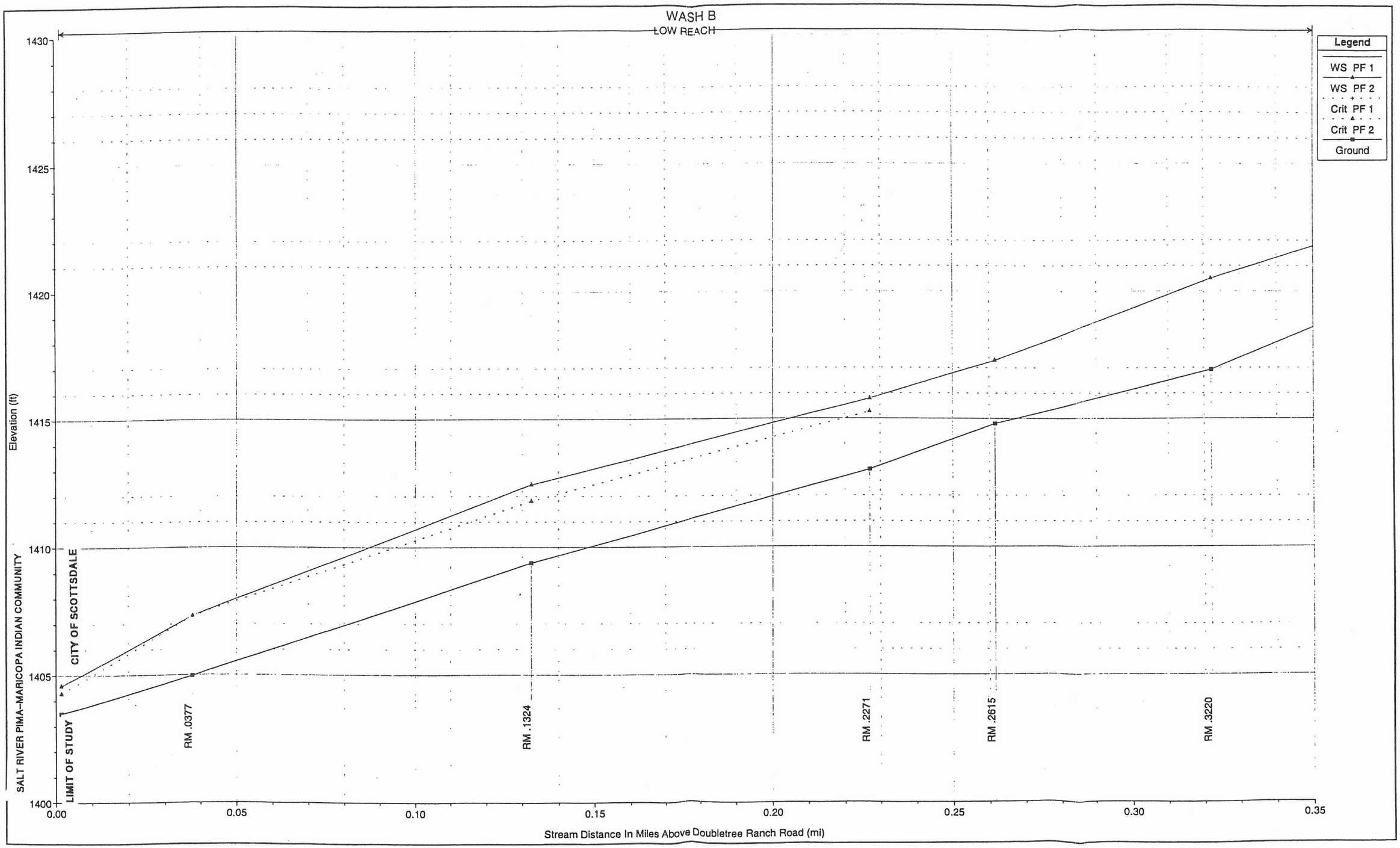

WASH B
River = WASH B Reach = TRIBUTARY RM .3748 RS = 0.3748
.066
.061
.066
1620
1615
1610
1605
1600
1595
Elevation (ft)
9700
9800
9900
10000
10100
10200
10300
10400
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = TRIBUTARY RM .3057 RS = 0.3057
.066
.061
.066
1610
1605
1600
1595
1590
1585
Elevation (ft)
9700
9800
9900
10000
10100
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta


WASH B
River = WASH B Reach = TRIBUTARY RM .2473 RS = 0.2473
.066
.061
.066
Elevation (ft)
1604
1602
1600
1598
1596
1594
1592
1590
1588
1586
1584
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = TRIBUTARY RM .1922 RS = 0.1922
.066
.061
.066
Elevation (ft)
1594
1592
1590
1588
1586
1584
1582
1580
9800
9850
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Ground
Bank Sta


WASH B
River = WASH B Reach = TRIBUTARY RM .1386 RS = 0.1386
.066
.061
.066
1590
1588
1586
1584
1582
1580
1578
1576
1574
Elevation (ft)
9800
9900
10000
10100
10200
10300
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Bank Sta
WASH B
River = WASH B Reach = TRIBUTARY RM .0587 RS = 0.0587
.066
.061
.066
1582
1580
1578
1576
1574
1572
1570
Elevation (ft)
9900
9950
10000
10050
10100
10150
10200
Station (ft)
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Levee
Bank Sta

APPENDIX B

Flood Profiles


WASH B
LOW REACH
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Elevation (ft)
1430
1425
1420
1415
1410
1405
1400
SALT RIVER PIMA–MARICOPA INDIAN COMMUNITY
CITY OF SCOTTSDALE
LIMIT OF STUDY
RM .0377
RM .1324
RM .2271
RM .2615
RM .3220
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
Stream Distance In Miles Above Doubletree Ranch Road (mi)

WASH B
LOW REACH

Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground

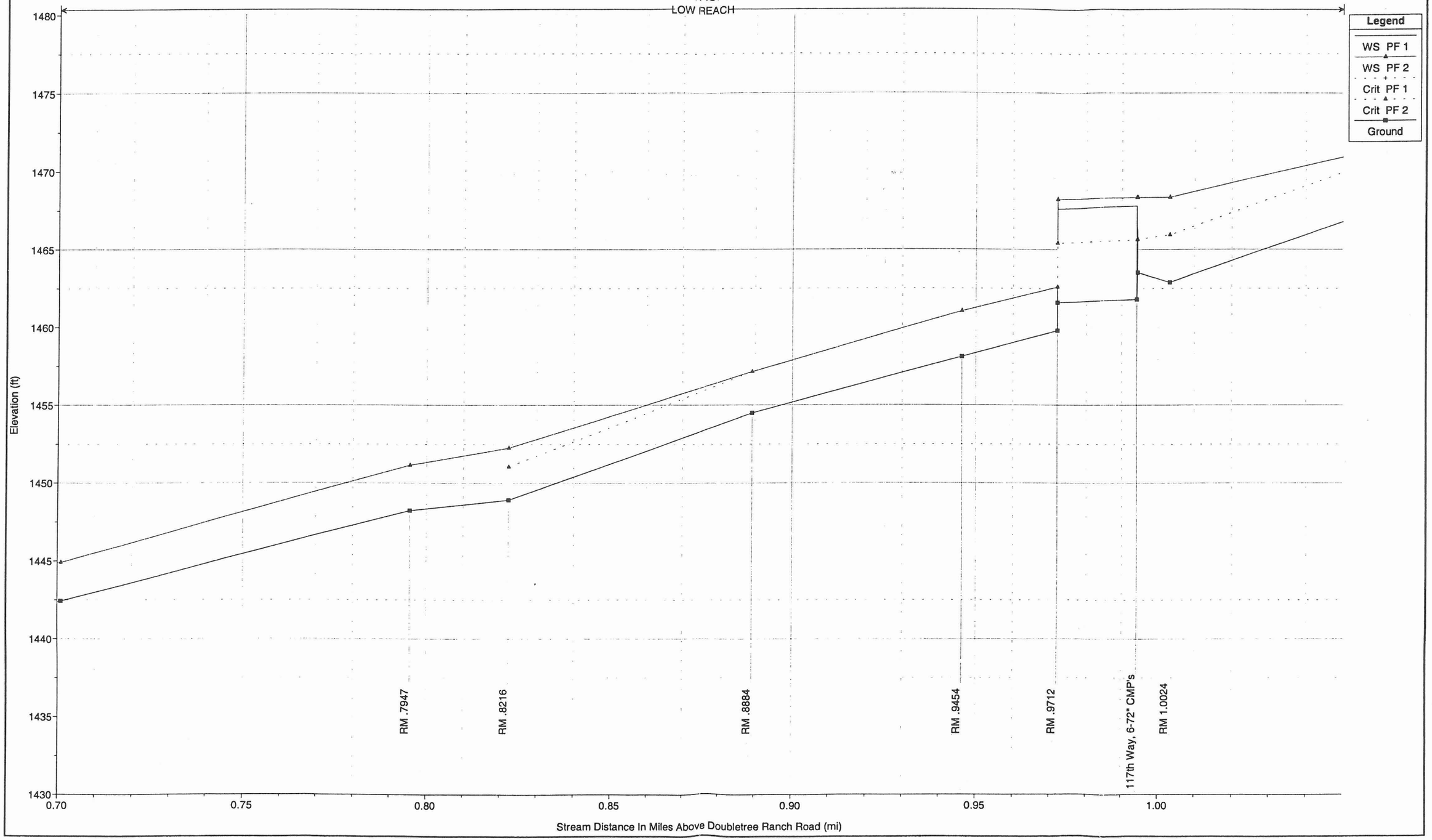
Elevation (ft)
1460
1455
1450
1445
1440
1435
1430
1425
1420
1415
1410

RM .3735
RM .4167
RM .4640
RM .5114
RM .5559
RM .5964
Mountain View Rd. Bridge
RM .6384

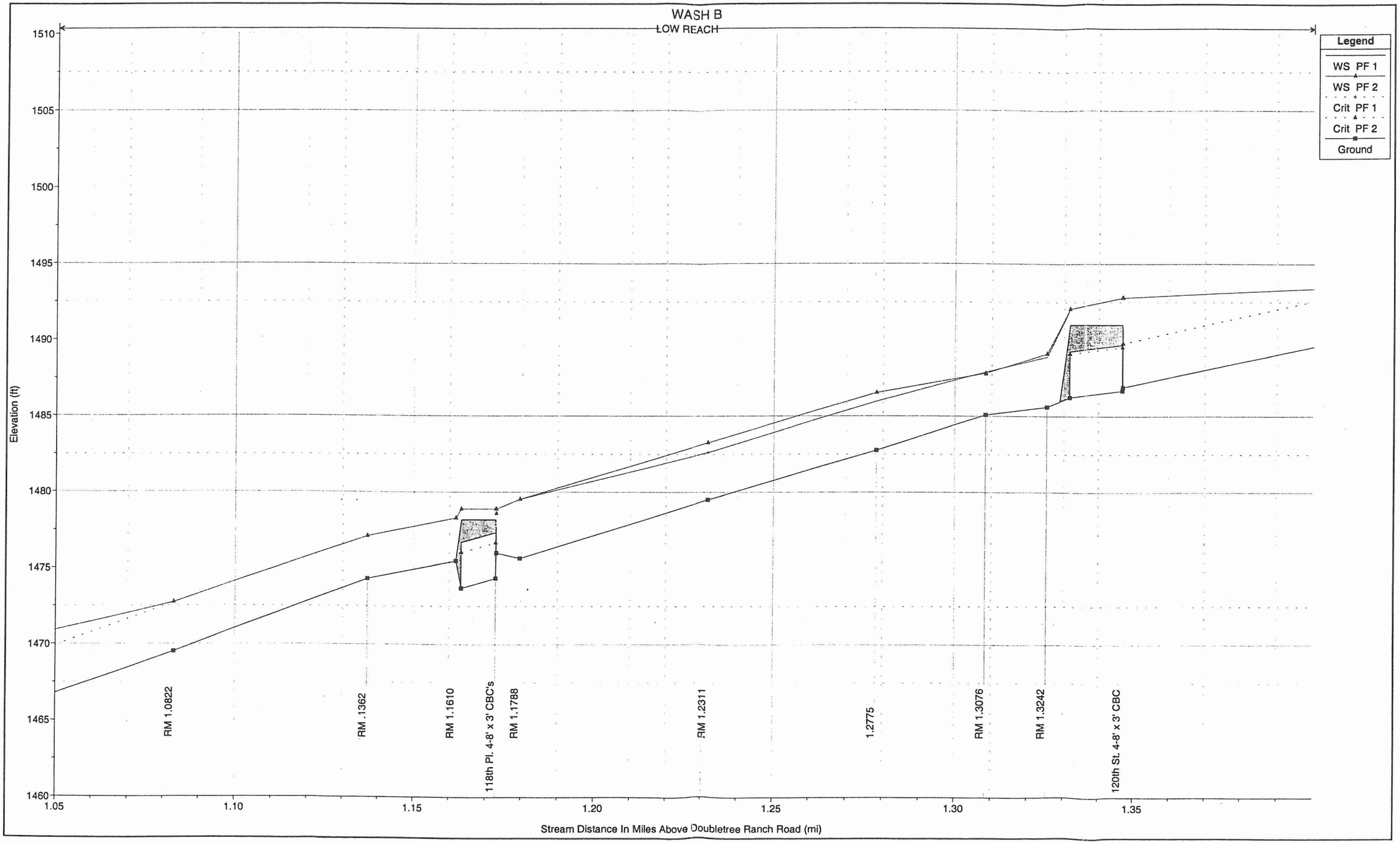
0.35
0.40
0.45
0.50
0.55
0.60
0.65

Stream Distance In Miles Above Doubletree Ranch Road (mi)

WASH B
LOW REACH



WASH B
LOW REACH



WASH B
LOW REACH

Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground

Elevation (ft)

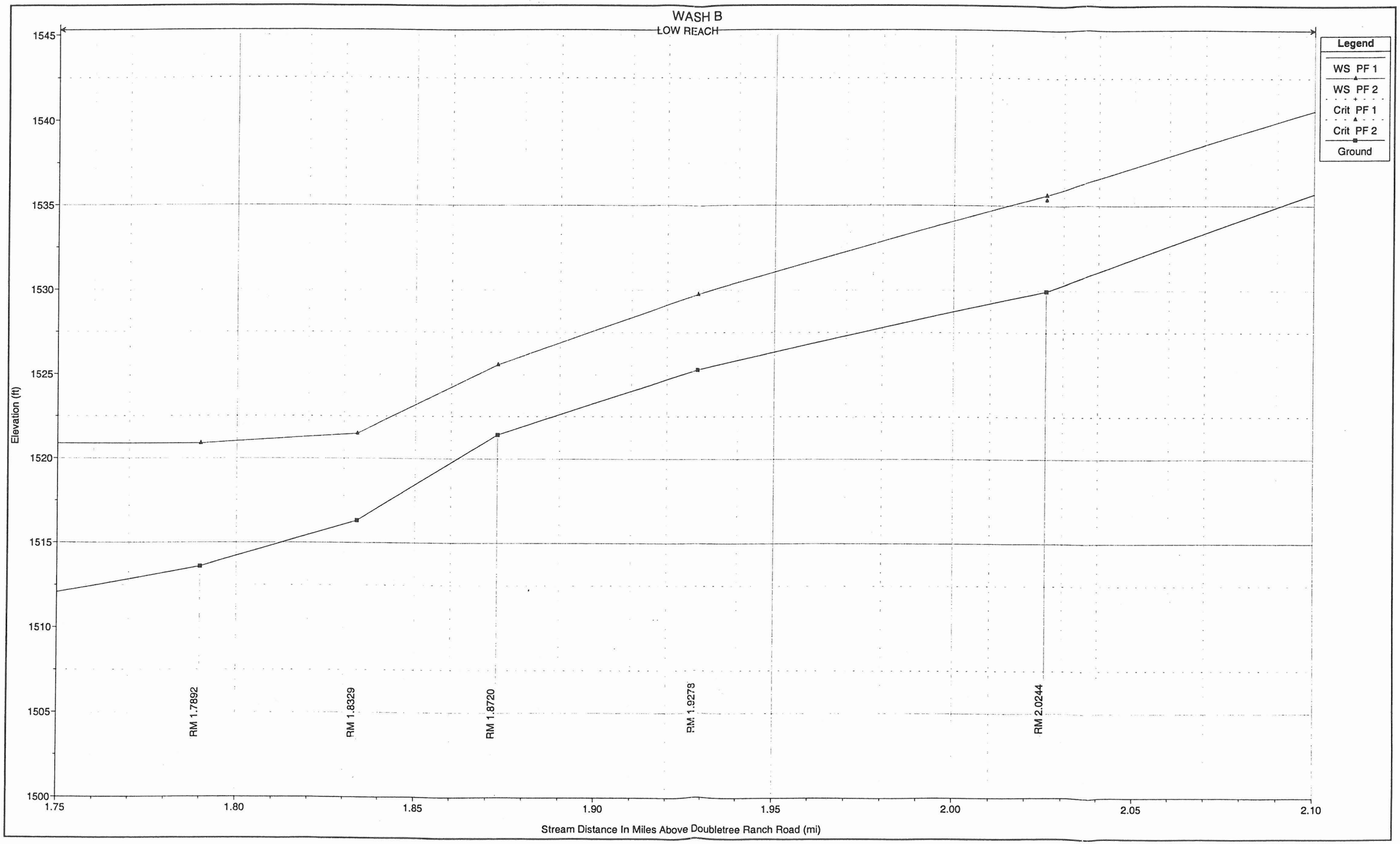
1525
1520
1515
1510
1505
1500
1495
1490
1485

1.40
1.45
1.50
1.55
1.60
1.65
1.70

Stream Distance In Miles Above Doubletree Ranch Road (mi)

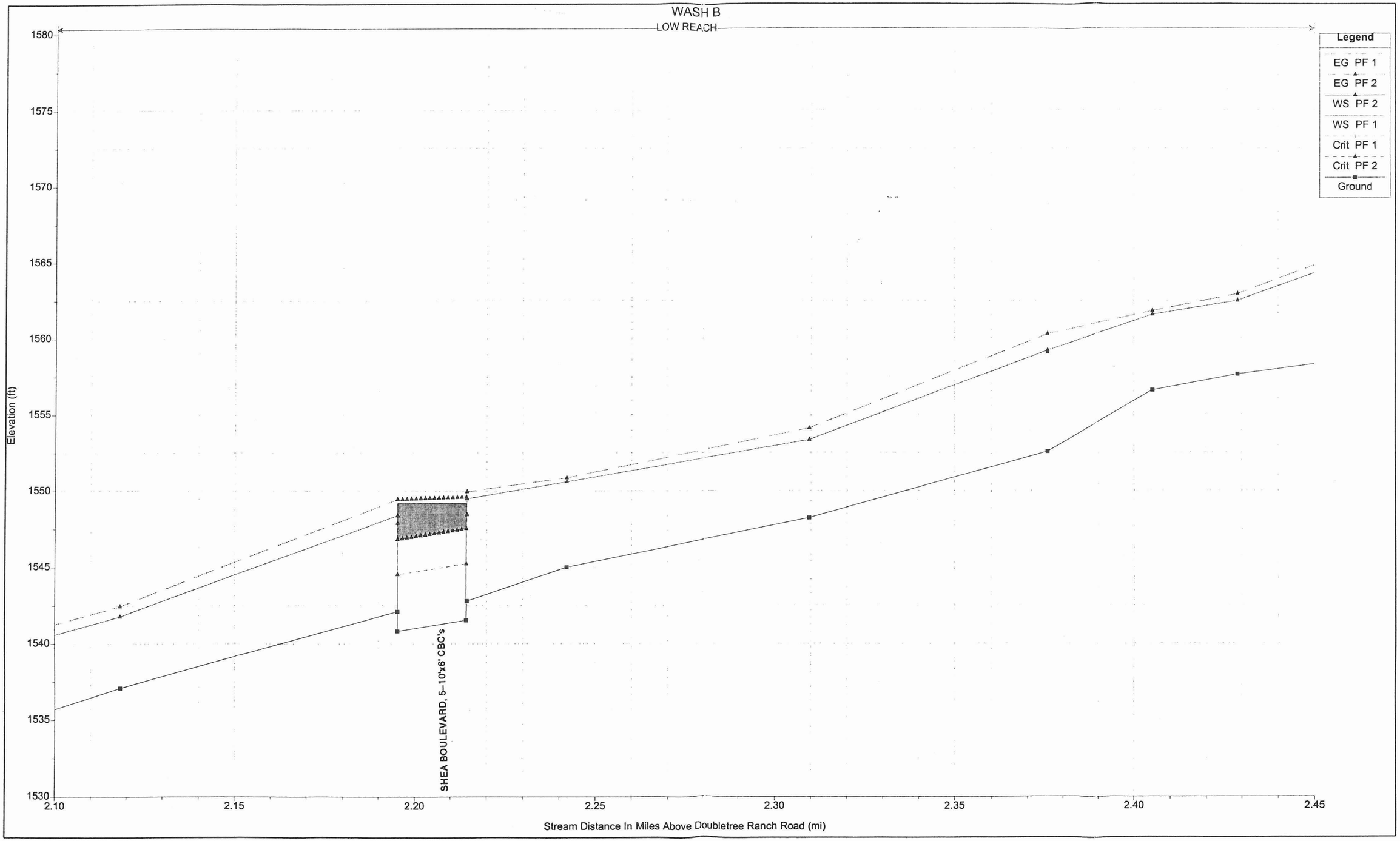
RM 1.4792
RM 1.5096
RM 1.5401
RM 1.5651
RM 1.5767
C.A.P. Crossing; 3-72" Steel Pipes
RM 1.6445
(RM 1.7383)

SEE ATTACHED FOR CROSS SECTION OF C.A.P.
REFER TO APPENDIX SECTION IX, OF HYDROLOGY REPORT (SECTION 4 OF TDN)
FOR C.A.P. CAPACITY CALCULATIONS


WASH B
LOW REACH
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Elevation (ft)
1545
1540
1535
1530
1525
1520
1515
1510
1505
1500
RM 1.7892
RM 1.8329
RM 1.8720
RM 1.9278
RM 2.0244
1.75
1.80
1.85
1.90
1.95
2.00
2.05
2.10
Stream Distance In Miles Above Doubletree Ranch Road (mi)

WASH B

LOW REACH



WASH B

LOW REACH

Legend

WS PF 1

WS PF 2

Crit PF 1

Crit PF 2

Ground

Elevation (ft)

1600
1595
1590
1585
1580
1575
1570
1565
1560
1555
1550

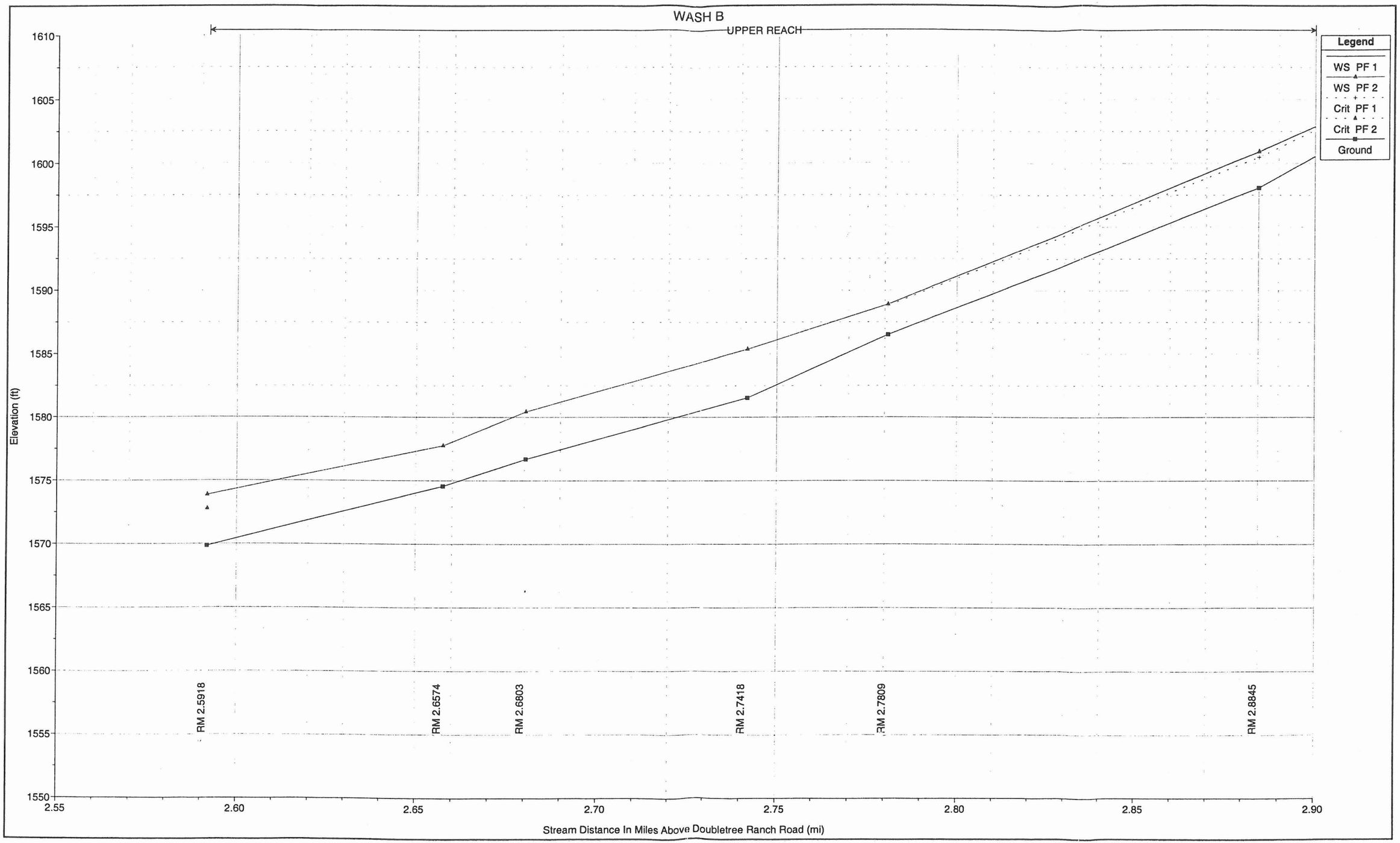
CONFLUENCE WITH TRIBUTARY

RM 2.4973

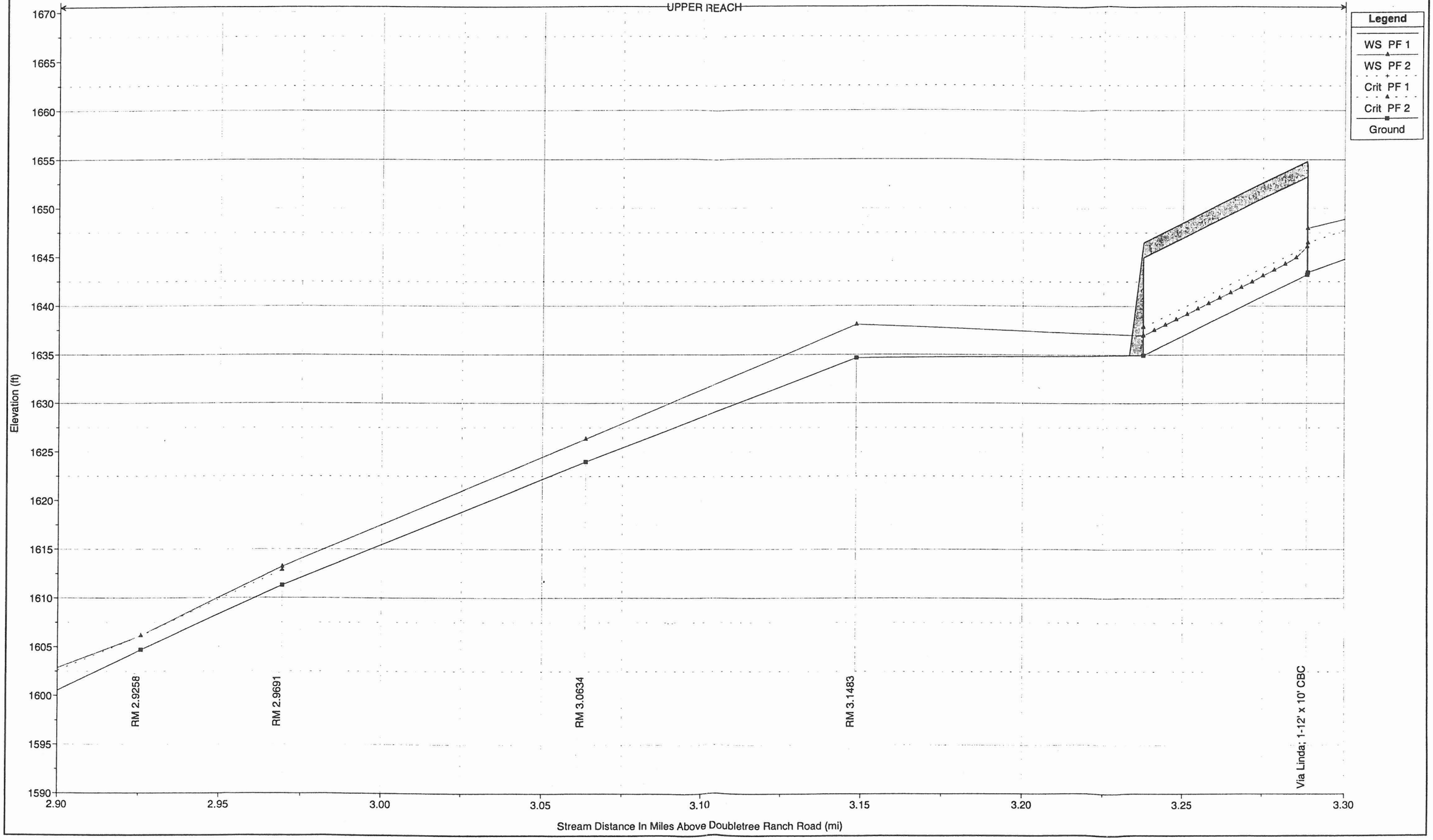
RM 2.5294

2.45
2.50
2.55
2.60
2.65
2.70
2.75
2.80

Stream Distance In Miles Above Doubletree Ranch Road (mi)


WASH B
UPPER REACH
Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground
Elevation (ft)
1610
1605
1600
1595
1590
1585
1580
1575
1570
1565
1560
1555
1550
RM 2.5918
RM 2.6574
RM 2.6803
RM 2.7418
RM 2.7809
RM 2.8845
2.55
2.60
2.65
2.70
2.75
2.80
2.85
2.90
Stream Distance In Miles Above Doubletree Ranch Road (mi)

WASH B
UPPER REACH



WASH B
UPPER REACH

Legend
WS PF 1
WS PF 2
Crit PF 1
Crit PF 2
Ground

Elevation (ft)
1720
1715
1710
1705
1700
1695
1690
1685
1680
1675
1670
1665
1660
1655
1650
1645
1640
1635
1630
1625
1620

RM 3.2524
RM 3.3466
RM 3.4405
RM 3.5347

3.30
3.35
3.40
3.45
3.50
3.55
3.60
3.65

Stream Distance In Miles Above Doubletree Ranch Road (mi)

WASH B

UPPER REACH

LIMIT OF STUDY

Legend

- WS PF 1
- WS PF 2
- Crit PF 1
- Crit PF 2
- Ground

RM 3.5932

RM 3.6294

RM 3.7235

RM 3.8174

RM 3.8799

Elevation (ft)

1785
1780
1775
1770
1765
1760
1755
1750
1745
1740
1735
1730
1725
1720
1715
1710
1705
1700
1695
1690
1685

3.65
3.70
3.75
3.80
3.85
3.90
3.95
4.00

Stream Distance In Miles Above Doubletree Ranch Road (mi)

WASH B

TRIBUTARY

LIMIT OF STUDY

CONFLUENCE WITH WASH 'B'

Legend

- WS PF 1
- WS PF 2
- Crit PF 1
- Crit PF 2
- Ground
- LOB
- ROB

Elevation (ft)

1605
1600
1595
1590
1585
1580
1575
1570

0.1386
0.1922
0.2473
0.3057
0.3748

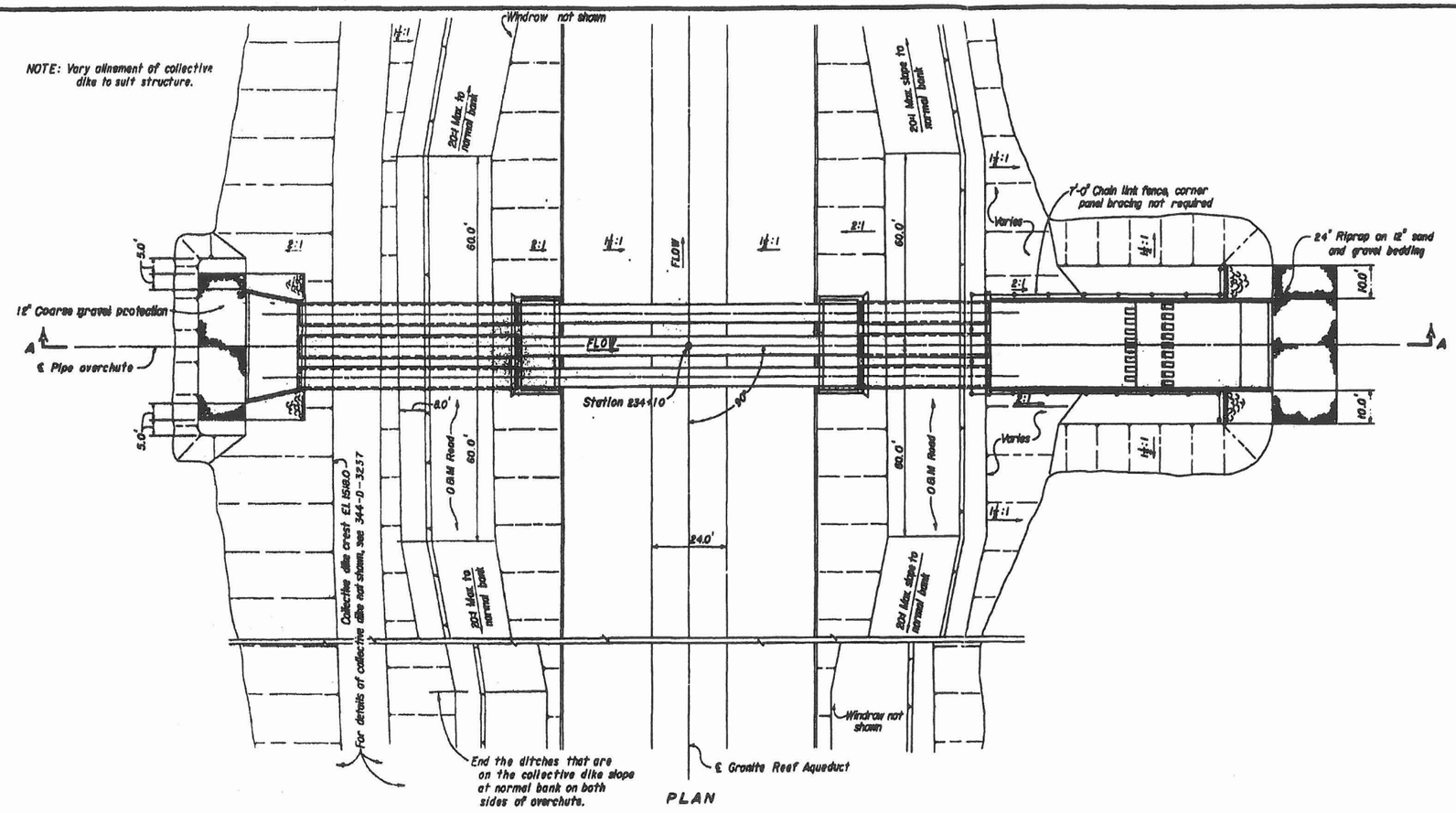
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35

Stream Distance In Miles Above Doubletree Ranch Road (mi)

C.A.P. CROSSING

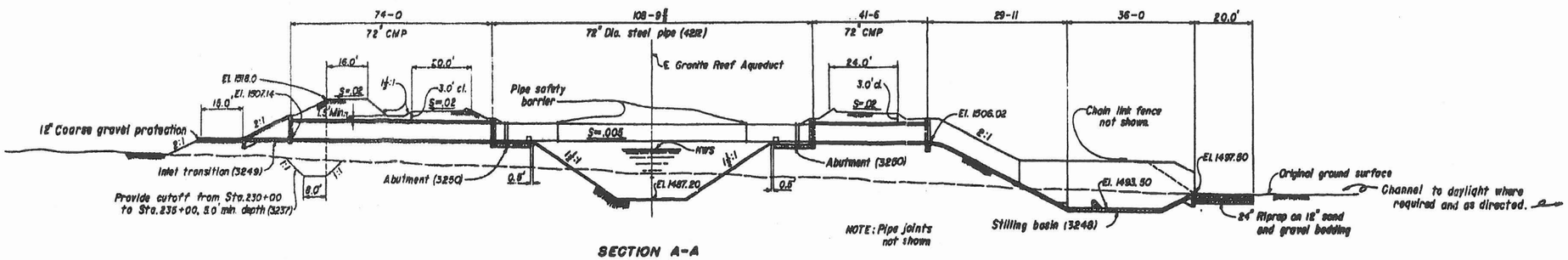
Cross-Section

NOTE: Vary alinement of collective dike to suit structure.



PLAN

SCALE OF FEET



NOTE: Pipe joints not shown

SECTION A-A

NOTES

For general notes, see 344-D-3241.
For chain link fencing details, see 40-D-6269. EXCEPT barbed wire supporting arms shall be oriented vertically.
For pipe safety barrier details, see 344-D-4221.
For typical aqueduct section details not shown, see 344-D-3237.

7-15-82 | AS BUILT BY SSD, LTR. 6-6-82.

WORK THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CENTRAL ARIZONA PROJECT
GRANITE REEF DIVISION - ARIZONA

GRANITE REEF AQUEDUCT

REACH 12
Sta. 234+10

72" DIA. THREE BARREL PIPE OVERCHUTE PLAN AND SECTION

DESIGNED J.F. Hinds | TRACED J.F. Hinds
DRAWN J.R. Wood | SUBMITTED 20 Oct 82
APPROVED Bill Jackson | APPROVED Dale D. Gant
CHIEF, DESIGN BRANCH | CHIEF, WATER CONSTRUCTION DIVISION

DENVER, COLORADO | MARCH 29, 1979 | 344-D-3248

APPENDIX C

Local Ponding Behind CAP Canal (Zone A LOMR)

CITY OF SCOTTSDALE

• "Most Livable City" U.S. Conference of Mayors •

October 9, 2000

Federal Emergency Management Agency
Mitigation Directorate
Hazard Identification Branch
500 C Street, SW
Washington, DC 20472

Dear Sir or Madam:

We are submitting the enclosed request and supporting documentation for a Map Revision of the Wash "B" A Zone on the upstream side of the Central Arizona Project (CAP) Canal. CVL Consultants, Inc. has completed the enclosed re-study at the request of the city, while under contract to the Flood Control District of Maricopa County.

The existing A Zone mapping on panels 1710 and 1705 completed sometime prior to 1988 was apparently based on preliminary plans for the canal. The proposed revision is based on more detailed 1993 city topographic mapping and 1993 and 1999 aerial photos that reveal the correct as-built location of the canal. The actual location is considerably different from the location shown on the existing FIRMs, which show ponding water on the downstream side of the canal.

The City of Scottsdale has reviewed and approved of the proposed revision and requests that it be approved as soon as possible. If you have any questions regarding this information, please call Collis Lovely, city Public Works Planner. at 602-312-7852. Thanks in advance for your cooperation on this matter.

Sincerely,

Bill Erickson
Acting Floodplain Administrator
Floodplain and Stormwater Management

Enclosures

c: Collis Lovely, City Of Scottsdale
David Boggs, Flood Control District of Maricopa County
Burke Lokey, P.E., CVL

CITY OF SCOTTSDALE • TRANSPORTATION SYSTEMS DEPARTMENT • 7447 E. INDIAN SCHOOL RD., SUITE 205 • SCOTTSDALE, ARIZONA • 85251
PHONE (480) 312-7696 • FAX (480) 312-4000

COE & VAN LOO CONSULTANTS, INC.
Land Planning • Civil Engineering • Water Resources Engineering • Environmental Sciences • Landscape Architecture • Surveying • Construction Management

Founded in 1958 by
P.E. Coe, P.E. (1915-1977)
H.W. Van Loo, P.E.

October 2, 2000

Mr. Collis Lovely
City of Scottsdale Engineering Department
3939 Civic Center Boulevard
Scottsdale, AZ 85251

Re: Wash B-Upstream of CAP-Zone A F.D.S.
City of Scottsdale LOMR
CVL Project No: 99-7002-01

Dear Mr. Lovely:

This is a request for a Letter of Map Revision (LOMR) to the Flood Insurance Rate Map (FIRM), for the City of Scottsdale, Arizona. Pertinent information about this request is listed below:

Community Affected:	Scottsdale, Arizona
Flooding Source:	McDowell Mountains, North and East of Wash B
FIRM Panels Affected:	04013C1705E (September 30, 1995) and 04013C1710D (April 15, 1988)

The existing condition is a ponded Zone A caused by an elevated top of bank of the Central Arizona Project (CAP), also known as the Granite Reef Aqueduct. The top of bank intercepts the flows from the east, concentrates it and directs the flows to the various culverts located along the CAP. The flows are directed to the outlets via drainage ditches along the toe of the eastern bank of the CAP.

The new Zone A boundary has been delineated based on new topography. The new topography includes the as-built elevations for the CAP alignment, as well as existing elevations for the containment berm just south of the three 72-inch metal overchute pipes crossing the CAP.

It is believed that the existing Zone A area was plotted with the proposed alignment for the CAP, which does not match the actual existing as-built alignment. The Zone A ponding area must be revised to reflect the true alignment of the CAP and the existing topography. The proposed Zone A area is significantly different from the current Zone A area, particularly along 124th St. between Shea Boulevard and Mountain View Road. Also, it should be noted that the Zone A area does not extend west of the eastern bank of the CAP. The revised Zone A boundary does not encompass any new structures and removes several structures from the flood plain, therefore, eliminating the need for flood insurance for the residents in the current Zone A flood plain.

N:\LLC\997002\Admin\02-001L.wp8

4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014-4291 (602) 264-6831 FAX (602) 264-0928

Transportation Department

7447 E. Indian School Road, Suite 205
Scottsdale, Arizona 85251
Phone: (480) 312-7696 • FAX: (480) 312-4000

FAX COVER SHEET

FAX #: 602-506-4601	**From:** Collis Lovely, Drainage Planner
Name: David Boggs	**Date:** January 11, 2001
Company: FCDMC	**Project:** Wash "B" FDS

Total Number of Pages: 3 ☐ Originals Being Sent via: _____

REMARKS:

☒ Urgent	☐ For your information	☐ Please comment	☐ Reply ASAP

Per your request is a copy of the letter from FEMA. Case No. 01-09-074P.
I am not sure what it is you are reviewing. I have not anything from CVL recently.

If you are experiencing any difficulties in receiving this facsimile, please call (480) 312-7696.

Collis

Federal Emergency Management Agency

Washington, D.C. 20472

TRANSPORTATION DEPT.
DEC 0 5 2000

November 30, 2000

Mr. Bill Erickson
Acting Floodplain Administrator
Floodplain and Stormwater Management
City of Scottsdale
7447 East Indian School Road, Suite 205
Scottsdale, AZ 85251

IN REPLY REFER TO:
Case No.: 01-09-074P
Community: City of Scottsdale, AZ
Community No.: 045012

316-ACK.FEX

Dear Mr. Erickson:

This responds to your request dated October 9, 2000, that the 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:	Wash "B" Upstream of CAP – Zone A FDS
Flooding Source:	Ponding Areas North and East of Wash "B"
FIRM Panel(s) Affected:	04013C1705 E and 1710 D

As you may know, FEMA has implemented a procedure to recover costs associated with reviewing and processing requests for modifications to published flood information and maps. However, because your request corrects a mapping or study analysis error, and 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.

We have completed an inventory of the items you submitted. We have received the required data to begin a detailed technical review of your request. If additional data are required, we will inform you within 60 days of the date of this letter.

Please direct all technical questions concerning your request to our Map Coordination Contractor at the following address:

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, VA 22304-6425

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

If you have any questions concerning your request, FEMA policy, or the National Flood Insurance Program in general, please call the Revisions Coordinator for your State, Pernille Buch-Pedersen, who may be reached, toll free, at 1-877-FEMA MAP (1-877-336-2627).

Sincerely,

Max H. Yuan, P.E., Project Engineer
Hazards Study Branch
Mitigation Directorate

cc: Mr. Burke Lokey, P.E.
Director, Water Resources
Coe & Van Loo Consultants, Inc.

APPENDIX D

HY8 Output

CURRENT DATE: 12-28-2000
CURRENT TIME: 13:20:11

FILE DATE: 12-27-2000
FILE NAME: VIALINDA (1915)

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1643.20	1634.95	268.13	1 RCB	12.00	10.00	.013	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: VIALINDA DATE: 12-27-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1643.20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1644.35	33.3	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1644.84	66.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1645.36	99.9	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
.82	133.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1646.23	166.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1646.61	199.8	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1646.99	233.1	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1647.34	266.4	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1647.68	299.7	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1648.00	333.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: VIALINDA DATE: 12-27-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1643.20	0.000	0.00	0.00	0.00
1644.35	0.000	33.30	0.00	0.00
1644.84	0.000	66.60	0.00	0.00
1645.36	0.000	99.90	0.00	0.00
1645.82	0.000	133.20	0.00	0.00
1646.23	0.000	166.50	0.00	0.00
1646.61	0.000	199.80	0.00	0.00
1646.99	0.000	233.10	0.00	0.00
1647.34	0.000	266.40	0.00	0.00
1647.68	0.000	299.70	0.00	0.00
1648.00	0.000	333.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

PERFORMANCE CURVE FOR CULVERT 1 - 1(12.00 (ft) BY 10.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1643.20	0.00	-8.25	0-NF	0.00	0.00	0.00	-0.30	0.00	0.00
33.30	1644.35	1.15	-2.94	1-S2n	0.15	0.62	0.22	0.74	12.50	3.39
66.60	1644.84	1.64	-2.75	1-S2n	0.31	0.99	0.39	1.10	14.33	4.30
99.90	1645.36	2.16	-2.58	1-S2n	0.46	1.29	0.49	1.39	16.86	4.93
133.20	1645.82	2.62	-2.43	1-S2n	0.61	1.57	0.67	1.64	16.63	5.40
166.50	1646.23	3.03	-2.29	1-S2n	0.76	1.82	0.85	1.87	16.23	5.74
199.80	1646.61	3.41	-2.14	1-S2n	0.92	2.05	0.85	2.08	19.50	6.03
233.10	1646.99	3.79	-2.00	1-S2n	1.04	2.28	0.98	2.28	19.90	6.28
266.40	1647.34	4.14	-1.86	1-S2n	1.12	2.49	1.17	2.45	19.00	6.51
299.70	1647.68	4.48	-1.73	1-S2n	1.20	2.69	1.27	2.62	19.64	6.72
333.00	1648.00	4.80	-1.59	1-S2n	1.28	2.89	1.38	2.76	20.15	6.90

El. inlet face invert 1643.20 ft El. outlet invert 1634.95 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	16915.00 ft
INLET ELEVATION	1643.20 ft
OUTLET STATION	16647.00 ft
OUTLET ELEVATION	1634.95 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0308
CULVERT LENGTH ALONG SLOPE	268.13 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	12.00 ft
BARREL RISE	10.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.013
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION

FILE NAME: VIALINDA
FILE DATE: 12-27-2000

MAIN CHANNEL ONLY

LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING n LEFT OVER BANK	0.000
MANNING n MAIN CHANNEL	0.058
MANNING n RIGHT OVER BANK	0.000
SLOPE OF CHANNEL	0.0308 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	9949.96	1646.17
2	9953.14	1645.70
3	9965.98	1644.04
4	9976.29	1641.11
5	9980.83	1639.65
6	9990.91	1636.55
7	9991.92	1635.30
8	10004.30	1634.65
9	10015.00	1639.44
10	10019.50	1641.27
11	10024.46	1643.35
12	10045.12	1647.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1634.65	0.000	-0.30	0.00	0.00
33.30	1635.69	0.728	0.74	3.39	1.26
66.60	1636.05	0.768	1.10	4.30	1.80
99.90	1636.34	0.791	1.39	4.93	2.20
133.20	1636.59	0.806	1.64	5.40	2.53
166.50	1636.82	0.819	1.87	5.74	2.77
199.80	1637.03	0.828	2.08	6.03	2.98
233.10	1637.22	0.837	2.28	6.28	3.17
266.40	1637.40	0.844	2.45	6.51	3.35
299.70	1637.57	0.851	2.62	6.72	3.51
333.00	1637.71	0.857	2.76	6.90	3.65

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	0.00 ft
CREST LENGTH	50.00 ft
OVERTOPPING CREST ELEVATION	1654.84 ft

CURRENT DATE: 12-28-2000
CURRENT TIME: 13:46:53

FILE DATE: 12-28-2000
FILE NAME: SHEA (11688)

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

C U L V NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1541.53	1540.83	101.00	5 RCB	10.00	6.00	.013	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: SHEA DATE: 12-28-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1542.11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1543.93	201.8	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1544.67	403.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1545.29	605.4	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
.75	807.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
546.23	1009.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1546.68	1210.8	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1547.13	1412.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1547.54	1614.4	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1547.89	1816.2	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1548.37	2018.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: SHEA DATE: 12-28-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1542.11	0.000	0.00	0.00	0.00
1543.93	0.000	201.80	0.00	0.00
1544.67	0.000	403.60	0.00	0.00
1545.29	0.000	605.40	0.00	0.00
1545.75	0.000	807.20	0.00	0.00
1546.23	0.000	1009.00	0.00	0.00
1546.68	0.000	1210.80	0.00	0.00
1547.13	0.000	1412.60	0.00	0.00
1547.54	0.000	1614.40	0.00	0.00
1547.89	0.000	1816.20	0.00	0.00
1548.37	0.000	2018.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

PERFORMANCE CURVE FOR CULVERT 1 - 5(10.00 (ft) BY 6.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1542.11	0.00	0.58	0-NF	0.00	0.00	0.00	1.28	0.00	0.00
201.80	1543.93	1.22	2.40	3-M1t	0.62	0.80	2.94	2.94	1.37	2.41
403.60	1544.67	1.93	3.14	3-M1t	0.95	1.27	3.58	3.58	2.25	3.06
605.40	1545.29	2.53	3.76	3-M1t	1.26	1.66	4.10	4.10	2.95	3.51
807.20	1545.75	3.07	4.22	3-M1t	1.51	2.01	4.54	4.54	3.56	3.86
1009.00	1546.23	3.58	4.70	3-M1t	1.77	2.33	4.91	4.91	4.11	4.17
1210.80	1546.68	4.05	5.15	3-M1t	2.00	2.64	5.25	5.25	4.61	4.46
1412.60	1547.13	4.49	5.60	3-M1t	2.22	2.92	5.56	5.56	5.08	4.72
1614.40	1547.54	4.91	6.01	5-M1t	2.44	3.19	5.86	5.86	5.51	4.95
1816.20	1547.89	5.32	6.36	4-FFt	2.64	3.45	6.00	6.13	6.05	5.16
2018.00	1548.37	5.74	6.84	4-FFt	2.85	3.71	6.00	6.40	6.73	5.36

El. inlet face invert 1541.53 ft El. outlet invert 1540.83 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	11688.00 ft
INLET ELEVATION	1541.53 ft
OUTLET STATION	11587.00 ft
OUTLET ELEVATION	1540.83 ft
NUMBER OF BARRELS	5
SLOPE (V/H)	0.0069
CULVERT LENGTH ALONG SLOPE	101.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	10.00 ft
BARREL RISE	6.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.013
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION

FILE NAME: SHEA
FILE DATE: 12-28-2000

MAIN CHANNEL ONLY	
LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING n LEFT OVER BANK	0.000
MANNING n MAIN CHANNEL	0.058
MANNING n RIGHT OVER BANK	0.000
SLOPE OF CHANNEL	0.0070 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	9964.39	1550.67
2	9978.31	1542.89
3	10016.29	1542.11
4	10038.43	1542.66
5	10060.91	1545.52
6	10067.43	1548.80

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1542.11	0.000	1.28	0.00	0.00
201.80	1543.77	0.388	2.94	2.41	0.52
403.60	1544.41	0.412	3.58	3.06	0.75
605.40	1544.93	0.426	4.10	3.51	0.92
807.20	1545.37	0.435	4.54	3.86	1.05
1009.00	1545.74	0.444	4.91	4.17	1.19
1210.80	1546.08	0.451	5.25	4.46	1.31
1412.60	1546.39	0.457	5.56	4.72	1.42
1614.40	1546.69	0.462	5.86	4.95	1.53
1816.20	1546.96	0.466	6.13	5.16	1.63
2018.00	1547.23	0.471	6.40	5.36	1.73

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	80.00 ft
CREST LENGTH	500.00 ft
OVERTOPPING CREST ELEVATION	1549.97 ft

CURRENT DATE: 12-28-2000
CURRENT TIME: 14:02:41

FILE DATE: 12-28-2000
FILE NAME: CAP (8557)

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1508.80	1507.80	232.00	3 RCP	6.00	6.00	.012	IMPR SDT REC
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: CAP DATE: 12-28-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1508.80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1512.26	250.9	250.9	0.0	0.0	0.0	0.0	0.0	0.00	1
1513.95	501.8	501.8	0.0	0.0	0.0	0.0	0.0	0.00	1
1516.01	752.7	752.7	0.0	0.0	0.0	0.0	0.0	0.00	1
1517.69	1003.6	1003.6	0.0	0.0	0.0	0.0	0.0	0.00	1
1519.38	1254.5	1203.3	0.0	0.0	0.0	0.0	0.0	47.91	6
1519.76	1505.4	1244.1	0.0	0.0	0.0	0.0	0.0	259.40	4
1520.04	1756.3	1273.4	0.0	0.0	0.0	0.0	0.0	476.61	3
1520.29	2007.2	1298.9	0.0	0.0	0.0	0.0	0.0	703.38	3
1520.52	2258.1	1321.7	0.0	0.0	0.0	0.0	0.0	932.76	3
1520.73	2509.0	1342.4	0.0	0.0	0.0	0.0	0.0	1163.72	3
1519.19	1182.7	1182.7	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CAP DATE: 12-28-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1508.80	0.000	0.00	0.00	0.00
1512.26	0.000	250.90	0.00	0.00
1513.95	0.000	501.80	0.00	0.00
1516.01	0.000	752.70	0.00	0.00
1517.69	0.000	1003.60	0.00	0.00
1519.38	-0.005	1254.50	3.33	0.27
1519.76	-0.002	1505.40	1.90	0.13
1520.04	-0.006	1756.30	6.28	0.36
1520.29	-0.004	2007.20	4.88	0.24
1520.52	-0.003	2258.10	3.66	0.16
1520.73	-0.002	2509.00	2.84	0.11

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

PERFORMANCE CURVE FOR CULVERT 1 - 3(6.00 (ft) BY 6.00 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1508.80	0.00	-1.00	0-NF	0.00	0.00	0.00	-0.49	0.00	0.00
250.90	1512.26	3.24	3.46	1-S2n	2.15	2.45	2.15	0.90	9.18	8.21
501.80	1513.95	5.15	4.72	1-S2n	3.19	3.52	3.12	1.54	11.28	10.57
752.70	1516.01	7.21	6.32	5-S2n	4.18	4.33	4.13	2.08	12.11	12.21
1003.60	1517.69	8.89	8.34	2-M2c	6.00	4.94	4.94	2.54	13.46	13.51
1203.26	1519.38	10.58	9.96	2-M2c	6.00	5.32	5.32	2.96	15.15	14.55
1244.11	1519.76	10.96	10.35	2-M2c	6.00	5.40	5.40	3.34	15.48	15.47
1273.41	1520.04	11.24	10.78	2-M2c	6.00	5.45	5.45	3.70	15.76	16.27
1298.94	1520.29	11.49	11.15	2-M2c	6.00	5.50	5.50	4.05	16.00	17.00
1321.68	1520.52	11.72	11.40	2-M2c	6.00	5.55	5.55	4.37	16.22	17.65
1342.44	1520.73	11.93	11.63	2-M2c	6.00	5.58	5.58	4.68	16.42	18.25

El. inlet face invert 1508.80 ft El. outlet invert 1507.80 ft
El. inlet throat invert 1508.80 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	8557.00 ft
INLET ELEVATION	1508.80 ft
OUTLET STATION	8325.00 ft
OUTLET ELEVATION	1507.80 ft
NUMBER OF BARRELS	3
SLOPE (V/H)	0.0043
CULVERT LENGTH ALONG SLOPE	232.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	6.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	IMPR SDT RECT
INLET EDGE AND WALL	SQUARE EDGE TOP (26-90 DEG WINGWALL)
INLET DEPRESSION	NONE

***** SIDE-TAPERED RECTANGULAR IMPROVED INLET ***

FACE WIDTH	6.00 ft
SIDE TAPER (4:1 TO 6:1) (X:1)	4.00

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION

FILE NAME: CAP
FILE DATE: 12-28-2000

MAIN CHANNEL ONLY	
LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING n LEFT OVER BANK	0.000
MANNING n MAIN CHANNEL	0.013
MANNING n RIGHT OVER BANK	0.000
SLOPE OF CHANNEL	0.0043 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	9979.24	1515.27
2	9983.64	1507.59
3	10007.25	1507.31
4	10014.53	1515.41

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1507.31	0.000	-0.49	0.00	0.00
250.90	1508.70	1.319	0.90	8.21	0.31
501.80	1509.34	1.390	1.54	10.57	0.45
752.70	1509.88	1.429	2.08	12.21	0.56
1003.60	1510.34	1.455	2.54	13.51	0.65
1254.50	1510.76	1.474	2.96	14.55	0.73
1505.40	1511.14	1.490	3.34	15.47	0.80
1756.30	1511.51	1.502	3.70	16.27	0.86
2007.20	1511.85	1.512	4.05	17.00	0.92
2258.10	1512.17	1.521	4.37	17.65	0.97
2509.00	1512.48	1.528	4.68	18.25	1.02

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	40.00 ft
CREST LENGTH	200.00 ft
OVERTOPPING CREST ELEVATION	1519.19 ft

CURRENT DATE: 12-28-2000
CURRENT TIME: 14:25:35

FILE DATE: 12-28-2000
FILE NAME: 120THST (7107)

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1486.69	1486.26	80.00	4 RCB	8.00	3.00	.025	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 120THST DATE: 12-28-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1486.69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1488.00	119.2	119.2	0.0	0.0	0.0	0.0	0.0	0.00	1
1488.77	238.4	238.4	0.0	0.0	0.0	0.0	0.0	0.00	1
1489.42	357.6	357.6	0.0	0.0	0.0	0.0	0.0	0.00	1
1489.99	476.8	476.8	0.0	0.0	0.0	0.0	0.0	0.00	1
1490.55	596.0	596.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1491.22	715.2	709.7	0.0	0.0	0.0	0.0	0.0	4.46	3
1491.65	834.4	753.6	0.0	0.0	0.0	0.0	0.0	76.83	5
1491.90	953.6	770.4	0.0	0.0	0.0	0.0	0.0	179.81	5
1492.05	1072.8	791.0	0.0	0.0	0.0	0.0	0.0	271.55	3
1492.18	1192.0	803.0	0.0	0.0	0.0	0.0	0.0	377.65	3
1491.02	677.1	677.1	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 120THST DATE: 12-28-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1486.69	0.000	0.00	0.00	0.00
1488.00	0.000	119.20	0.00	0.00
1488.77	0.000	238.40	0.00	0.00
1489.42	0.000	357.60	0.00	0.00
1489.99	0.000	476.80	0.00	0.00
1490.55	0.000	596.00	0.00	0.00
1491.22	-0.004	715.20	1.01	0.14
1491.65	-0.006	834.40	3.95	0.47
1491.90	-0.010	953.60	3.39	0.36
1492.05	-0.009	1072.80	10.28	0.96
1492.18	-0.009	1192.00	11.32	0.95

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

PERFORMANCE CURVE FOR CULVERT 1 - 4(8.00 (ft) BY 3.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1486.69	0.00	-0.43	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
119.20	1488.00	1.29	1.31	2-M2c	0.99	0.76	0.76	0.65	4.92	1.84
238.40	1488.77	2.03	2.08	2-M2c	1.57	1.20	1.20	0.93	6.20	2.29
357.60	1489.42	2.65	2.73	2-M2c	2.07	1.57	1.57	1.15	7.10	2.59
476.80	1489.99	3.24	3.30	2-M2c	2.54	1.91	1.91	1.34	7.81	2.82
596.00	1490.55	3.86	3.83	2-M2c	3.00	2.21	2.21	1.50	8.42	3.01
709.73	1491.22	4.53	4.46	2-M2c	3.00	2.49	2.49	1.64	8.92	3.17
753.62	1491.65	4.81	4.96	2-M2c	3.00	2.59	2.59	1.77	9.10	3.34
770.40	1491.91	4.92	5.22	2-M2c	3.00	2.63	2.63	1.88	9.17	3.49
790.96	1492.05	5.06	5.36	2-M2c	3.00	2.67	2.67	1.99	9.25	3.63
803.03	1492.14	5.15	5.45	2-M2c	3.00	2.70	2.70	2.09	9.29	3.76

El. inlet face invert 1486.69 ft El. outlet invert 1486.26 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	7107.00 ft
INLET ELEVATION	1486.69 ft
OUTLET STATION	7027.00 ft
OUTLET ELEVATION	1486.26 ft
NUMBER OF BARRELS	4
SLOPE (V/H)	0.0054
CULVERT LENGTH ALONG SLOPE	80.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 ft
BARREL RISE	3.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.025
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION

FILE NAME: 120THST
FILE DATE: 12-28-2000

MAIN CHANNEL ONLY
LEFT CHANNEL BOUNDARY 0
RIGHT CHANNEL BOUNDARY 0
MANNING n LEFT OVER BANK 0.000
MANNING n MAIN CHANNEL 0.038
MANNING n RIGHT OVER BANK 0.000
SLOPE OF CHANNEL 0.0054 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	9859.39	1492.00
2	9931.92	1486.40
3	9981.50	1486.26
4	10018.15	1486.26
5	10107.41	1487.90
6	10259.75	1493.70

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1486.26	0.000	0.00	0.00	0.00
119.20	1486.91	0.453	0.65	1.84	0.17
238.40	1487.19	0.478	0.93	2.29	0.24
357.60	1487.41	0.493	1.15	2.59	0.29
476.80	1487.60	0.504	1.34	2.82	0.33
596.00	1487.76	0.512	1.50	3.01	0.36
715.20	1487.90	0.519	1.64	3.17	0.39
834.40	1488.03	0.526	1.77	3.34	0.42
953.60	1488.14	0.532	1.88	3.49	0.45
1072.80	1488.25	0.537	1.99	3.63	0.48
1192.00	1488.35	0.541	2.09	3.76	0.50

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE PAVED
EMBANKMENT TOP WIDTH 80.00 ft

***** USER DEFINED ROADWAY PROFILE

CROSS-SECTION COORD. NO.	X ft	Y ft
1	9800.00	1492.01
2	10000.00	1491.02
3	10200.00	1497.17
4	10259.75	1495.70

CURRENT DATE: 10-04-2000
CURRENT TIME: 08:09:21

FILE DATE: 10-04-2000
FILE NAME: 6188

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1474.34	1473.69	50.00	4 RCB	8.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 6188 DATE: 10-04-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1474.34	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1476.94	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1478.37	800.0	692.6	0.0	0.0	0.0	0.0	0.0	104.17	8
1478.64	1192.0	740.6	0.0	0.0	0.0	0.0	0.0	444.64	4
1478.89	1600.0	729.3	0.0	0.0	0.0	0.0	0.0	866.41	4
1479.05	2000.0	800.0	0.0	0.0	0.0	0.0	0.0	1193.82	3
1479.23	2400.0	800.0	0.0	0.0	0.0	0.0	0.0	1586.01	3
1479.40	2800.0	800.0	0.0	0.0	0.0	0.0	0.0	1988.49	3
1479.56	3200.0	800.0	0.0	0.0	0.0	0.0	0.0	2390.19	3
1479.70	3600.0	800.0	0.0	0.0	0.0	0.0	0.0	2790.64	3
1479.84	4000.0	800.0	0.0	0.0	0.0	0.0	0.0	3190.65	3
1478.20	661.0	661.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 6188 DATE: 10-04-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1474.34	0.000	0.00	0.00	0.00
1476.94	0.000	400.00	0.00	0.00
1478.37	-0.005	800.00	3.23	0.40
1478.64	-0.003	1192.00	6.78	0.57
1478.89	-0.002	1600.00	4.29	0.27
1479.05	-0.002	2000.00	6.18	0.31
1479.23	-0.005	2400.00	13.99	0.58
1479.40	-0.004	2800.00	11.51	0.41
1479.56	-0.003	3200.00	9.81	0.31
1479.70	-0.003	3600.00	9.36	0.26
1479.84	-0.003	4000.00	9.35	0.23

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 10-04-2000
CURRENT TIME: 08:09:21

FILE DATE: 10-04-2000
FILE NAME: 6188

PERFORMANCE CURVE FOR CULVERT 1 - 4(8.00 (ft) BY 3.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1474.34	0.00	-0.65	0-NF	0.00	0.00	0.00	-0.19	0.00	0.00
400.00	1476.94	2.60	2.13	1-S2n	1.01	1.70	1.20	1.54	10.45	5.27
692.60	1478.36	4.02	3.35	5-S2n	1.46	2.45	1.81	2.40	11.98	6.70
740.59	1478.64	4.30	4.21	4-FFt	1.53	2.56	1.53	3.40	15.14	5.66
729.30	1478.90	4.23	4.56	4-FFt	1.51	2.53	3.00	3.78	7.60	6.17
800.00	1479.51	4.67	5.17	4-FFt	1.61	2.69	3.00	4.11	8.33	6.58
800.00	1479.80	4.67	5.46	4-FFt	1.61	2.69	3.00	4.40	8.33	6.99
800.00	1480.09	4.67	5.75	4-FFt	1.61	2.69	3.00	4.69	8.33	7.25
800.00	1480.21	4.67	5.87	4-FFt	1.61	2.69	3.00	4.81	8.33	7.36
800.00	1480.21	4.67	5.87	4-FFt	1.61	2.69	3.00	4.81	8.33	7.36
800.00	1480.21	4.67	5.87	4-FFt	1.61	2.69	3.00	4.81	8.33	7.36

El. inlet face invert 1474.34 ft
El. inlet throat invert 0.00 ft
El. outlet invert 1473.69 ft
El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	1474.34 ft
OUTLET STATION	50.00 ft
OUTLET ELEVATION	1473.69 ft
NUMBER OF BARRELS	4
SLOPE (V/H)	0.0130
CULVERT LENGTH ALONG SLOPE	50.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 ft
BARREL RISE	3.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (30-75 DEG. FLARE)
INLET DEPRESSION	NONE

CURRENT DATE: 10-04-2000
CURRENT TIME: 08:09:21

FILE DATE: 10-04-2000
FILE NAME: 6188

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION

FILE NAME: 6188
FILE DATE: 10-04-2000

MAIN CHANNEL ONLY	
LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING n LEFT OVER BANK	0.000
MANNING n MAIN CHANNEL	0.038
MANNING n RIGHT OVER BANK	0.000
SLOPE OF CHANNEL	0.0100 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	9945.00	1478.50
2	9960.00	1478.00
3	9970.00	1477.00
4	9980.00	1473.50
5	10020.00	1473.50
6	10025.00	1476.20
7	10070.00	1476.50
8	10090.00	1477.10
9	10100.00	1477.80

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1473.50	0.000	-0.19	0.00	0.00
400.00	1475.23	0.737	1.54	5.27	0.98
800.00	1476.09	0.780	2.40	6.70	1.40
1192.00	1477.08	0.752	3.40	5.66	1.09
1600.00	1477.47	0.768	3.78	6.17	1.24
2000.00	1477.80	0.781	4.11	6.58	1.36
2400.00	1478.09	0.792	4.40	6.99	1.49
2800.00	1478.38	0.799	4.69	7.25	1.58
3200.00	1478.50	0.802	4.81	7.36	1.61
3600.00	1478.50	0.802	4.81	7.36	1.61
4000.00	1478.50	0.802	4.81	7.36	1.61

Note: Shear stress was calculated using R.

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	30.00 ft
CREST LENGTH	500.00 ft
OVERTOPPING CREST ELEVATION	1478.20 ft

CURRENT DATE: 10-04-2000
CURRENT TIME: 08:55:46

FILE DATE: 10-04-2000
FILE NAME: 5245

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1461.80	1461.60	117.00	6 CSP	6.00	6.00	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: 5245 DATE: 10-04-2000

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1461.80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1465.30	400.0	400.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1466.95	800.0	800.0	0.0	0.0	0.0	0.0	0.0	0.00	1
1468.39	1192.0	1177.6	0.0	0.0	0.0	0.0	0.0	3.09	13
1468.72	1600.0	1274.1	0.0	0.0	0.0	0.0	0.0	316.52	4
1468.95	2000.0	1319.2	0.0	0.0	0.0	0.0	0.0	677.29	4
1469.14	2400.0	1355.9	0.0	0.0	0.0	0.0	0.0	1025.50	3
1469.31	2800.0	1402.3	0.0	0.0	0.0	0.0	0.0	1388.51	3
1469.47	3200.0	1437.4	0.0	0.0	0.0	0.0	0.0	1755.24	3
1469.62	3600.0	1469.7	0.0	0.0	0.0	0.0	0.0	2124.09	3
1469.77	4000.0	1485.3	0.0	0.0	0.0	0.0	0.0	2504.26	3
1468.37	1177.6	1177.6	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

JMMARY OF ITERATIVE SOLUTION ERRORS FILE: 5245 DATE: 10-04-2000

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1461.80	0.000	0.00	0.00	0.00
1465.30	0.000	400.00	0.00	0.00
1466.95	0.000	800.00	0.00	0.00
1468.39	-0.010	1192.00	11.30	0.95
1468.72	-0.005	1600.00	9.38	0.59
1468.95	-0.008	2000.00	3.47	0.17
1469.14	-0.007	2400.00	18.58	0.77
1469.31	-0.003	2800.00	9.19	0.33
1469.47	-0.002	3200.00	7.34	0.23
1469.62	-0.002	3600.00	6.25	0.17
1469.77	-0.003	4000.00	10.44	0.26

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 10-04-2000
CURRENT TIME: 08:55:46

FILE DATE: 10-04-2000
FILE NAME: 5245

PERFORMANCE CURVE FOR CULVERT 1 - 6(6.00 (ft) BY 6.00 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1461.80	0.00	-0.20	0-NF	0.00	0.00	0.00	-0.10	0.00	0.00
400.00	1465.30	3.03	3.50	2-M2c	3.71	2.16	2.16	1.14	7.25	4.97
800.00	1466.95	4.55	5.15	2-M2c	6.00	3.12	3.12	1.71	8.98	6.15
1177.61	1468.40	5.87	6.60	2-M2c	6.00	3.82	3.82	2.14	10.36	6.92
1274.10	1468.72	6.23	6.92	2-M2c	6.00	3.97	3.97	2.51	10.70	7.55
1319.24	1468.95	6.40	7.15	2-M2c	6.00	4.05	4.05	2.81	10.84	8.07
1355.92	1469.15	6.54	7.35	2-M2c	6.00	4.11	4.11	3.10	10.96	8.53
1402.31	1469.31	6.72	7.51	2-M2c	6.00	4.19	4.19	3.35	11.10	8.92
1437.42	1469.47	6.85	7.67	2-M2c	6.00	4.24	4.24	3.58	11.23	9.27
1469.66	1469.62	6.98	7.82	2-M2c	6.00	4.28	4.28	3.81	11.37	9.59
1485.30	1469.84	7.05	8.04	7-M2c	6.00	4.30	4.30	4.01	11.43	9.89

El. inlet face invert 1461.80 ft El. outlet invert 1461.60 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	1461.80 ft
OUTLET STATION	117.00 ft
OUTLET ELEVATION	1461.60 ft
NUMBER OF BARRELS	6
SLOPE (V/H)	0.0017
CULVERT LENGTH ALONG SLOPE	117.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	6.00 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 10-04-2000
CURRENT TIME: 08:55:46

FILE DATE: 10-04-2000
FILE NAME: 5245

TAILWATER

***** USER DEFINED CHANNEL CROSS-SECTION

FILE NAME: 5245
FILE DATE: 10-04-2000

MAIN CHANNEL ONLY	
LEFT CHANNEL BOUNDARY	0
RIGHT CHANNEL BOUNDARY	0
MANNING n LEFT OVER BANK	0.000
MANNING n MAIN CHANNEL	0.030
MANNING n RIGHT OVER BANK	0.000
SLOPE OF CHANNEL	0.0100 ft/ft

CROSS-SECTION COORD. NO.	X (ft)	Y (ft)
1	9750.00	1472.10
2	9960.00	1467.20
3	9980.00	1466.30
4	10000.00	1461.50
5	10050.00	1461.50
6	10100.00	1464.00
7	10180.00	1469.00

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	1461.50	0.000	-0.10	0.00	0.00
400.00	1462.74	0.873	1.14	4.97	0.63
800.00	1463.31	0.920	1.71	6.15	0.86
1192.00	1463.74	0.948	2.14	6.92	1.03
1600.00	1464.10	0.968	2.51	7.55	1.17
2000.00	1464.41	0.985	2.81	8.07	1.30
2400.00	1464.70	0.998	3.10	8.53	1.41
2800.00	1464.95	1.009	3.35	8.92	1.51
3200.00	1465.18	1.019	3.58	9.27	1.60
3600.00	1465.41	1.028	3.81	9.59	1.68
4000.00	1465.61	1.035	4.01	9.89	1.76

Note: Shear stress was calculated using R.

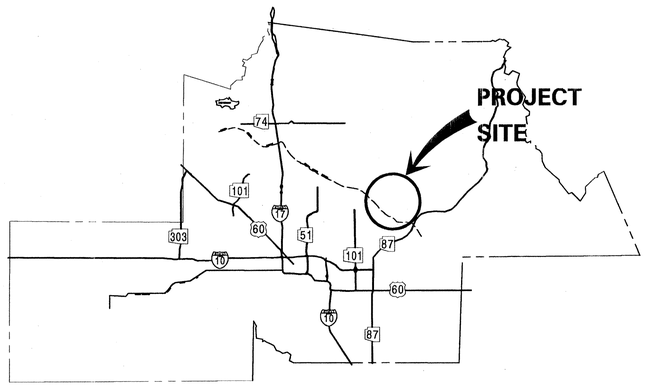
ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	80.00 ft
CREST LENGTH	500.00 ft
OVERTOPPING CREST ELEVATION	1468.37 ft

APPENDIX E

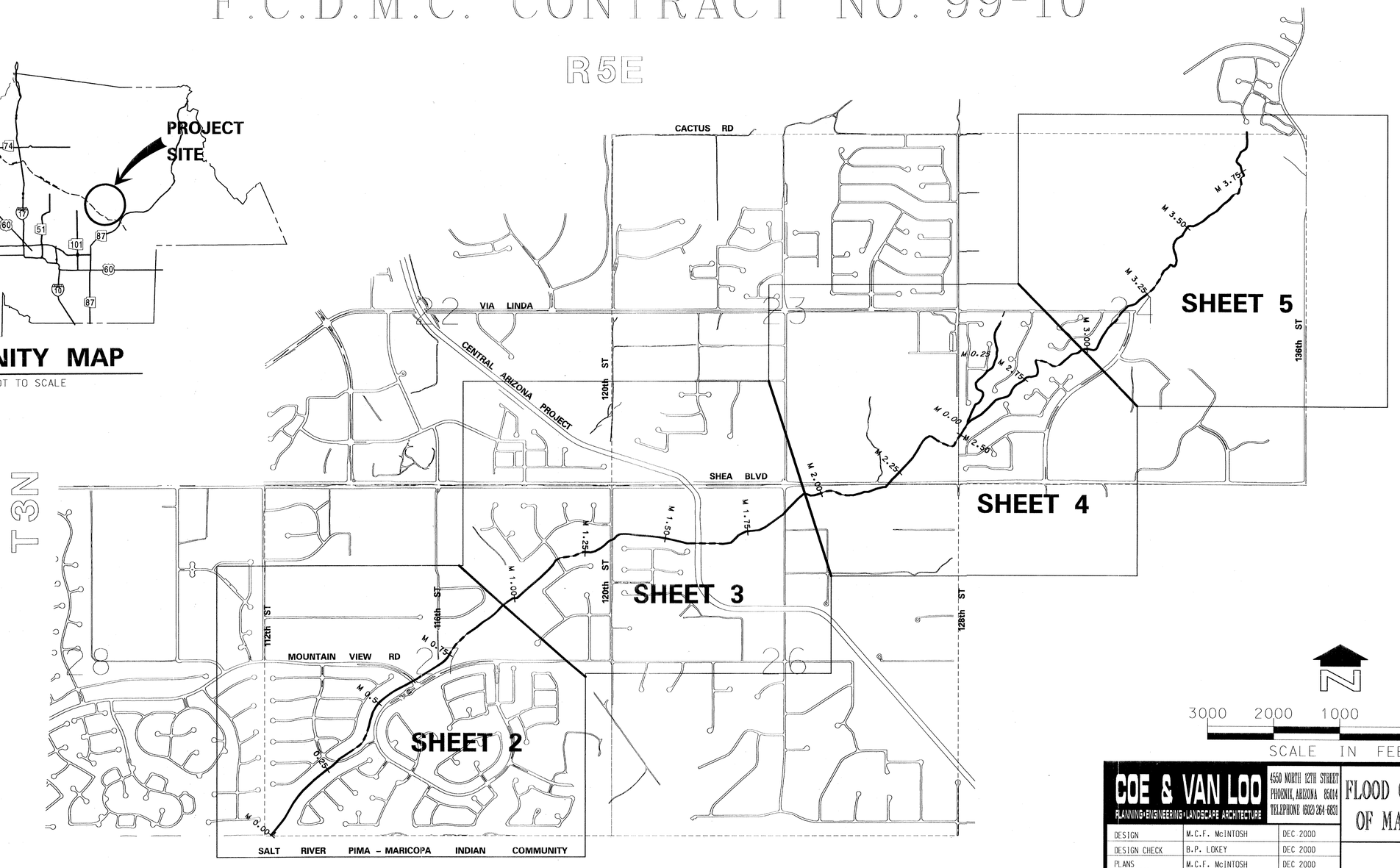
Floodplain Delineation Maps

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
WASH-B "AE" ZONE FLOODPLAIN DELINEATION STUDY
CITY OF SCOTTSDALE, ARIZONA
F.C.D.M.C. CONTRACT NO. 99-10



VICINITY MAP

NOT TO SCALE



3000 2000 1000 0 1000

SCALE IN FEET

DESIGN	M.C.F. McINTOSH	DEC 2000
DESIGN CHECK	B.P. LOKEY	DEC 2000
PLANS	M.C.F. McINTOSH	DEC 2000
PLANS CHECK	B.P. LOKEY	DEC 2000
PROJECT NO.	LLC-997002-01	DEC 2000
SUBMITTED BY: PROJECT MANAGER		

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264 6831

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

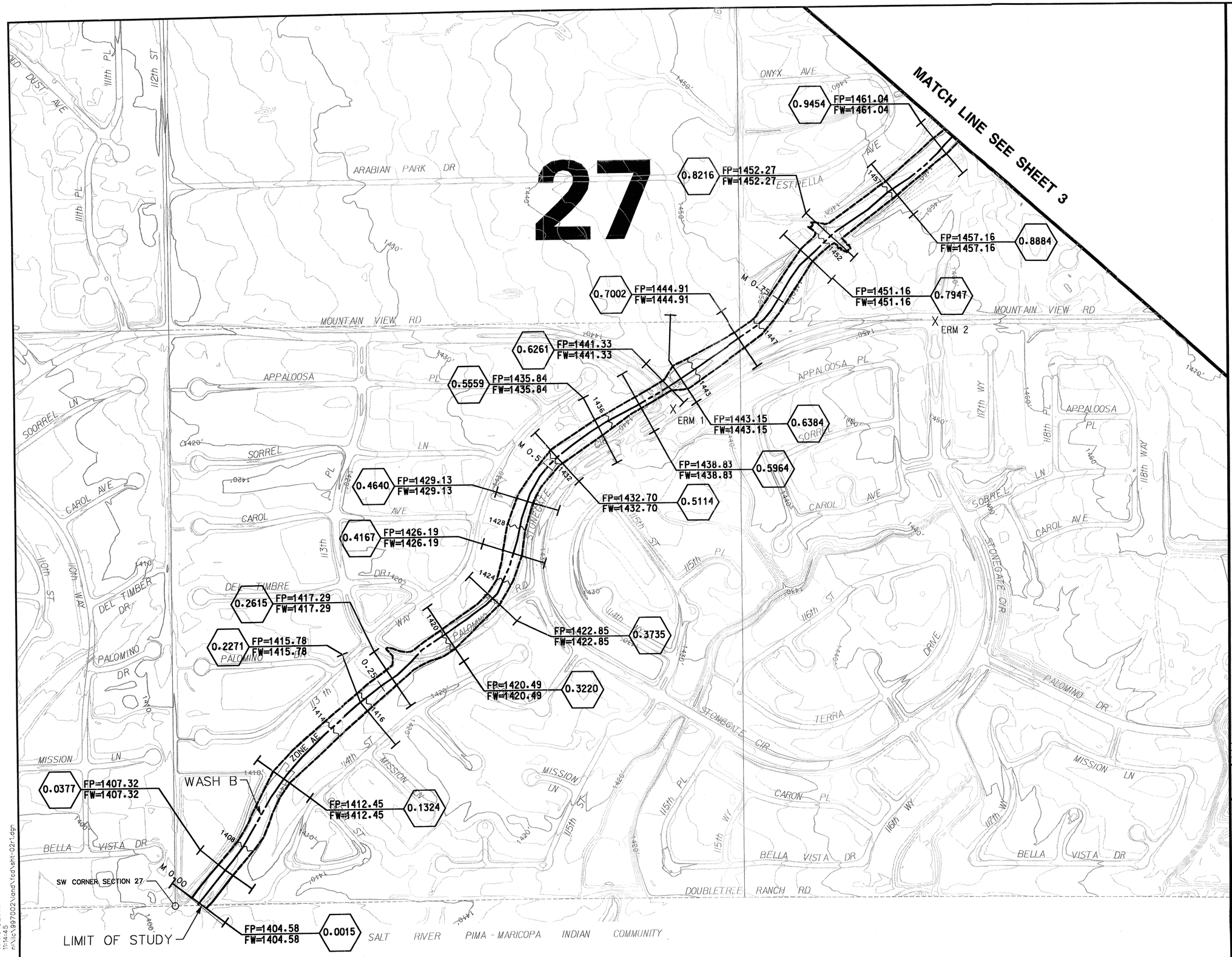
RECOMMENDED BY

APPROVED: CHIEF ENGINEER & GENERAL MANAGER

SHEET 1 OF 5

THIS MAPPING WAS PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, FROM CITY OF SCOTTSDALE 1993 TOPO

DATE= Jun. 04, 2002
TIME= 1113:59
FILE= n:\ks\997002\arch\fcd\vert-01.dgn



LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE STATION	M12.0 M13.0
CROSS SECTION	1.234 FP= 100 Yr WSE FW= Floodway WSE
ELEVATION REFERENCE MARK	ERM XXX
BASE FLOOD ELEVATIONS	1221
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary

ELEVATION REFERENCE MARKS

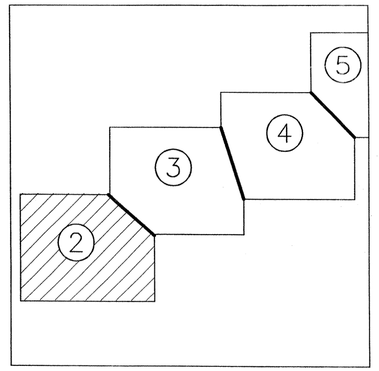
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1929 NGVD TO 1988 NAVD= + 1.77

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 1	NAVD '88 1442.770	CITY OF SCOTTSDALE BRASS CAP IN HAND HOLD AT INTERSECTION OF MOUNTAIN VIEW AND STONEGATE CIRCLE LAT=33-34'-26" LONG=111-49'-54"
ERM 2	NAVD '88 1454.980	CITY OF SCOTTSDALE BRASS CAP FLUSH AT INTERSECTION OF MOUNTAIN VIEW AND STONEGATE CIRCLE/ 117th ST. LAT=33-34'-31" LONG=111-49'-40"

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10.000 UNLESS NOTED OTHERWISE

INDEX MAP



200 0' 200 400

SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: SEPTEMBER 1993

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF WASH - B F.C.D. CONTRACT NO. 99-10

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

Registered Professional Engineer Certificate No. 13788 LES F. OLSON, JR. Date Signed 7-11-02 ARIZONA, U.S.A.

	BY	DATE
DESIGN	M.C.F. McINTOSH	DEC 2000
DESIGN CHK.	B.P. LOKEY	DEC 2000
PLANS	M.C.F. McINTOSH	DEC 2000
PLANS CHK.	B.P. LOKEY	DEC 2000

SHEET 2 OF 5

THIS MAPPPING WAS PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY. FROM CITY OF SCOTTSDALE 1993 TOPO

DATE- Jun. 04, 2002
TIME- 15:14:45
FILE- n:\cs\9897002\land\fcd\sht-02r1.dgn

CENTRAL ARIZONA PROJECT

SAHUARO DRIVE

118th ST

BECKER LN

SHEA BLVD

ERM 4

NW CORNER SECTION 26
NE CORNER SECTION 27

ERM 3

1.3242 FP=1488.92 FW=1489.12

1.2311 FP=1482.62 FW=1483.21

1.2775 FP=1485.98 FW=1486.55

1.3076 FP=1487.92 FW=1487.83

1.1788 FP=1479.54 FW=1479.54

0.9936 FP=1468.34 FW=1468.34

0.9712 FP=1462.61 FW=1462.61

1.1610 FP=1478.31 FW=1478.31

1.4195 FP=1493.62 FW=1493.62

1.5097 FP=1498.42 FW=1498.43

1.5651 FP=1503.32 FW=1503.32

1.5767 FP=1511.28 FW=1511.28

1.6445 FP=1520.88 FW=1520.88

1.9278 FP=1529.78 FW=1529.78

1.8329 FP=1521.48 FW=1521.48

1.6233 FP=1520.87 FW=1520.87

1.7383 FP=1520.89 FW=1520.89

1.7892 FP=1520.89 FW=1520.89

1.8720 FP=1525.58 FW=1525.58

1.3462 FP=1492.79 FW=1492.79

1.4792 FP=1497.15 FW=1497.16

1.5494 FP=1499.27 FW=1499.28

1.1722 FP=1478.90 FW=1478.90

1.1362 FP=1477.10 FW=1477.10

1.0822 FP=1472.73 FW=1472.73

1.0024 FP=1468.35 FW=1468.35

WASH B

LIMIT OF STUDY

ZONE AE

ZONE A

M 1.00

M 1.25

M 1.50

M 1.75

BERLY AVE

GOLD DUST AVE

SUNSTLAND TR

ARABIAN PARK DRIVE

IRONWOOD DR

MOUNTAIN VIEW RD

120th ST

119th PL

124th ST

TURQUOISE AVE

MATCH LINE SEE SHEET 2

MATCH LINE SEE SHEET 4

26

DATE:- Jun. 04, 2002
TIME:- 11:17:32
FILE:- n:\vlc9997002\land\cad\sht-03.dgn

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE STATION	M12.0 M13.0
CROSS SECTION	1.234 FP= 100 Yr WSE / FW= Floodway WSE
ELEVATION REFERENCE MARK	ERM XXX
BASE FLOOD ELEVATIONS	1221
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary

ELEVATION REFERENCE MARKS

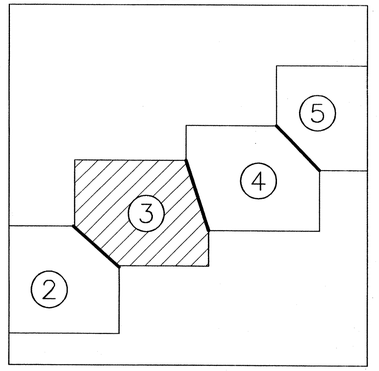
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.
CONVERSION FACTOR 1929 NGVD TO 1988 NAVD= + 1.77

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 3	NAVD '88 1543.070	CITY OF SCOTTSDALE BRASS CAP IN HAND HOLD IN MEDIAN OF SHEA BLVD. AND 124th ST. LAT=33-34'-56.73" LONG=111-48'-48.13"
ERM 4	NAVD '88 1516.975	CITY OF SCOTTSDALE BRASS CAP IN HAND HOLD AT INTERSECTION OF SHEA BLVD. AND 120th ST. LAT=33-34'-57" LONG=111-49'-19"

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE

INDEX MAP



N

200 0' 200 400

SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: SEPTEMBER 1993

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF WASH - B
F.C.D. CONTRACT NO. 99-10

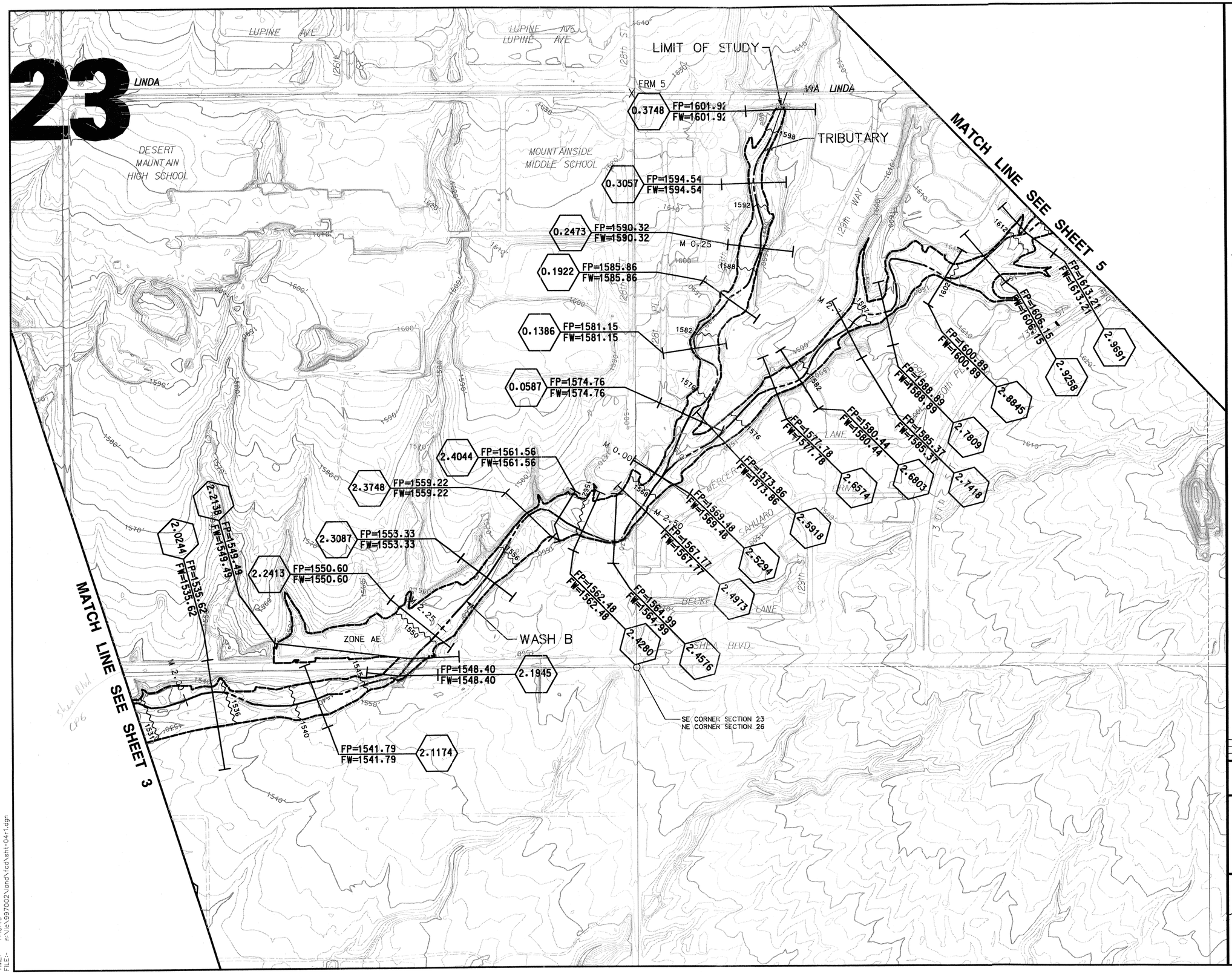
Registered Professional Engineering Arizona 13788 LES F. OLSON, JR. Date Signed 7-11 ARIZONA, U.S.A.

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831

	BY	DATE
DESIGN	M.C.F. McINTOSH	DEC 2000
DESIGN CHK.	B.P. LOKEY	DEC 2000
PLANS	M.C.F. McINTOSH	DEC 2000
PLANS CHK.	B.P. LOKEY	DEC 2000

SHEET 3 OF 5

THIS MAPPING WAS PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, FROM CITY OF SCOTTSDALE 1993 TOPO



LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE STATION	M12.0 M13.0
CROSS SECTION	1.234 FP= 100 Yr WSE FW= Floodway WSE
ELEVATION REFERENCE MARK	ERM XXX
BASE FLOOD ELEVATIONS	1221
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary

ELEVATION REFERENCE MARKS

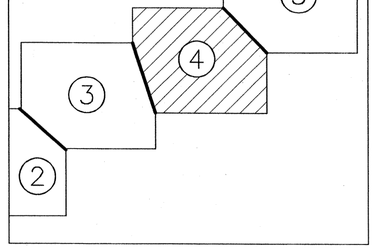
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1929 NGVD TO 1988 NAVD= + 1.77

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 5	NAVD '88 1630.180	CITY OF SCOTTSDALE BRASS CAP FLUSH CL INTERSECTION OF VIA LINDA AND 128th STREET

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10.000 UNLESS NOTED OTHERWISE

INDEX MAP



200 0' 200 400
SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: SEPTEMBER 1993

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF WASH - B
F.C.D. CONTRACT NO. 99-10

COE & VAN LOO
PLANNING • ENGINEERING • LANDSCAPE ARCHITECTURE
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE (602) 264-6831

Registered Professional Engineer CERTIFICATE NO. 13798 LES F. OLSON, JR. Date Signed 7-11-01 ARIZONA, U.S.A.

	BY	DATE
DESIGN	M.C.F. McINTOSH	DEC 2000
DESIGN CHK.	B.P. LOKEY	DEC 2000
PLANS	M.C.F. McINTOSH	DEC 2000
PLANS CHK.	B.P. LOKEY	DEC 2000

SHEET 4 OF 5

THIS MAPPING WAS PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, FROM CITY OF SCOTTSDALE 1993 TOPO

DATE- Jun 04, 2002
TIME- 11:18:49
FILE- n:\lo\9970021\land\fed\sht-04-1.dgn

LIMIT OF STUDY

FP=1782.73
FW=1782.73
3.8799

ERM 6

NE CORNER SECTION 24

WASH B

FP=1767.79
FW=1767.79
3.8174

3.7235 FP=1744.07
FW=1744.07

3.5932 FP=1709.04
FW=1709.04

FP=1720.74
FW=1720.74
3.6294

3.4405 FP=1682.84
FW=1682.84

FP=1700.09
FW=1700.09
3.5347

3.3466 FP=1666.53
FW=1666.53

3.2524 FP=1652.01
FW=1652.01

3.2038 FP=1647.97
FW=1647.97

VIA LINDA

24

FP=1638.07
FW=1638.07

FP=1626.35
FW=1626.35
3.0634

3.1483

MATCH LINE SEE SHEET 4

136th ST

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE STATION	M12.0 M13.0
CROSS SECTION	1.234 FP= 100 Yr WSE FW= Floodway WSE
ELEVATION REFERENCE MARK	ERM XXX
BASE FLOOD ELEVATIONS	1221
ZONE DESIGNATIONS	ZONE AE
CORPORATE LIMITS	Corporate Limits
COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary

ELEVATION REFERENCE MARKS

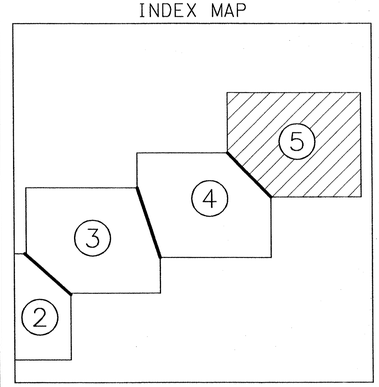
NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929. CONVERSION FACTOR 1929 NGVD TO 1988 NAVD= + 1.77

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
ERM 6	NAVD '88 1804.42	AMC BCHH, 1974, DOWN 1.2', +/-50' NE OF INTERSECTION OF CACTUS ROAD AND 136TH STREET

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE

INDEX MAP



200 0' 200 400
SCALE: 1"= 200 FEET
CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: SEPTEMBER 1993

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

FLOOD DELINEATION STUDY OF WASH B
F.C.D. CONTRACT NO. 99-10

Registered Professional Engineer (Civil) 19786 LES F OLSON, JR. Date Signed 7-11-01 ARIZONA, U.S.A.

COE & VAN LOO
PLANNING•ENGINEERING•LANDSCAPE ARCHITECTURE
4550 NORTH 12TH STREET PHOENIX, ARIZONA 85014 TELEPHONE: (602) 264-6831

	BY	DATE
DESIGN	M.C.F. McINTOSH	DEC 2000
DESIGN CHK.	B.P. LOKEY	DEC 2000
PLANS	M.C.F. McINTOSH	DEC 2000
PLANS CHK.	B.P. LOKEY	DEC 2000

SHEET 5 OF 5

THIS MAPPING WAS PROVIDED BY THE FLOOD CONTROL DISTRICT OF MARICOPA COUNTY, FROM CITY OF SCOTTSDALE 1993 TOPO

DATE:- Sun, 12, 2001
TIME:- 16:22:37
FILE:- n:\civil\97002\land\tech\sht-05rf.dgn

6.0 GENERAL DOCUMENTATION AND CORRESPONDENCE

6.1 Special Problem Reports

During the course of this floodplain delineation study, several unique situations were identified. Although there were not any special problem reports, these special problems and solutions were documented in other sections of the Technical Data Notebook (TDN). Hydrologic Special Problems and solutions are documented in the Hydrology Report under separate cover, and Hydraulic Special Problems are documented in the Hydraulics Report under separate cover.

6.2 Contact

The majority of the coordination between the FCDMC and CVL, including submittals for this floodplain delineation study were made through meetings. However, some coordination was made over the telephone, by facsimile machine, by memoranda, by email or by letter. Typically, meeting times were coordinated by email, and the draft minutes to the meetings were sent to the FCDMC by email for acceptance or modifications. Telephone coordination agreements were often followed up with memoranda or letters. Copies of these Communication Documentation, Memoranda, and letters are included in the appendix.

6.3 Meeting Minutes

Numerous meetings were held between the FCDMC and CVL to discuss the flood insurance study and to make technical decisions. CVL prepared minutes of these meetings. Copies of these minutes are included in the appendix.

7.0 DRAFT FIS REPORT

Hydrologic and hydraulic analyses for Wash "B" (between Cactus Road and Doubletree Ranch Road) and one tributary were performed for the Flood Control District of Maricopa County. This work was performed by *Coe & Van Loo Consultants, Inc.*, and was completed in December 2000.

Flooding Source	Limits of Study
Wash "B"	From the Cactus Road alignment to Doubletree Ranch Road
Tributary	From confluence with Wash "B" to Via Linda

Wash "B" and one tributary flow southwesterly to the Salt River/Pima Indian Reservation.

Flooding Source and Location	Location Section-Section	Peak Discharge (cfs) 10-year	50-year	100-year	500-year
Wash "B"					
	1.160-1.404	---1	---1	333	---1
	1.449-1.819	---1	---1	739	---1
	1.839-2.197	---1	---1	2018	---1
	2.294-2.682	---1	---1	2509	---1
Tributary to Wash "B"	0.389-0.723	---1	---1	1066	---1

Cross section data for delineations performed for the Wash "B" Floodplain Delineation Study were developed from 1" = 200' scale, 2-foot contour interval topographic mapping. Starting water surface elevations were computed using the slope-area method.

Flooding Source	Channel	Overbanks
Wash "B" below C.A.P. Canal	0.045-0.065	0.04-0.09
Wash "B" above C.A.P. Canal	0.046-0.058	0.065-0.08
Tributary	0.061	0.066

APPENDICES

APPENDIX A

A-1

FEMA Response Letter

Federal Emergency Management Agency

Washington, D.C. 20472

JUL 02 2002

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 02-09-1084X

The Honorable Mary Manross
Mayor, City of Scottsdale
3939 North Drinkwater Boulevard
Scottsdale, AZ 85251

Community: City of Scottsdale, AZ
Community No.: 045012
Panels Affected: 04013C1705 F and 1710 E
Effective Date of This Revision: OCT 24 2002

102-I-A-C

Dear Mayor Manross:

This responds to a request that the Federal Emergency Management Agency (FEMA) revise the effective Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) report for Maricopa County, Arizona and Incorporated Areas (the effective FIRM and FIS report for your community), in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a letter dated July 24, 2001, Mr. Richard P. Harris, P.E., Project Manager, Flood Control District of Maricopa County, requested that FEMA revise the FIRM and FIS report to show the effects of new hydrologic and hydraulic analyses and existing culverts along Wash B from Doubletree Ranch Road to approximately 3,800 feet upstream of Via Linda and along Wash B Tributary from the confluence with Wash B to approximately 2,000 feet upstream. In response to Mr. Harris's request, we issued a Letter of Map Revision (LOMR) on May 21, 2002, that will become effective on September 12, 2002 (Case No. 01-09-987P). This LOMR is a re-issuance of the May 21 LOMR to incorporate improved flood hazard information on the above-referenced map panels and to revise the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood).

All data required to complete our review of this request were submitted with letters from Mr. William Erickson, Floodplain Administrator, Storm Water Division, Transportation Systems Department, City of Scottsdale; Mr. Marc McIntosh, E.I.T., Assistant Project Manager, Water Resources Department, Coe & Van Loo Consultants, Inc.; and Mr. Harris. Because this LOMR is based on a detailed hydrologic or hydraulic study conducted by a Federal, State, or local agency to replace an approximate study conducted by FEMA and shown on the flood map, fees were not assessed for the review.

We have completed our review of the submitted data and the flood data shown on the effective FIRM and in the effective FIS report. We have revised the FIRM and FIS report to modify the elevations, floodplain and floodway boundary delineations, and zone designations of the base flood along Wash B from Doubletree Ranch Road to approximately 3,800 feet upstream of Via Linda and along Wash B Tributary from the confluence with Wash B to approximately 2,000 feet upstream. As a result of the modifications, the Base Flood Elevations (BFEs) for Wash B from 116th Street (Extended) to the Hayden Rhodes Aqueduct increased, and the width of the Special Flood Hazard Area (SFHA), the area that would be inundated by the base flood, increased in some areas and decreased in other areas. A regulatory floodway was added along Wash B from 116th Street (Extended) to the Hayden Rhodes Aqueduct. BFEs, SFHAs, and regulatory floodways were added along Wash B from Doubletree Ranch

Road to 116th Street (Extended); along Wash B from approximately 1,100 feet upstream of the Hayden Rhodes Aqueduct to approximately 3,800 feet upstream of Via Linda; and along Wash B Tributary from the confluence with Wash B to approximately 2,000 feet upstream. An SFHA designated Zone A, with no BFEs determined, along Wash B was modified from the Hayden Rhodes Aqueduct to approximately 1,100 feet upstream. The modifications are shown on the enclosed annotated copies of FIRM Panels 04013C1705 F and 04013C1710 E and affected portions of the Summary of Discharges Table and Floodway Data Table. Profile Panels 1199P through 1207P were added to the FIS report. This LOMR hereby revises the above-referenced panels of the effective FIRM and the affected portions of the FIS report, both dated July 19, 2001.

The modifications are effective as of the date shown above. The map panels as listed above and as modified by this letter will be used for all flood insurance policies and renewals issued for your community.

The following table is a partial listing of existing and modified BFEs:

Location	Existing BFE (feet)*	Modified BFE (feet)*
Wash B:		
Approximately 50 feet upstream of Doubletree Ranch Road	None	1,403
At 120th Street	1,488	1,491
At Hayden Rhodes Aqueduct	1,506	1,517
Approximately 1,110 feet upstream of Hayden Rhodes Aqueduct	None	1,519
Approximately 3,800 feet upstream of Via Linda	None	1,781
Wash B Tributary:		
Approximately 250 feet upstream of confluence with Wash B	None	1,572
Approximately 100 feet downstream of Via Linda	None	1,600

*Referenced to the National Geodetic Vertical Datum, rounded to the nearest whole foot

Public notification of the proposed modified BFEs will be given in the *Arizona Republic* on or about July 18 and July 25, 2002. This public notification supersedes the prior public notification of proposed modified BFEs that was published in the *Arizona Republic* on or about June 6 and June 13, 2002. A copy of this (July) notification is enclosed. In addition, a notice of changes will be published in the *Federal Register*. Within 90 days of the second publication in the *Arizona Republic*, any interested party may request that FEMA reconsider the determination made by this LOMR. Any request for reconsideration must be based on scientific or technical data. All interested parties are on notice that, until the 90-day period elapses, the determination to modify the BFEs made by this LOMR may itself be modified.

Because this LOMR will not be printed and distributed to primary users, such as local insurance agents and mortgage lenders, your community will serve as a repository for these new data. We encourage you to disseminate the information reflected by this LOMR throughout the community, so that interested persons, such as property owners, local insurance agents, and mortgage lenders, may benefit from the

information. We also encourage you to prepare a related article for publication in your community's local newspaper. This article should describe the assistance that officials of your community will give to interested persons by providing these data and interpreting the 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 panels and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

The floodway is provided to your community as a tool to regulate floodplain development. Therefore, the floodway modifications described in this LOMR, while acceptable to FEMA, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

This LOMR is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development and for ensuring all necessary permits required by Federal or State law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the SFHA. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

The basis of this LOMR is, in whole or in part, a channel-modification/culvert project. NFIP regulations, as cited in Paragraph 60.3(b)(7), require that communities 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 regulations. Consequently, the ultimate responsibility for maintenance of the modified channel and culverts rests with your community.

This determination has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and is 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. 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 minimum NFIP criteria. These criteria are the minimum and do not supersede any State or local requirements of a more stringent nature. This includes adoption of the effective FIRM to which the regulations apply and the modifications described in this LOMR. Our records show that your community has met this requirement.

A Consultation Coordination Officer (CCO) has been designated to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Mr. Jack Eldridge
Chief, Community Mitigation Programs Branch
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7184

If you have any questions regarding floodplain management regulations for your community or the NFIP in general, please call the CCO for your community at the telephone number cited above. If you have any questions regarding this LOMR, please call our Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627).

Sincerely,

Max H. Yuan, P.E., Project Engineer
Hazards Study Branch
Federal Insurance and
Mitigation Administration

For: Matthew B. Miller, P.E., Chief
Hazards Study Branch
Federal Insurance and
Mitigation Administration

Enclosures

cc: Mr. Richard P. Harris, P.E.
Project Manager
Flood Control District
of Maricopa County

Mr. William Erickson
Floodplain Administrator
Storm Water Division
Transportation Systems Department
City of Scottsdale

Ms. Shanna Yager
Floodplain Administrator
Flood Control District
of Maricopa County

Mr. Victor Calderon
Community Assistance Program Manager
Arizona Division of Emergency
Management

Mr. Marc McIntosh, E.I.T.
Assistant Project Manager
Water Resources Department
Coe & Van Loo Consultants, Inc.

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE CITY OF SCOTTSDALE, MARICOPA COUNTY, ARIZONA, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On July 19, 2001, the Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the City of Scottsdale, Maricopa County, Arizona, through issuance of a Flood Insurance Rate Map (FIRM). The Federal Insurance and Mitigation Administration 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. The modified Base Flood Elevations (BFEs) revise the FIRM for the community.

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.

A hydraulic analysis was performed to incorporate the effects of new hydrology and existing culverts along Wash B from Doubletree Ranch Road to approximately 3,800 feet upstream of Via Linda and along Wash B Tributary from the confluence with Wash B to approximately 2,000 feet upstream. This has resulted in the establishment of a regulatory floodway, increases and decreases in SFHA width, and increased BFEs for Wash B from 116th Street (Extended) to the Hayden Rhodes Aqueduct. BFEs, SFHAs, and regulatory floodways were established along Wash B from Doubletree Ranch Road to 116th Street (Extended); along Wash B from approximately 1,100 feet upstream of the Hayden Rhodes Aqueduct to approximately 3,800 feet upstream of Via Linda; and along Wash B Tributary from the confluence with Wash B to approximately 2,000 feet upstream. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Wash B:		
Approximately 50 feet upstream of Doubletree Ranch Road	None	1,403
At 120th Street	1,488	1,491
At Hayden Rhodes Aqueduct	1,506	1,517
Approximately 1,110 feet upstream of Hayden Rhodes Aqueduct	None	1,519
Approximately 3,800 feet upstream of Via Linda	None	1,781
Wash B Tributary:		
Approximately 250 feet upstream of confluence with Wash B	None	1,572
Approximately 100 feet downstream of Via Linda	None	1,600

*National Geodetic Vertical Datum, rounded to nearest whole foot

Under the above-mentioned Acts of 1968 and 1973, the Federal Insurance and Mitigation Administration 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.

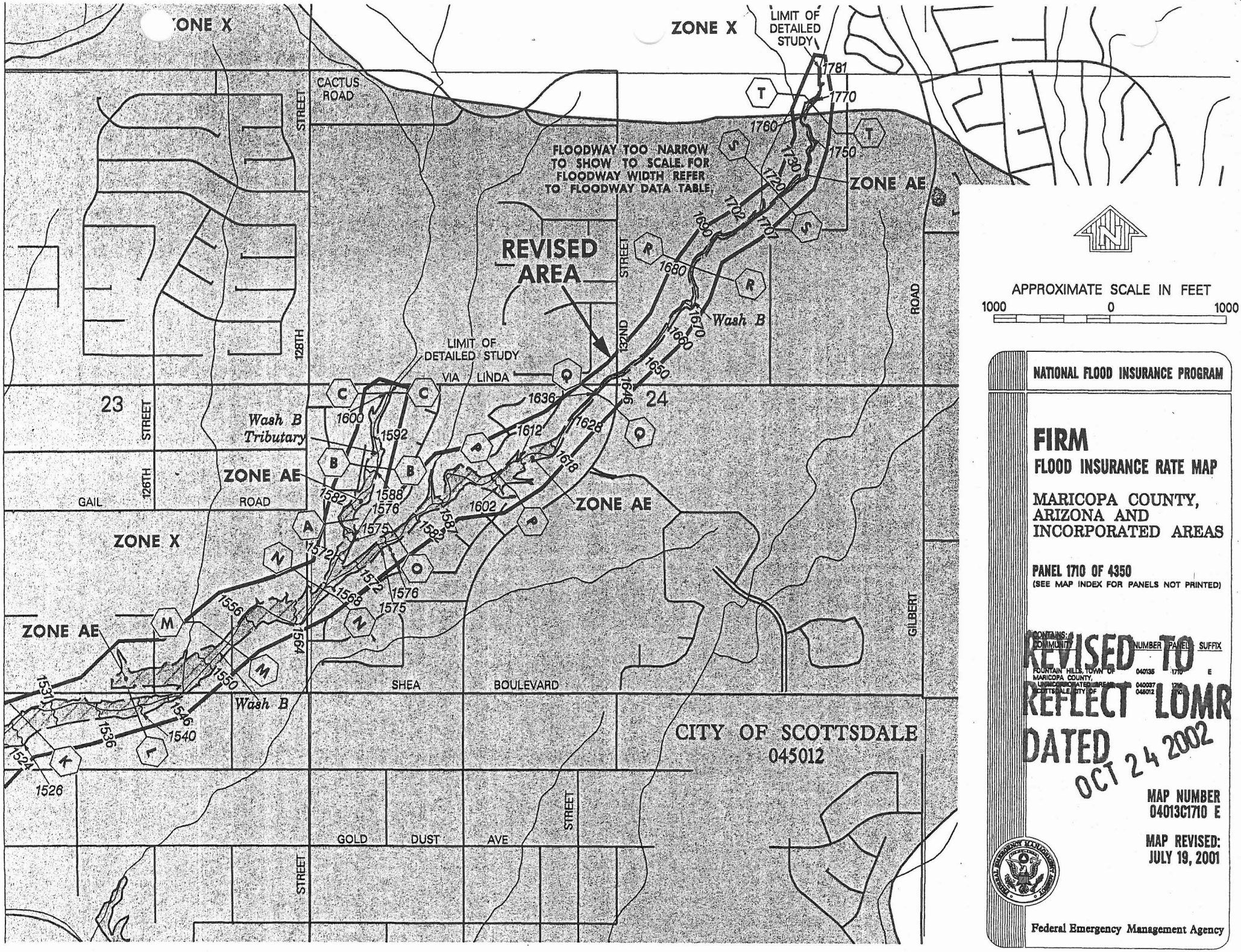
Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Federal Insurance and Mitigation Administration reconsider the determination. Any request for reconsideration 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 Federal Insurance and Mitigation Administration's determination to modify the BFEs may itself be changed.

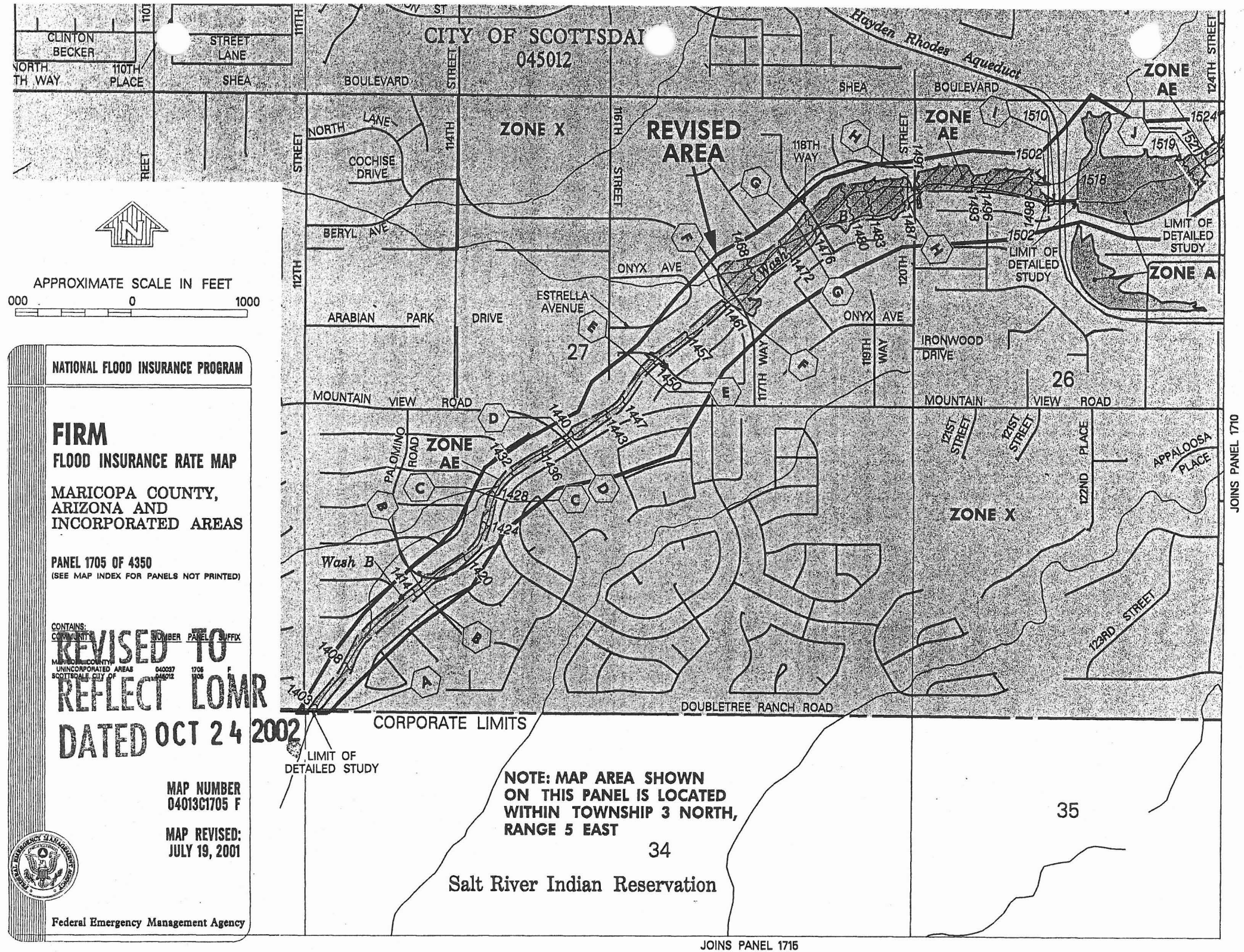
Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Mary Manross
Mayor, City of Scottsdale
3939 North Drinkwater Boulevard
Scottsdale, AZ 85251

A-2

Revised Firm Map


ZONE X
ZONE X
LIMIT OF DETAILED STUDY
CACTUS ROAD
128TH STREET
FLOODWAY TOO NARROW TO SHOW TO SCALE. FOR FLOODWAY WIDTH REFER TO FLOODWAY DATA TABLE.
ZONE AE
REVISED AREA
132ND STREET
ROAD
Wash B
LIMIT OF DETAILED STUDY
VIA LINDA
23
24
Wash B Tributary
ZONE AE
126TH STREET
GAIL ROAD
ZONE AE
ZONE X
ZONE AE
GILBERT
SHEA BOULEVARD
Wash B
CITY OF SCOTTSDALE
045012
GOLD DUST AVE
STREET
JOINS PANEL 1705
APPROXIMATE SCALE IN FEET
1000 0 1000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS
PANEL 1710 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
FOUNTAIN HILLS, TOWN OF 040135 1710 E
MARICOPA COUNTY, UNINCORPORATED AREAS 040037 1710 E
SCOTTSDALE, CITY OF 045012 1710 E
REVISED TO REFLECT LOMR DATED OCT 24 2002
MAP NUMBER
04013C1710 E
MAP REVISED:
JULY 19, 2001
Federal Emergency Management Agency


CITY OF SCOTTSDALE
045012
REVISED AREA
ZONE X
ZONE AE
ZONE A
Hayden Rhodes Aqueduct
SHEA BOULEVARD
NORTH LANE
COCHISE DRIVE
BERYL AVE
ONYX AVE
ESTRELLA AVENUE
ARABIAN PARK DRIVE
MOUNTAIN VIEW ROAD
IRONWOOD DRIVE
PALOMINO ROAD
APPALOOSA PLACE
DOUBLETREE RANCH ROAD
Wash B
Wash A
LIMIT OF DETAILED STUDY
CORPORATE LIMITS
112TH STREET
114TH STREET
116TH STREET
118TH WAY
119TH WAY
120TH STREET
117TH WAY
121ST STREET
122ND PLACE
123RD STREET
124TH STREET
27
26
35
NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 3 NORTH, RANGE 5 EAST
34
Salt River Indian Reservation
JOINS PANEL 1710
JOINS PANEL 1715
APPROXIMATE SCALE IN FEET
000 0 1000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS
PANEL 1705 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
MARICOPA COUNTY UNINCORPORATED AREAS 040037 1705 F
SCOTTSDALE CITY OF 045012 1705 F
REVISED TO REFLECT LOMR DATED OCT 24 2002
MAP NUMBER 04013C1705 F
MAP REVISED: JULY 19, 2001
Federal Emergency Management Agency

A-3

Summary of Discharges

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second) 10-Year	50-Year	100-Year	500-Year
Wash B					
At 112th Street	2.47	_1	_1	1,192	_1
At Shea Boulevard	0.21	_1	_1	2,018	_1
Approximate 3,900 feet upstream of Via Linda	0.26	_1	_1	333	_1
Wash B Tributary					
Approximately 1,000 feet North of the Confluence with Wash B	0.69	_1	_1	1,066	_1

[1]Not computed

REVISED TO
REFLECT LOMR
DATED OCT 24 2002

A-4

Floodway Data

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)			
Wash B								
A	8	172	252	3.9	1,402.8	1,402.8	1,402.8	0.0
B	1,381	87	171	7.0	1,415.5	1,415.5	1,415.5	0.0
C	2,450	82	166	7.2	1,427.3	1,427.3	1,427.3	0.0
D	3,306	58	136	9.5	1,439.5	1,439.5	1,439.5	0.0
E	4,196	78	182	6.6	1,449.4	1,449.4	1,449.4	0.0
F	5,128	104	1,134	8.0	1,460.8	1,460.8	1,460.8	0.0
G	5,999	215	299	4.7	1,475.3	1,475.3	1,475.3	0.0
H	6,992	195	735	5.8	1,487.1	1,487.1	1,487.1	0.0
I	8,264	69	110	7.9	1,501.5	1,501.5	1,501.5	0.0
J	9,678	169	329	8.9	1,519.7	1,519.7	1,519.7	0.0
K	10,179	213	432	7.6	1,528.0	1,528.0	1,528.0	0.0
L	11,180	165	407	7.0	1,540.0	1,540.0	1,540.0	0.0
M	12,190	95	289	7.0	1,551.5	1,551.5	1,551.5	0.0
N	13,355	106	315	6.5	1,567.7	1,567.7	1,567.7	0.0
O	14,152	95	158	4.7	1,578.6	1,578.6	1,578.6	0.0
P	15,448	90	62	5.4	1,604.4	1,604.4	1,604.4	0.0
Q	16,623	26	58	5.8	1,636.3	1,636.3	1,636.3	0.0
R	18,166	25	44	7.6	1,681.1	1,681.1	1,681.1	0.0
S	19,163	21	41	8.0	1,718.9	1,718.9	1,718.9	0.0
T	20,156	47	54	6.1	1,766.0	1,766.0	1,766.0	0.0

REVISED TO REFLECT LOMR DATED OCT 24 2002

[1]Feet above Doubletree Ranch Road

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

WASH B

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)			
Wash B Tributary								
A	732	128	250	4.3	1,579.4	1,579.4	1,579.4	0.0
B	1,306	110	253	4.2	1,588.5	1,588.5	1,588.5	0.0
C	1,979	42	147	7.2	1,600.1	1,600.1	1,600.1	0.0

REVISED TO REFLECT LOMR DATED OCT 24 2002

[1]Feet above confluence with Wash B

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

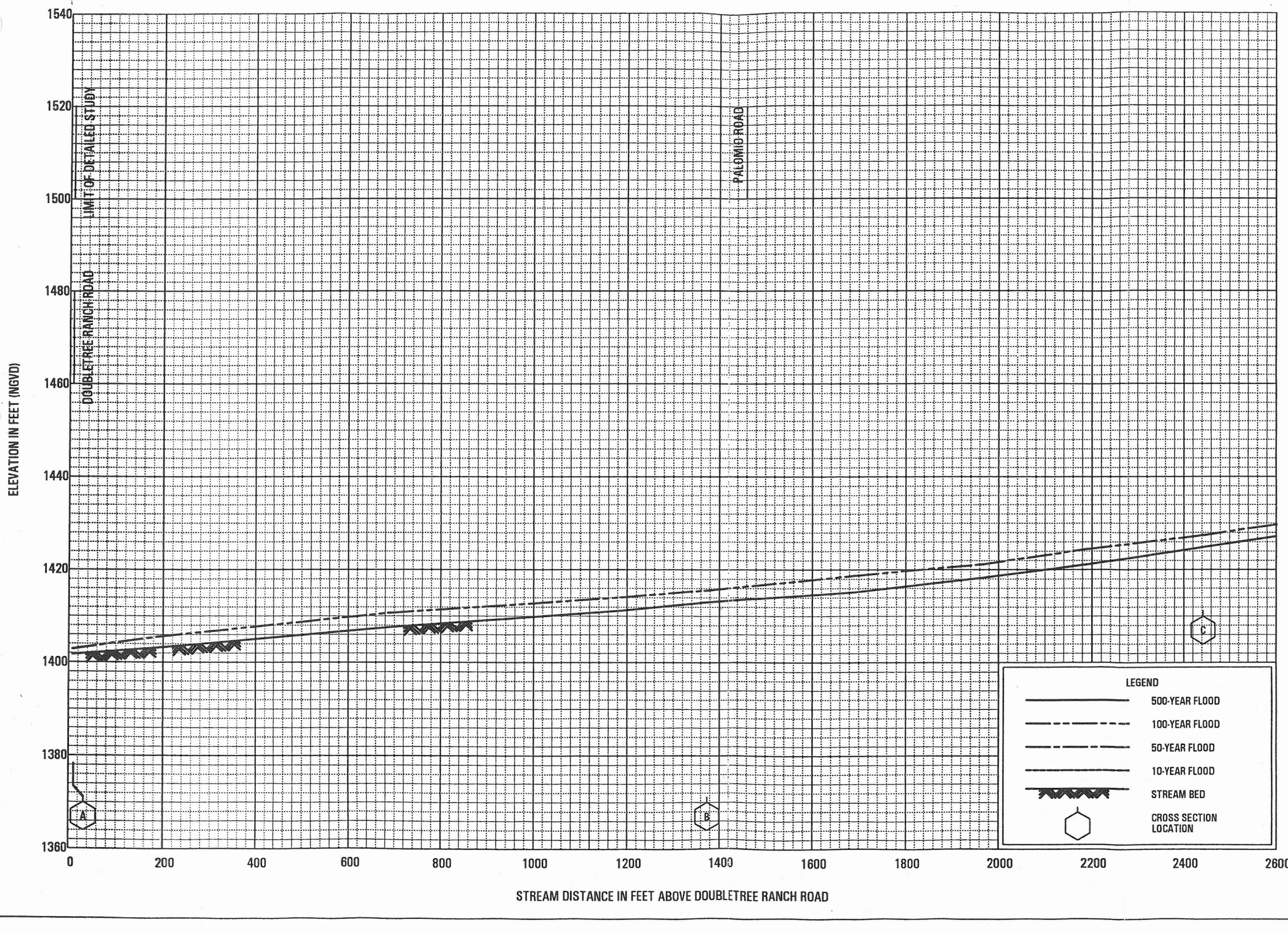
MARICOPA COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

WASH B TRIBUTARY

A-5

Flood Profiles



REVISED TO REFLECT LOMR DATED OCT 24 2002

FLOOD PROFILES

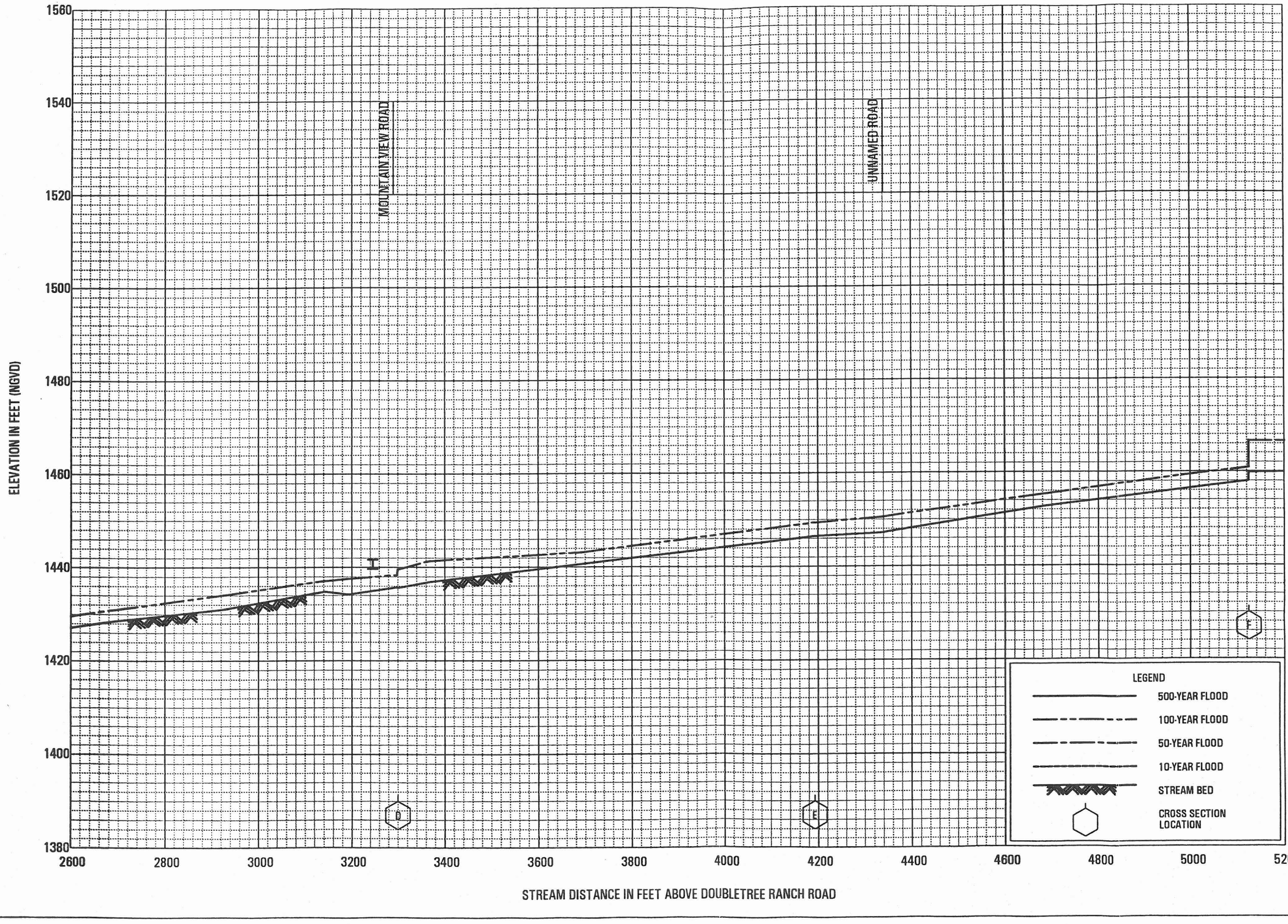
WASH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1199P



REVISED TO REFLECT LOMR DATED OCT 24 2002

FLOOD PROFILES

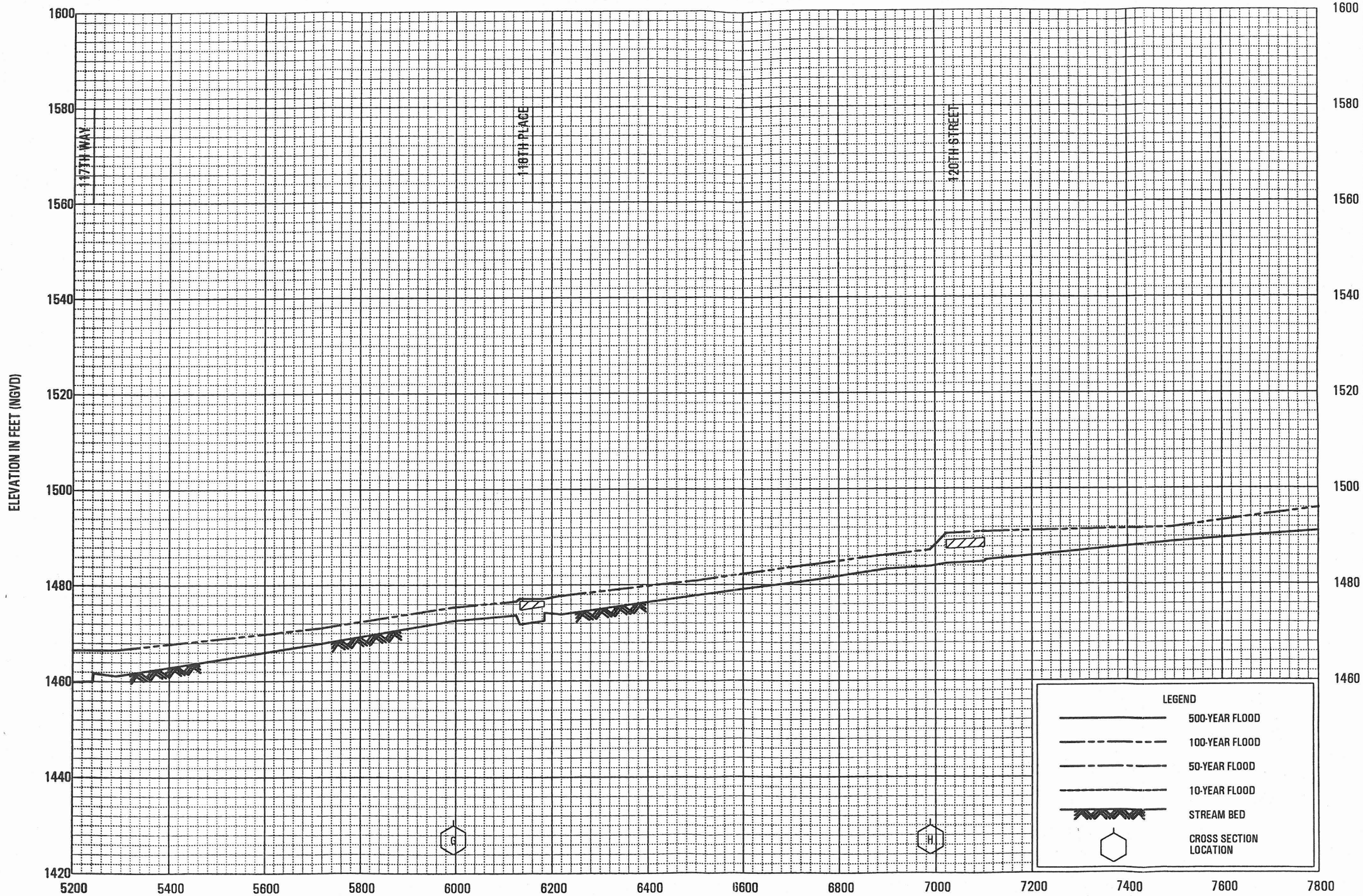
WASH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1200P



REVISED TO REFLECT LOMR DATED OCT 24 2002

FLOOD PROFILES

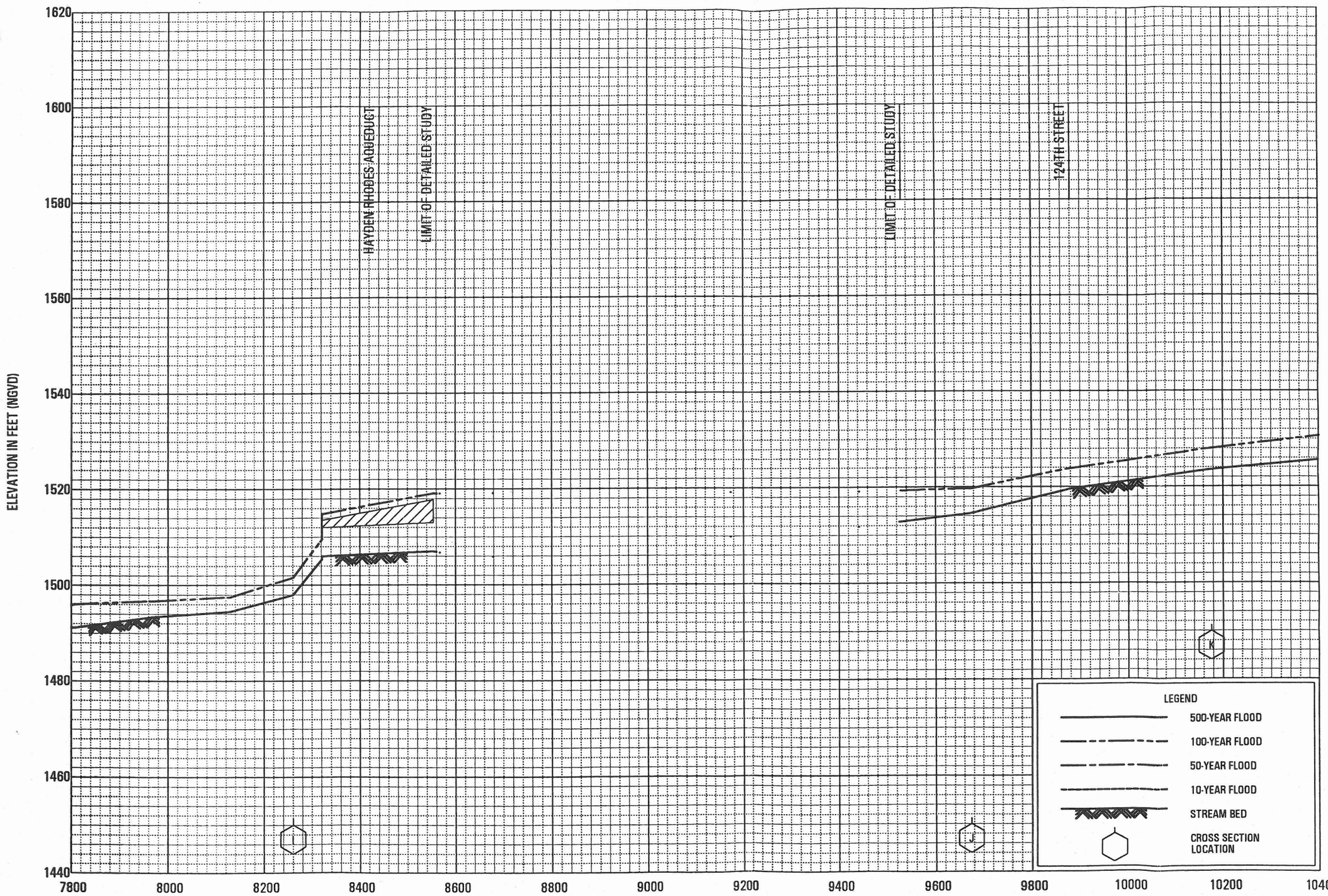
WASH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1201P



REVISED TO REFLECT LOMR DATED OCT 24 2002

FLOOD PROFILES

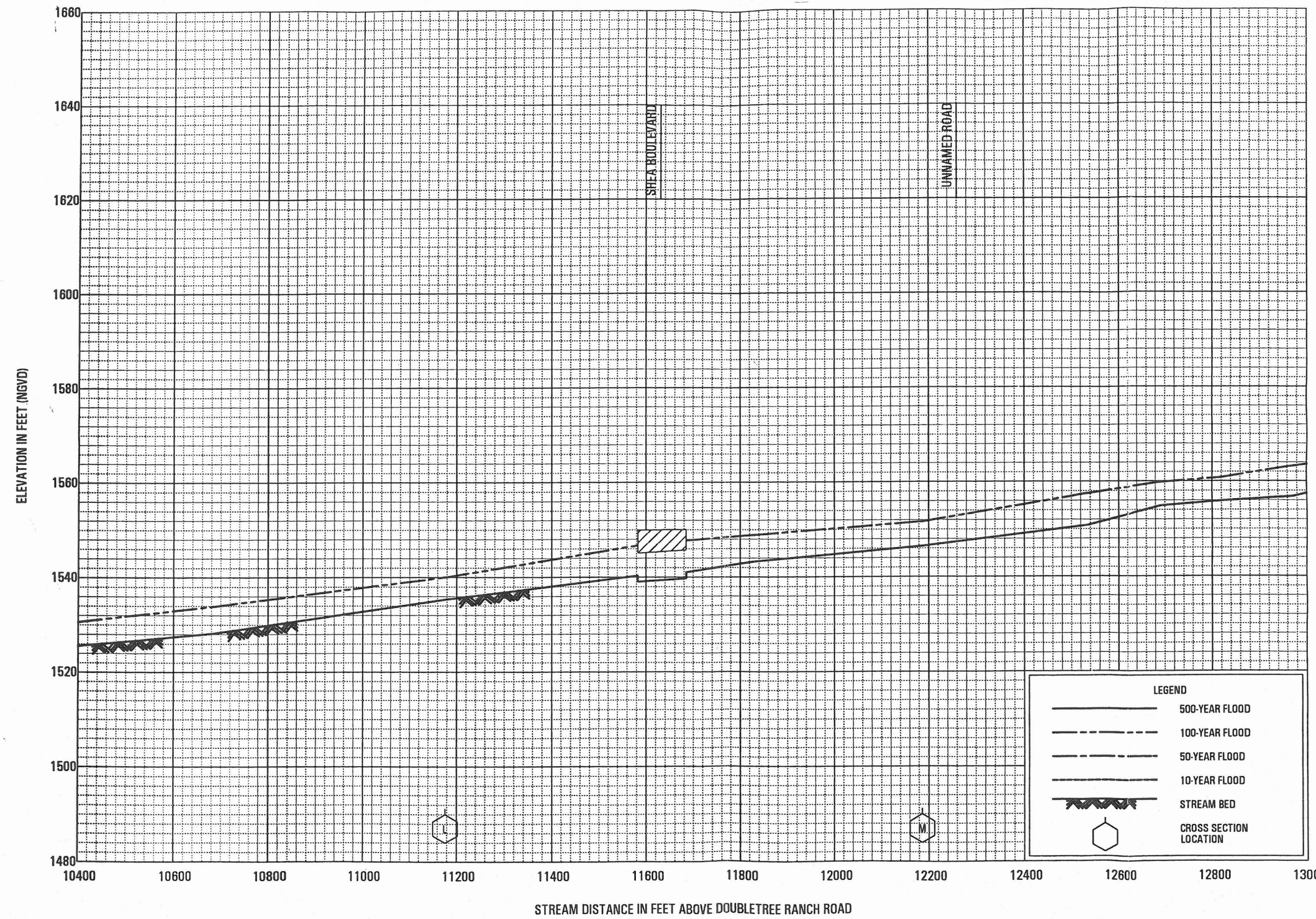
WASH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1202P



REVISED TO REFLECT LOMR DATED OCT 24 2002

FLOOD PROFILES

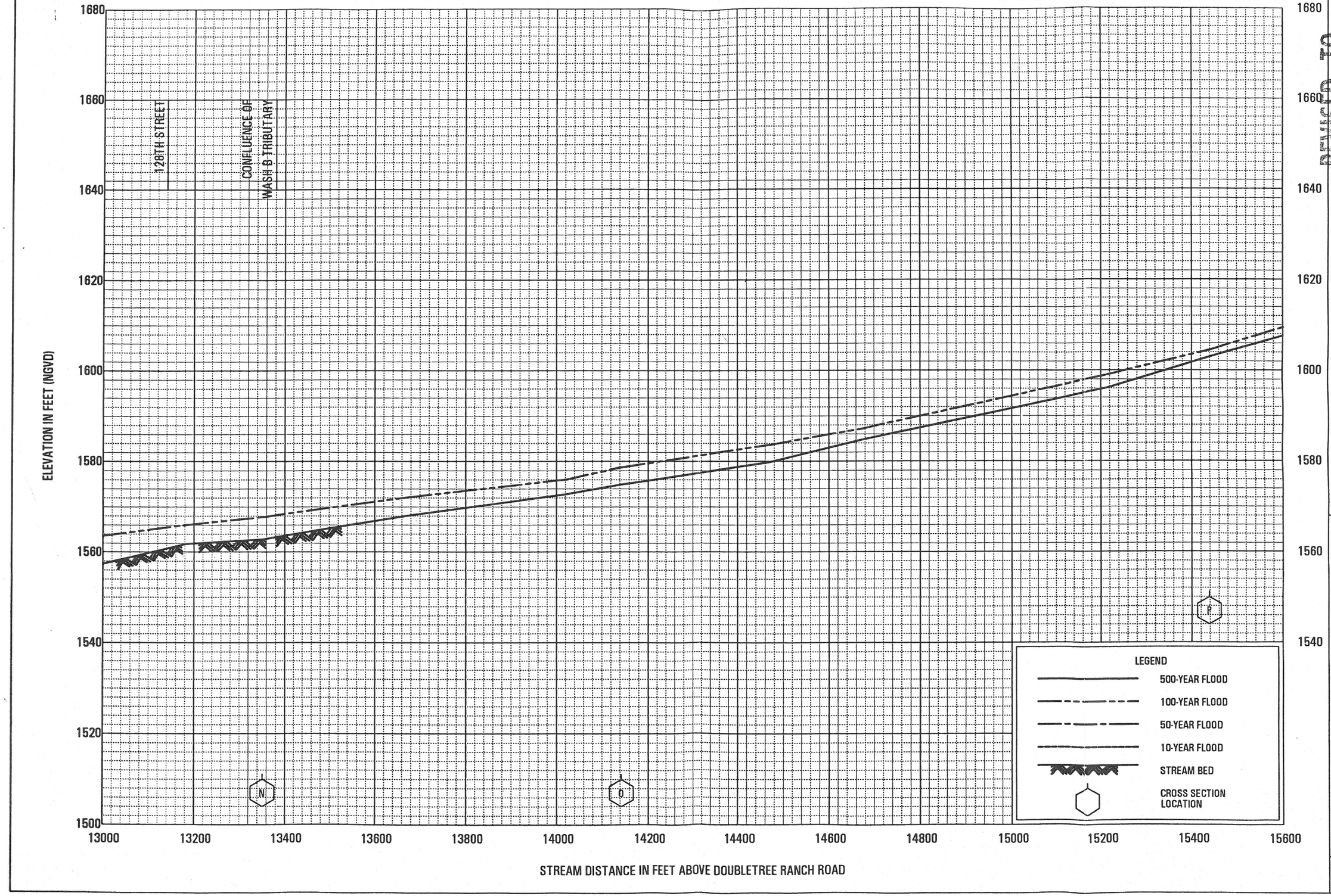
WASH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1203P



REVISED TO REFLECT LOMR DATED OCT 24 2002

FLOOD PROFILES

WASH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1204P

ELEVATION IN FEET (NGVD)

1740
1720
1700
1680
1660
1640
1620
1600
1580
1560

VIA LINDA

132ND STREET

Q

R

LEGEND

500-YEAR FLOOD

100-YEAR FLOOD

50-YEAR FLOOD

10-YEAR FLOOD

STREAM BED

CROSS SECTION LOCATION

15600 15800 16000 16200 16400 16600 16800 17000 17200 17400 17600 17800 18000 18200

STREAM DISTANCE IN FEET ABOVE DOUBLETREE RANCH ROAD

REVISED TO REFLECT LOMR DATED OCT 24 2002

FLOOD PROFILES

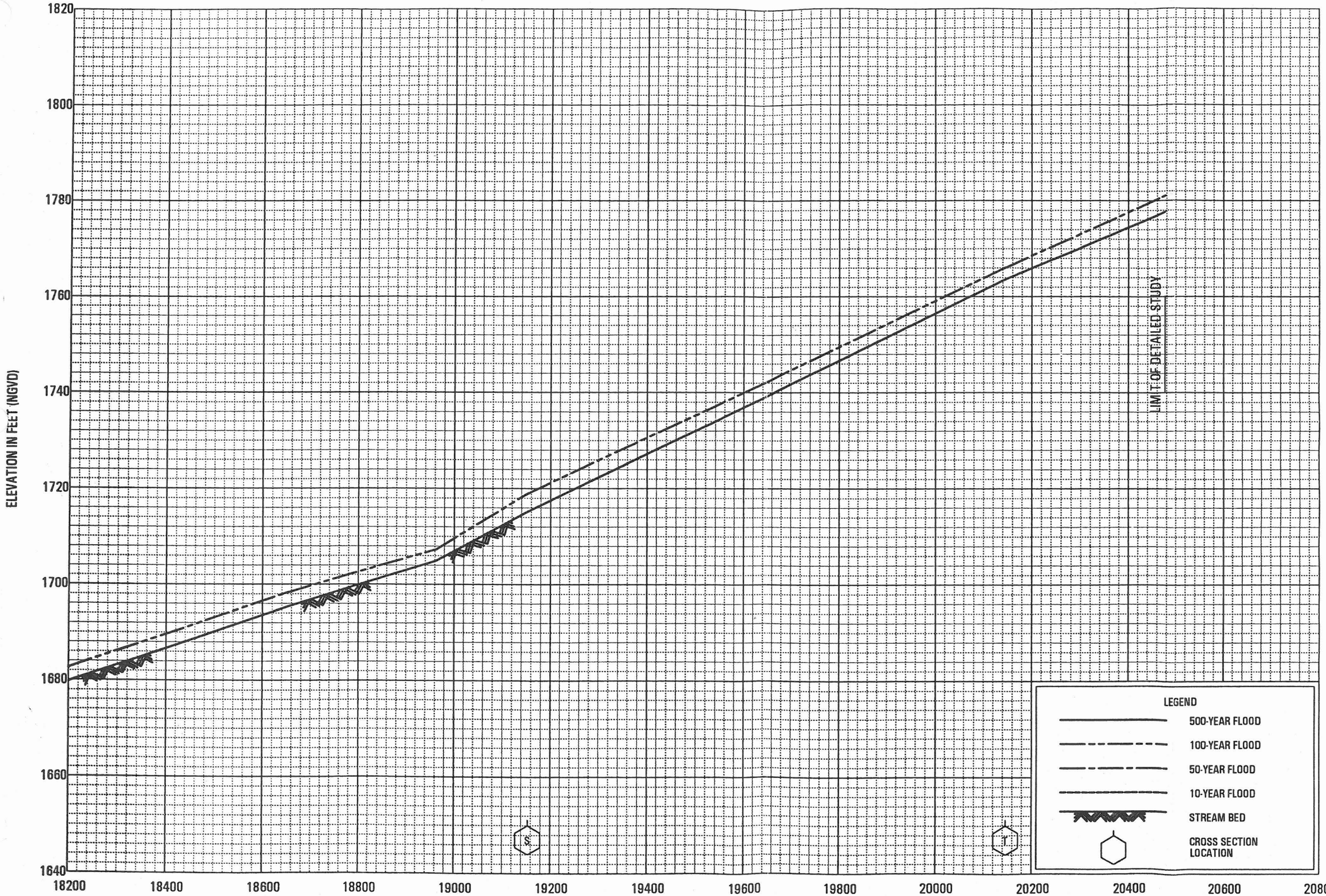
WASH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1205P



REVISED TO REFLECT LOMR DATED OCT 2 4 2002

FLOOD PROFILES

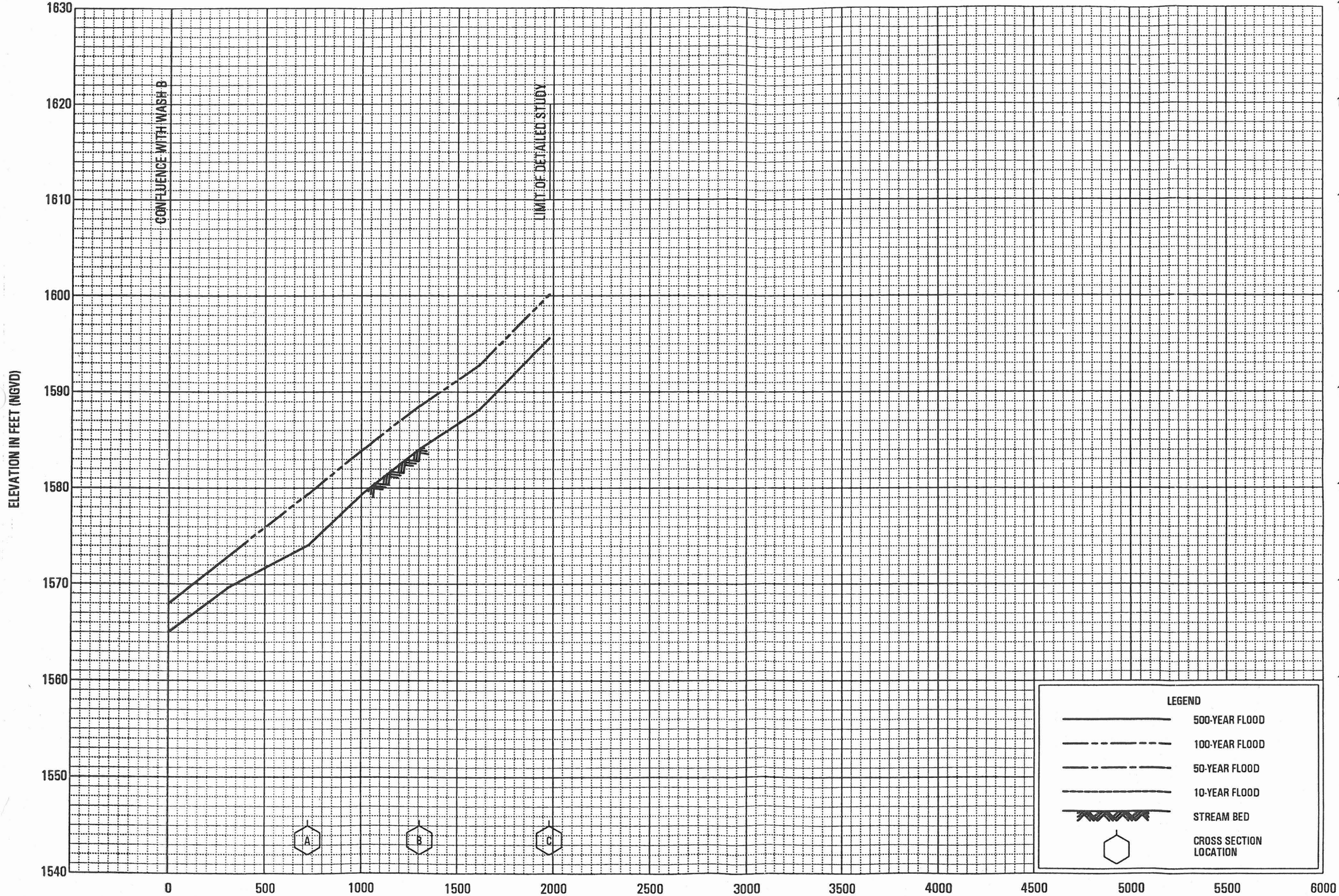
WASH B

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1206P



REVISED TO REFLECT LOMR DATED OCT 24 2002

FLOOD PROFILES

WASH B TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND INCORPORATED AREAS

1207P

A-6

Communication Documentation, Memoranda and Letters

NATIONAL FLOOD INSURANCE PROGRAM

FEMA MAP COORDINATION CONTRACTOR

FLOOD CONTROL DIST. OF MC
RECEIVED
FEB 25 '02
D-S&S
P.D
ADMIN
REG
✓ENG
CONTRACTS
ROUTING
RPH

February 22, 2002

Mr. Richard P. Harris, P.E.
Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

IN REPLY REFER TO:
Case No.: 01-09-987P
Community: City of Scottsdale, AZ
Community No.: 045012

316-AD/ACK

Dear Mr. Harris:

This acknowledges receipt of additional data in support of your request for a Letter of Map Revision for the above-referenced community. Our review of the submitted data indicates we have the minimum data needed to continue our evaluation. If we need additional data to complete our evaluation, or if delays are encountered, we will notify you in writing within 60 days of the date of this letter.

If you write to us about your request, please include the case number shown above in your letter. If you have general questions about your request, Federal Emergency Management Agency (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, Pernille Buch-Pedersen, who may be reached at (703) 317-6224.

Sincerely,

Andrea L. Ryon

Andrea L. Ryon, P.E., Director
Engineering Division
Michael Baker Jr., Inc.

cc: Mr. William Erickson
Floodplain Administrator
Storm Water Division
Transportation Systems Department
City of Scottsdale

Ms. Shanna Yager
Floodplain Administrator
Flood Control District
of Maricopa County

Mr. Victor Calderon
Community Assistance Program Manager
Arizona Division of Emergency
Management

Mr. Marc McIntosh, E.I.T.
Assistant Project Manager
Water Resources Department
Coe & Van Loo Consultants, Inc.

3601 Eisenhower Avenue, Suite 600, Alexandria, Virginia 22304-6425 PH: 703.960.8800 FX: 703.960.9125

Michael Baker Jr., Inc., under contract with the FEDERAL EMERGENCY MANAGEMENT AGENCY, is a Map Coordination Contractor for the National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FEMA MAP COORDINATION CONTRACTOR

JAN - 8 2002

FLOOD CONTROL DISTRICT
RECEIVED
JAN 14 '02
CH & GM
PIO
ADMIN
REC
ENG
CONTRACTS
ROUTING
RPH

Mr. Richard P. Harris, P.E.
Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

IN REPLY REFER TO:
Case No.: 01-09-987P
Community: Scottsdale, AZ
Community No.: 045012

316-AD

Dear Mr. Harris:

This is in regard to your July 24, 2001, request that the Federal Emergency Management Agency (FEMA) issue a Letter of Map Revision for the above-referenced community. In a previous letter, you were informed that additional data might be required to complete our review of the request. The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed below.

1. Our detailed review revealed water-surface elevations (WSELs) higher than the end points of the cross sections at Cross Sections 0.015, 1.6233, 1.6445, and 2.4044 of the Lower Reach in the revised conditions HEC-RAS hydraulic model for Wash B. Please extend the cross sections so that the end points of all cross sections are equal to or higher than the corresponding WSEL, or provide documentation that quantifies the amount of split flow that would occur if the cross sections were not extended and show the extent of all flow breakouts.

2. The base floodplain and floodway topwidths in the revised conditions HEC-RAS model for Wash B at Cross Sections 1.0024 and 1.6445, 354 feet and 664 feet, respectively, do not match the approximate topwidths shown on the submitted work map, 475 feet and 875 feet, respectively. Please provide an explanation for these discrepancies, or make the appropriate changes to the submitted HEC-RAS model or work map.

3. The proposed floodplain boundary delineations on the submitted topographic work map indicate that the high ground along the revised Lower Reach of Wash B from Cross Section 0.0015 through Cross Section 0.2271 may act as a levee. Please provide evidence that the levee complies with the requirements of Section 65.10 of the National Flood Insurance Program (NFIP) regulations, or provide an explanation why the high ground at the various cross sections along the revised reach does not act as a levee.

4. Our review of the submitted work map entitled "Flood Delineation Study of Wash B," prepared by Coe & Van Loo Consultants, Inc., dated December 2000, revealed a floodplain and floodway width of approximately 40 feet at the Central Arizona Project Canal. From the submitted work map, it is not clear how this width was determined. The submitted revised conditions HEC-RAS model indicates that approximately 1,299 cubic feet per second of weir flow would occur along Wash B at the canal. Please provide backup data that supports the floodplain and floodway boundary delineations along Wash B at the canal.

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.

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.

If you are unable to meet the 90-day deadline for submittal of required items, and would like us to continue processing your request, you must request an extension of the deadline. This request must be submitted to us in writing and must provide (1) the reason why the data cannot be submitted within the requested timeframe, and (2) a new date for the submittal of the data. FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. Therefore, the fees will be forfeited for any request for which neither the requested data nor a written extension request is received within 90 days.

If you have general questions about your request, FEMA policy, or the NFIP, 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, Pernille Buch-Pedersen, who may be reached at (703) 317-6224.

Sincerely,

Andrea L. Ryon, P.E., Director
Engineering Division
Michael Baker Jr., Inc.

Enclosure

cc: Mr. Collis Lovely
Floodplain Administrator
City of Scottsdale

Ms. Shanna Yager
Floodplain Administrator
Flood Control District
of Maricopa County

Mr. Victor Calderon
Community Assistance Program Manager
Arizona Division of Emergency
Management

Federal Emergency Management Agency

Washington, D.C. 20472

FEE SCHEDULE FOR PROCESSING REQUESTS FOR MAP CHANGES

This notice contains the revised fee schedule for processing certain types of requests for changes to National Flood Insurance Program (NFIP) maps. The change in the fee schedule will allow FEMA to further reduce the expenses to the NFIP by more fully recovering the costs associated with processing conditional and final map change requests. The revised fee schedule for map changes is effective for all requests dated June 1, 2000, or later and supersedes the current fee schedule, which was established on March 1, 1999.

To develop the revised fee schedule for conditional and final map change requests, FEMA evaluated the actual costs of reviewing and processing requests for Conditional Letters of Map Amendment (CLOMAs), Conditional Letters of Map Revision – based on Fill (CLOMR-Fs), Conditional Letters of Map Revision (CLOMRs), Letters of Map Revision – based on Fill (LOMR-Fs), Letters of Map Revision (LOMRs), and Physical Map Revisions (PMRs).

Fee Schedule for Requests for CLOMAs, CLOMR-Fs, and LOMR-Fs

Based on our review of actual cost data for Fiscal Year 1999, we are continuing to charge the following review and processing fees, which requesters must submit with all requests:

Request for single-lot/single-structure CLOMA, CLOMR-F, and LOMR-F	$400
Request for single-lot/single-structure LOMR-F based on as-built information (CLOMR-F previously issued by us)	$300
Request for multiple-lot/multiple-structure CLOMA	$700
Request for multiple-lot/multiple-structure CLOMR-F and LOMR-F	$800
Request for multiple-lot/multiple-structure LOMR-F based on as-built information (CLOMR-F previously issued)	$700

Fee Schedule for Requests for CLOMRs

Based on our review of actual cost data for Fiscal Year 1999, we are continuing to charge the following review and processing fees, which requesters must submit with all requests unless exempted by 44 CFR 72.5:

Request based on new hydrology, bridge, culvert, channel, or combination of any of these	$3,100
Request based on levee, berm, or other structural measure	$4,000

NATIONAL FLOOD INSURANCE PROGRAM
FEMA MAP COORDINATION CONTRACTOR

FLOOD CONTROL DISTRICT
RECEIVED
OCT 15 '01
CH & GM | FINANCE
PIO | LANDS
ADMIN | O & M
REG | P & PM
ENG | FILE
CONTRACTS
ROUTING

October 10, 2001

Mr. Richard P. Harris, P.E.
Flood Control District
of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009-6399

IN REPLY REFER TO:
Case No.: 01-09-987P
Community: Scottsdale, AZ
Community No.: 045012

316-ACK.FEX

Dear Mr. Harris:

This responds to your request dated July 24, 2001, that the 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:	Wash B
Flooding Source:	McDowell Mountains, North and East of Wash B
FIRM Panel(s) Affected:	04013C1705 F and 1710 E

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 a detailed hydrologic or hydraulic study conducted by a Federal, State, or local agency to replace an approximate study conducted by FEMA and shown on the flood map, no fees will be assessed for our review.

We have completed an inventory of the items that you submitted. We have received all the data we require to begin a detailed technical review of your request. If additional data are required, we will inform you within 60 days of the date of this letter.

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

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

3601 Eisenhower Avenue, Suite 600, Alexandria, Virginia 22304-6425 PH: 703.960.8800 FX: 703.960.9125

Michael Baker Jr., Inc., under contract with the FEDERAL EMERGENCY MANAGEMENT AGENCY, is a Map Coordination Contractor for the National Flood Insurance Program

(1-877-336-2627). If you have specific questions concerning your request, please call the Revisions Coordinator for your State, Pernille Buch-Pedersen, who may be reached at (703) 317-6224.

Sincerely,

Monther S. Madanat, Director
Engineering Division
Michael Baker Jr., Inc.

cc: Mr. Collis Lovely
Floodplain Administrator
City of Scottsdale

Ms. Shanna Yager
Floodplain Administrator
Flood Control District
of Maricopa County

Mr. Victor Calderon
Community Assistance Program Manager
Arizona Division of Emergency
Management

Want to talk to a Map Specialist about Flood Hazard Mapping?

If your home or business is located in the floodplain, you will need to purchase and maintain flood insurance. If you have a mortgage, your bank will require it.

FEMA MAP ASSISTANCE CENTER

FMAC

1-877-FEMA MAP

For all your flood hazard map questions, call toll-free:

1-877-FEMA MAP (1-877-336-2627)

or visit our Web Site at www.fema.gov/mit/tsd

FEMA's flood hazard maps— also called Flood Insurance Rate Maps or FIRMs— are used to determine your property's flood risk. Increasing development, severe weather events, and other activities in the floodplain will change the flood risks shown on the maps. FEMA is working hard to update and modernize all of the flood hazard maps. However, with more than 18,000 communities participating in the National Flood Insurance Program (NFIP), this will take time. Meanwhile, the FEMA Map Assistance Center (FMAC) has a staff of trained professionals ready to help

Typical flood hazard map questions we answer:

Property Owner: "My home has never flooded. Why do I need flood insurance?"

Real Estate Agent: "I think the previous owner had an exemption from flood insurance— is there a record of this exemption?"

Developers and Engineers: "What is the status of my request for a map change? How long will it take?"

Community Officials: "How do I request a physical revision to a flood map?"

Lenders: "How can we help our customers whose homes are located in a flood zone?"

Other important National Flood Insurance Program toll-free numbers:

- To purchase flood hazard maps for a nominal fee... **1-800-358-9616**
- For general flood insurance information... **1-800-427-4661**
- To order any current FEMA publication... **1-800-480-2520**
- For lender questions on flood policy coverage and rates... **1-800-611-6125**
- For agent questions on policy coverage and rates... **1-800-720-1093**

National Flood Insurance Program

NFIP

Administered by FEMA

September 18, 2001

CITY OF SCOTTSDALE

• "Most Livable City" U.S. Conference of Mayors •

FLOOD CONTROL DISTRICT
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CONTRACTS
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Mr. Richard P. Harris, P.E.
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009-6399

Mr. Monther S. Madanat, Director
Engineering Division
Michael Baker Jr. Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304-6425

Subject: Letter of Map Revision, Case No.: 01-09-987P
Scottsdale Arizona
Community Number 045012
Firm Panels 04013C1705F and 1710E

Gentlemen:

In reference to your August 27,2001 letter, second paragraph, item 2., the City of Scottsdale Arizona has continuously been a member of the regular National Flood Insurance Program starting in September of 1973.

As such the City has and will by statute enforce the requirements of the program in accordance with the provisions of the program as outlined in 44 CFR Ch. I pp 60.3 (e).

Any changes to the Flood Insurance Rate Map by the Federal Emergency Management Agency are adopted by reference as dictated by the Scottsdale Revised Code, Sec. 37-18 (a) as copied below.

" Sec. 37-18. Basis for establishment of special flood hazard areas and regulatory floodways.

"(a) The city is a participant in the National Flood Insurance Program (NFIP). The special flood hazard areas and the parts of those areas which are designated as regulatory floodways are identified and delineated by the federal emergency management agency (FEMA) in an engineering report titled "Flood Insurance Study, Scottsdale, Arizona" with accompanying flood insurance rate maps (FIRM) and flood hazard boundary maps (FHBM). Such studies and maps are prepared for communities participating in the NFIP. The first study and maps for Scottsdale were dated June 1972, and there have been several revisions. The current flood insurance study and flood insurance rate maps for

Scottsdale are on file at the city clerk's office, and **they are hereby adopted by reference and declared to be a part of this article."**

Further, in accordance with the provisions of the Arizona Revised Statutes, Title 48, Chapter 21 "Flood Control Districts" Article 1, "County Flood Control Districts" the City of Scottsdale adopted part 48-3610 in 1984 which requires the City to perform the same functions as the Flood Control District of Maricopa County with the exception of the taxing abilities of the District.

In short, by statute, the City of Scottsdale has adopted all current revisions to the Flood Insurance Rate Map and must enforce City, State and Federal provisions.

If there are further questions, please telephone me at (480) 312-7652.

Sincerely,

William Erickson
Floodplain Administrator

c: Mr. Victor Calderon, Arizona Division of Emergency Management
Mr. Collis Lovely, Public Works Planner

July 9, 2001

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

Review of project FCD 99-10, Wash 'B'.
Specifications for Review:
1. The CADD Data Delivery Specification, Revision 1.0, was used for the review of this study.
2. Reviewed by: Mark Brewer, G.I.S. Database Administrator (602) 506-2953
3. The PRJ_RID for this project is 1093.
4. The following files were reviewed as follows:
   [ ] Need to be addressed.
   [x] Passed the review.
   [f] Corrected by FCD in order to be accepted.

Current Submittal Comments:
Submitted: June 27 and July 2 and 3, 2001

CARTO.DXF, CARTO.XLS (CP-302)
1.[x] The remaining features for the DXF deliverable are accepted at this time. The XLS file was accepted from a previous submittal, see below.

DRNBSN.DXF, DRNBSN.XLS (CP-306)
1.[x] The DXF file is accepted at this time. The XLS file was accepted from a previous submittal, see below.

DRNPTH.DXF, DRNPTH.XLS (CP-308)
The DXF file is accepted at this time based on the following correction made by FCD. The XLS file was accepted from a previous submittal, see below.
1.[f] Some of the line work (1) is on an incorrect level designating the type of line that it is, i.e.: routing reach, time-of-concentration or both.

FPCTLFCD.XLS (CP-109 thru CP-111)
File is accepted at this time based on the following corrections made by FCD.
1.[f] Column MNT_LID is coded incorrectly for four points. The value was determined from the monument type described in column DESC.
2.[f] Column VER_LID is coded incorrectly for six points. The value was determined from an e-mail sent from the City of Scottsdale to John Stock at FCD.
3.[f] The values for ERM3 and ERM4 are reversed.
4.[f] Column XNAD83 has an incorrect value for ERM4.

Previous Submittal History:
Submitted: December 11, 2000
Submitted: January 17, 2001
Submitted: March 12, 16 and 19, 2001
Submitted: April 7, 2001
Submitted: May 2 and 7, 2001
Submitted: May 16 and June 14 and 19, 2001

CARTO.DXF, CARTO.XLS (CP-302)
1.[x] XLS file accepted with the May 2 and 7, 2001 submittal.
2.[f] Part one of the DXF file accepted with the May 16 and June 14 and 19, 2001 submittal.

DQ.XLS (CP-304)
1.[x] File accepted with the May 2 and 7, 2001 submittal.

DRNBSN.DXF, DRNBSN.XLS (CP-306)
1.[f] XLS file accepted with the May 16 and June 14 and 19, 2001 submittal.

DRNPTH.DXF, DRNPTH.XLS (CP-308)
1.[f] XLS file accepted with the May 16 and June 14 and 19, 2001 submittal.

FPBLN.DXF, FPBLN.XLS (CP-310)
1.[x] DXF file accepted with the April 7, 2001 submittal.
2.[x] XLS file accepted with the May 2 and 7, 2001 submittal.

FPSRFFCD.DXF (CP-311)
1.[f] File accepted with the May 2 and 7, 2001 submittal.

FPXFCD.DXF, FPXFCD.XLS (CP-313)
1.[f] DXF file accepted with the April 7, 2001 submittal.
2.[x] XLS file accepted with the May 2 and 7, 2001 submittal.

FPZNFCD.DXF, FPZNFCD.XLS (CP-315)
1.[x] DXF file accepted with the May 2 and 7, 2001 submittal.
2.[x] XLS file accepted with the April 7, 2001 submittal.

HEC-RAS OUTPUT (CP-319)
1.[f] File WB.TXT accepted with the May 16 and June 14 and 19, 2001 submittal.

NDXPRJ.DXF (CP-324)
1.[x] File accepted with the March 12, 16 and 19, 2001 submittal.

PRJ.DXF (CP-325)
1.[f] File accepted with the March 12, 16 and 19, 2001 submittal.

PRJDAT.XLS (CP-326)
1.[f] File accepted with the March 12, 16 and 19, 2001 submittal.

SOIL.DXF (CP-327)
1.[x] This file was supplied by FCD to the consultant, therefore it is not a required deliverable.

rph
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FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009-6399
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5897

BOARD OF DIRECTORS
Betsey Bayless
Jan Brewer
Fulton Brock
Don Stapley
Mary Rose Garrido Wilcox

July 6th, 2001

Coe & Van Loo, Inc.
4550 N. 12th Street
Phoenix, AZ 85014

Re: Wash "B" Floodplain Delineation Study (FCD 99-10)
Attn: Marc Mcintosh

Dear Mr. Mcintosh,

This is to acknowledge that we have reviewed the Hydraulics Analysis for this project and accept it as submitted.

Thank you.

Sincerely,

Richard P. Harris, P.E.
Project Manager

Cc Burke Lokey, CVL
Collis Lovely, City of Scottsdale

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009-6399
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BOARD OF DIRECTORS
Jan Brewer
Fulton Brock
Andrew Kunasek
Don Stapley
Mary Rose Garrido Wilcox

December 5, 2000

Coe and Van Loo, Inc
4550 N. 12th Street
Phoenix, AZ 85014

Re: Wash "B" Floodplain Delineation Study (FCD 99-10)
Attn: Emili Kolevski

Dear Ms. Koleveski:

This is to acknowledge that we have reviewed the Hydrology Repot and accept it as submitted.

Thank you.

Sincerely,

David B Boggs

David B. Boggs, P.E., CFM
Project Manager

Cc Joe Rumann
Burke Lokey, CVL
Collis Lovely, City of Scottsdale

April 14, 2000

Coe and Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, Arizona 85014-0928

Attn: Ms. Emilija Kovevski

Re: Wash "B" FDS (FCD-99-10): Mannings "n" Value Estimation Report

Dear Ms. Kolevski:

We have completed our review of the "n" Value Determination Report and find it is acceptable. The report is therefore approved and the "n" values should be used for hydrologic modeling. However, during the HEC-RAS modeling, if the computed depth of flow is found to be unreasonably high or low, it might be necessary to modify the "n" values slightly, to obtain reasonable results for the water surface profiles generated.

Our next meeting is tentatively scheduled for Wednesday, May 10, 2000 at your office. I will confirm the date and time after I hear from Collis Lovely from Scottsdale. By the way, could you add a discussion of progress on the first FEMA submittal, based solely upon the CAP alignment shift to the Agenda of the upcoming meeting?

Sincerely,

David B. Boggs
Project Manager

Cc Collis Lovely
Project files

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
WASH B FLOODPLAIN DELINEATION STUDY
FCD 99-10

PROGRESS REPORT
November 2000

1. Work Accomplished Up to and Through the Month of November.

Planning and coordination of the meetings on November 9, 2000 and December 8, 2000.

Completion of HEC-RAS floodplain delineation and Methods 1 and 4.

Completion and finalization of hydrologic model and Hydrology Report. Completion of CAD deliverables for hydrology.

2. Work Completed by Task

Task	% Complete This Period	% Complete to Date
1. Coordination	1%	91%
2. Data Collection	0%	95%
3. Topographic Mapping	0%	95%
4. Field Survey	0%	95%
5. Hydrology	5%	100%
6. Floodplain Delineation	20%	80%
7. HIS Data	N/A	N/A
8. Deliverables	20%	20%

3. Work to be Accomplished During the Months of November and December.

Finalizing Method 1 and method 4 analysis and review and compilation of Hydraulics Report, CAD deliverables and Technical Data Notebook.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
WASH B FLOODPLAIN DELINEATION STUDY
FCD 99-10

PROGRESS REPORT
September 2000

1. Work Accomplished Up to and Through the Month of September.

Planning of the meeting on September 15, 2000 and coordination between CVL, COS and FCD for agreement on cross-sections to be used in the HEC-RAS delineation.

Data was obtained from US Bureau of Reclamation on CAP overchute design data, regression curves for discharge ranges in Scottsdale area from the US Geological Survey and a HEC-2 model for the Wash B area from FEMA that pre-dates the CAP Canal.

Comments from COS and FCD were discussed at 9/15 meeting and were addressed and revised report was delivered to COS and FCD prior to October 5, 2000 meeting. HEC-1 model has (had) been approved and hydrology report would be approved after revisions were made.

Cross-sections were given to COS and FCD for comment. Several cross-sections were added to improve floodplain alignment and per comments by COS. Revised cross sections were prepared for October meeting.

2. Work Completed by Task

Task	% Complete This Period	% Complete to Date
1. Coordination	30%	90%
2. Data Collection	25%	95%
3. Topographic Mapping	75%	95%
4. Field Survey	90%	95%
5. Hydrology	54%	95%
6. Floodplain Delineation	40%	60%
7. HIS Data	N/A	N/A
8. Deliverables	0%	0%

3. Work to be Accomplished During the Months of October and November.

Finalizing of HEC-1 model and Hydrology Report for Final Submittal. Finalizing of HEC-RAS cross-sections and model. Method 1 and method 4 analysis and review and compilation of Hydraulics Report and Technical Data Notebook.

PROGRESS REPORT
WASH B
CONTRACT NO.: 99-10

MEETINGS:

Kick-off Meeting, February 8, 2000:

Tim Kelly, Marc McIntosh and Emili Kolevski from CVL met with David Boggs and Joe Rumann from the Maricopa County Flood Control District (MCFCD) and with Collis Lovely from the City of Scottsdale to kick-off the Wash B Floodplain Delineation project. The MCFCD stated that there would be two separate FEMA submittals, one would be the CAP Canal alignment shift LOMR based on as-builts using the top of embankment ponding limits (due 4/14), and the second would be a final LOMR including new hydrology and HEC-RAS for Wash B and tributaries above CAP (to Cactus Rd. and Via Linda Rd., due 8/8). This final LOMR would include the ponding area behind the CAP based on storage routing and overchute capacity and the delineation HEC-RAS from the CAP to Doubletree Ranch Rd.

The MCFCD also stated that there are no new aerial photos, CVL would use 1993 topographic mapping overlayed on 1999 semi-rectified aerial photographs. Also, no HEC-RAS runs would be accepted until HEC-1 discharges were OK'd in writing by the MCFCD.

A field investigation was scheduled for February 10, 2000.

FIELD INVESTIGATIONS:

February 10, 2000:

Marc McIntosh and Emili Kolevski met with David Boggs, Joe Rumann and Collis Lovely at the Wash B site to investigate the channel and drainage paths. All of the investigation occurred at the southern portion of Wash B, below Shea Boulevard and at the Zone A area.

An artificial berm was discovered just south of the overchute spillway at the CAP Canal. This berm would prevent any flow from the east or southeast of Wash B from going into the spillway overchute. This berm caused two separate ponding areas to form behind the CAP Canal, each independent of one another. However, David Boggs and Joe Rumann stated that the lower ponding areas, although a separate issue, did contribute to the Zone A area and should be included in the Wash B study. Also a 36-inch-diameter culvert underchute was discovered south of the berm area.

Next, the investigation continued southwest from the CAP Canal overchute to the Salt River Indian Reservation Boundary. Almost all road crossings and bridges were investigated and some portions of the wash were walked through.

February 16, 2000:

Another field investigation was conducted by Tim Kelly, Marc McIntosh and Emili Kolevski to collect information on "n" values and to take photographs. The road and bridge crossings were re-examined and measured and almost the entire main wash was walked through including the secondary tributary to Via Linda Rd. Notes were taken on the bed materials, vegetation, obstructions, side slopes of the channels and the size of the culvert openings at bridges and under roads. Photographs were taken and documented.

DATA COLLECTION:

To this date, CVL has not received any hydrologic or hydraulic data regarding Wash B or any portion of the affected area that has been previously developed and studied, from the City of Scottsdale. Four sheets of cross-sections of the Granite Reef Aqueduct (CAP Canal) from station 140+00 to station 360+00 were provided by the City of Scottsdale and a summary of Wash B discharges was found at CVL in a 1995 Flood Insurance Study for Maricopa County done by FEMA. A sheet of the CAP Canal showing cross drainage structures was sent by the MCFCD on 2/16/00. Mapping data obtained has been 1993 topographic mapping at a 2-foot contour level, and some aerial photography provided by the City of Scottsdale, and 1999 semi-rectified aerial photographs provided by the MCFCD .

MAPPING:

The 1993 topographic mapping provided by the City of Scottsdale has been overlayed onto 1999 aerial photographs and the plan sheets and a cover sheet have been layed out. Over 55 cross-sections have also been layed out for the HEC-RAS. Drainage basin sheets for Wash B and Zone A showing the drainage areas and sub-basins, an exhibit showing the routing path and Plate 1 showing the soils delineation have also been layed out for use with the hydrology report. Several other sheets were layed out as well for obtaining areas and volumes of ponding (exhibit 2), for hydrologic and soil data (data files) required for MCFCD submittal and several cross-sections of Wash B and the CAP Canal and berm for use in he HEC-1 model development.

HYDROLOGY:

The sub-basins for the watershed have been delineated and their areas and flow paths calculated. Rainfall depth was determined using charts provided in the Drainage Design Manual for Maricopa County. Areal reduction was applied for both the 6-hour and 24-hour storms and the Green-Ampt methodology was used to estimate rainfall losses. This information plus the soils information found in the SCS Soils Survey for the Aguila-Carefree Area were entered into the

DDMS programs and MCUHP2 program to provide the input for the HEC-1 model, such as unit hydrographs (S-graph method) and times of concentration, etc. All channel routings through the watershed and their respective cross-sections have been developed using the Normal Depth Routing and the routing through the CAP Canal overchute has been completed including its rating table and

this has also been input into the HEC-1 model. The preliminary HEC-1 runs for the 100-year, 6-hour storm and the 24-hour storm have been completed and sent to the MCFCD for review on 3/8/00. The preliminary discharges developed by the HEC-1 model will be discussed by CVL , the MCFCD and the City of Scottsdale in a meeting scheduled for 3/15/00.

The hydrology report has been adapted from a previous study, the Luke Wash Delineation, and revised with Wash B statistics and general information. Almost all graphs, tables and charts have been modified for the Wash B study. However, the report cannot be finalized until the preliminary discharges from the HEC-1 runs have been reviewed and accepted by the MCFCD.

ZONE A:

The watershed contributing to the Zone A ponding at the CAP Canal was also divided into sub-basins. The areas and flow lengths were calculated. The sub-basin nearest to the Wash B watershed, just below the berm, was run through a mini-HEC-1 program to determine the depth of ponding, the routing through the culvert underchute under the CAP (at CAP station 243+00) and ultimately if it does or does not overtop the canal at any point. At this point, the CAP canal is about 10 feet lower than the areas just north (at Wash B) and south. The berm prevents it from flowing towards the CAP Canal overchute at Wash B (at CAP station 234+10) and a high ground elevation prevents it from flowing south and contributing to the Zone A areas south of the underchute. The preliminary HEC-1 in this area shows that it will not overtop the CAP.

The two sub-basins south of this area, however, cannot be analyzed within the scope of this project. Their areas and flow paths were calculated, but after looking at topographic mapping in this area, it is obvious that these two sub-basins are only a part of a larger watershed, approximately 2.5 square miles, that contributes to flow and ponding at another CAP Canal overchute located several thousand feet out of the study area (at CAP station 332+75).

PROGRESS REPORT
WASH B
CONTRACT NO.: 99-10

MEETINGS:

March 15, 2000:

Tim Kelly, Marc McIntosh and Emili Kolevski from CVL met with David Boggs and Joe Rumann from the Maricopa County Flood Control District (MCFCD) and with Collis Lovely from the City of Scottsdale (COS) at CVL. The key points of discussion included removing the loss cards from the HEC-1 routing and verifying the on-site retention in Scottsdale to justify using the divert cards in the HEC-1 model. Also, a clarification was made of where new hydrology will be done and where the top-of-bank elevation will be used in the floodplain delineation of the Wash B and the Zone A areas. The "n" values used in the HEC-1 model would have to be modified to reflect the final "n" value report. It was determined that some adjustments would be made to the input parameters for the HEC-1 model, such as the percent imperviousness factor (%RTIMP), and the MCFCD promised to provide comments within a week so that the HEC-1 model could be revised. Collis Lovely from COS promised new, year 2000 aerials of the Wash B study area and the exact number and location of subdivisions within the study area with on-site retention. It was agreed by all that the final Q determined by CVL at the overchute outlet at the CAP Canal and approved by MCFCD and COS would be used to do the HEC-RAS modeling.

CVL promised to continue to work on the Zone A delineation while the HEC-1 input was being reviewed. The "n" value report was completed on 3/15/00 and sent to the MCFCD and COS for review.

FIELD INVESTIGATIONS:

March 29, 2000:

Marc McIntosh returned to the Wash B site for another field investigation to collect more detailed information on "n" values and to re-evaluate some parameters in accordance with comments provided in the MCFCD's review of the "n" value report on 3/26/00. Notes were taken on the bed materials, vegetation, obstructions, side slopes of the channels and the size of the culvert openings at bridges and under roads. Photographs were taken and documented.

DATA COLLECTION:

N/A

MAPPING:

Two figures, Figure 3, Study Area and Location Map, and Figure 4, Community Map, have been finalized for use in the hydrology report. Mapping is currently being developed for the floodplain delineation in the Zone A areas.

HYDROLOGY:

Some minor revisions have been made to the input parameters for the Wash B HEC-1 model per discussions made with MCFCD and COS at the 3/15/00 meeting. However, the hydrology, HEC-1 model, for Wash B can not be continued until comments/revisions are received from the MCFCD and an accurate number for on-site retention is provided by COS.

The hydrology report is almost complete, however, the report cannot be finalized until the preliminary discharges from the HEC-1 runs have been reviewed and accepted by the MCFCD. The technical data notebook is currently being assembled.

ZONE A:

Some minor revisions have been made to the Zone A HEC-1 and mapping is being developed for the floodplain delineation in these areas.

HYDRAULICS:

The manning's "n" value report was revised and re-submitted on 4/5/00 after another field investigation was performed on 3/29/00.

A water surface profile was created in HEC-RAS for the entire reach and tributary not including any road crossings. A detailed survey of the road crossings, bridges and culverts, the final Q's and the final "n" values are needed to complete the model.

PROGRESS REPORT
WASH B
CONTRACT NO.: 99-10
April/May 2000

MEETINGS:

May 10, 2000:

Tim Kelly, Marc McIntosh and Emili Kolevski from CVL met with David Boggs and Joe Rumann from the Maricopa County Flood Control District (MCFCD) and with Collis Lovely from the City of Scottsdale (COS) at CVL. The key points of discussion included the modified HEC-1 with the adjusted input parameters (%RTIMP, Vegetal Cover, etc). The revised HEC-1 will be reviewed by the MCFCD and COS within the next few weeks. Due to the lack of on-site retention in the subdivisions in COS, no diverts will be used in the modified HEC-1 model. However, the COS is investigating the on-site retention for an elementary and middle school in the Wash B drainage area. Depending on the amount of retention, some of the flows from this area may be diverted from the Wash B drainage area. The modified HEC-1 shows a total flow of 3122 cfs entering the CAP overchute and 2849 cfs routed through the overchute. These flows will cause a depth of 1.1 feet of overtopping and approximately 273 cfs of overtopping flows. This overtopping flow will be split with 50% overtopping the CAP and 50% overtopping the berm south of the CAP, due to a low area in this region. The HEC-1 will be revised to show this flow split and the addition of the flows to the area south of the berm.

The first FEMA submittal will be based on the new topography, the CAP alignment shift and the top of bank elevation of the CAP. This submittal should be completed within the next few weeks. Surveying of the road crossings and structures in the Wash B area along with an acceptable final Q will be necessary in order to complete the HEC-RAS model. Also, the COS will research their files for any as-builts or drainage reports that pertain to the box culvert structure at 120th Street.

FIELD INVESTIGATIONS:

A field investigation for the box culvert on 120th Street may be necessary in the next several weeks unless more detailed information can be found for this structure.

DATA COLLECTION:

A 400 scale 1999 aerial map of the Wash B area was obtained from the COS for more detailed subdivision/development information to assist in the revisions to the input parameters for the modified HEC-1 model.

MAPPING:

Mapping is currently being developed for the floodplain delineation in the Zone A areas.

HYDROLOGY:

The input parameters for the Wash B HEC-1 model have been revised per discussions made with MCFCD and COS at the 3/15/00 meeting and comments made 4/14/00 by the MCFCD. The percentage of developed areas, % of vegetal cover, % imperviousness have all been modified to reflect the 1999 aerial map and COS standards. The COS requires a minimum of 25% natural area for each development and has a vegetal cover requirement of 15-25%. The revised HEC-1 was resubmitted to the MCFCD and the COS for a second review. The HEC-1 is currently being revised to reflect the split flows at the CAP and berm, however, it can not be continued after that point until comments/revisions are received from the MCFCD and an accurate number for on-site retention is provided by COS.

The hydrology report is being modified to reflect the HEC-1 model changes, however, the report cannot be finalized until the final discharges from the HEC-1 runs have been reviewed and accepted by the MCFCD. The technical data notebook is currently being assembled.

A new version of DDMS has recently become available through the MCFCD's web site. At the MCFCD's request, the entire HEC-1 model is currently being re-inputed into the new version of DDMS. All sub-basin information will have to be re-entered and the HEC-1 model will have to be re-created within the new program. This effort may take several weeks to complete.

ZONE A:

Zone A mapping is currently being developed for the floodplain delineation in these areas for the first FEMA submittal.

HYDRAULICS:

A water surface profile was created in HEC-RAS for the entire reach and tributary not including any road crossings. A detailed survey of the road crossings, bridges and culverts and the final Q's are needed to complete the model.

PROGRESS REPORT
WASH B
CONTRACT NO.: 99-10
May/June 2000

MEETINGS:

May 10, 2000:

Tim Kelly, Marc McIntosh and Emili Kolevski from CVL met with David Boggs and Joe Rumann from the Maricopa County Flood Control District (MCFCD) and with Collis Lovely from the City of Scottsdale (COS) at CVL. The key points of discussion included the modified HEC-1 with the adjusted input parameters (%RTIMP, Vegetal Cover, etc). The revised HEC-1 will be reviewed by the MCFCD and COS within the next few weeks. Due to the lack of on-site retention in the subdivisions in COS, no diverts will be used in the modified HEC-1 model. However, the COS is investigating the on-site retention for an elementary and middle school in the Wash B drainage area. Depending on the amount of retention, some of the flows from this area may be diverted from the Wash B drainage area. **(The amount of area that has on-site retention is 85.9 acres, this includes 3 schools, their grounds and athletic fields and a church site. This area will be removed from the corresponding sub-basin areas and the HEC-1 model will be re-run to reflect this on-site storage.)** The modified HEC-1 shows a total flow of 3122 cfs entering the CAP overchute and 2849 cfs routed through the overchute. These flows will cause a depth of 1.1 feet of overtopping and approximately 273 cfs of overtopping flows. This overtopping flow will be split with 50% overtopping the CAP and 50% overtopping the berm south of the CAP, due to a low area in this region. The HEC-1 will be revised to show this flow split and the addition of the flows to the area south of the berm.

The first FEMA submittal will be based on the new topography, the CAP alignment shift and the top of bank elevation of the CAP. This submittal should be completed within the next few days. Surveying of the road crossings and structures in the Wash B area along with an acceptable final Q will be necessary in order to complete the HEC-RAS model. Also, the COS will research their files for any as-builts or drainage reports that pertain to the box culvert structure at 120th Street.

FIELD INVESTIGATIONS:

A field investigation for the on-site retention areas at Anazi Elementary, Desert Mountain and Mountain Middle School and a new church site at Gail Street and 124th Street was conducted on 5/23/00 by Tim Kelly and Emili Kolevski. It was determined that the retention basins (the athletic fields) retained only the on-site flows. No off-site flows are directed into the basins. The

church site retention basin also only handles its own on-site flow. The amount of area that has this on-site retention was approximated using 1999 aerial maps from the COS to be 85.9 acres.

DATA COLLECTION:

N/A

MAPPING:

Mapping is currently being developed for the floodplain delineation in the Zone A areas. The top of bank elevation at the CAP Canal was used to determine the extent of the Zone A floodplain. The original delineation was based on an erroneous alignment of the CAP Canal. Both the original delineation and the new delineation based on the CAP alignment shift and top of bank elevation will be overlayed on 1999 aerial photographs of the area for the first FEMA submittal.

HYDROLOGY:

The Wash B HEC-1 model has been revised per discussions made with MCFCD and COS at the 5/10/00 meeting. The amount of flow that actually overtops at the berm south of the CAP has been modified per the request of the MCFCD. A new version of DDMS has recently become available through the MCFCD's web site. At the MCFCD's request, the entire HEC-1 model (sub-basin data) was input into the new version of DDMS. All sub-basin information (land-use and soils) was re-entered into the new DDMS, however any changes to the sub-basin runs were input into the existing HEC-1 model and the model was not re-created within the new program. The new HEC-1 model was re-submitted to the MCFCD and COS on 5 /25/00. Also, the drainage area was reduced by the 85.9 acres of on-site retention to come up with a quick check as to how much of a reduction in the total Q this caused. These results were sent to the MCFCD and the COS on 6/7/00.

ZONE A:

Zone A mapping is currently being developed for the floodplain delineation in these areas for the first FEMA submittal. Both the original delineation and the new delineation based on the CAP alignment shift and top of bank elevation will be overlayed on 1999 aerial photographs of the area for the first FEMA submittal (LOMA). The FEMA application forms for the Zone A delineation are currently being put together and the entire application should be ready for submittal by June 9, 2000.

HYDRAULICS:

A water surface profile was created in HEC-RAS for the entire reach and tributary not including any road crossings. A detailed survey of the road crossings, bridges and culverts are

needed to complete the model. The plan view of the channel cross-sections were submitted to Joe Rumann at MCFCD on June 5, 2000 for review and comments. The final HEC-RAS model can not be initialized until the discharge from the HEC-1 model hydrology has been accepted and approved by the MCFCD and the COS.

APPENDIX B

Meeting Minutes

Coe & Van Loo Consultants, Inc.
4550 North 12th Street
Phoenix, Arizona 85014-4291
Phone: 602/264-6831 Fax: 602/264-0928

MEETING MINUTES/STATUS & AGENDA

Project Name:	Wash B	Project Number:	99700201
Date:	2/10/00	Time:	1:00 pm
Purpose:	Walk through of Wash B		
Location:	Intersection of CAP and Shea Blvd		
Attendees:	Dave Boggs, Collis Lovely, Joe Ruhman, Marc McIntosh, Emili Kolevski		
Distribution:	Attendees		

Marc McIntosh and Emili Kolevski met with Dave Boggs and Joe Ruhman of the FCD and Collis Lovely of the City of Scottsdale at the Wash B site to take a look at the channel and drainage paths. All of the investigation occurred at the portion of Wash B below Shea Blvd.

An artificial berm was discovered just south of the spillway (3, 6-foot-diameter culverts) over the CAP canal for Wash B. This berm would prevent any flow from the east or southeast of Wash B, non-tributary, from flowing into the spillway overflow over the canal at this point. The spillway system and berm were designed by the Bureau of Reclamation. It was discovered that 2 or 3 separate systems south of the berm would potentially pond water behind the canal and eventually go through another culvert crossing under the canal or overflow into the canal at another location. An artificial, dugout channel was discovered along the canal in this area designed to convey flow to the single culvert crossing. Further south, past the intersection of the CAP with 124th St, another artificial berm was discovered along the north, northeast edge of the canal. This berm was possibly designed and constructed in conjunction with the adjacent subdivision. It was determined that this berm prevented the natural overflow of drainage into the canal and caused quite a bit of ponding in the area. Signs of overflow into the canal were also noted.

During this investigation, the ponding areas led to a discussion of how these areas would affect Wash B. It was determined that there was no connection due to the berm designed by the Bureau of Reclamation which prevented flow from crossing over into the spillway overflow. However, Dave Boggs and Joe Ruhman pointed out that these separate ponding areas, although a separate issue, did contribute to the ponding behind the CAP, Zone A, and therefore should be included in the Wash B floodplain delineation.

At this point, the investigation continued at the downstream portion of Wash B beginning at the spillway overflow outlet and continuing south to the Salt River Indian Reservation Boundary. Almost all of the road crossings and bridges were investigated and some portions of the Wash B channel. The detention basin at the south end of the project, just north of the Indian Reservation was also investigated. It was determined that it would be relatively ineffective at preventing any flooding

in the channel above. Only after major flooding raised the depths of water in the channel would the flood flows overflow into the basin. At the Indian Reservation the Wash B channel then widens extensively and begins to sheet flow across the desert.

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MEETING MINUTES

Project Name:	Wash B	Project Number:	99700201
Date:	3/15/00	Time:	1:30 pm
Purpose:	Preliminary HEC-1 Comments		
Location:	CVL		
Attendees:	T. Kelly, M. McIntosh, E. Kolevski, D. Boggs, J. Rumann, C. Lovely		
Distribution:	Attendees		

Tim Kelly, Marc McIntosh and Emili Kolevski from CVL met with David Boggs and Joe Rumann from the Maricopa County Flood Control District (MCFCD) and with Collis Lovely from the City of Scottsdale (COS) at the CVL offices to discuss the preliminary HEC-1 model for Wash B. The key points of the discussion were as follows:

1. The routing loss must be removed from the HEC-1 routing cards.

2. The divert cards in the HEC-1 model must be modified to reflect the 100-yr, 2-hr storm that the COS uses as standard for designing on-site retention in subdivisions. However, these diversions can only occur in areas that have been verified to have retention basins. Collis Lovely will determine the number and location of subdivisions within the study area that indeed have on-site retention and get back to CVL with those numbers.

3. New hydrology and storage routing will be done in (a) the Wash B ponding area and (b) the ponding area southeast of (a), at the 36-inch-diameter underchute. In (c), the ponding area southeast of (b), the floodplain will be delineated using the top-of-bank elevation of the CAP. No hydrology or storage routing will be done in area (c).

4. The "n" values used in the routing must be updated to accurately reflect what is determined in the final "n" value report.

5. Joe Rumann and David Boggs were given the "Sub-Basin Summary"sheets from the DDMS (MCUHP2) input files to review. The MCFCD will give comments to CVL next week on what modifications or adjustments may be necessary in order to more accurately reflect the actual land-use types and other input parameters. The percentage imperviousness (%RTIMP) used for each sub-basin was of particular concern and will be reviewed and revised by MCFCD as necessary.

6. Collis Lovely from COS will provide to CVL the 2000 aerial photos for the Wash B study area next week.

7. The final discharge obtained by CVL at the overchute outlet at the CAP Canal and accepted by MCFCD and COS will be used in the HEC-RAS model, not the previously determined 1380 cfs (at a point 4500 feet downstream of 124th Street) found in the FEMA study.

CVL will continue to work on the Zone A delineation while the HEC-1 input is being reviewed and while waiting for the updated aerial photographs and information on the on-site retention in the subdivisions. The "n" value report was completed on 3/15/00 and copies will be sent to the MCFCD and COS on 3/16/00.

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MEETING MINUTES

Project Name:	Wash B	Project Number:	99700201
Date:	5/10/00	Time:	1:30 pm
Purpose:	Hydrology/ HEC-1 Comments		
Location:	CVL		
Attendees:	T. Kelly, M. McIntosh, E. Kolevski, D. Boggs, J. Rumann, C. Lovely		
Distribution:	Attendees		

Tim Kelly, Marc McIntosh and Emili Kolevski from CVL met with David Boggs and Joe Rumann from the Maricopa County Flood Control District (MCFCD) and with Collis Lovely from the City of Scottsdale (COS) at the CVL offices to discuss the preliminary HEC-1 model for Wash B. The key points of the discussion were as follows:

1. The new HEC-1 run with the modified input parameters (%RTIMP, Vegetal Cover) prepared by CVL will be reviewed by MCFCD and COS. According to the MCFCD, the review process should take approximately 2 to 3 weeks (by 5/31/00). Modifications to the HEC-1 model may be necessary after the review process is complete.

2. COS maintains that no on-site retention has been done for any of the subdivisions in the entire Wash B drainage area, therefore, diverts are not applicable in the HEC-1 model. However, the COS will provide information on the on-site retention for the elementary and middle school located in the Wash B drainage area. In the case that the schools do have on-site retention for the 100yr-2hr storm or greater, then it may be possible to remove/reduce the flows from this area in the HEC-1 model. The COS will provide this information by 5/19/00.

3. The final Q to be used for the HEC-RAS model will be determined after the review of the HEC-1 model has been completed by the MCFCD. The current HEC-1 model shows that 3122 cfs is the total combined flow for Wash B before it is routed through the 3, 72-inch-diameter culverts (CAP overchute). 2849 cfs are routed through the CAP overchute and the remaining 273 cfs overtops both the CAP and the berm at this location. Due to this unusual situation, it was decided that this 273 cfs flow would be split at the CAP with 136.5 cfs going directly into the CAP and the other 136.5 cfs overtopping the berm and heading south towards the 36-inch-diameter underchute at the CAP. Cross-sections, maximum water surface elevation, and as-builts of the CAP will be necessary to show that the CAP has sufficient capacity to contain the 136.5 cfs flow that enters the CAP at the overchute. The remaining 136.5 cfs will be modeled in the HEC-1 to show overtopping of the berm and the impact it may have on the sub-basin directly south of the Wash B drainage area. CVL will modify the HEC-1 model to reflect these changes before the review has been completed by the MCFCD on the input parameter issues.

4. The progress of the first FEMA submittal based on the CAP alignment shift was discussed. The Zone A floodplain will be delineated using the top-of-bank elevation of the CAP. CVL will prepare this submittal within the next several weeks.

5. For the HEC-RAS model for Wash B, a survey of most road crossing and structures will be necessary. Drainage reports and/or as-builts will also be necessary for the culvert crossing at 120th Street south of Shea Blvd. The COS will research what information is available for the culvert crossing and send CVL any copies of drainage reports or as-builts that are found.

Meeting Minutes

Project Name:	Wash B	Project Number:	99700201
Day, Date:	Wednesday, ~~May 10,~~ SEPT. 7 2000	Time:	3:00
Purpose:	Hydrology Report Comments and Hydraulics Status		
Attendees:	Burke Lokey, Marc McIntosh, and Emili Kolevski from CVL, David Boggs and Joe Rumann from MCFCD, and Collis Lovely from COS.		
Distribution:	Attendees		

Burke Lokey, Marc McIntosh and Emili Kolevski from CVL met with David Boggs and Joe Rumann from the MCFCD and Collis Lovely from the COS at the CVL office to discuss the hydrology report comments, Zone A delineation and the status of the HEC-RAS floodplain delineation.

1. The Zone A delineation had been sent to the COS for review. The Zone A was revised by Marc and was ready to be submitted to FEMA after Collis supplied some minor information details. The Zone A should be submitted the week of September 11-16.

2. The hydrology report comments were received on July 10 and the report is currently being revised. The issue of what Q will be acceptable at the CAP overchute, to be used in the HEC-RAS was discussed. The original Q determined by a nomograph procedure was around 1150 cfs. The routed outflow from the ponded area behind the CAP is approximately 3001 cfs total. This flow fills the low spots first and then begins flowing through the overchute. The overchute (3, 72-inch-diameter pipes) flows under pressure as the ponded water rises to the top of the embankment. At this point the weir equation was used with an overtopping depth of 0.96 feet, as determined by the HEC-1 analysis, and resulted in a total overtopping flow of approximately 1157 cfs. Therefore, 3001 – 1157 = 1844 cfs would be routed through the overchute.

   HY-8 will be used to verify the Q found using the weir equation (1844 cfs) with head equal to the top of embankment. This is the Q that will be used in the HEC-RAS downstream of the CAP. Once the Q overchute at the top of embankment is determined the Qmax from the outflow of the routed hydrograph (if greater than Q overchute capacity) will overtop the CAP and the berm to the south. The 0.96 feet depth of flow may change depending upon the HY-8 result. The overtopping flow at the CAP will be split 50-50 to the west over the CAP and to the south over the berm. The report will be revised and re-submitted by CVL the week of September 18-23.

3. The FEMA request for previous studies in the Wash B area did not result in any information. Dave Boggs will look into the matter by contacting FEMA.

4. The hydraulics will be well underway once the final Q exiting the CAP overchute is verified. All other necessary Q's, above the CAP overchute, are already outlined in the hydrology report and will not change. No new inflows below the CAP will enter Wash B due to topography and/or revised developments. The surveyed crossings were discussed and some problems still exist, i.e. at the skewed crossing at 120th street. Marc will set up an initial HEC-RAS run and submit it to the MCFCD before he finalizes it. The initial HEC-RAS should be submitted by September 22.

5. A new project schedule was discussed and the date for the final submittal of the Technical Data Notebook and all of the Hydraulics is October 25, 2000. All attendees agreed upon the new schedule.

Coe & Van Loo Consultants, Inc.
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Phone: 602/264-6831 Fax: 602/264-0928

MEETING MINUTES

Project Name:	Wash B	Project Number:	99700201
Date:	10/05/00	Time:	3:00 pm
Purpose:	Hydrology Report and Hydraulic Analysis Comments		
Location:	CVL		
Attendees:	B. Lokey, M. McIntosh, E. Kolevski, D. Boggs, J. Rumann, C. Lovely		
Distribution:	Attendees		

Burke Lokey, Marc McIntosh and Emili Kolevski from CVL met with David Boggs and Joe Rumann from the Maricopa County Flood Control District (MCFCD) and with Collis Lovely from the City of Scottsdale (COS) at the CVL offices to discuss the Hydrology Report and Hydraulic Analysis for Wash B. The key points of the discussion were as follows:

1. Zone A submittal. The comments from the COS had been addressed and Marc gave the revised plans to Collis for a final review. Collis will submit the Zone A to FEMA once any final corrections are made.

2. Hydrology Report. The hydrology report was approved and only one revision to the HEC-1 model needs to be made before CVL can submit the final copies to FCD and COS. Per the FCD and COS, Sub-basin G, must be added in at Concentration Point 6 (CP6) rather than at CP7. The final hydrology report will be submitted to the FCD and COS by October 25.

3. Hydraulics. The floodplain delineation has been revised and several cross-sections were added per COS comments. The revised cross-sections (sheets 4 and 5) were submitted to the FCD and the COS for review. The review will be completed and any comments will be sent to CVL by the 27th of October.

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MEETING MINUTES

Project Name:	Wash B	Project Number:	99700201
Date:	11/09/00	Time:	3:30 pm
Purpose:	Hydrology Report and Hydraulic Analysis Comments		
Location:	CVL		
Attendees:	B. Lokey, M. McIntosh, E. Kolevski, D. Boggs, C. Lovely		
Distribution:	Attendees		

Burke Lokey, Marc McIntosh and Emili Kolevski from CVL met with David Boggs from the Maricopa County Flood Control District (MCFCD) and with Collis Lovely from the City of Scottsdale (COS) at the CVL offices to discuss the Hydrology Report and Hydraulic Analysis for Wash B. The key points of the discussion were as follows:

1. Zone A submittal. Collis has submitted the Zone A and Michael Baker has received it.

2. Hydrology Report. The final hydrology report was submitted to the FCD and COS. Disks for the HEC-1 models were included in the report for the FCD. An email copy of the models was sent to the COS on 11/9/00.

3. Hydraulics. The review of the HEC-RAS floodplain delineation run will be completed by the FCD by the end of next week and the Method 4 HEC-RAS encroachment run will begin immediately thereafter. The zone A ponding needs to be shown on the delineation at the CAP. After the FCD has completed their review, Marc will have 2 weeks to prepare Method 4 and Method 1. These methods will be done on the following sections:

Sheet 2:	None, floodway = floodplain on this sheet. Everything is developed there is nowhere to encroach.
Sheet 3:	Just below CAP and (above) east of 124th. Not at ponding area behind CAP.
Sheet 4:	Up to split (confluence), some isolated areas near matchline for Sheet 5.
Sheet 5:	Most of sheet 5 has high banks and floodway/floodplain is confined. No encroachment is possible.

The details of these possible encroachment areas were discussed at the meeting and the applicable sections for Methods 4 and 1 were agreed upon and outlined on the sheets.

4. Deliverables. The deliverables, CAD (Microstation) data files for the hydrology portion will be sent to the FCD as soon as they are complete.

5. Technical Data Notebook. The TDN is in the process of being completed and will be submitted after the hydraulic calculations have been completed.

COE & VAN LOO

AGENDA

Meeting:	Wash B		
Day, Date:	Thursday, September 7, 2000		
Start Time:	3:00 P.M.	Estimated Ending Time:	4:00 P.M.
Attendees:	David Boggs and Joe Rumann from MCFCD, Collis Lovely from COS, and Burke Lokey, Emili Kolevski, and Marc McIntosh from CVL.		
Distribution:	Attendees:		

DISCUSSION ITEMS:

1. Zone A submittal: Information from COS on datum, source and date of topography, etc. Status of submittal.

2. Hydrology:

   a. Comments from FCD and COS, status of revisions.
   b. Discussion on which final Q's will be acceptable for use in HEC-RAS model.
   c. Data from Bureau of Reclamation on CAP overchute.
   d. (Lack of) Data received from FEMA on Wash B Study area.

   week of 18th.

3. Hydraulics:

   a. Status of floodplain analysis and plots, and floodplain delineation.
   b. Discussion on results of surveyed crossings.

4. New project schedule.

CVL

AGENDA

Meeting:	Wash B		
Day, Date:	Thursday, November 9, 2000		
Start Time:	3:30 P.M.	Estimated Ending Time:	4:30 P.M.
Attendees:	David Boggs and Joe Rumann from MCFCD, Collis Lovely from COS, and Burke Lokey, Emili Kolevski, and Marc McIntosh from CVL.		
Distribution:	Attendees		

DISCUSSION ITEMS:

1. Zone A submittal: Status of submittal.

2. Hydrology: Final copies of Hydrology Report Submitted to COS and FCD

3. Hydraulics: Status of Hydraulic Analysis and Report.

CVL

AGENDA

Meeting:	Wash B		
Day, Date:	Friday, December 8, 2000		
Start Time:	3:30 P.M.	Estimated Ending Time:	4:30 P.M.
Attendees:	David Boggs and Joe Rumann from MCFCD, Collis Lovely from COS, and Burke Lokey, Emili Kolevski, and Marc McIntosh from CVL.		
Distribution:	Attendees		

DISCUSSION ITEMS:

1. Hydraulics: Status of Hydraulic Analysis and Report

2. Technical Data Notebook: Status

3. CAD Deliverables: Status

APPENDIX C

Survey Notes

JDS ASSOCIATES, LLC
Surveying & Mapping
PO Box 3240 Camp Verde AZ 86322
Phone (520) 567-8543 – Fax (520) 567-4066
Email – jdsassociates@sedona.net

FAX TRANSMISSION

August 21, 2000

Mr. Fred Klein
Coe & Van Loo Consultants, Inc
4550 N 12th Street
Phoenix AZ 85014-4291
Phone (602) 264-6831
Fax (602) 264-0928

Subject: WASH "B"
CVL Project No. 997002

No. of Pages: 11

REMARKS: Please find Sketches for the drainage structures/dips for Wash "B". Field notes to follow by US mail

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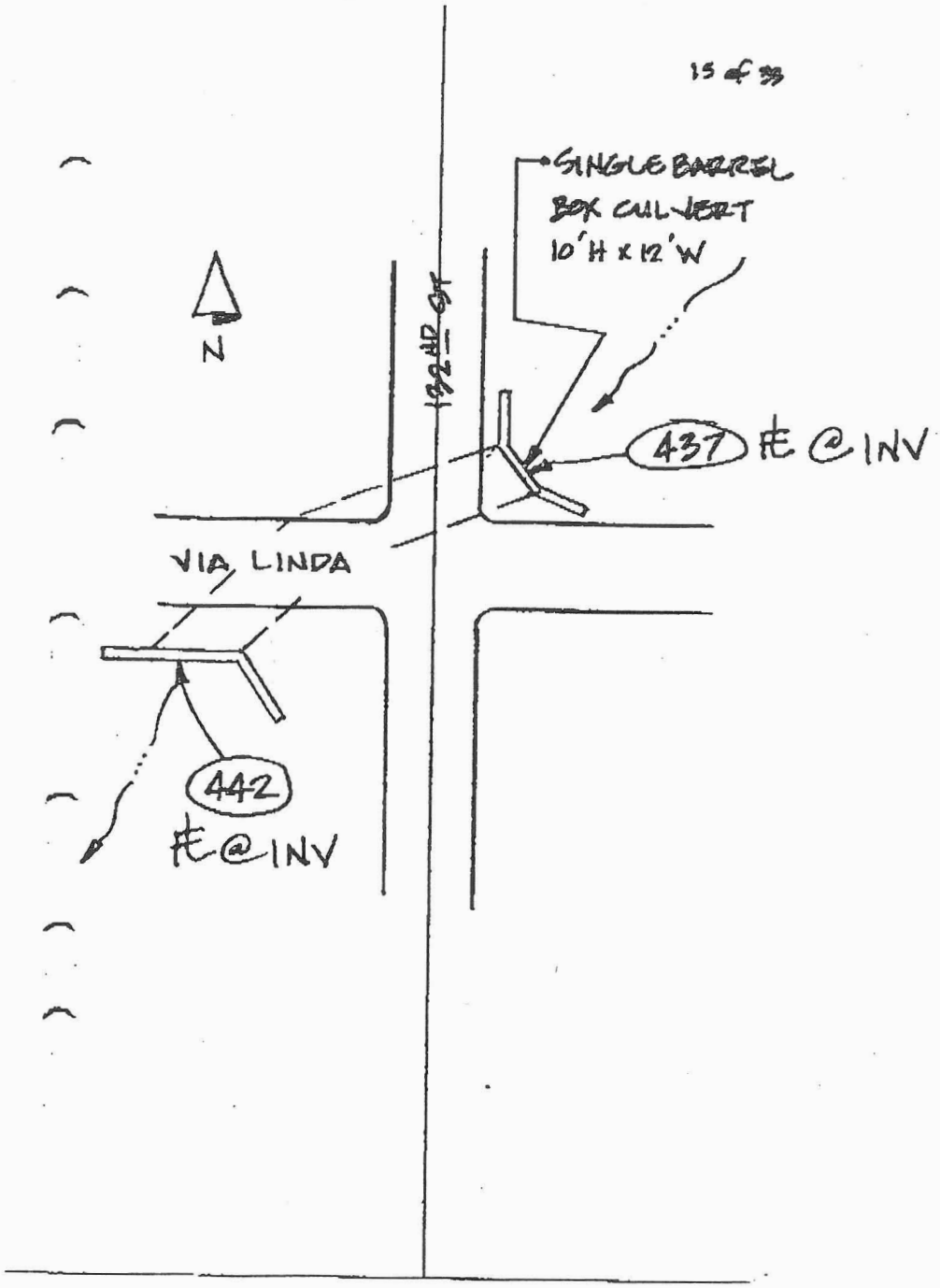

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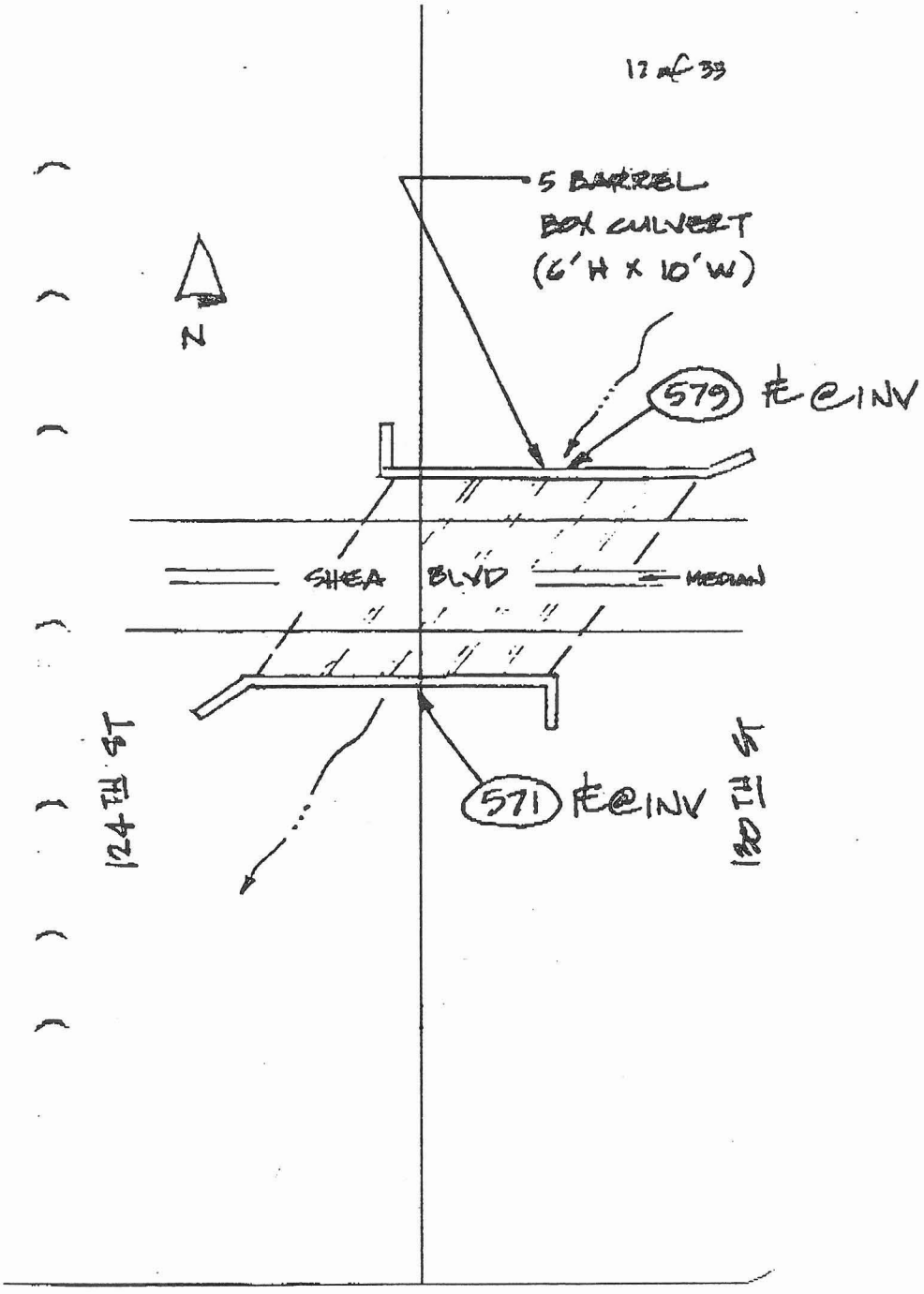
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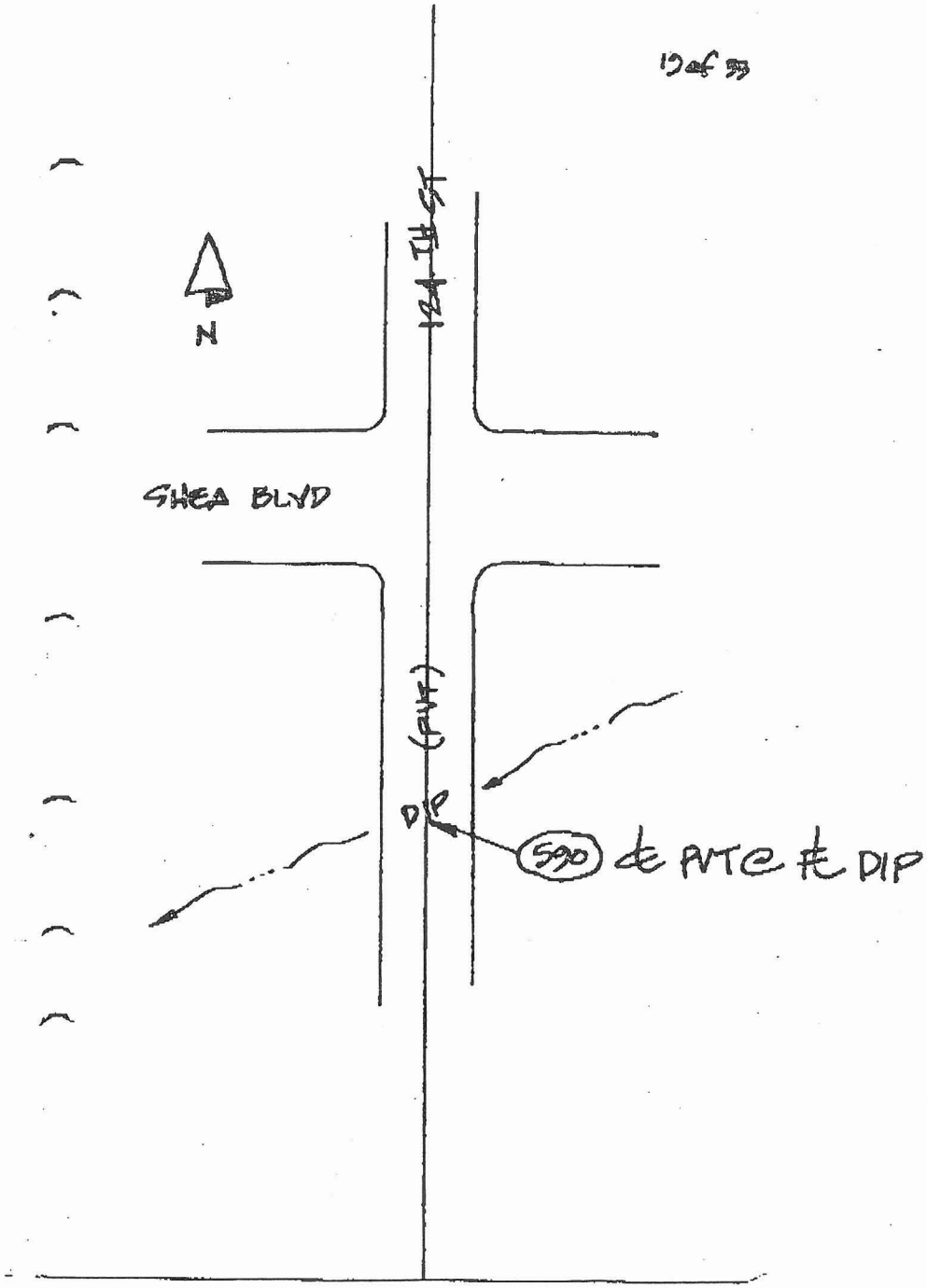

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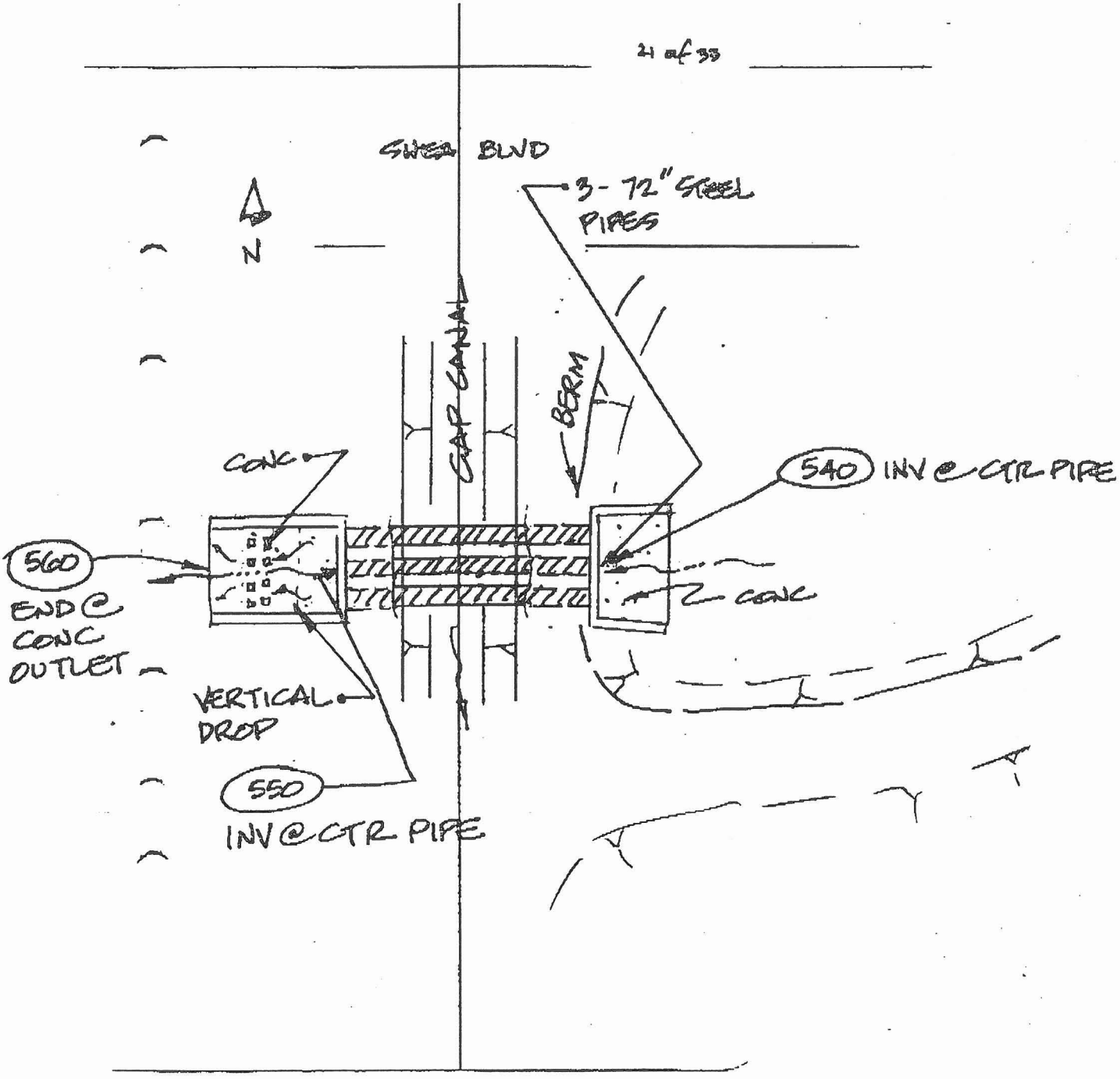

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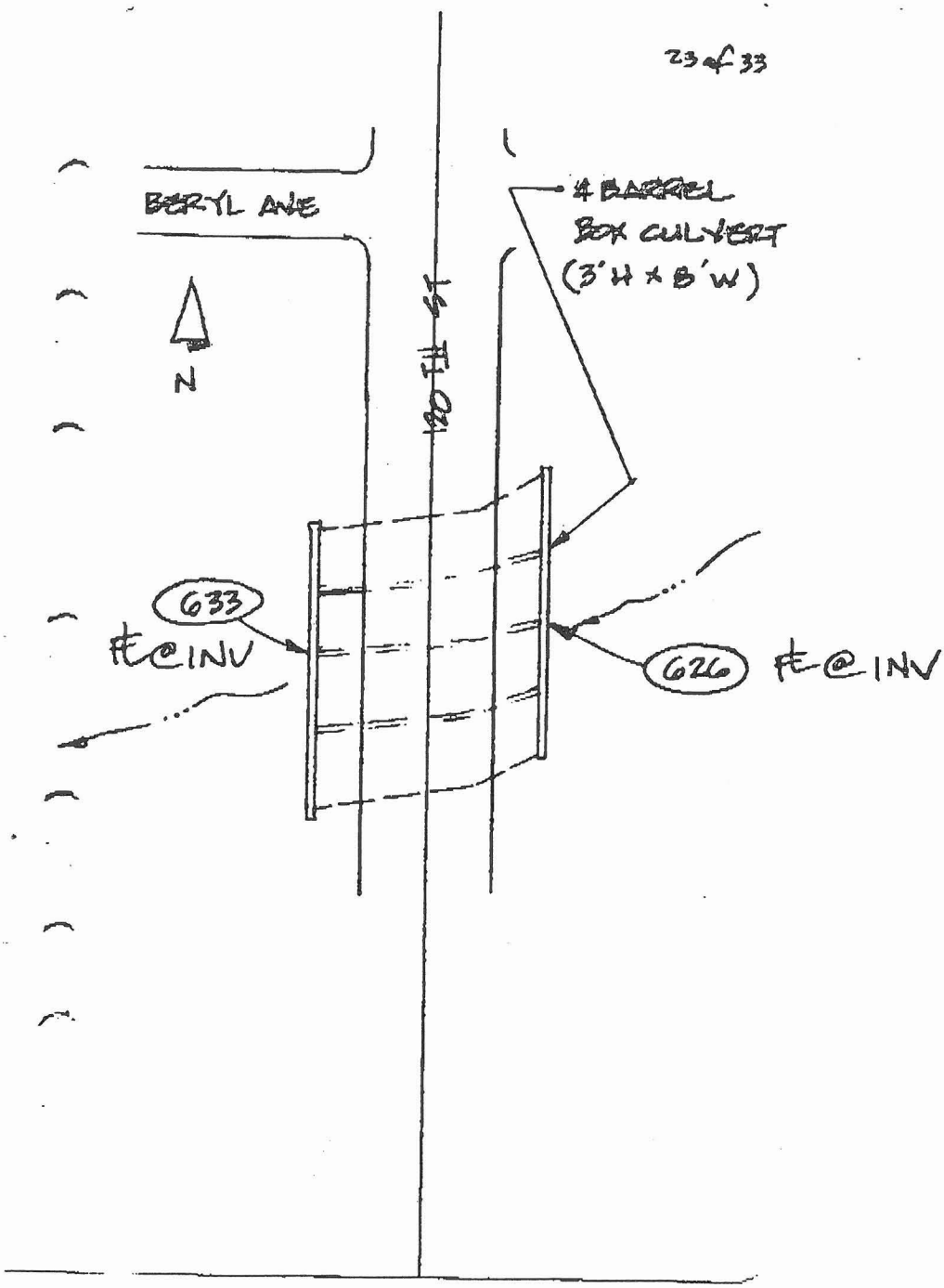

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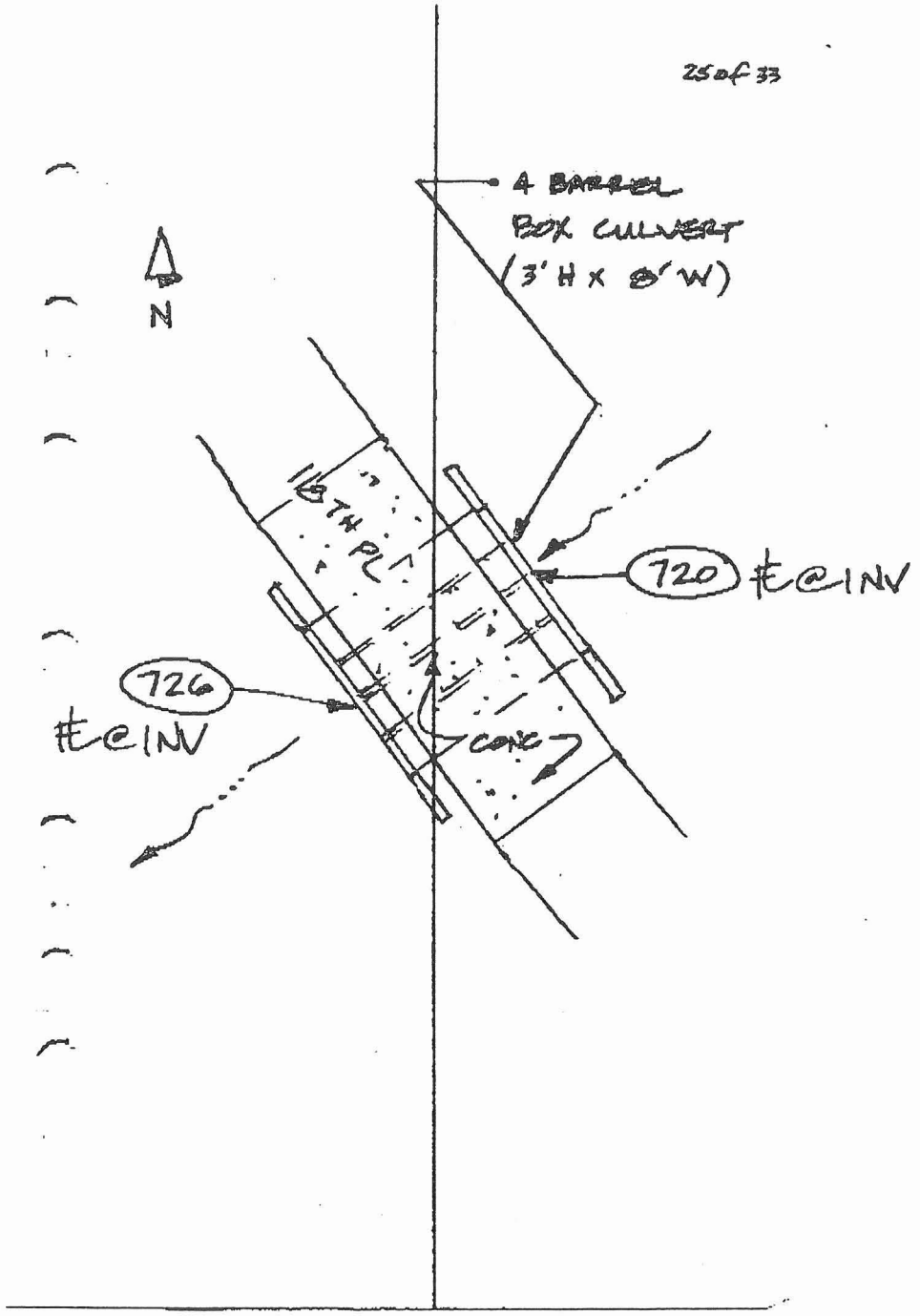

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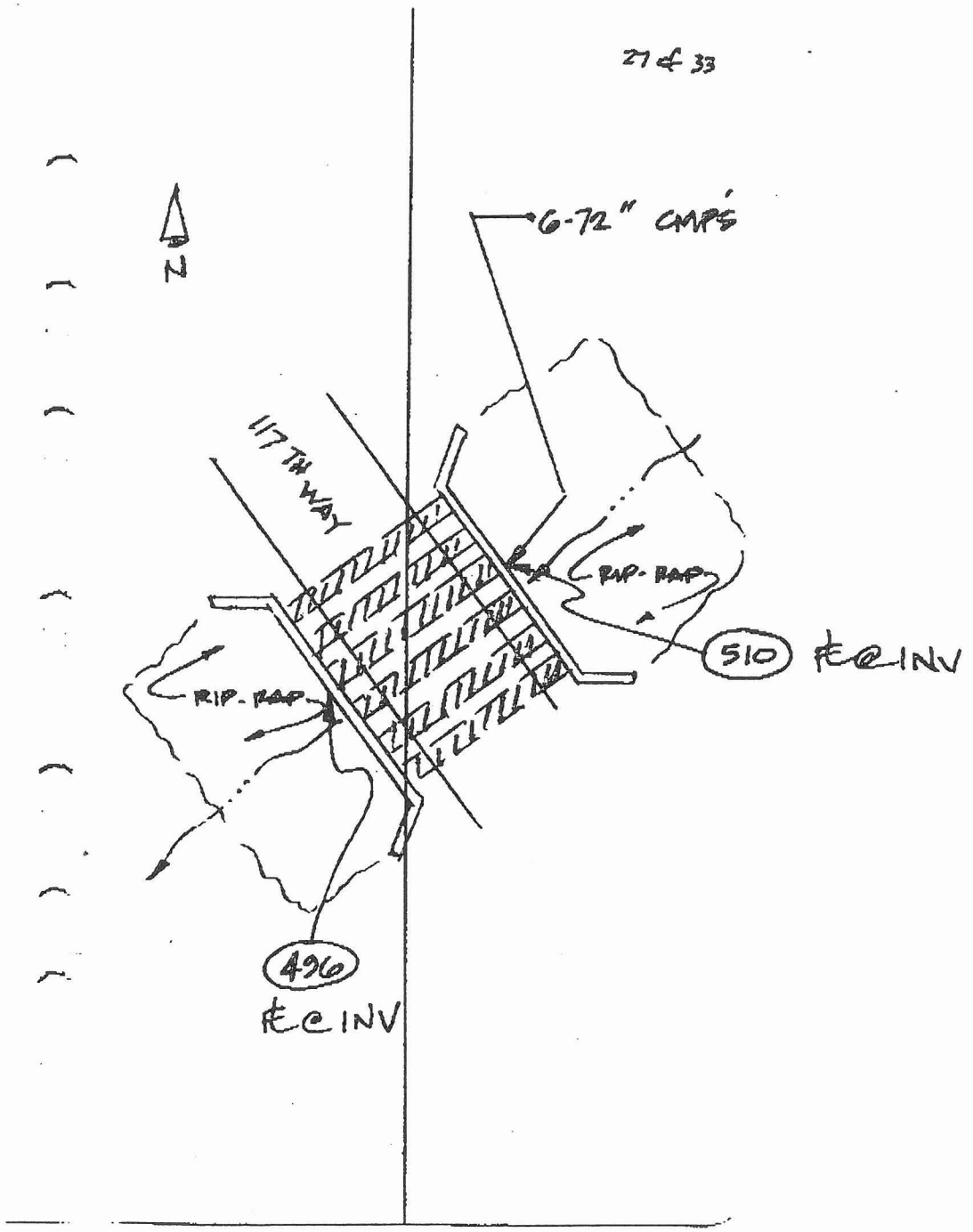

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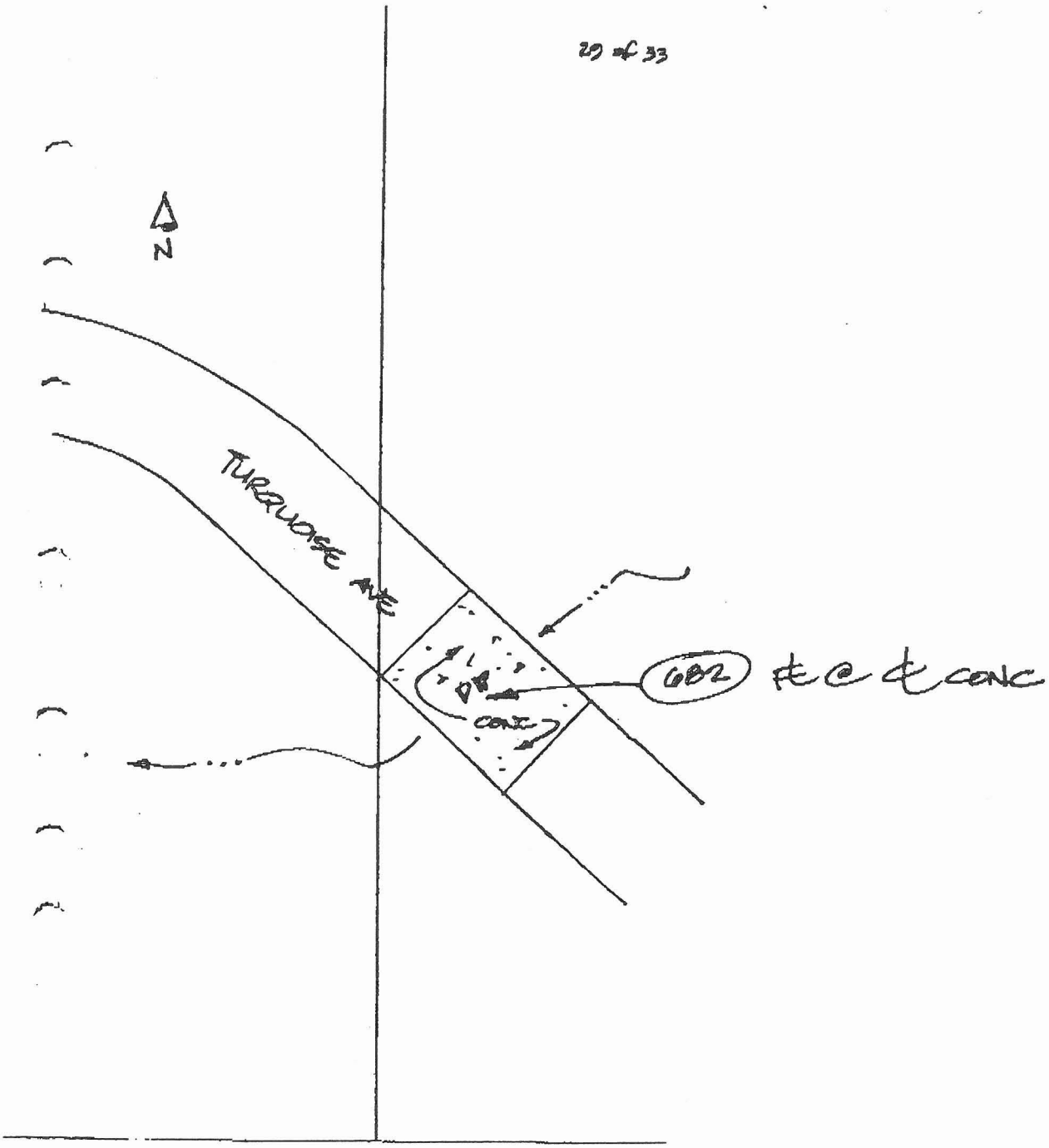

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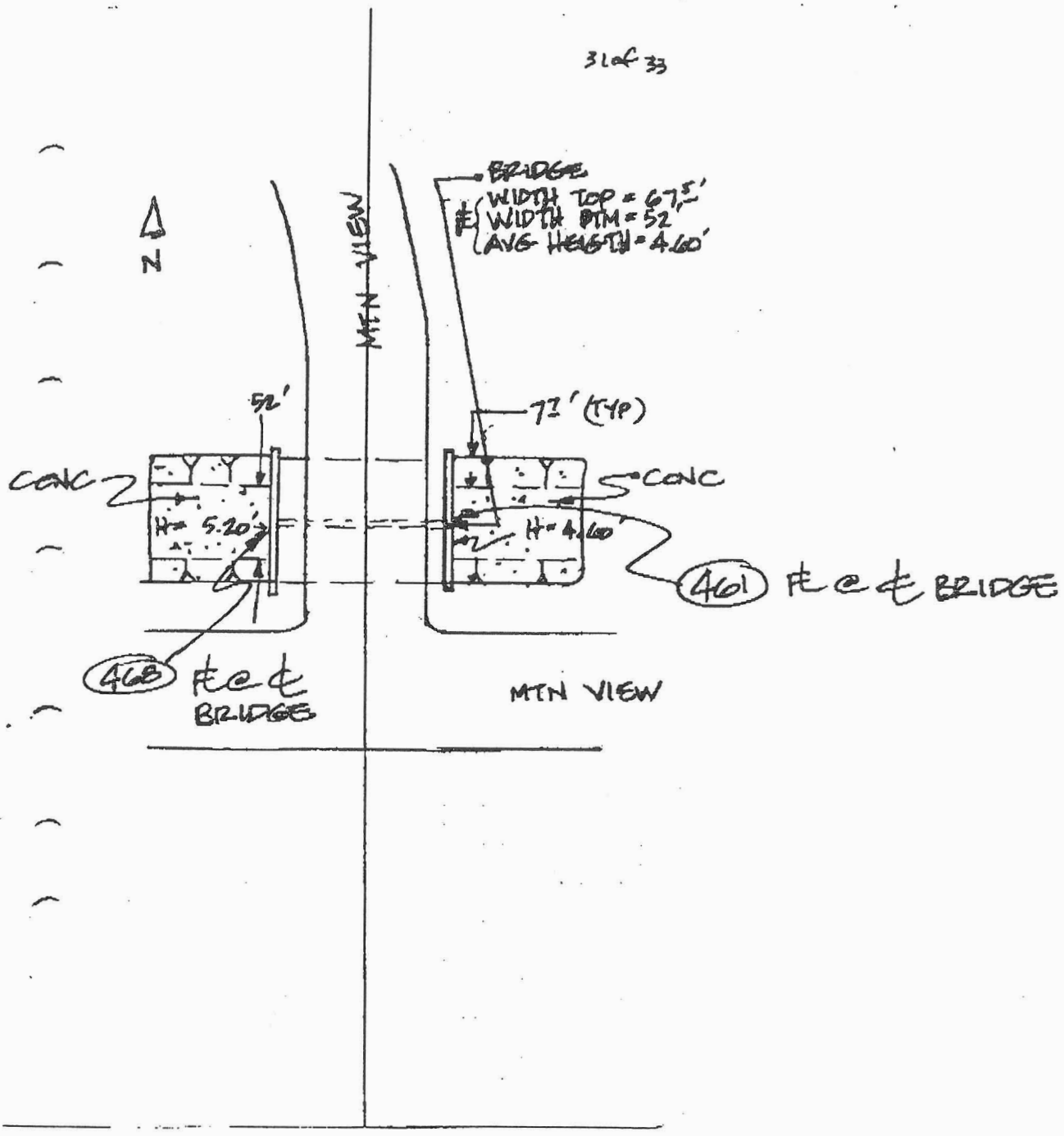

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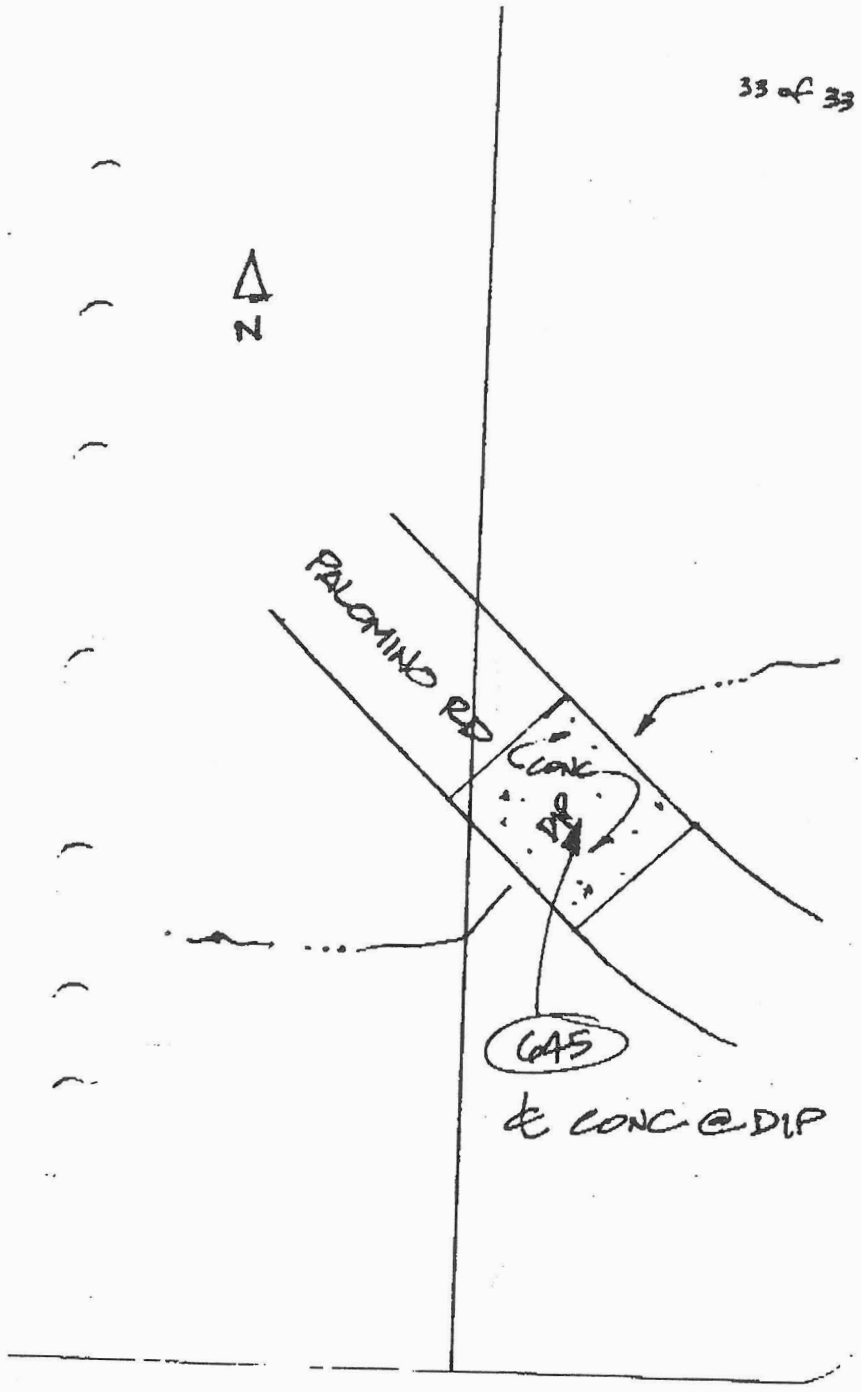

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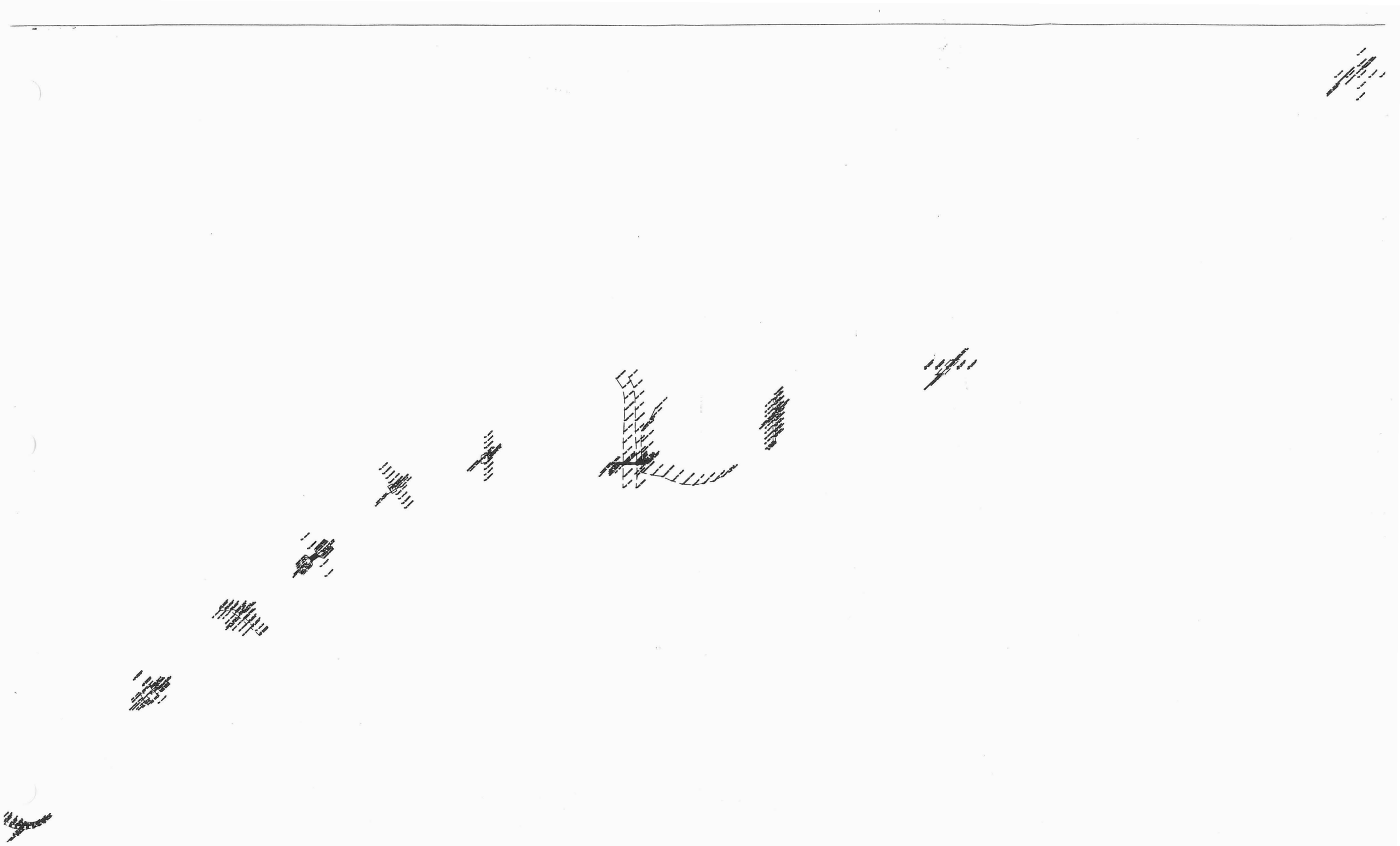

Richard Harris - FCDX

From: John Stock - FCDX
Sent: Thursday, June 28, 2001 4:37 PM
To: Richard Harris - FCDX
Subject: FW: Additional Control

GPS9199.bmp

SURVEY DATUM.xls

-----Original Message-----
From: Dry, Ron [mailto:rdry@ci.scottsdale.az.us]
Sent: Thursday, June 28, 2001 9:14 AM
To: 'jrs@mail.maricopa.gov'
Subject: Additional Control

John,
Good Morning. Here is the same excell file with the new point information. I have also included a photo showing its location to save you a little field time searching for it.
<<GPS9199.bmp>> <<SURVEY DATUM.xls>>
Ron Dry
Land Survey Coordinator
City of Scottsdale
480-312-8106
E-mail rdry@ci.scottsdale.az.us

Point	VERTICAL		HORIZONTAL		NAVD '88 DATUM	NGVD '29 DATUM	WGS 84		STATE PL
	ORDER	CLASS	ORDER	CLASS			LATITUDE	LONGITUDE	NORTHING
ERM #1	3RD		3RD	I	1442.770	1441.000	33° 34' 26"	111° 49' 54"	936425.222
ERM #2	3RD		3RD	I	1454.980	1453.210	33° 34' 31"	111° 49' 40"	936816.485
ERM #4	3RD				1488.175	1486.405			
ERM #5	3RD		2ND	I	1543.070	1541.300	33° 34' 56.726"	111° 48' 48.127"	939456.369
ERM #6	3RD		2ND	I	1516.975	1515.205	33° 34' 56.710"	111° 49' 19.308"	939452.221
ERM #7	3RD				1583.671	1581.901			
ERM #8	3RD				1620.990	1619.220			
ERM #9	3RD		2ND	I	1630.180	1628.410	33° 35' 22.843"	111° 48' 16.981"	942098.767
ERM #10	3RD				1652.570	1650.800			
ERM #11	3RD		3RD	I	1727.770	1726.000	33° 35' 38"	111° 47' 33"	943629.004
GPS #9199	3RD		2ND	I	1804.420	1802.650	33° 35' 48.902"	111° 47' 14.552"	944738.731

Description: AMC BCHH, 1974, down 1.2', +/-50' NE of intersection of Cactus Road and 136th Street

ANE GRID EASTING	COS NORTHING	GRID EASTING
725876.805	936417.320	725879.370
727082.056	936808.660	727084.860
731458.851	939449.068	731462.524
72882.103	939444.919	728824.252
734090.814	942091.990	734095.009
737756.738	943622.530	737761.660
739368.287	944732.478	739373.529

SURVEY DATUM

Point	VERTICAL		HORIZONTAL		NAVD '88 DATUM	NGVD '29 DATUM	WGS 84		STATE PLANE GRID		COS GRID	
	ORDER	CLASS	ORDER	CLASS			LATITUDE	LONGITUDE	NORTHING	EASTING	NORTHING	EASTING
ERM #1	3RD		3RD	I	1442.770	1441.000	33° 34' 26"	111° 49' 54"	936425.222	725876.805	936417.320	725879.370
ERM #2	3RD		3RD	I	1454.980	1453.210	33° 34' 31"	111° 49' 40"	936816.485	727082.056	936808.660	727084.860
ERM #4	3RD				1488.175	1486.405						
ERM #5	3RD		2ND	I	1543.070	1541.300	33° 34' 56.726"	111° 48' 48.127"	939456.369	731458.851	939449.068	731462.524
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ERM #7	3RD				1583.671	1581.901						
ERM #8	3RD				1620.990	1619.220						
ERM #9	3RD		2ND	I	1630.180	1628.410	33° 35' 22.843"	111° 48' 16.981"	942098.767	734090.814	942091.990	734095.009
ERM #10	3RD				1652.570	1650.800						
ERM #11	3RD		3RD	I	1727.770	1726.000	33° 35' 38"	111° 47' 33"	943629.004	737756.738	943622.530	737761.660
GPS #9199	3RD		2ND	I	1804.420	1802.650	33° 35' 48.902"	111° 47' 14.552"	944738.731	739368.287	944732.478	739373.529
Description: AMC BCHH, 1974, down 1.2', +/-50' NE of intersection of Cactus Road and 136th Street												

NOTE:

The information provided above was supplied by the Flood Control District who received it from the City of Scottsdale staff. Upon review of the above data an error was found for the Easting value of ERM #6, the data was checked on the City of Scottsdale's website and the correct value was found to be 728821.103.

APPENDIX D

Contract Documents

FLOOD CONTROL DISTRICT
of
Maricopa County

2801 West Durango Street • Phoenix, Arizona 85009-6399
Telephone (602) 506-1501
Fax (602) 506-4601
TT (602) 506-5897

BOARD OF DIRECTORS
Jan Brewer
Fulton Brock
Andrew Kunasek
Don Stapley
Mary Rose Garrido Wilcox

January 25, 2000

Mr. John B. Nelson, Director
Coe & Van Loo consultants, L.L.C.
4550 North 12th Street
Phoenix, AZ 85014

Subject: Notice to proceed with Contract FCD 99-10
Wash "B" Floodplain Delineation and Topographic Mapping

Congratulations on award to your firm of the subject contract. This letter confirms our verbal notice to proceed with contract performance on January 24, 2000 and complete performance within three hundred (300) calendar days. Contract completion date is November 19,2000. A fully executed copy of the contract is enclosed for your files.

The Flood Control District welcomes your participation as a Consultant to the District and we look forward to a mutually beneficial contract agreement. We want to remind you, at this very early stage of award, of the importance the District places upon the contract completion date. Maintaining schedule milestones is imperative in meeting the District's planning and future funding goals. Your contract completion date is not only a contractual requirement, but is also a commitment on the part of your firm. Throughout the term of the contract we expect it will be treated with a high degree of importance.

If you have not already done so, we request that you submit your M/WBE Affidavit and Insurance Certificates for this project. This contract has a minority goal of five percent (5%)

Again, we welcome your participation and look forward to an enjoyable and profitable relationship.

Sincerely,

Dortha Klaahsen

Dortha Klaahsen
Contracts Specialist

Job NO.
99700201

Pursuant to the provisions of the Arizona Revised Statutes Section 48-3603, the Board of Directors has the authority to enter into contracts.

The Flood Control District of Maricopa County, Arizona, hereinafter called the "District", is desirous of having certain professional services performed in connection with Contract FCD 99-10, Wash "B" Floodplain Delineation and Topographic Mapping, hereinafter called the "Project," as more fully described in Exhibit A, Scope of Work, and in accordance with Exhibit B, Fee Proposal; and

Coe & Van Loo Consultants, L.L.C., hereinafter called "Consultant", with its principal office located at 4550 North 12th Street, Phoenix, Arizona 85014, 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 Manager, Engineering Division shall prepare studies, reports, surveys, plans, drawings, specifications and cost estimates as are necessary for the Project and according to the directions and designated standards of the District and in accordance with Exhibit A. It is understood and agreed that the District's authorized representative shall be the Manager, Engineering Division or his duly authorized representative, hereinafter called the "Agent" and that 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.

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

SECTION II - PERIOD OF SERVICE

The Consultant shall complete all work per the schedule provided in Exhibit A, Scope of Work, **within three hundred (300) calendar days** from the date of Notice to Proceed, including 60 days for District review and 90 days for FEMA review. 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 year from the date of original contract expiration, adjustment(s) of the consultant's fee(s) may, upon agreement by both the District and the Consultant, be made in accordance with the Consumer Price Index for Urban Consumers, Western Division published by the U.S. Department of Labor, Bureau of Labor Statistics, using the published edition coinciding with the initial contract expiration date. Any such fee adjustment shall only apply to the extended contract time period.

SECTION III - PAYMENTS TO THE CONSULTANT

The Consultant shall be paid for work under this Contract a **lump sum fee of eighty-four thousand nine hundred ninety-seven dollars ($84,997.00)** plus any adjustments that have been approved in writing in accordance with the Maricopa County Procurement Code.

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

When the contract is fifty percent (50%) completed, one-half (1/2) of the amount retained will be paid to the Consultant provided the Consultant is making satisfactory progress on the contract and there is no specific cause or claim requiring a greater amount to be retained. After the contract is fifty percent (50%) completed, no more than five percent (5%) of the amount of any subsequent progress payments shall be retained providing the Consultant is making satisfactory progress on the project, except 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 above provisions, the Consultant will complete and furnish Attachment No. 1 herein, the District-provided Minority/Women-owned Business Enterprise Participation Report, with each request for payment, indicating payment distribution to MBE/WBE firms. The Minority/Women-owned participation for this contract is five percent (5%).

Following approval and acceptance by the District of all work described in Exhibit A, but prior to submittal by the District to FEMA, the Consultant shall submit (1) a "Certificate of Substantial Performance" form (Attachment 2); (2) a Final D/M/WBE Participation Report (Attachment 1) stating the total payments received by the prime as well as total payments the prime has made to MBE and WBE subconsultants, vendors, and suppliers, and (3) a final invoice for release of all monies due the Consultant, except for five percent (5%) retention.

Any retention monies shall be paid or substitute security released, as applicable, to the Consultant within forty-five (45) calendar days after (1) FEMA acceptance/approval of the project, including completion of all final work required by the Consultant in order for the District to receive FEMA acceptance, (2) receipt of a "Certificate of Performance" form (Attachment 3), and (3) an invoice for any sums remaining due and payable under this Contract.

SECTION IV - THE DISTRICT'S RESPONSIBILITIES

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

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

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

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

D. Examination of documents submitted by the Consultant and rendering of decisions pertaining thereto promptly, 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 written 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 District has approved the contract amendment and the Consultant has been notified to proceed by the Agent. It is distinctly understood and agreed that no claim for extra work done 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 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 his own risk, cost, and expense, and he hereby agrees that without such written authorization he will make no claim for compensation for such work or materials furnished.

SECTION VI - RECORDS

Records of the Consultant's payroll expense pertaining to this Project 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. The records shall be subject to audit by appropriate grantor agency if the Project is funded all or in part by a grant.

All Consultant and District procurement records shall be retained for a period of one 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.

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, which include reasonable charges for time and material for the percentage of work satisfactorily completed and turned over to the District.

The District reserves the right to postpone, terminate or abandon this Project 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 its sole discretion.

The District hereby gives notice that pursuant to A.R.S. Section 38-511 "A" this contract may be canceled without penalty or further obligation within three years after execution if any person significantly involved in initiation, negotiation, securing, drafting, or creating a contract on behalf of the District is, at anytime while the contract or any extension of the contract is in effect, an employer, agent, or 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 Chief Engineer and General Manager is received by all of the parties of the contract. In addition, the District may recoup any fee for commission paid or due to any person significantly involved in initiation, negotiation, securing, drafting, or creating the contract on behalf of the District from any other party to the contract arising as a result of the Contract.

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

SECTION IX - OWNERSHIP OF DOCUMENTS

All original documents including, but not limited to studies, reports, tracings, drawings, physical and computer models, estimates, field notes, investigations, design analyses, 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 reserves the right to reuse the documents as it sees fit. However, the District will not reuse, alter, or modify these documents without noting such alterations, modifications, or intent of their reuse, and will hold the Consultant harmless from any claims arising from the reuse, alteration, or modification of the documents. The Consultant may retain reproducible copies of all such documents delivered to the District.

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 this 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. Prior to beginning the work, the Consultant shall furnish the District for approval the names of its key employees, and of its sub-consultants and their key employees to be used on this Project. Any subsequent changes are subject to the written approval of the District.

With the exception of the District or the Federal Emergency Management Agency, the Consultant agrees not to accept any clients within the area of the 100-year floodplain for the project, during the period of the

Contract, without the expressed written authority from the Chief Engineer and General Manager of the District.

The Consultant in replacing a MBE/WBE subcontractor should attempt to contract with another MBE/WBE.

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

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

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

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

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/Supervisors or any employee of the District has any interest, financially or otherwise, in the Consultant 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 Flood Control District of Maricopa County 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 Flood Control District of Maricopa County without being discriminated against on the grounds of race, religion, sex, age, disability, or national origin.

The Consultant agrees not to discriminate against any employee or applicant for employment because of race, religion, color, sex, 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 - INDEMNIFICATION

For Professional Liability:

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

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

For all other hazards, liabilities, and exposures:

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

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

Abrogation of Arizona Revised Statutes Section 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 or the 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 or the County.

SECTION XVI - INSURANCE

General Clauses. The 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, Inc. Rating of B++6, or approved unlicensed companies in the State of Arizona with policies and forms satisfactory to the District.

Coverage Term. 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.

Primary Coverage. 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.

Waiver. 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.

Claim Reporting. 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.

Deductible/Retention. The 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.

Copies of Policies. The District reserves the right to request and to receive, within 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 the Consultant's obligations under this Contract.

Other Insureds. The insurance policies required by this Contract, except Workers' Compensation and professional Liability, shall name the District and the County, their 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 coverage shall include X, C, U.

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, Form B, 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.

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 Workers' Compensation and Employer's Liability insurance to at least the same extent as required of the Consultant.

Professional Liability. The Consultant 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, the Consultant shall furnish the District with a Certificate of Insurance, Attachment No. 4, or formal endorsements as required by the Contract, issued by the Consultant's insurer(s), as evidence that policies providing the coverage, conditions and limits required by this Contract are in full force and effect. Such certificates shall identify this Contract number and title, as well as all other information stated on Attachment 4 Insurance Certificate.

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

Cancellation and Expiration Notice. Insurance evidenced by this Certificate shall not expire, be canceled, or materially changed without thirty (30) days prior written notice to the District. If a policy does expire during the life of the contract, a renewal Certificate must be sent to the District at least fifteen (15) days prior to the expiration date.

. . . . . .

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

COE & VAN LOO CONSULTANTS, L.L.C.

Principal (Signature)

JOHN B NELSON
Printed Name

Director
Title

Date: Dec 13, 1999

86045 5672
Federal Tax Identification Number

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

RECOMMENDED BY:

1/3/2000
Michael S. Ellegood, P.E. Date
Chief Engineer and General Manager

ACCEPTED AND APPROVED:

JAN 19 2000
Chairman, Board of Directors Date

ATTEST:

JAN 19 2000
Clerk of the Board Date

Flood Control District of Maricopa County.

12/29/99
General Counsel, District Date

Contract FCD 99-10 Page 11 of 16

CONTRACT ATTACHMENTS

1. Minority/Women-owned Business Enterprises Program Participation Report
2. Certificate of Substantial Performance
3. Certificate of Performance
4. Certificate of Insurance

Attachment 1

MINORITY/WOMEN-OWNED BUSINESS ENTERPRISES PROGRAM

D/M/WBE PARTICIPATION REPORT
(To be attached with Each Request for Pay)

Date:_____

General Contractor/Prime Consultant: _____
Contact Person: _____
Address: _____
Telephone Number: _____
Fax Number: _____

Project Description: _____
Contract Number: _____
For Pay Period of (indicate dates): _____

D/M/WBE Subcontractor/Subconsultant Name: _____
Contact Person: _____
Address: _____
Telephone Number: _____

Type of Firm: _____
Type of Work performed for this project: _____

Total D/M/WBE Subcontract Amount: $_____

Amount Paid to this D/M/WBE Subcontractor this invoice: $_____

Total paid to this Subcontractor to date: $_____

Total D/M/WBE Contract Goal this project = ___**%**

Total D/M/WBE Participation on this contract to date = ____**%**

Send to: **The Flood Control District of Maricopa County**
Contracts Division
2801 West Durango Street
Phoenix, Arizona 85009

Attachment 2

CERTIFICATE OF SUBSTANTIAL PERFORMANCE OF ENGINEERING SERVICES AND PAYMENT OF CLAIMS

_____hereby certifies to the Flood Control District of Maricopa County (DISTRICT) that all lawful claims for labor, rental of equipment, material used, and any other claims by___ _____or its subcontractors in connection with the project described in DISTRICT Contract FCD _____ have been paid through the date of filing this Certificate of Substantial Performance.

_____ understands that with receipt of payment for any previously invoiced amounts plus any retained funds, this is a settlement of all claims of every nature and kind against the DISTRICT arising out of the performance of the DISTRICT's Contract FCD _____ _____ relating to the material, equipment and work covered in and required by the contract, through the date of filing this Certificate of Substantial Performance.

The undersigned hereby certifies that to his/her knowledge, no contractual disputes exist in regard to this contract and that he/she has no knowledge of any pending or potential claims in regard to this contract through the date of filing this Certificate of Substantial Performance.

Upon submission of this document, final payment will be processed except that five percent (5%) shall be retained pending completion and acceptance of all work. Subsequent to final acceptance, retention shall be released within forty-five (45) calendar days following issuance of a Certificate of Performance and submittal of an invoice for any sums remaining due and payable under this Contract.

State of Arizona)
)ss.
County of Maricopa)

Signed this _____ day of _____, 20___

_____
Signature

Title:_____

Subscribed and Sworn to before me this ____ day of _____, 20___.

_____
Notary Public

My Commission Expires:_____

Attachment 3

CERTIFICATE OF PERFORMANCE AND PAYMENT OF ALL CLAIMS

ENGINEERING CONTRACT

_____ hereby certifies to the Flood Control District Of Maricopa County
(Name of Signer)
(District) that all lawful claims for labor, rental of equipment, material used, and any other claims by____ _____or its subcontractors in connection with the project described in District Contract FCD_____ for_____have been paid.

_____understands that with receipt of payment for previously invoiced amounts plus any retained monies, that this is a settlement of all claims of every nature and kind against the District arising out of the performance of the District's Contract FCD _____, relating to the material, equipment, and work covered in and required by the contract.

The undersigned hereby certifies that to his/her knowledge, no contractual disputes exist in regard to this contract and that he/she has no knowledge of any pending or potential claims in regard to this contract.

Upon submission of this document and a separate invoice for any retained funds to the District, invoice processing will be completed within forty-five (45) calendar days.

State of Arizona)
) §
County of Maricopa)

Signed this ____ day of _____, 20___.

_____
Signature

_____
Title

SUBSCRIBED AND SWORN TO before me this ____ day of _____, 20___.

_____
Notary Public

My Commission Expires:_____

Attachment 4

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CERTIFICATE OF INSURANCE

CONTRACT FCD 99-10 PROJECT TITLE: Wash "B" Floodplain Delineation and TopographicMapping

NAME AND ADDRESS OF INSURANCE AGENCY	INSURANCE COMPANIES AFFORDING COVERAGES		
	Company Letter	A	
	Company Letter	B	
	Company Letter	C	
NAME AND ADDRESS OF INSURED	Company Letter	D	
	Company Letter	E	
	Company Letter	F	

This is to certify that policies of insurance listed below have been issued to the insured named above and are in force at this time

CO. LTR	TYPE OF INSURANCE	POLICY NUMBER	EFFECTIVE DATE (MM/DD/YY)	EXPIRATION DATE (MM/DD/YY)	LIMITS	
	COMMERCIAL GENERAL					
	☒ LIABILITY FORM				GENERAL LIABILITY EACH OCCURRENCE	$1,000,000
	☒ PREMISES OPERATIONS				PRODUCTS/COMPLETED OPERATIONS AGGREGATE	$2,000,000
	☒ CONTRACTUAL				GENERAL AGGREGATE	$2,000,000
	☒ BROAD FORM PROPERTY DAMAGE				BODILY INJURY AND PROPERTY DAMAGE	$1,000,000
	☒ EXPLOSION & COLLAPSE				PERSONAL INJURY	$1,000,000
	☒ PRODUCTS/COMPLETED OPERATIONS HAZARD				EACH OCCURRENCE	$1,000,000
	☒ UNDERGROUND HAZARD					
	☒ INDEPENDENT CONTRACTORS					
	☒ PERSONAL INJURY					
	COMPREHENSIVE AUTO					
	☒ LIABILITY & NON-OWNED				EACH OCCURRENCE	$1,000,000
	☐ EXCESS LIABILITY				NECESSARY IF UNDERLYING NOT ABOVE MINIMUM	
	☒ WORKERS' COMPENSATION AND EMPLOYERS' LIABILITY				Each Accident Disease - Each Employee Disease Policy Limit	$1,000,000 $1,000,000 $1,000,000
	☒ ENGINEERS PROFESSIONAL LIABILITY				EACH CLAIM AND ANNUAL AGGREGATE	$1,000,000
	☒ OTHER	The Flood Control District of Maricopa County and Maricopa County their agents, representatives, officers, directors, officials, and employees are to be named as additional insured.				

Except for Professional Liability Insurance and Workers' Compensation Insurance, the Flood Control District of Maricopa County is added as an additional insured on those types of policies described herein which are required to be furnished by this contract entered into between the insured and the Flood Control District. To the extent provided in this contract, insured shall hold harmless the Flood Control District of Maricopa County and Maricopa County from liability arising out of any services provided or duty performed by insured as required by statute, law, purchase order or otherwise required, with the exception of liability for loss or damage resulting from the sole negligence of Flood Control District, its agents, employees or indemnities. It is agreed that any insurance available to the named insured shall be primary of other sources that may be available. It is further agreed that no policy shall expire, be cancelled, or materially changed to affect the coverage available to the District without thirty (30) days written notice to the District. **THIS CERTIFICATE IS NOT VALID UNLESS COUNTERSIGNED BY AN AUTHORIZED REPRESENTATIVE OF THE INSURANCE COMPANY.**

FLOOD CONTROL District OF MARICOPA COUNTY
2801 West Durango Street
Phoenix, Arizona 85009

DATE ISSUED _____

_____
AUTHORIZED REPRESENTATIVE

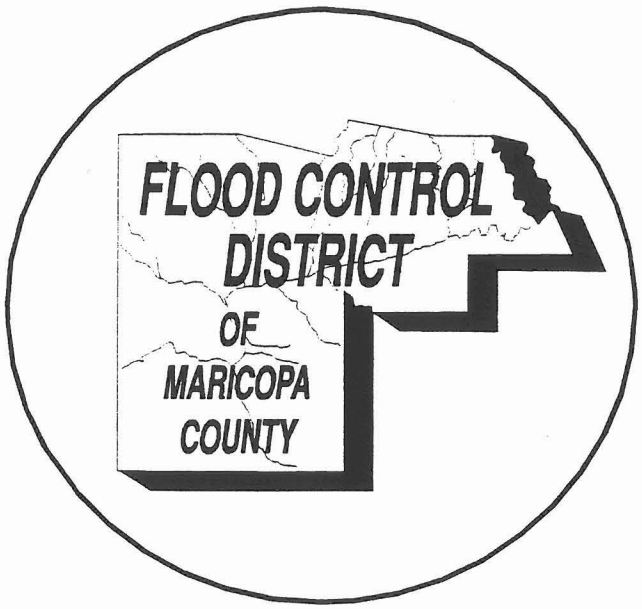


EXHIBIT A

SCOPE OF WORK

WASH "B" FLOODPLAIN DELINEATION AND TOPOGRAPHIC MAPPING
(Between Shea Boulevard and Doubletree Ranch Road)

CONTRACT FCD 99-10

SCOPE OF WORK
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
WASH "B" FLOODPLAIN DELINEATION AND TOPOGRAPHIC MAPPING
(Between Shea Boulevard and Doubletree Ranch Road)
CONTRACT FCD 99-10

GENERAL

The project consists of about **three point nine (3.9) river miles** of floodplain delineation south of the Cactus Road alignment and north of Doubletree Ranch Road in the City of Scottsdale. The reaches under study consist of the main stem and one tributary, broken down into three segments (1a, 1b, and 2). Segments 1a and 1b are the main stem, with 1a (2.1 miles) being the reach south of Shea Boulevard considered in the original scope of work.. Segment 1b in the main stem of Wash B is north of Shea Boulevard, comprising approximately 1.5 miles to Cactus Road. Segment 2 is tributary to the main stem and is roughly 0.3 miles terminating at Via Linda Road. In addition, the study will include the ponding area behind the Central Arizona Project (CAP) Canal. The limits of the contributory watershed are from section 13 of Township 3N Range 5E (on the north) to section 25 of Township 3N Range 5E (on the south), as shown in Exhibit 1. The study will utilize 1993 topographic mapping at one-foot contour intervals augmented by field survey, and 1998 horizontally-rectified digital photographic images. The hydrologic response of the approximately **4 square mile watershed** will be characterized using existing mapping sources, augmented by 1998 images and field survey. The Consultant will analyze the watershed hydrology using the Corps of Engineer' s HEC-1 computer model. The HEC-HMS computer model will not be accepted by the District. The consultant will carry out floodplain and floodway delineation using the HEC-2 or HEC-RAS computer models, if appropriate. The Consultant must use sound engineering judgement in the development of the hydrologic and hydraulic models. Model results must be compared to those of earlier studies in the vicinity, which will be provided by the District or other sources [such as Federal Emergency Management Agency (FEMA) and/or City of Scottsdale]. The results of the computer models must be analyzed carefully and refinements made to the input parameters in order to obtain the most realistic results. All work must meet or exceed Arizona Department of Water Resources (ADWR) and FEMA requirements for floodplain delineation. The results of this study must be reviewed and accepted by FEMA, prior to the finalization of this contract. All work under this scope of work (SOW) will be completed within **300 calendar days** from the date of Notice to Proceed, including **60 days** for District review and **90 days** for FEMA review.

TASK 1 - COORDINATION

1.1_ The Consultant shall submit a project schedule showing coordination meetings and completion dates for each of the tasks in the scope within **14 days** of Notice To Proceed. The Consultant shall update this project schedule when appropriate.

1.2_ The Consultant shall participate in regular coordination meetings (at least **once every four weeks**) with the District' s Project Manager and in milestone coordination meetings during

1.8 The District (with assistance from the Consultant) will plan and conduct one public meeting in conjunction with this study. The meeting will be to inform the public of the **purpose and scope** of the study, the **study results**, and obtain public comment. This meeting will be convened prior to the submittal of the final report to FEMA. The Consultant and the District shall be jointly responsible for the preparation of graphic displays for these meetings. One Consultant representative shall attend the meeting. The Consultant shall respond to public comments and make revisions to the study, if necessary, as guided by the District.

1.9 Consultant/District Performance Evaluations will be performed. An informal evaluation will be performed at the completion of the hydrologic analysis. A formal evaluation will be performed after project completion and receipt of all deliverables.

TASK 2 - DATA COLLECTION

2.1 The Consultant shall collect and review pertinent data from the District and other outside sources. Collected data will include previous flood hazard reports and hydrology for the Study Area, existing topographic mapping, historical flooding information, as-built plans for existing structures, FEMA Flood Hazard Boundary Maps and any Letters of Map Amendment and/or Revisions (LOMA/LOMRs), and other pertinent information.

2.2 A written report summarizing the data sources used and data collected shall be submitted to the District for information purposes. A preliminary draft of this report is due within **90 days** of Notice to Proceed.

TASK 3 - TOPOGRAPHIC MAPPING

3.1 The Consultant will obtain the existing topographic mapping from the District (at no cost to the Consultant). This mapping will be supplemented with survey cross sections (by Consultant) and 1998 aerial images supplied by the District. The Consultant will convert the existing topographic mapping datum to the appropriate FEMA datum.

3.2 The Consultant shall provide permanent non-erasable topographic mylars of the work study drawings. The drawings shall be 24"X36" in size, with a scale of 1 inch = 200 feet at a contour interval of 2 feet for all mapping. A cover sheet will be provided with the project title, date of topographic mapping, and a location map showing geographic range covered by each individual mapping sheet. Each drawing shall include separately floodplain and floodway delineation boundaries. All maps must display 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(s), an index map, and a description and elevation of each elevation reference mark (ERM). A note explaining the proper means to convert the NGVD 29 elevations to NAVD 88 elevations shall be included in "NOTES" in the map border.

TASK 4 - FIELD SURVEY

4.1 **Ground Control for Floodplain Delineations:**

4.1.1 All topographic mapping and survey work shall meet or exceed FEMA minimum criteria as defined in FEMA Document 37, Flood Insurance Study Guidelines and Specifications for Study Contractors, March 1993. This would include, but is not necessarily limited to the establishment of "permanent" elevation reference marks (ERMs), field control, and verification of profiles by the ground survey profile procedure.

4.2 The Consultant shall verify the accuracy of the mapping by the procedures called for in FEMA Document 37 or other methods approved by FEMA. This shall include the verification of cross sections used in the floodplain delineation.

4.3 Field surveys of bridges, culverts, and hydraulic structures are to be performed by the Consultant when as-built plans are not available or when changes significant to the HEC-2/HEC-RAS modeling, such as sedimentation, have occurred since the date of as-built. This information should be reduced and compiled into an 11"x17" (maximum size) drawing and included in the final report. The information presented in the drawing shall be in a format appropriate for use in the HEC-2/HEC-RAS model. 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, if the as-built plans are not referenced to the 1929 NGVD.

4.4 To clarify differences between 1993 conditions and current conditions, cross-sections of segments 1a, 1b, and 2 will be taken every 500'. In addition, up to 11 roadway crossings will be surveyed for hydraulic modelling purposes.

TASK 5 - HYDROLOGY

5.1 The hydrologic study of the watershed will be performed in accordance with the District's *Drainage Design Manual: Volume I: Hydrology*, and results shall be delivered to the District under separate cover from the hydraulic analysis. The Consultant shall use the U.S. Army Corps of Engineers computer program HEC-1, 1997 Version 4.1 to develop a hydrologic model for the area. Using appropriate hydrologic judgement, sub-basins are to be identified that provide reasonable depiction of the watershed condition. The sub-basins must be as homogeneous as possible, using watershed area, watershed type (mountainous and flat lands or urban and undeveloped areas), and time of concentration as criteria. Sub-basin breakdowns will be done in sufficient detail to provide peak discharges at structures, major road crossings, each major confluence, and at boundary lines. An appropriate time step and number of ordinates is to be selected that allows for complete calculation of the flood hydrograph without sacrificing resolution of the flood peak. All calculations or assumptions

used in developing sub-basin and routing parameters shall be documented and made a part of the appendix for the hydrology report. Field surveys could be required to obtain data for HEC-1 modeling purposes.

5.2 **Three meetings** associated with four tasks, and a **field trip** shall be held with the Flood Control District staff at the following milestones:

a. Joint kick-off meeting and field trip: A kick-off meeting with the District will be held immediately prior (same day) to and jointly with the field trip. The field trip will assess watershed hydrologic parameters, verify flow paths, determine n-values, and identify problems (if present) at critical points within the watershed. Scottsdale representatives may attend.

b. **Meeting number 1:** after the preliminary HEC-1 results have been obtained and a draft report has been prepared, the Consultant will meet with the District. A copy of the draft report and the copy of the HEC-1 on a floppy disc, compatible with the Districts computers, must be delivered two weeks prior to the meeting.

c. **Meeting number 2:** to review comments by the District.

5.3 The specific hydrologic techniques to be used in this study are:

a. Rainfall Depth: Point precipitation values shall be determined using the information and procedures described in the *Drainage Design Manual for Maricopa County, Arizona: Volume I- Hydrology*.

Rainfall Distribution: Peak discharges and peak volumes for the **100-year 6-hour** storm shall be estimated using the District's Distribution(s). **Peak discharges** and **peak volumes** for the **100-year 24-hour** storm shall be estimated using the **SCS Type II** rainfall distribution.

b. Areal Reduction: The point precipitation values shall be areally reduced for critical concentration points. Areal reduction for the **6-hour** rainfall duration shall be applied using the curves in the *Drainage Design Manual for Maricopa County, Arizona: Volume I - Hydrology*. NOAA HYDRO-40 shall be used with the **24-hour** rainfall reduction. Copies can be obtained from the District.

c. Rainfall Excess: The **Green and Ampt** methodology shall be utilized for estimation of rainfall losses. The Lotus spreadsheet and procedures, provided by the District, shall be used to determine composite parameter values for each sub-basin.

d. Unit Hydrograph: The **Clark** and **S-Graph** method shall be used following the procedures outlined in the *Drainage Design Manual for Maricopa County, Arizona.*

Volume I - Hydrology. The choices in methodology shall be at the discretion of the Consultant, with consent from the District.

e. Time of Concentration and S-Graph Lag Equation: The **Papadakis** method shall be used with the **Clark unit hydrograph**, along with the MCUHP 1 computer program, to determine the time of concentration. If this method results in unsuitable times of concentration, other method(s) must be used and compared for the most realistic result. The S-graph lag equation, along with the MCUHP2 computer program, shall be used with the appropriate S-graph (Phoenix Mountain or Phoenix Valley).

f. Channel Routing: Channel routing shall be accomplished using either the **Muskingum-Cunge** or the **Normal-Depth** option of HEC-1. The choice of methodology shall be at the discretion of the Consultant, with consent from the District. Average cross sections shall be developed utilizing available mapping and field reconnaissance data. Sufficient field cross sections shall be taken to ensure that routing reaches are reasonable and representative of field conditions.

The HEC-1 routing parameters for the reaches modeled using HEC-2 shall be adjusted **after** the HEC-2 cross sections become available. The resulting velocities and depths, for all reaches, must be assessed to ensure that realistic values are obtained.

g. Reservoir Routing: Detailed analysis of structures and ponding areas shall be accomplished using the **Modified Puls** reservoir routing option of HEC- 1. **Stage versus discharge tables** for hydraulic structures shall be estimated using appropriate hydraulic methodology approved by the District.

h. Channel Transmission Losses: Channel losses will not be modelled.

5.4 The District shall provide available, appropriate references to facilitate parameter estimation.

5.5 Output of the computer model shall be reviewed to see if the peak rates of flow and discharge volumes are realistic. Flows will be tested for reasonableness using approximate methods, including ADWR regional regression equations, District's unit discharge relationships, and consistency with other hydrologic studies in the vicinity.

5.6 The nearest stream gage will be identified and a discussion will be provided in the Final Report as to the comparability of the gaged watershed relative to the project watershed.

5.7 The Consultant must obtain District approval for each of the following events:

a. Acquisition of soil maps, watershed boundary maps, and land use maps; estimation of HEC-1 parameters; and estimation of HEC-1 flow diagram.

b. HEC-1 model results.

5.8 The Hydrologic Report (to be included in the Technical Data Notebook)

5.8.1 The findings of the hydrologic study shall be presented in Section 3 of the Technical Data Notebook and shall be prepared in accordance with *ADWR State Standards Attachment 1-97 (SSA 1-97).* The report shall be organized as specified by the District, following SSA 1-97 format.

5.8.2 Tables and Figures for the appendices:

a. Topographic base map(s) showing the sub-basins, routing reaches, time of concentration (t_c), flow paths or lag flow paths, major man-made structures, and references (i.e. street names, Township, Range, Section, etc.) at a scale of 1 inch = 400 feet.

b. Soils map(s) at the same scale as the base map.

c. Land use map(s) at the same scale as above.

d. Schematic map for the HEC-1 showing the sub-basins (area, t_c), the flow paths, the routing reaches (length, slope, friction, width, velocities, transmission losses, etc.), order of combining the hydrographs, channel, pipe or culvert dimensions (where appropriate).

e. Pertinent data on all structures (such as spillway elevation, rating curves, and others as required).

f. One set of study maps (i.e. sub-basin boundary maps, flow path maps, soils maps, land use maps) to be folded and delivered in a binder.

5.8.3 HIS submittals pertinent to Task 5 must be reviewed and approved prior to finalizing the Floodplain Delineation Task (Task 6).

Any deviations from this hydrologic scope shall not be undertaken by the Consultant without the District's specific written concurrence.

TASK 6 - FLOODPLAIN DELINEATION

6.1 Floodplain delineations must be performed using HEC-2 or HEC-RAS, and methodology acceptable to FEMA. This model will simulate the effects of floodplain geomorphology, flow changes, bridges, culverts, hydraulic roughness factors, effective flow limitations, split-flows, and other considerations. The Consultant shall prepare the study using the guidelines established in FEMA Document 37, *Flood Insurance Study Guidelines and Specification for*

Study Contractors, January, 1995, and FIA Document 12, *Appeals, Revisions, and Amendments to Flood Insurance Maps,* January 1990.

6.2 The delineation work shall meet requirements for floodplain and floodway delineation as prescribed by FEMA and the Arizona Department of Water Resources.

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

6.4 The Consultant is to make refinements to the HEC-2/HEC-RAS model based on review of the model results by the District, ADWR, FEMA, and the Technical Evaluation Contractor. The Consultant shall review the HEC-2/HEC-RAS model results for reasonableness. Adjustments to the input parameters for obtaining the most realistic results is expected to be completed within this scope.

6.5 Floodways are to be determined using equal conveyance encroachment method 4 to start with, but only encroachment method 1 will be used in the final analysis. The floodway encroachment is to be as near the one-foot maximum rise in elevation as possible. In areas where the overbank areas are fully developed, no encroachment will be modelled. If one overbank is fully developed and the other is not, a 0.5' maximum rise will be modelled by encroaching the undeveloped overbank.

6.6 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 location and alignment of cross-sections, thalwegs, and channel centerline.

c. Floodplain (natural) delineation.

d. Floodway delineation using equal conveyance encroachment.

e. Floodway delineation using encroachment method 1.

f. Final Hydraulics Report.

6.7 Field Reconnaissance

6.7.1 The Consultant shall conduct a field reconnaissance of the full study reach. This will include observation of channel and floodplain conditions for estimation of Manning's "n" values, photographic documentation of floodplain characteristics, determination of channel bank stations, observation of possible overflow areas, inspection of levees or other flood control structures, and measurement of bridge dimensions.

6.7.2 Manning "n" values are to be determined using the methodology in the USGS report, *Estimating Manning's Roughness Coefficients for Stream Channels and Flood Plains in Maricopa County, Arizona,* April 1991. Copies of the report are available from the District.

6.7.3 A draft report on the field reconnaissance shall be submitted to the District for review and approval prior to beginning the HEC-2/HEC-RAS modeling. The report shall present the determination of channel and overbank "n" values using captioned color photographs or color photocopies. The report shall 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 shall be displayed on reduced scale mapping and included in the Final Report.

6.8 Cross Sections

6.8.1 The location and alignment of cross sections and channel centerline shall be submitted for the District's review and approval prior to digitizing the cross section data. Cross section stationing shall be **from left to right looking downstream** with the thalweg as station 10,000. Cross sections will be spaced approximately every 500 feet, unless geographic or structural constraints dictate otherwise, and shall extend the full width of the area inundated by 100-year floodwaters. Identification of cross sections shall be in river miles, **increasing upstream**. The stationing shall start at the Doubletree Road alignment as river mile 0.0. Cross section orientation may need to be altered after running of HEC-2 model to ensure that sections are perpendicular to flow in conformity with FEMA criteria.

6.8.2 All cross sections shall be plotted using a pen, laser, or electrostatic plotter. The cross section plots shall show water surface profiles, ineffective flow areas, "n" values, and encroachments, channel stationing and other pertinent information. Each individual plot sheet must contain a legend and a reference map to the entire Study Area, showing the location of the particular sheet. These plots are to be made available at all reviews.

6.8.3 Cross section plots are limited to one plot at the following three stages of work: (a.) a plot of digitized "GR", STCHL, STCHR, thalweg (station 10,000) to be used as a check of input data and for working sections during compilation of the floodplain model; (b.) a plot of the cross section for the completed floodplain run, which shows the floodplain water surface elevation, ineffective flow areas, "n" factor, and encroachments to be used as working sections for development of the floodway model; (c.) a plot of the final floodway model cross sections which will show Type 1 encroachments and encroached water surface, in addition to data covered in items (a) and (b). The cross sections, detailed in (c), will be submitted in the Final Report.

6.9 Bridges and culverts must be modeled in compliance with HEC-2/HEC-RAS modeling requirements for the selected routine. Where multiple bridges occur, each bridge shall be modelled separately. The HEC-2/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 (such as the HY-8 feature within HEC-RAS).

6.10 Ponding areas identified as floodplains must be analyzed using the HEC-1 model, and the Consultant will provide the District with water surface elevations throughout these ponding areas at intervals to be specified during the study. In most such cases, the Consultant will be required to delineate conveyance areas (if any) joining two or more adjacent ponding areas to achieve continuity of flow.

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

6.12 The total area of the floodplain and floodway must be determined for each reach in square miles and acres (hectares).

6.13 The findings of the floodplain/floodway delineation study shall be presented in Section 4 of the Technical Data Notebook and shall be prepared in accordance with *ADWR State Standards Attachment 1-97 (SSA 1-97)*. The report shall be organized as specified by the District standards, following SSA 1-97 format.

TASK 7 - HIS DATA

Digital data will be prepared in conformance with the District's HIS Data Delivery Specifications, Rev 3.1, June 1998, for the following themes:

Name	Page No.	Description
NDXPRJ	CP-40	Shows the map sheet boundaries of the project
PRJ	CP-60	Defines the boundary of the project
CARTO	CP-110	Planimetric features captured but not used by HIS (Fences, tree lines, etc.)(if any)
CORNERS	CP-210	Section corners as defined by the PLSS (Public Land Survey System)
CTRL	CP-215	Other control points that are not corners
AGRCLTR	CP-305	Dairy and Agricultural Areas
STRCT	CP-360	Structures like building footprints (if any)

DQ.TBL	CP-410	Data Quality of Data: Scale, date, Vertical Datum, Projection
PRJ.REL	CP-430	Contractor name, Project Name, Project ID
FPBLN	CP-520	Floodway center line
FPCTLFCD	CP-523	Elevation Reference Marks
FPSRFFCD	CP-535	Surface Water Elevation
FPXFCD	CP-540	Cross sections used in HEC 2
FPZNFCD	CP-550	Floodplain Zones
FPZNHZ	CP-560	Floodplain Hazard Zones
CNL	CP-610	Canals (if any)
FLTY	CP-620	FCD Project in the area (if any)
RR	CP-650	Railroads in the area (if any)
STRTCLN	CP-655	Street Centerlines
ELV	CP-710	Contours and spot elevations
BRIDGE	CP-608	Bridges, including any headwalls or wing walls
CULVERT	CP-612	Culverts, including any headwalls or wing walls
VEG	CP-775	Areas of similar vegetative mix
DRNBSN	CP-920	Drainage basins
DRNPTH	CP-930	Drainage Path
LAKE	CP-950	Lakes are in the area (if any)
RIVER	CP-960	Washes or streams in the area (if any)

This is a comprehensive listing of possible features. If there are no features collected under one of the categories mentioned, then the theme does not need to be delivered. Mapping should be done according to the District's *HIS Data Delivery Specifications*, Rev 3.1, June 1998.

The HIS data submittal under Task 7 will be subject to a quality control (QC) check by the District staff. The District makes use of a checklist and a computer program to document and automate the QC process. A hardcopy of the checklist is enclosed with this scope of work. The Consultant shall use the checklist to review each HIS data submittal for compliance and deliver a completed copy of the checklist to the District along with the data submittal.

The computerized application that automates the QC process is available upon request at no charge to the Consultant. The Consultant is recommended to make use of the computer application to review the data prior to the HIS submittal. The application is available for Arc/Info on all UNIX platforms.

All required HIS submittal must be reviewed and accepted prior to finalizing the Technical Data Notebook for submittal to FEMA (Task 9.1).

TASK 8 - ZONE A

8.1 The Consultant shall revise the Wash B Zone A delineation upstream of the Central Arizona Project Canal and south of Shea Boulevard. The Consultant shall check the elevations along the canal to determine the as-built condition and prepare the maps (on furnished City of Scottsdale topographic mapping). The Consultant shall prepare the necessary data and submit to FEMA for the Letter of Map Revision (LOMR) for the Zone A.

TASK 9 - DELIVERABLES

9.1 **FEMA Submittal:** The Consultant will submit the following items to the District, the City of Scottsdale, and any other appropriate governmental agency prior to submittal to FEMA. All of the following products are considered deliverables for the FEMA submittal:

9.1.1 Original Affidavits of Publication.

9.1.2 Two (2) complete sets of blueline topographic base maps with the floodplain/floodway delineations shown. All drawings shall be signed and sealed by persons of appropriate professional registration(s). Each registrant shall provide a specific statement as to what service they performed.

9.1.3 Two (2) complete copies of the Technical Data Notebook, including HEC-1 and HEC-2 input/output files on diskettes. The Technical Data Notebook shall be prepared in accordance with ADWR State Standards, Attachment 1-97 (SSA 1-97). The notebook shall be organized as specified by the District, following SSA 1-97 format.

9.1.4 Two (2) sets of completed FEMA forms shall be submitted in a notebook separate from the Final Report.

9.1.5 One (1) copy of the Digital Terrain Model (DTM) shall be submitted following the guidelines stated in the District's *HIS Data Delivery Specification*, Rev. 3.1, April 25, 1997.

9.1.6 Three (3) sets of complete survey notes shall be submitted in a notebook separate from the Final Report.

9.1.7 Two (2) copies of the current FIRM panels showing the proposed delineation.

9.1.8 Zone A LOMR re-delineation of the areas requested by the City of Scottsdale.

9.2 **Final Submittal:** The following products are considered deliverables for the final submittal to the District after FEMA approval is issued:

9.2.1 One (1) complete set of non-erasable topographic mylars of the work study drawings. Sheets shall be 24" x 36" in size and numbered to correspond to the delineation maps.

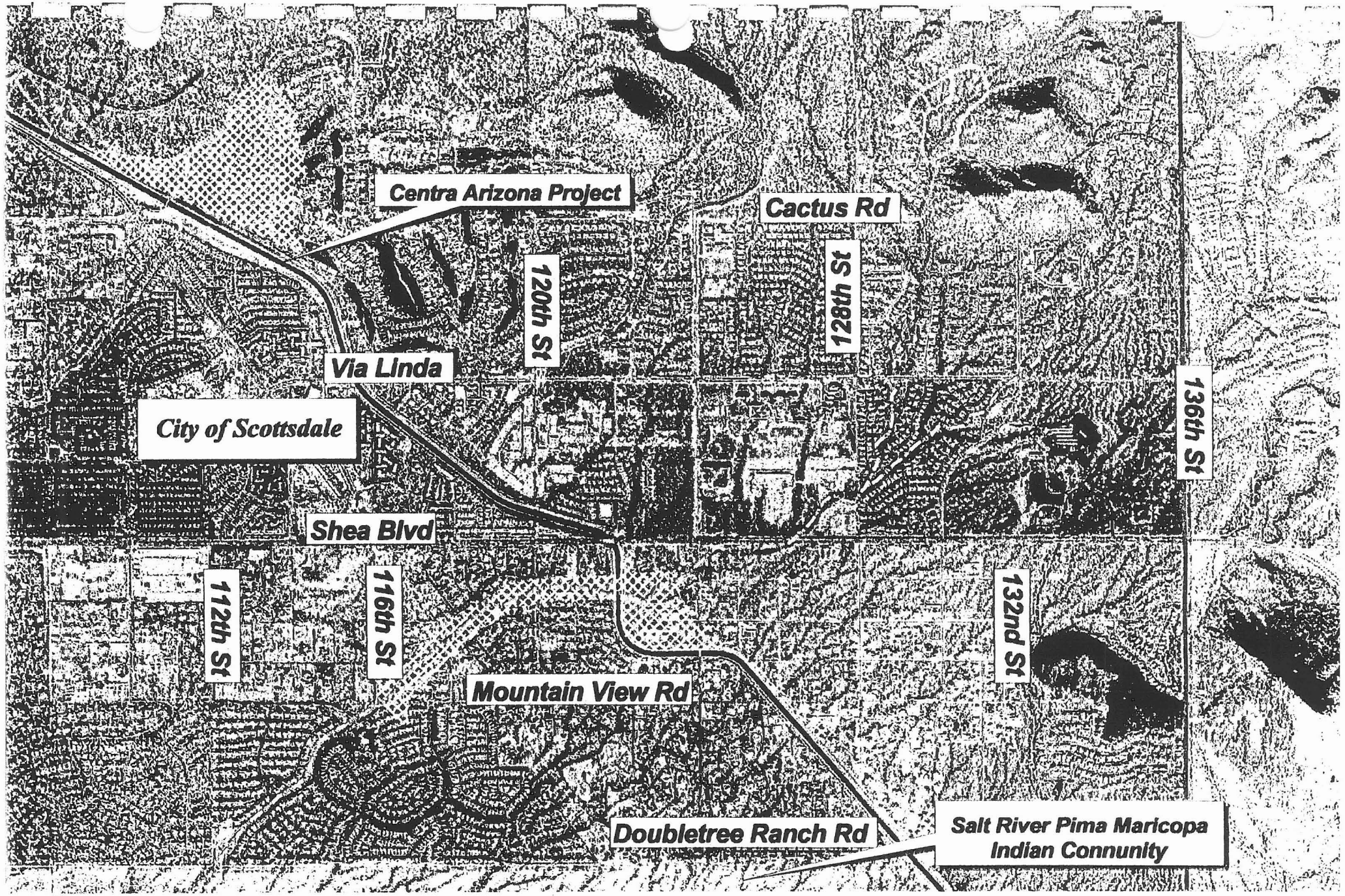
9.2.2 One (1) complete sets of mylars and four (4) complete sets of sealed blueline topographic base maps with the floodplain/floodway delineations shown. All drawings shall be signed and sealed by persons of appropriate professional registration(s). Each registrant will provide a specific statement as to what service they performed.

9.2.3 Omitted.

9.2.4 Omitted.

9.2.5 Digitized topographic data and floodplain/floodway data in conformance with the District's *HIS Data Delivery Specifications*, Rev. 3.1, April 25, 1997.

9.2.6 Four (4) complete copies of the Technical Data Notebook including HEC-1 and HEC-2/HEC-RAS input/output files on diskettes. The Technical Data Notebook shall be prepared in accordance with ADWR State Standards Attachment 1-97 (SSA 1-97). The notebook shall 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, modifications to the delineation maps, the HEC-1 model, the HEC-2/HEC-RAS model, and/or the Final Report.



WASH "B" STUDY AREA
Exhibit 1

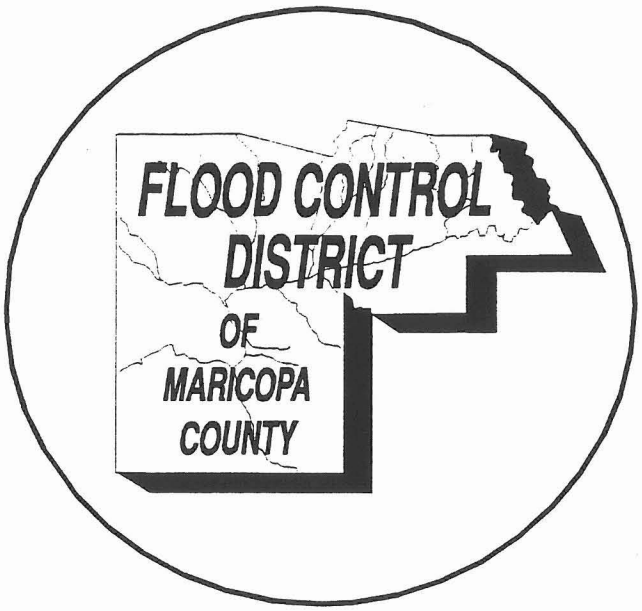


EXHIBIT B

FEE PROPOSAL

WASH "B" FLOODPLAIN DELINEATION AND TOPOGRAPHIC MAPPING
(Between Shea Boulevard and Doubletree Ranch Road)

CONTRACT FCD 99-10

Exhibit A

CONSULTANT/SUBCONSULTANT COST PROPOSAL SUMMARY

CONSULTANT/SUBCONSULTANT: Coe & Van Loo Consultants, L.L.C.

PROJECT NAME: Wash B

CONTRACT NO.: FCD 99-10

CHANGE ORDER NO.:

DIRECT LABOR			
Classifications	Manhours	Hourly Rates	Labor Costs
Principal	0	$48.00	$0
Project Manager	121.5	$33.69	$4,093
Senior Project Engineer	4	$31.73	$127
Project Engineer	0	$24.00	$0
Design Engineer	432	$20.40	$8,813
Designer	24	$17.21	$413
Technician/Drafter	505	$15.02	$7,585
Secretary/clerical	37	$13.00	$481

Subtotal Labor	$21,512
Overhead @ 150% of Labor	$32,268
Total Labor	$53,780

DIRECT AND OUTSIDE EXPENSES	
DESCRIPTION	EXPENSE AMOUNT
See Exhibit C 1	$9,055

Total Expense	$9,055

SUBCONSULTANTS		
Name of Subconsultant	Task	Cost
Project Engineering	Survey 10 road crossings	$6,300
	Survey 41 cross sections	$9,408

Total Subconsultants	$15,708
Total Labor (Primary)	$53,780
Net Fee (Total Primary Labor x 12 %)	$6,454
Total Consultants Cost	$75,942
Total Expenses	$9,055
TOTAL PROPOSED FEE	$84,997

Timothy E Kelly
Signature

Director - W.R. Dept
Title

12/2/99
Date

Exhibit B

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
CONSULTANTS/SUBCONSULTANT SCHEDULED PROJECT MANHOURS

CONSULTANT/SUBCONSULTANT NAME: Coe & Van Loo Consultants, L.L.C.

PROJECT NAME: Wash B

DATE: December 2, 1999

CONSULTANT MANHOURS		2000											
PROJECT PERSONNEL		JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	AUG	OCT	TOTAL HOURS
Principal		0.0											0.0
Project Manager		24.3	24.3	24.3	24.3			24.3					121.5
Senior Project Engineer		4.0											4.0
Project Engineer													0.0
Design Engineer		86.4	86.4	86.4	86.4			86.4					432.0
Designer		24.0											24.0
Technician/Drafter		101.0	101.0	101.0	101.0			101.0					505.0
Secretary/clerical		3.7	3.7	7.4	11.1			11.1					37.0
Survey Crew													0.0
													0.0
													0.0
													0.0
													0.0
													0.0
													0.0
													0.0
													0.0
													0.0
TOTAL HOURS	0.0	243.4	215.4	219.1	222.8	0.0	0.0	222.8	0.0	0.0	0.0	0.0	1,123.5

Exhibit C 1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
CONSULTANTS/SUBCONSULTANTS ESTIMATED MANHOURS AND DIRECT LABOR

CONSULTANT/SUBCONSULTANT NAME: Coe & Van Loo Consultants, L.L.C. **CONTRACT NO:** FCD 99-10

PROJECT NAME: Wash B

DATE: December 2, 1999

HOURLY RATE	($/HR) $33.69	($/HR) $31.73	($/HR) $24.00	($/HR) $20.40	($/HR) $17.21	($/HR) $15.02	($/HR) $13.00	($/HR) $105	($/HR)	($/HR) $48.00	TOTAL MANHOUR	TOTAL LABOR	Expenses
CONTRACT TASK/PHASE													
Task 1 - Coordination											0	$0	
1.1 Develop schedule	6						2				8	$228	
1.2 Monthly Coord. mtgs	22						8				30	$845	$150
1.3 Billing estimates - 3 qtrs.	4						3				7	$174	
1.4 Monthly Progress Rpts.	12						4				16	$456	
1.5 Public Notice		4									4	$127	$6,000
1.6 Rights of Entry ltr & list	2			4							6	$149	$30
1.7 Scottsdale PWD mtg.	2			4							6	$149	$20
1.8 Public mtgs. & comments	2										2	$67	$40
1.9 Performance Evaluations	2										2	$67	$40
											0	$0	
Task 2 - Data Collection											0	$0	
2.1 Data collection & review	4			36	8						48	$1,007	$125
2.2 Data summary report	4			8			2				14	$324	$100
											0	$0	
Task 3 - Topo											0	$0	
3.1 Obtain Scottsdale topo				3							3	$61	$0
3.2 Prepare base sheets				8							8	$163	
											0	$0	
											0	$0	

Exhibit C 1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
CONSULTANTS/SUBCONSULTANTS ESTIMATED MANHOURS AND DIRECT LABOR

CONSULTANT/SUBCONSULTANT NAME: Coe & Van Loo Consultants, L.L.C. **CONTRACT NO:** FCD 99-10

PROJECT NAME: Wash B

DATE: December 2, 1999

HOURLY RATE	($/HR) $33.69	($/HR) $31.73	($/HR) $24.00	($/HR) $20.40	($/HR) $17.21	($/HR) $15.02	($/HR) $13.00	($/HR) $105	($/HR)	($/HR) $48.00	TOTAL MANHOUR	TOTAL LABOR	Expenses
CONTRACT TASK/PHASE													
Task 4 - Survey											0	$0	
4.1 Survey road crossings	5										5	$168	
survey review & subconsultant coord.													
											0	$0	
Task 5 - Hydrology											0	$0	
5.2 2 Mtgs. & 1 field trip											0	$0	$120
Document soils & land use				6							6	$122	
Delineate Basins - 15											0	$0	
Develop HEC-1 parameters											0	$0	
HEC-1 flow chart & routing	2			16							18	$394	
Report											0	$0	$200
Figures											0	$0	
											0	$0	
Task 6 - Floodpln Delineation											0	$0	
Compliance w/ regulatory stds	2			4							6	$149	
N value inspection & report	11.5			61.5	16	91.5	3.5				184	$3,337	$240
Develop x-sections	3.5			24		16	2.5				46	$880	
Develop 2 HEC-2 models	5			52							57	$1,229	
Create Floodway - 2 models	2.5			44							46.5	$982	
Bridge Analysis - 6	5.5			31.5							37	$828	
Model revisions	6			30							36	$814	
Prepare maps & quantities	2.5			11.5		82					96	$1,550	
Hydraulics Report	3.5			26		83.5					113	$1,902	$300
Plot cross sections	0			0		40					40	$601	
											0	$0	
Task 7 HIS Data											0	$0	
Overview stds. & set-up	1					68					69	$1,055	

Total Hydraulic Analysis 3.9 river miles 222.5
Manhours/mile 57

Exhibit C 1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
CONSULTANTS/SUBCONSULTANTS ESTIMATED MANHOURS AND DIRECT LABOR

CONSULTANT/SUBCONSULTANT NAME: Coe & Van Loo Consultants, L.L.C. **CONTRACT NO:** FCD 99-10

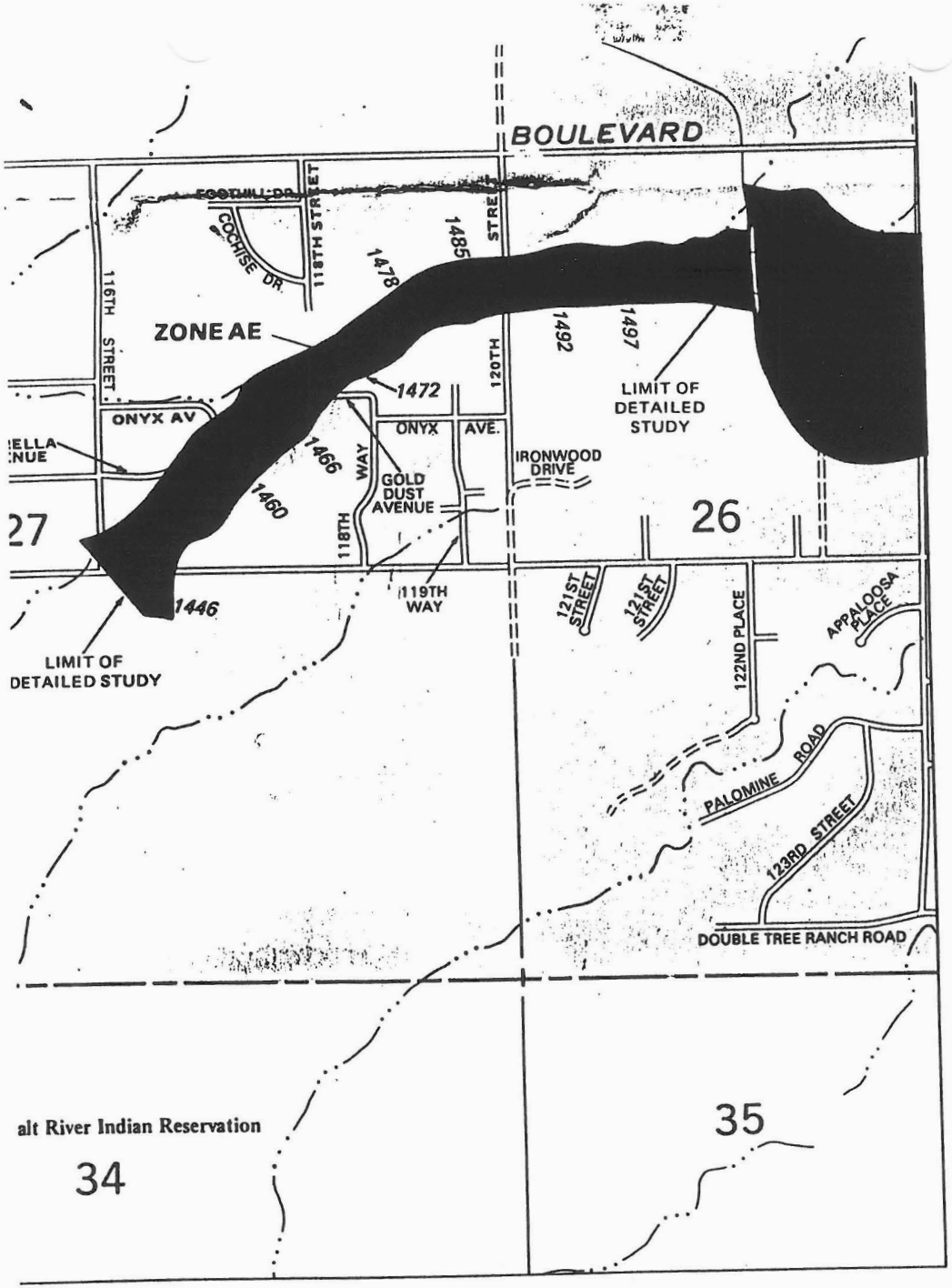
PROJECT NAME: Wash B

DATE: December 2, 1999

HOURLY RATE CONTRACT TASK/PHASE	($/HR) $33.69	($/HR) $31.73	($/HR) $24.00	($/HR) $20.40	($/HR) $17.21	($/HR) $15.02	($/HR) $13.00	($/HR) $105	($/HR)	($/HR) $48.00	TOTAL MANHOUR	TOTAL LABOR	Expenses
											0	$0	
Task 8 - Zone A Revision											0	$0	
Plot Crest elevations + 1' on topo											0	$0	
Prepare FEMA submittal	4			10		6	3				23	$468	
Task 9 - Deliverables													
9.1.2 Bluelines						3.5					3.5	$53	$140
9.1.3 Tech Data Notebooks				19		38					57	$958	$310
9.1.4 FEMA Forms	2.5			10			4.5				17	$347	$90
9.1.5 Digital Terrain Model						4					4	$60	$30
9.1.6 Survey Notes - 3						6					6	$90	$15
9.1.7 Modify exist. FIRM				2.5		4.5					7	$119	$35
9.2.1 Work drawings				2.5		4.5					7	$119	$110
9.2.2 Signed Maps	1			2.5		7					10.5	$190	$240
9.2.3 Photo mylars						2.5					2.5	$38	$120
9.2.6 Tech Data Notebooks	4			16		48	4.5				72.5	$1,241	$600
											0	$0	
Total by classification	121.5	4	0	432	24	505	37	0	0	0	1123.5	$21,512	$9,055

APPENDIX E

Flood Insurance Rate Maps



APPROXIMATE SCALE IN FEET

1000 0 1000

1705E

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1705 OF 4350

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1705	E
SCOTTSDALE, CITY OF	045012	1705	E

MAP NUMBER
04013C1705 E

MAP REVISED:
SEPTEMBER 30, 1995

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1710 OF 4350

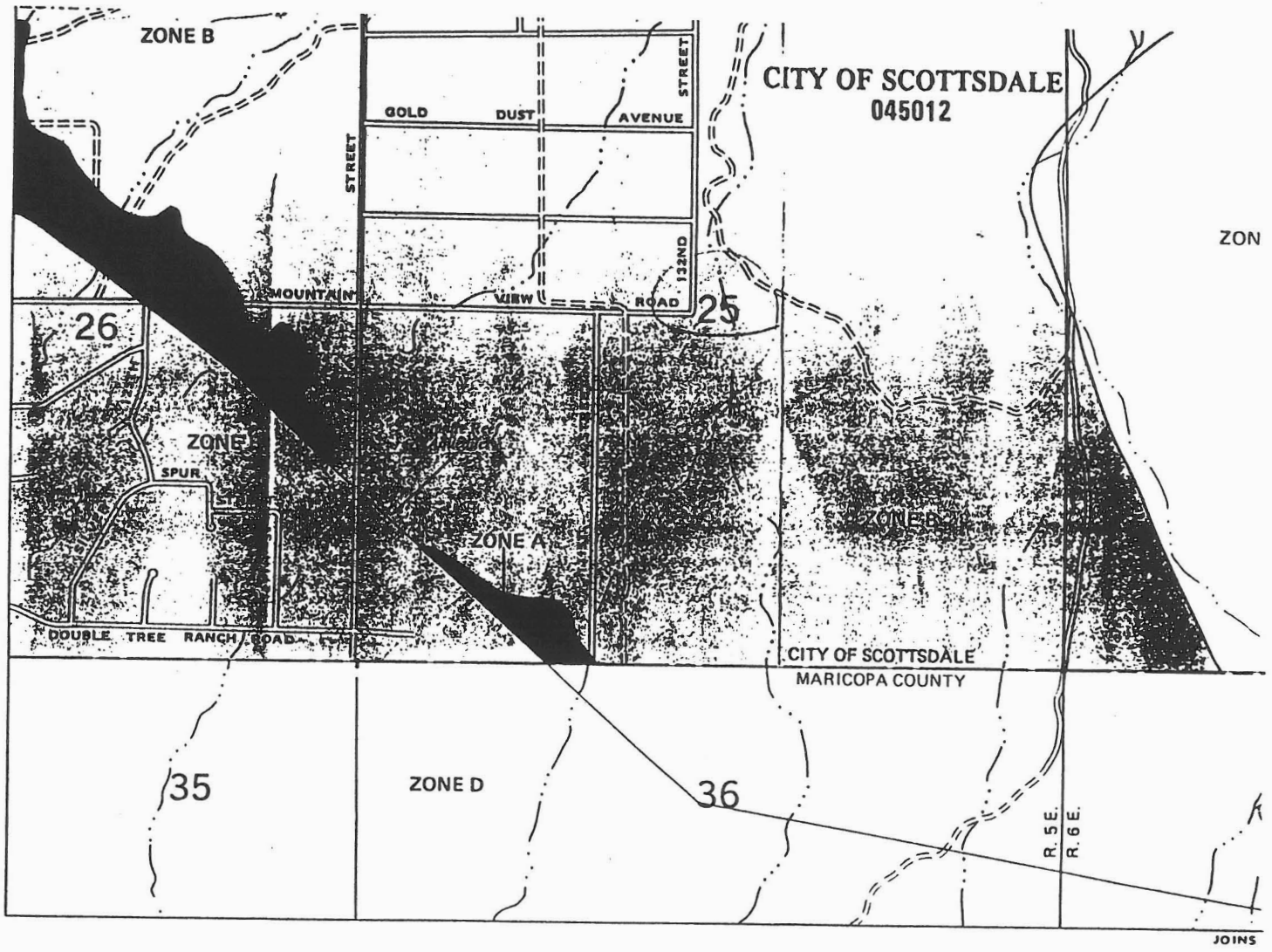
CONTAINS

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1710	D
SCOTTSDALE, CITY OF	045012	1710	D

MAP NUMBER
04013C1710 D

EFFECTIVE DATE:
APRIL 15, 1988

Federal Emergency Management Agency



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWI
TOWNSHIP 3 NORTH 5 EAST
and TOWNSHIP 3 NORTH RANGE 6 EAST

APPENDIX F

Key to Cross Section Labeling

KEY TO CROSS-SECTION LABELING

Community Name: Maricopa County, Arizona and Incorporated Areas
County: Maricopa County
State: Arizona

Prepared by: Coe & Van Loo Consultants, Inc.

Stream Name: Wash "B"
Run Date: December 2000

XS Letter - Draft FIS	Computer Stationing	XS Letter - Final FIS	EPA Reach No.
	0.0015		
	0.0377		
	0.1324		
	0.2271		
	0.2615		
	0.3220		
	0.3735		
	0.4167		
	0.4640		
	0.5114		
	0.5559		
	0.5964		
	0.6261		
	0.6384		
	0.7002		
	0.7947		
	0.8216		
	0.8884		
	0.9454		
	0.9712		
	0.9936		
	1.0024		
	1.0822		
	1.1362		
	1.1610		
	1.1722		
	1.1788		
	1.2311		
	1.2775		
	1.3076		
	1.3242		
	1.3462		
	1.4195		
	1.4972		
	1.5097		
	1.5401		
	1.5651		
	1.5767		

KEY TO CROSS-SECTION LABELING

Community Name: Maricopa County, Arizona and Incorporated Areas
County: Maricopa County
State: Arizona

Prepared by: Coe & Van Loo Consultants, Inc.

Stream Name: Tributary
Run Date: December 2000

XS Letter - Draft FIS	Computer Stationing	XS Letter - Final FIS	EPA Reach No.
	0.0587		
	0.1386		
	0.1922		
	0.2473		
	0.3057		
	0.3748		

APPENDIX G

N Value Determination Report

WASH "B" FLOODPLAIN DELINEATION STUDY

Between Cactus Road and Doubletree Ranch Road

FCDMC CONTRACT #99-10

N VALUE DETERMINATION REPORT

March 2000

Prepared for:

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

Prepared by:

Coe & Van Loo Consultants, L.L.C.
4550 N. 12th Street
Phoenix, AZ 85014
(602) 264-6831
CVL # 99-7002-01

WASH "B" FLOODPLAIN
DELINEATION STUDY
N VALUE DETERMINATION REPORT

TABLE OF CONTENTS

Page

I. Wash "B" Background 1

II. N Value Definition 1

III. N Value Determination for Wash "B" 3

IV. References 4

Appendix

1. Manning's N Value Determination

2. Photograph Index Map

3. Photographs of Selected Locations in the Study Area

I. WASH "B" BACKGROUND

Coe & Van Loo Consultants, Inc., (CVL) has contracted with the Flood Control District of Maricopa County (FCDMC) to perform a Floodplain Delineation Study for Wash "B" located in Maricopa County, Arizona.

The project consists of floodplain and floodway delineation of approximately 3.9 river miles of Wash "B" between Cactus Road and Doubletree Ranch Road. The hydrology is being revised by CVL from the currently effective Flood Insurance Study (FIS) to reflect recent development and changes in topography. Backwater analysis will be conducted by CVL using the HEC-RAS computer model to determine floodplain and floodway delineations for the 100-year peak flood.

As a part of the Wash "B" Floodplain Delineation, the purpose of this *N Value Determination Report* is to document the assumptions made in the selection of n values used in the HEC-RAS computer model. The n value selections are based on a compilation of field notes, photographs (included in the appendix of this report), and aerial photographs.

II. "N" VALUE DEFINITION

The roughness coefficient (Manning's n value) in open channels represents the resistance to flow that is related to a variety of factors, such as vegetation, obstructions, and type of bed material, as described in reference 1. Determination of this resistance to flow for natural washes requires judgement and expertise that is acquired primarily through experience. A description of some of the aspects in determining Manning's n value will be covered in this section.

The n value for a channel or floodplain is determined by evaluating the n value factors of the various components of the waterway. These components are the base n value (n_b), the degree

of irregularity and variations of channel cross section geometry (n_1), relative effect of obstructions (n_2), vegetation (n_3), and degree of meandering (m). These components are used to calculate a composite n value using the following equation:

$$\text{n value} = (n_b + n_1 + n_2 + n_3)m$$

The base n value (n_b) reflects the type of bed material or surface roughness. This generally ranges from $n_b = 0.020$ for earth to $n_b = 0.028$ for coarse gravel material to $n_b = .05$ for cobble material.

The n_1 value is composed of two separate factors. The first factor is the degree of irregularity which consists of the extents of side slope erosion which can be noted by ridges, depressions, sand bars and holes on the channel bed. The second factor is variations in the channel cross-section geometry which can be noted by the effects of contraction and expansion. When the two factors are combined, the degree of irregularity and variations of cross-section geometry range from smooth ($n_1 = 0.000$) to severe ($n_1 = 0.020$).

The n_2 value is the relative effect of obstructions which takes into account the presence and characteristics of obstructions within the waterway. Some of the obstructions may include debris deposits, stumps, exposed roots, logs, piers, and isolated boulders. These obstructions range from negligible ($n_2 = 0.000$) to severe ($n_2 = 0.060$), as the effect is increased.

Vegetation, n_3, can have a large effect on the n value depending on the type and amount of vegetation, and the depth of flow. The range for vegetation is from small ($n_3 = 0.002$) to large ($n_3 = 0.050$).

The last component part of the total n value is the degree of meandering. The range for meandering is from minor (m = 1.00) to severe (m = 1.30). This factor is multiplied by the sum of the other components to calculate the total n. For typical washes in Arizona, this factor is

considered minor and will have little effect on the total n value. Wash "B" has virtually no meandering, and therefore the factor m = 1.00.

III. "N" VALUE DETERMINATION FOR THE WASH "B"

The Manning's n values used in this study were estimated by use of the following materials:

1. Aerial photographs - 1"=500' print prepared by the City of Scottsdale.
2. Extensive field reconnaissance for the purposes of determining Manning's n value.
3. Photographs taken during field reconnaissance trips.
4. Reference documents as listed in the reference section.

The method of determining Manning's n values outlined in the previous section has been used for each reach of this study. The calculated Manning's n value was then reviewed and evaluated to see if it seemed reasonable for the wash section. Where the calculated n value did not seem reasonable, the components were re-evaluated and adjusted.

Throughout the study reach, there are many diverse conditions. Therefore this study utilizes a wide range of Manning's n values. Some examples of these conditions are as follows:

1. North Side of Palomino Drive

   A majority of the left overbank is paved with landscaped tracts parallel to the edge of pavement, therefore the base n value for the left overbank is 0.015. The landscaped tracts are relatively vegetated with small bushes and trees, therefore the n_3 value is estimated to be at 0.01. The degree of irregularity and variations of channel cross-section geometry (n_1) is negligible, as well as the relative effect of obstructions (n_2). The composite n value for the left overbank is 0.025.

   The channel bed material is comprised of coarse sand and coarse gravel, therefore the base n value is 0.028. Small trees and bushes are interspersed throughout the channel bed, the n_3 value is estimated to be at 0.01. The degree off irregularity and

variations of channel cross-section geometry (n_1) and the relative effect of obstructions (n_2) are insignificant. Therefore, the total n value for the channel is estimated at 0.038.

The right overbank is comprised of coarse sand and coarse gravel, therefore, the base n value is 0.028. There are turf grasses as well as small trees and bushes throughout the right overbank, when combined the n_3 value is estimated to be 0.03. The degree of irregularity and variations of channel cross-section geometry (n_1) and relative effect of obstructions (n_2) are negligible. Thus, the composite n value for the right overbank is 0.058. See Photograph #2 in the Appendix, as well as Section .322-.4167, in the *Manning "n" Value Determination Table* provided in the Appendix.

2. Downstream of the C.A.P.

The overbanks are made up of a variety of bed material, ranging from coarse sand to cobble stone, therefore the base n value for the overbanks is estimated at 0.035. The overbanks are moderately scoured, but there is virtually no variation in channel cross-section geometry. Thus, the n_1 value is estimated to be 0.005. Vegetation along the overbanks is fairly dense and the depth of flow is not above the height of the vegetation, so the n_3 value is estimated to be 0.05. The relative effect of obstructions is minuscule, therefore the n_2 value is 0.0. The composite n value for the overbanks is estimated at 0.09.

The channel bed material is comprised of material ranging from coarse sand to cobble stone. So, the base n value for the channel was estimated at 0.035. The channel is slightly scoured and there are no variations in the channel cross-section

geometry. Therefore, the n value is estimated at 0.005. There are virtually no obstructions in the channel, thus the n_2 value is estimated at 0.0. The channel bed is slightly vegetated with small bushes and weeds, therefore the n_3 value is estimated at 0.01. The composite n value is 0.05. See Photograph #5 provided in the Appendix. A summary of n values for cross-section 1.3547-1.5693 can be seen in the table provided in the Appendix.

3. Reach 2

The channel bed is made up of several different types of material ranging from coarse sand to coarse gravel interspersed with cobble stone. Therefore, the base n value for the channel is estimated at 0.03. The channel is relatively eroded and there is no significant variation in channel cross-section geometry, the n_1 value is estimated to be 0.006. The channel is free of any significant obstructions therefore, the n_2 value is estiamted to be 0.0. Vegetation in the channel bottom is slightly dense with small trees, bushes and weeds giving n_3 a value of 0.025. The total n value for the channel bottom is 0.061.

The bed material in the overbanks is comprised of the same material as the channel bed, the base n value is 0.03. The overbanks are slightly eroded and there is no variation in cross-sectional geometry, therefore the n_1 value is 0.006. There are no obstructions, thus the n_2 value is 0.0. The vegetation is slightly more dense than in the channel so the n_3 value is estimated to be 0.03. These values result in a composite n value of 0.066 for the overbanks. See Photographs # 1A & 2A in the Appendix. A summary for the n values is provided on Page 3 of the Mannings n Value Determination Table.

These examples illustrate the wide range of Manning's n values that occur throughout the study reach. The appendix includes Manning's n value determination worksheets throughout the study reach and photographs of selected locations.

IV. REFERENCES

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

2. V.T. Chow, *Open Channel Hydraulics*, New York, McGraw-Hill, 1959.

3. Aldridge, B.N. and Garrett, J.M., *Roughness Coefficients for Streams in Arizona*, U.S. Geological Survey Open-File Report 78-3, 87 p., 1973.

APPENDIX

1. Manning's "n"-Value Determination Table

2. Photograph Index Map

3. Photographs of Selected Locations in the Study Area

WASH "B"
MANNING'S "n" VALUE DETERMINATION TABLE
(Page 1)

Reach 1 (Section - Section)	Channel Portion	Base "n" (n_b)	Degree of Irregularity & Variations of Channel Cross Section Geometry (n_1)	Relative Effect of Obstructions (n_2)	Vegetation (n_3)	Composite "n"
.000 - .2273	Channel	.026	0	0	.01	.036
.000 - .2273	Left Overbank	.026	0	0	.025	.051
.000 - .2273	Right Overbank	.026	0	0	.025	.051
Refer to Photograph Number 1						
.322 - .4167	Channel	.028	0	0	.010	.038
.322 - .4167	Left Overbank	.015	0	0	.010	.040
.322 - .4167	Right Overbank	.028	0	0	.003	.058
Refer to Photograph Number 2						
.5114 - .6061	Channel	.028	.002	0	.005 - .01	.035 -.040
.5114 - .6061	Left Overbank	.028	.002	0	.03	.06
.5114 - .6061	Right Overbank	.028	.002	0	.03	.06
Refer to Photograph Number 3						
.7008 - 1.2885	Channel	.028	.002	0	.005 - .01	.035 -.040
.7008 - 1.2885	Left Overbank	.030	.005	0	.04	.075
.7008 - 1.2885	Right Overbank	.030	.005	0	.04	.075
Refer to Photograph Number 4						

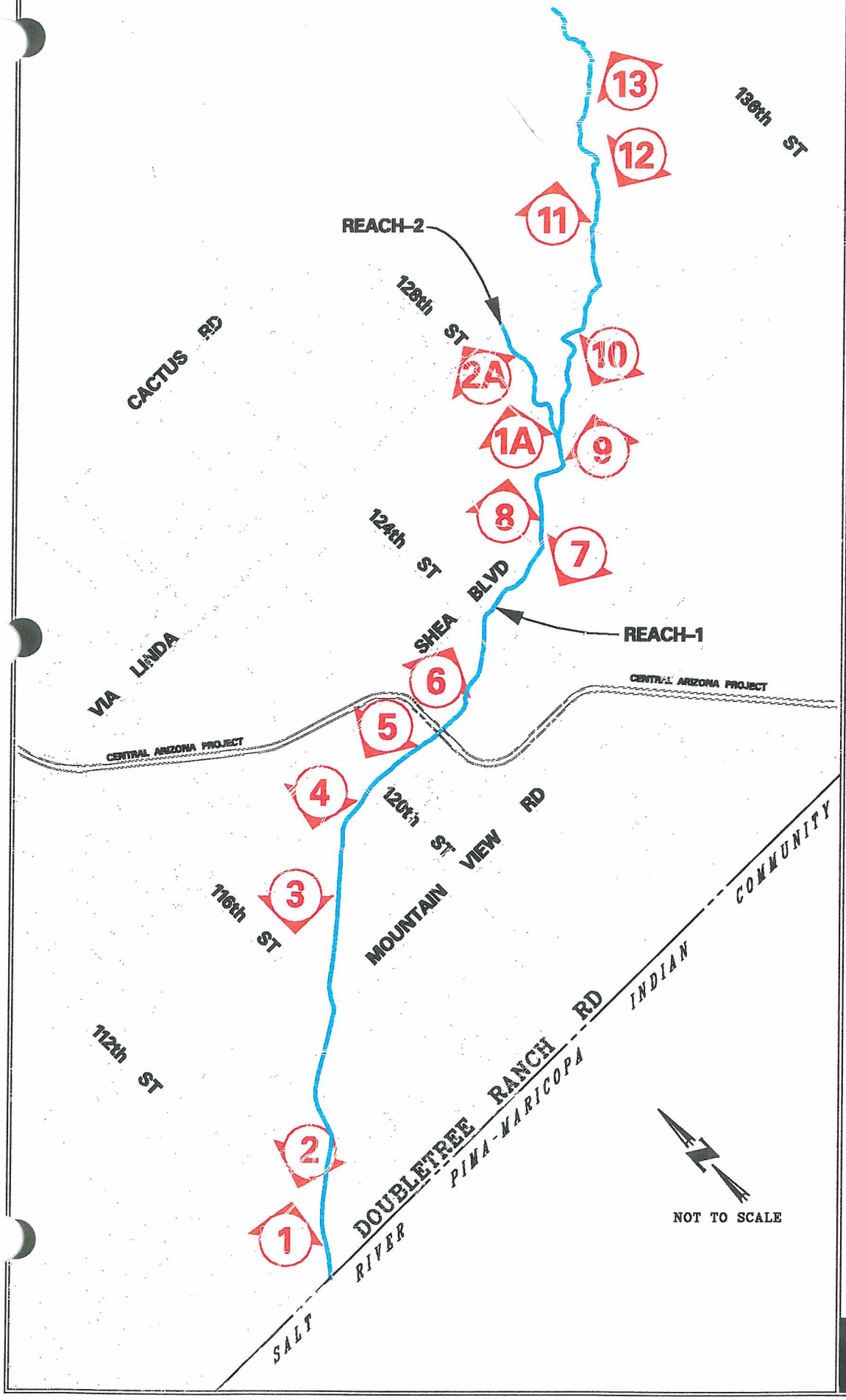
WASH "B"
MANNINGS "n" VALUE DETERMINATION TABLE
(Page 2)

Reach 1 (Section - Section)	Channel Portion	Base "n" (n_b)	Degree of Irregularity & Variations of Channel Cross Section Geometry (n_1)	Relative Effect of Obstructions (n_2)	Vegetation (n_3)	Composite "n"
1.3547 - 1.5693	Channel	.035	.005	0	.01	.05
1.3547 - 1.5693	Left Overbank	.035	.005	0	.05	.09
1.3547 - 1.5693	Right Overbank	.035	.005	0	.05	.09
Refer to Photograph Number 5						
1.6446 - 2.1921	Channel	.030	.006	0	.01	.046
1.6446 - 2.1921	Left Overbank	.030	.005	0	.03	.065
1.6446 - 2.1921	Right Overbank	.030	.005	0	.03	.065
Refer to Photograph Number 6 & 7						
2.2106 - 3.1498	Channel	.030	.008	0	.02	.058
2.2106 - 3.1498	Left Overbank	.030	.01	0	.04	.080
2.2106 - 3.1498	Right Overbank	.030	.008	0	.04	.078
Refer to Photograph Number 8, 9 & 10						
3.1718 - 3.8851	Channel	.035	.01	.002	.01	.057
3.1718 - 3.8851	Left Overbank	.035	.01	.002	.03	.077
3.1718 - 3.8851	Right Overbank	.035	.01	.002	.03	.077
Refer to Photograph Numbers 11, 12 & 13						

WASH "B"
MANNINGS "n" VALUE DETERMINATION TABLE
(PAGE 3)

Reach 2 (Section - Section)	Channel Portion	Base "n" (n_b)	Degree of Irregularity & Variations of Channel Cross Section (n_1)	Relative Effect of Obstructions (n_2)	Vegetation (n_3)	Composite "n"
.0589 - .3747	Channel	.03	.006	0	.025	.061
.0589 - .3747	Left Overbank	.03	.006	0	.03	.066
.0589 - .3747	Right Overbank	.03	.006	0	.03	.066
Refer to Photograph Numbers 1A &2A						

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
WASH-B FLOODPLAIN
DELINATION STUDY
F.C.D. CONTRACT NO. 99-10



LEGEND

7 PHOTO I.D. & DIRECTION

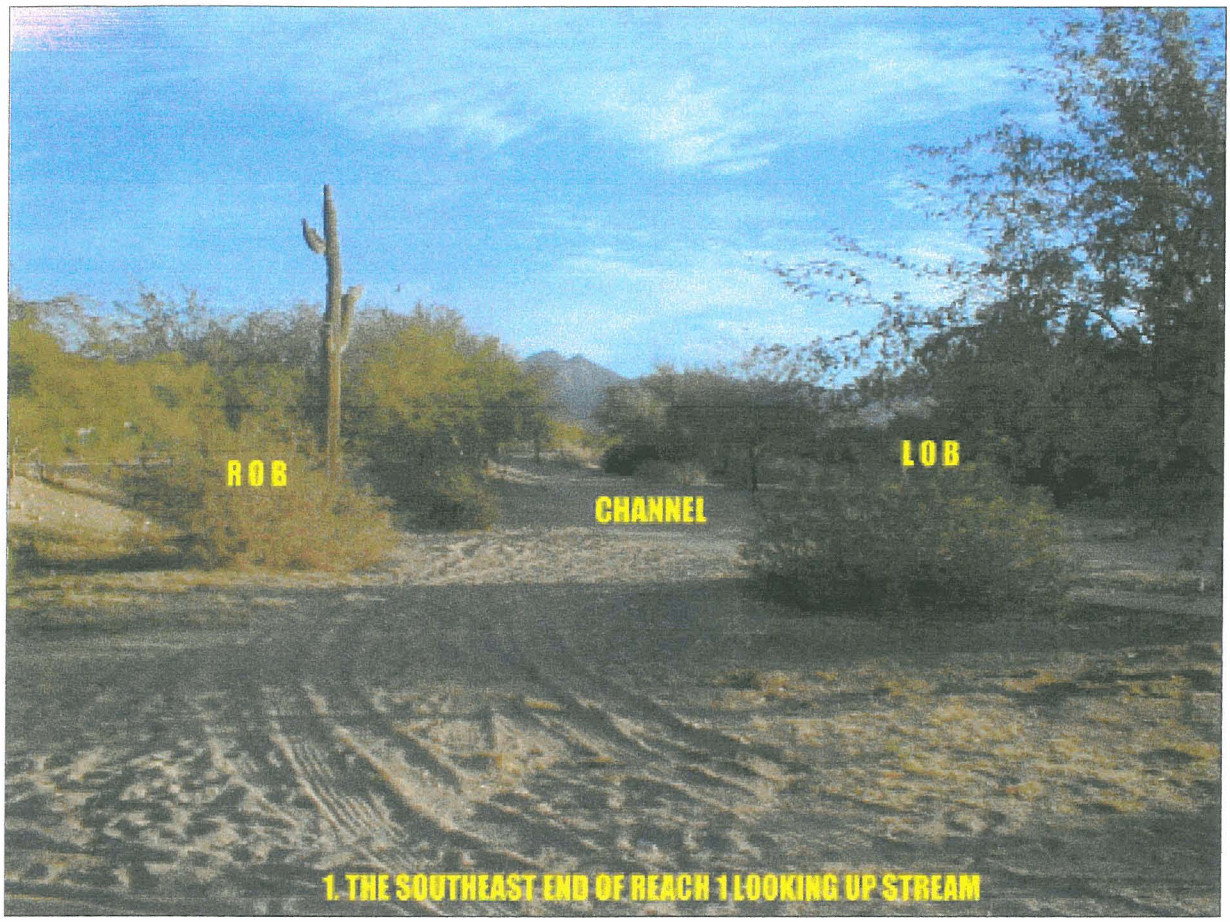
REACH FLOW LINE

L O B LEFT OVER BANK

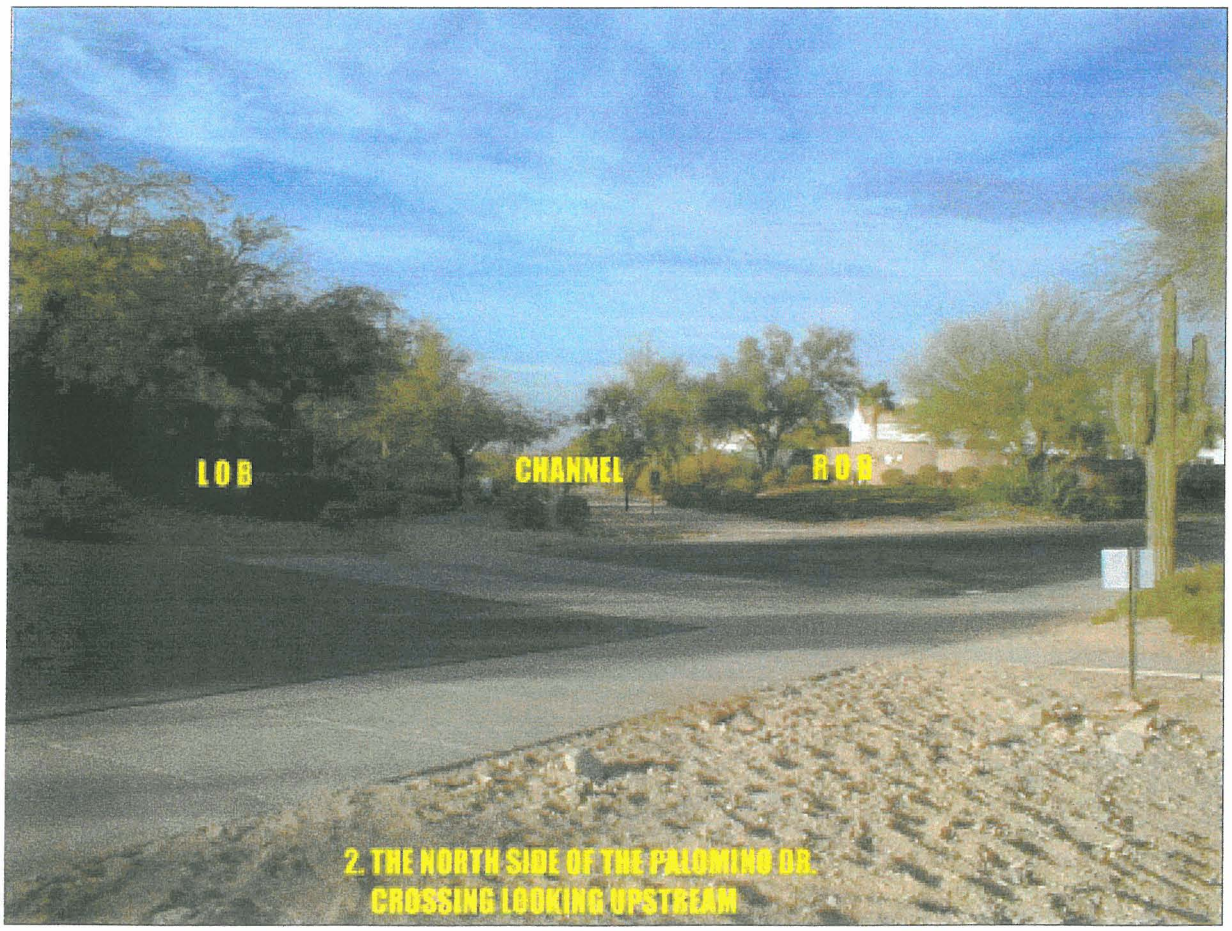
R O B HIGHT OVER BANK

N VALUE
DETERMINATION REPORT
PHOTOGRAPH INDEX
LOCATION PLAN

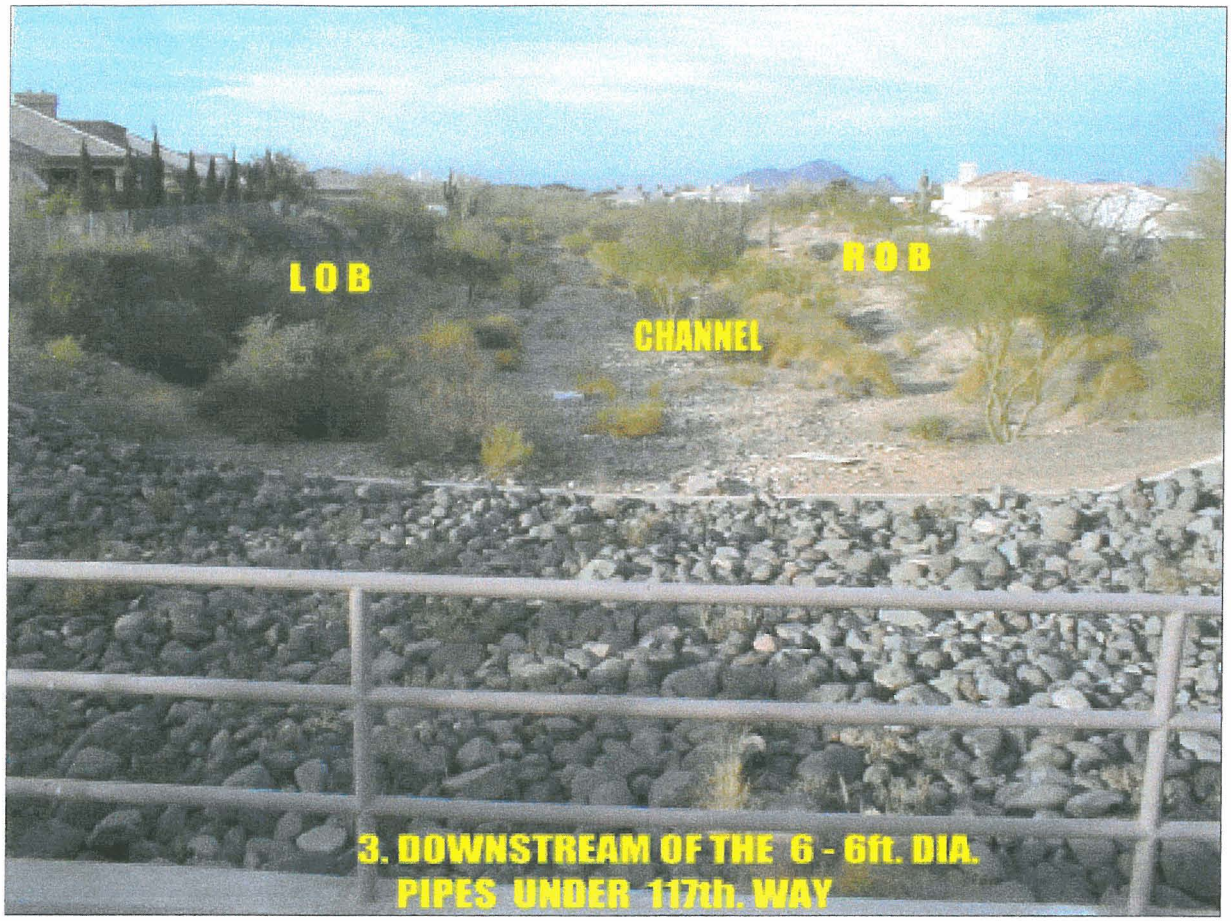
COE & VAN LOO
4550 NORTH 12TH STREET
PHOENIX, ARIZONA 85014
TELEPHONE (602) 264-6831



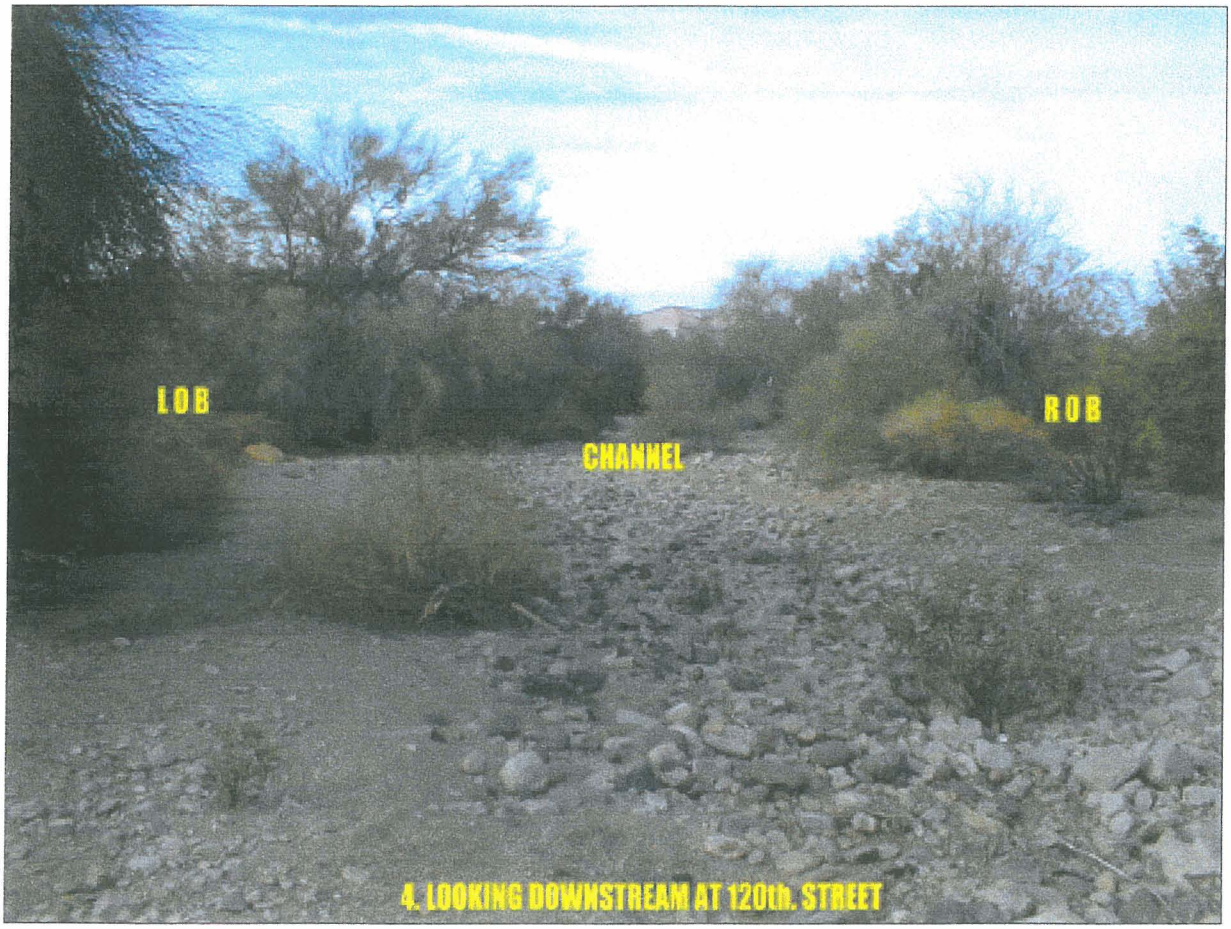
1. THE SOUTHEAST END OF REACH 1 LOOKING UP STREAM



2. THE NORTH SIDE OF THE PALOMINO DR.
CROSSING LOOKING UPSTREAM



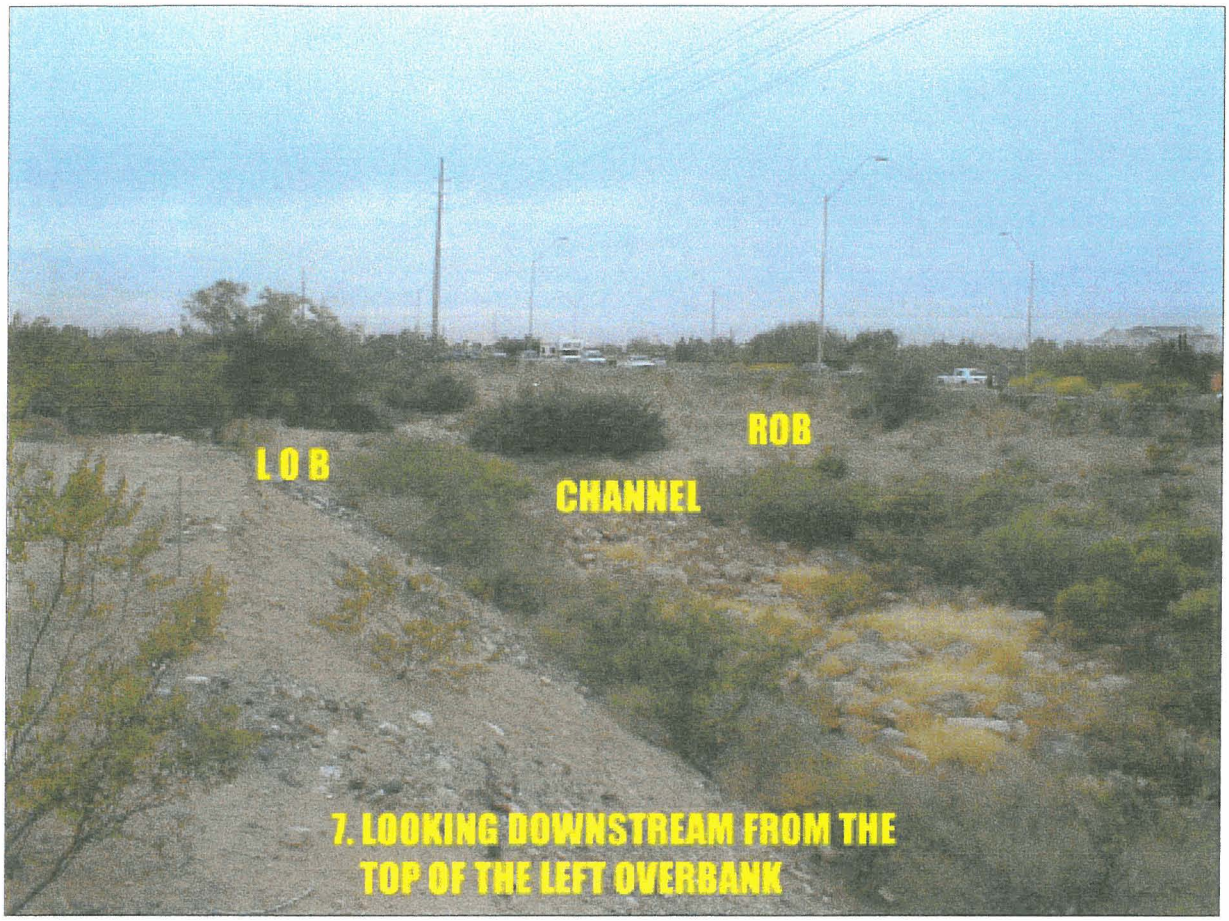
3. DOWNSTREAM OF THE 6 - 6ft. DIA. PIPES UNDER 117th. WAY



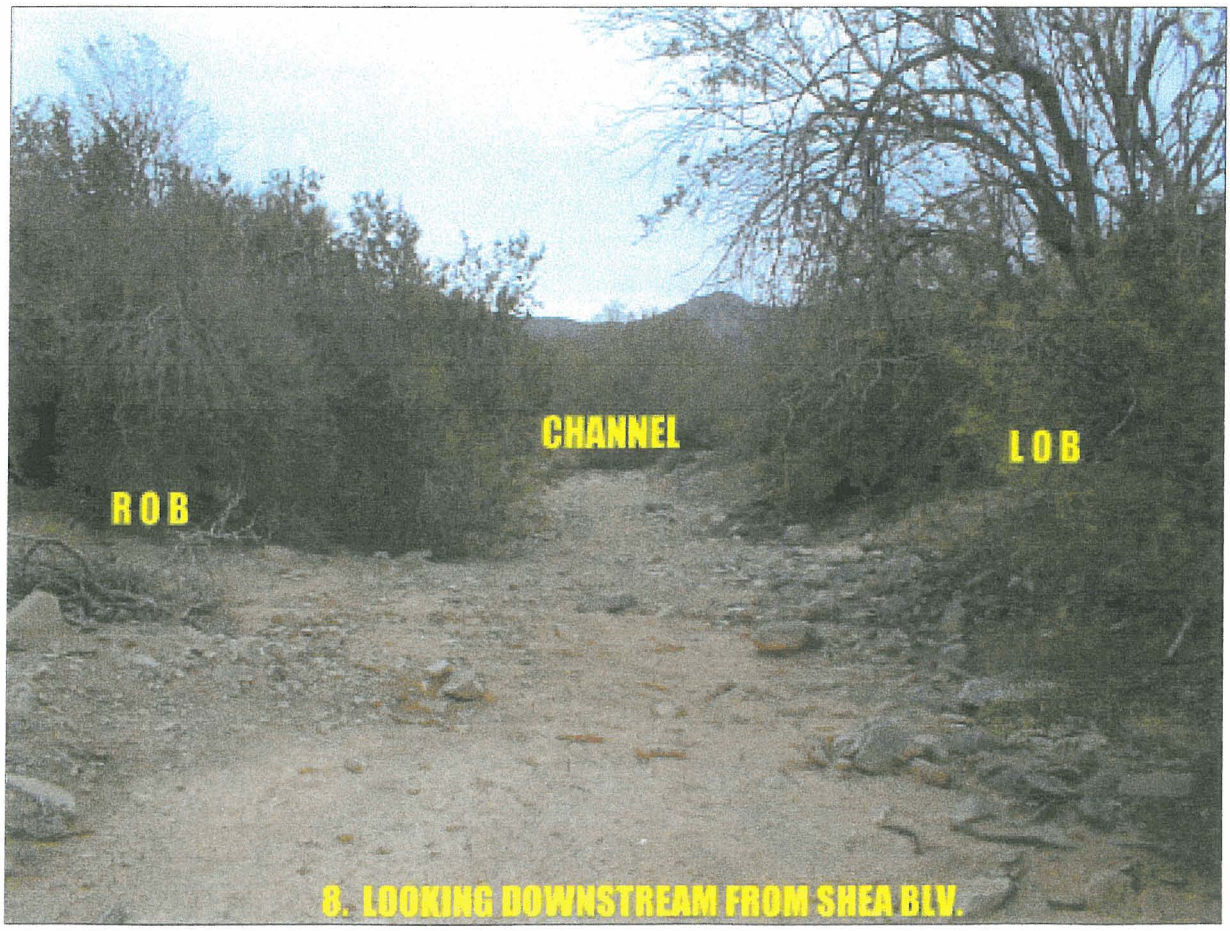
4. LOOKING DOWNSTREAM AT 120th. STREET

5. LOOKING DOWNSTREAM FROM THE SOUTH SIDE OF THE CENTRAL ARIZONA PROJECT

6. LOOKING UPSTREAM FROM THE NORTH SIDE OF THE CENTRAL ARIZONA PROJECT

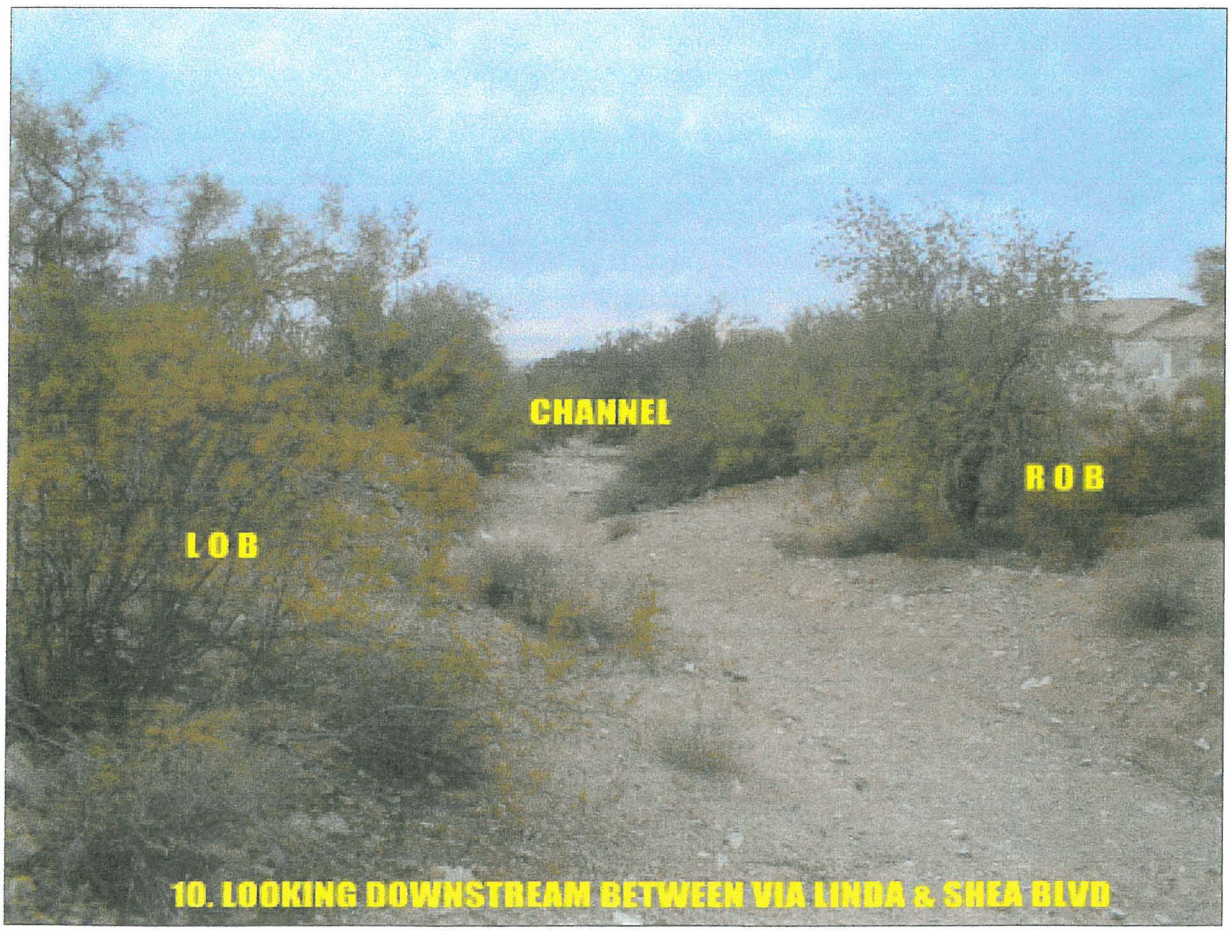


7. LOOKING DOWNSTREAM FROM THE TOP OF THE LEFT OVERBANK



8. LOOKING DOWNSTREAM FROM SHEA BLV.

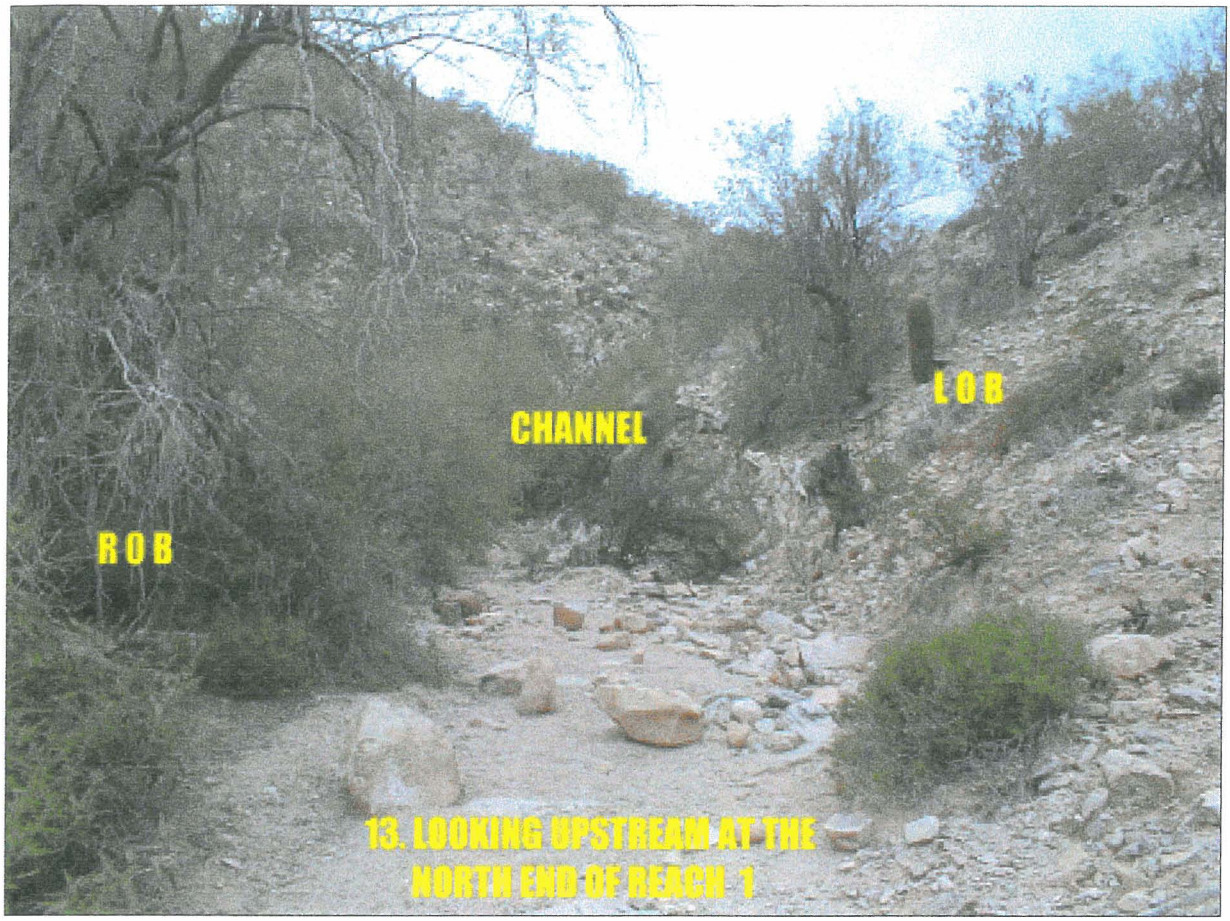
9. LOOKING UPSTREAM AT THE CONFLUENCE OF REACH 1 AND REACH 2



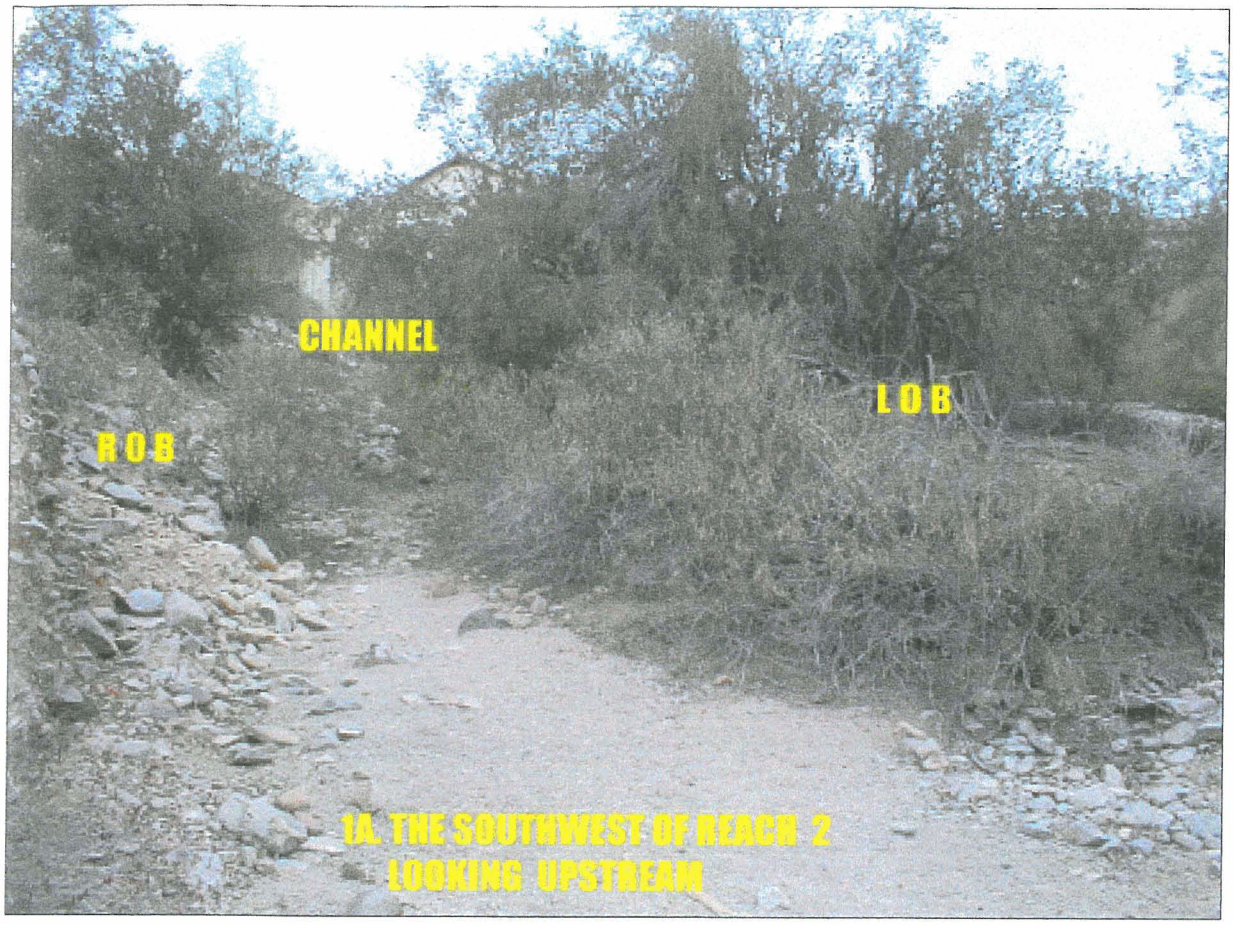
10. LOOKING DOWNSTREAM BETWEEN VIA LINDA & SHEA BLVD

11. LOOKING UPSTREAM AT VIA LINDA

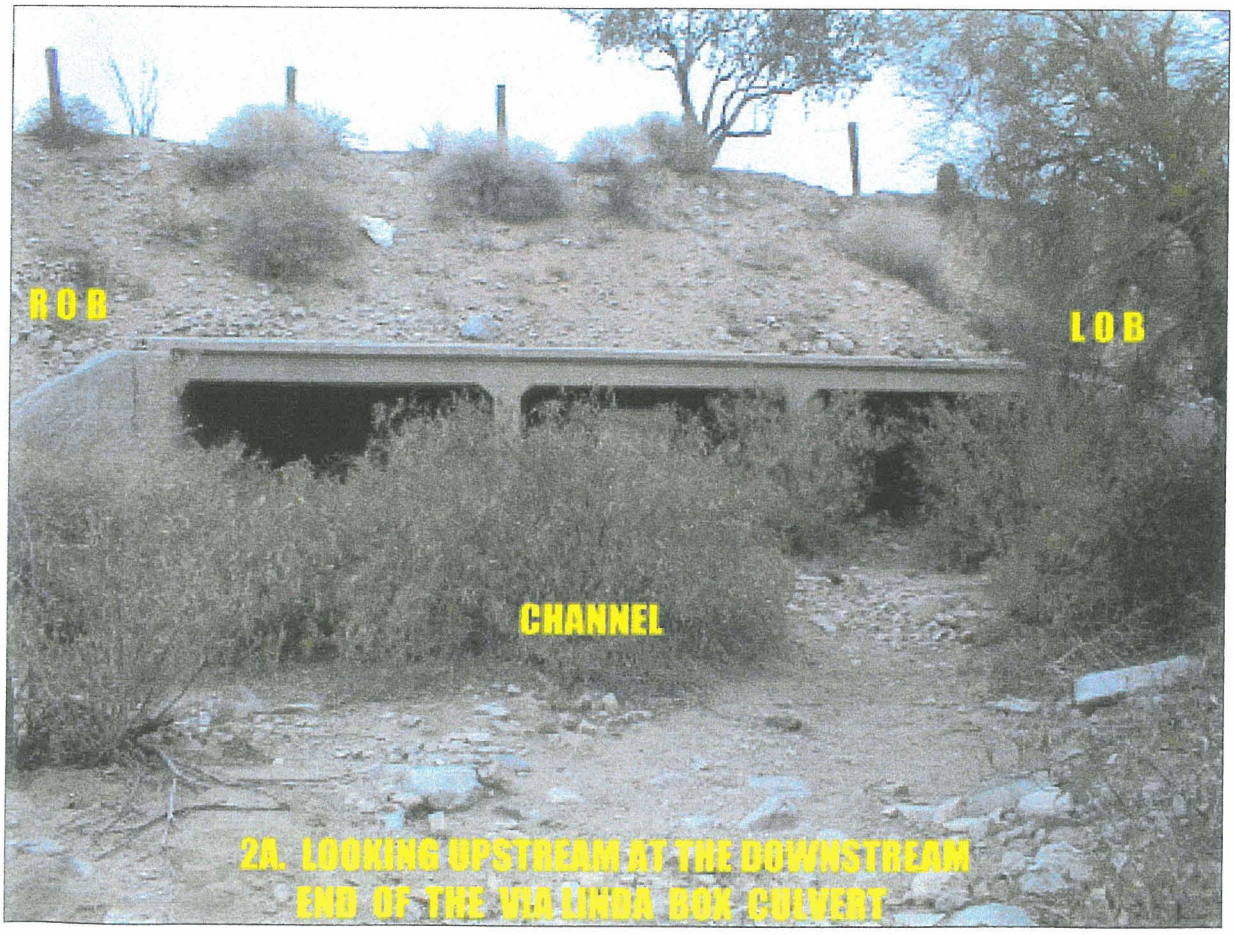
12. UPSTREAM OF THE VIA LINDA
CROSSING LOOKING DOWNSTREAM



13. LOOKING UPSTREAM AT THE NORTH END OF REACH 1



1A. THE SOUTHWEST OF REACH 2
LOOKING UPSTREAM



2A. LOOKING UPSTREAM AT THE DOWNSTREAM
END OF THE VIA LINDA BOX CULVERT