North Peoria Area Drainage Master Plan

Flood Insurance Study Technical Data Notebook

Book 1 of 2

June 2001

Prepared for the
Flood Control District
of Maricopa County

and the
City of Peoria

Prepared by

Stantec

Project No. 82000146
Contract FCD 99-45

NORTH PEORIA AREA DRAINAGE MASTER PLAN

Flood Insurance Study
Hydrologic and Hydraulic Technical Data Notebook

Book 1 of 2

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PREPARED FOR:

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PREFACE

The North Peoria Area Drainage Master Plan (Contract No. FCD 99-45) was performed for:

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SECTION 1: INTRODUCTION

1.1 Purpose of Report

The following report is a comprehensive document that contains the results and supporting computations for the hydrology and hydraulics portion of the North Peoria Area Drainage Master Plan (ADMP) located in Maricopa County, Arizona. Our sincere appreciation is extended to the following agencies for their help and perspective while studying this watershed:

- Arizona Department of Water Resources
- Flood Control District of Maricopa County
- City of Peoria
- Central Arizona Project
- U.S. Natural Resource Conservation Service

The purpose of this study is to provide baseline data for the identification of potential flooding problems associated with impending development to aide in the establishment of guidelines and policies for the management of future development in the study area, particularly along the study watercourses. Development of baseline data involves the estimation of peak discharges resulting from a 100-year storm at key locations in the watershed, determination of the floodplain and floodway limits along designated study reaches and to evaluate the potential of erosion hazards along designated study reaches. The primary focus of this report is to document the hydrologic and hydraulic data, assumptions, procedures and criteria used in conducting this study. This report is generally structured in a Technical Data Notebook format in accordance with Arizona Department of Water Resources requirements of State Standard SS1-97 and State Standard SSA1-97.

The study area, which encompasses approximately 67 square miles of portions of the City of Peoria, Maricopa and Yavapai Counties, was undertaken by the Flood Control District of Maricopa County in cooperation with the City of Peoria. The study area in relationship to the State of Arizona is shown on the Location Map, Figure 1-1. The study area in relationship to the City of Peoria corporate limits and Maricopa County is shown on the Vicinity Map, Figure 1-2.

The hydrology portion of this study is executed using the methodology contained in the Drainage Design Manual for Maricopa County, Arizona, Volume I, Hydrology, (Design Manual), 1995, Flood Control District of Maricopa County. Hydrologic modeling is accomplished using the US Army Corps of Engineers (COE) HEC-1 computer program, version 4.1. Detailed floodplain and floodway delineation is performed for approximately 18 miles along three separate watercourses within the study area and is accomplished using the COE HEC-RAS computer program, version 3.0. Additionally, approximate method floodplain delineation is performed for approximately 18 miles along several watercourses within the study area. The limits of both the detailed and approximate method study reaches in relation to the study area are shown in Figure 1-3 as well as in Plate 8.

Figure 1-1

Location Map

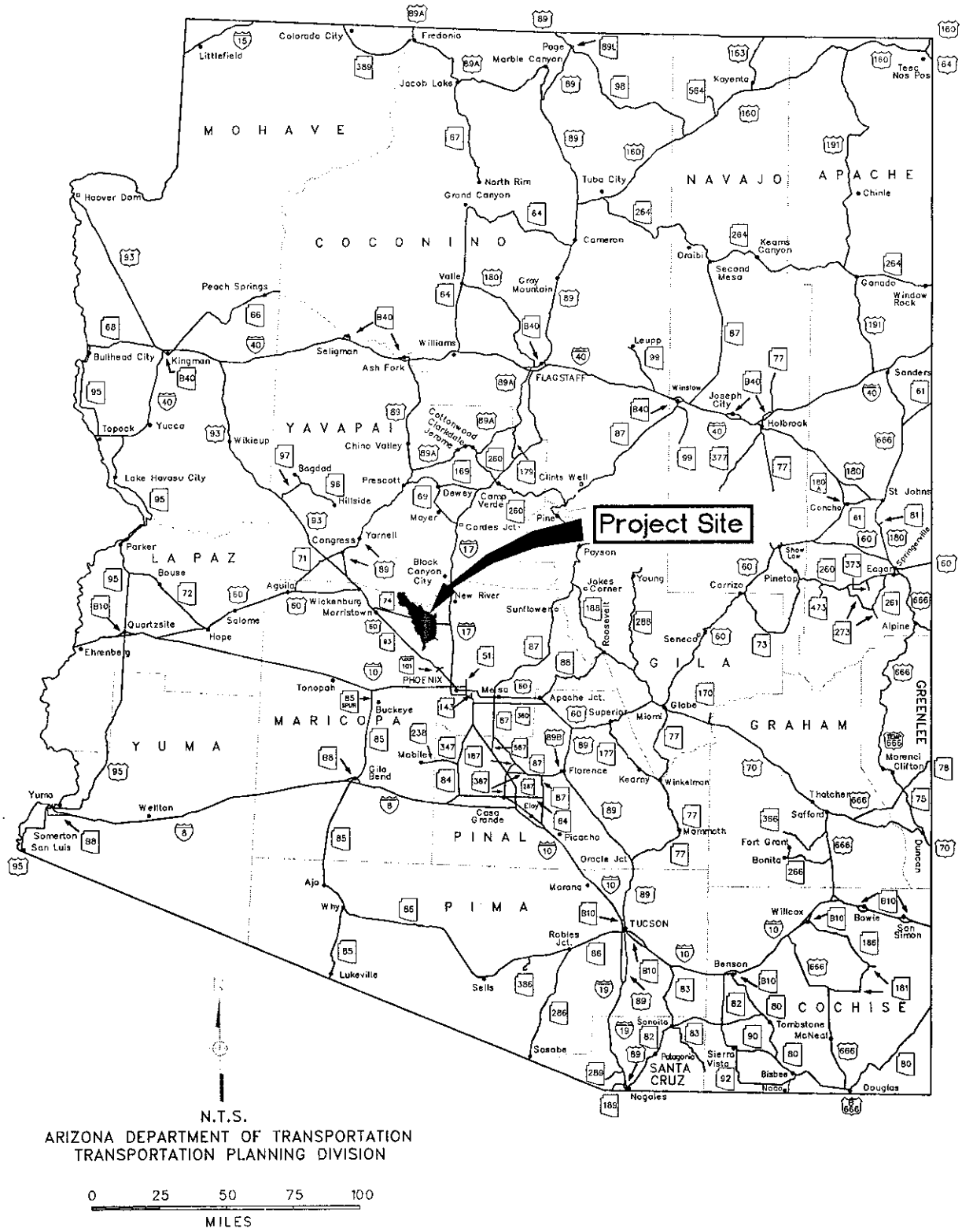


Figure 1-2

Vicinity Map

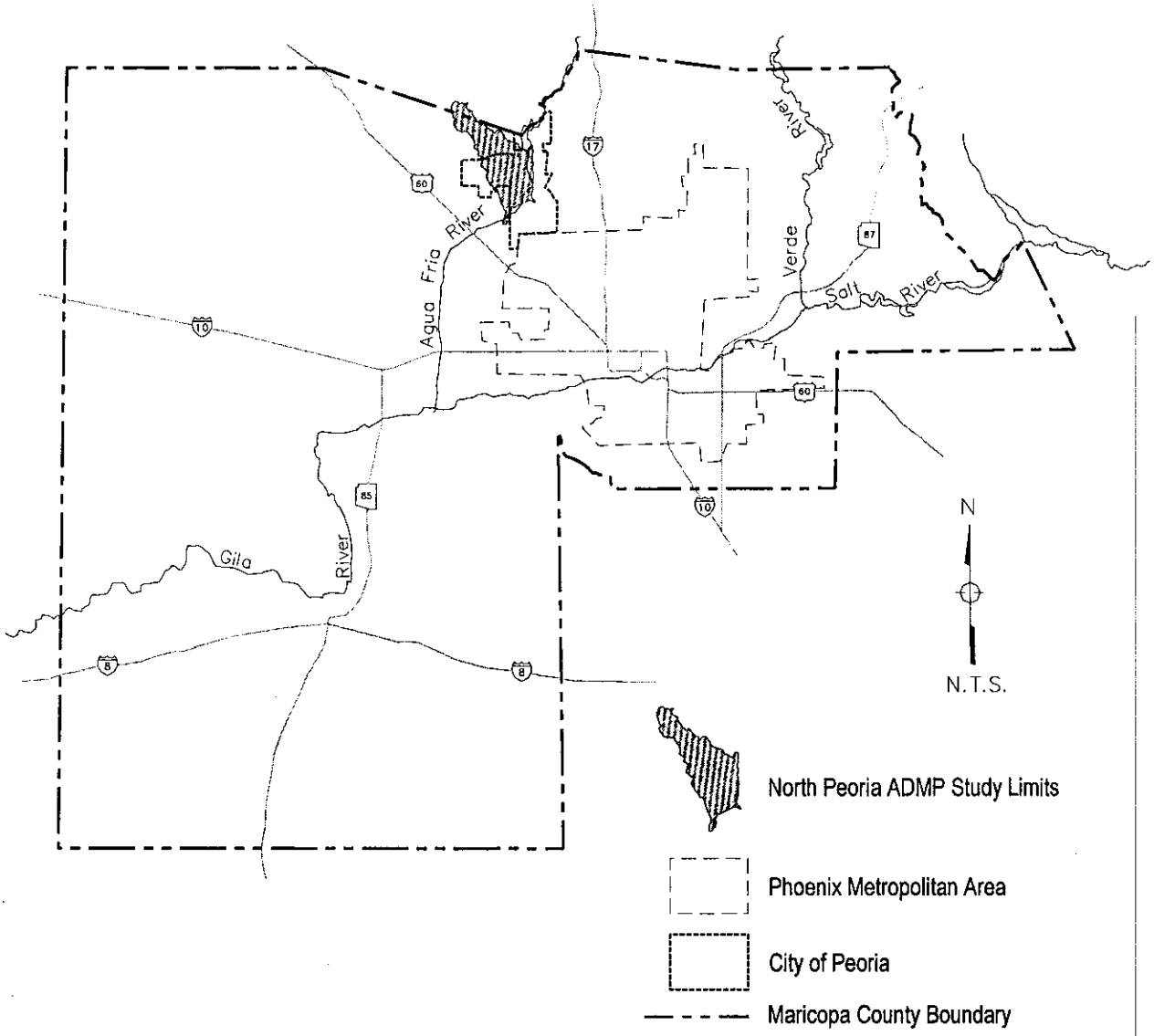
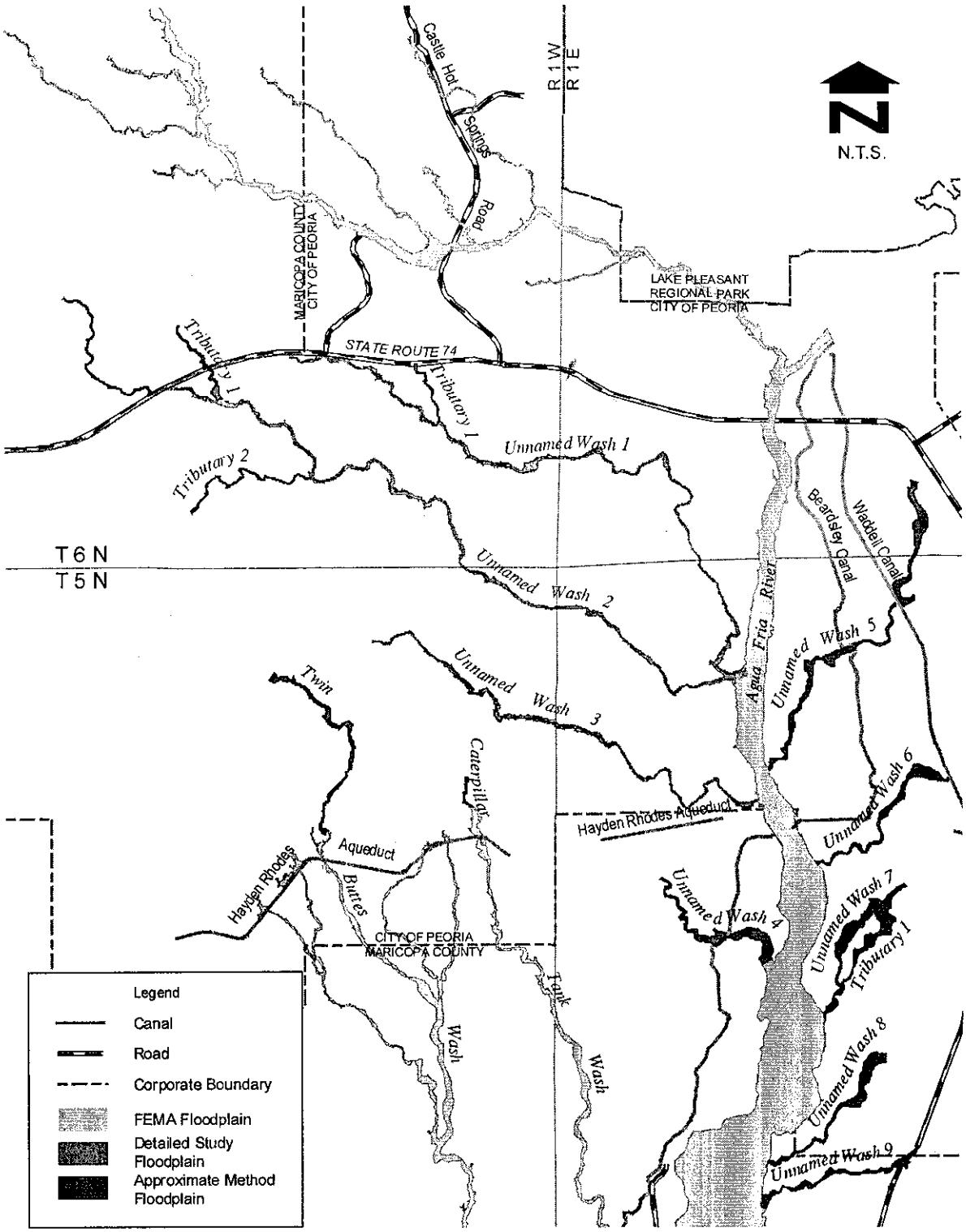


Figure 1-3

Study Watercourse Location Map



1.2 Study Documentation Abstract

This section, the Study Documentation Abstract, lists pertinent information concerning authority for study, Contractor, Reviewer and Key elements of the hydrologic analyses. The abstract is listed in a table format.

STUDY DOCUMENTATION ABSTRACT

GENERAL INFORMATION

1A	COMMUNITY	City of Peoria and parts of unincorporated Maricopa County
1B	COMMUNITY NUMBER	040050 & 040037
1C	COUNTY	Maricopa
1D	STATE	Arizona
1E	DATE STUDY ACCEPTED	
1F	STUDY CONTRACTOR	Stantec Consulting Inc.
	CONTACTS	Pat Ellison, P.E.
	ADDRESS	Stantec Consulting, Inc. 8211 S. 48th Street Phoenix, Arizona 85044
	PHONE	(602) 438-2200 (602) 431-9562 (FAX)
	SUBCONSULTANTS	Cooper Aerial Surveys Company Valco Land Surveyors, Inc.
1G	TECH. REVIEWER (FEMA, contractor)	
	PHONE	
1H	FEMA REGIONAL REVIEWER	
	PHONE	
1I	STATE REVIEWER	N/A
	PHONE	
1J	LOCAL REVIEWER	Flood Control District of Maricopa County Kofi Awumah, Ph.D., P.E.
	PHONE	(602) 506-1501
1K	RIVER OR STREAM NAME	Various tributaries of the Agua Fria River
1L	REACH DESCRIPTION	N/A
1M	STUDY TYPE	Floodplain/Floodway Delineations

STUDY DOCUMENTATION ABSTRACT (continued)

MAPPING INFORMATION

2A	USGS QUAD SHEETS	Baldy Mountain
		Biscuit Flat
		Calderwood Butte
		Garfias Mountain
		Governors Peak
		Hedgepeth Hills
		Hieroglyphic Mountains SW
2B	MAPPING FOR HYDROLOGIC STUDY TYPE/SOURCE	USGS Quad maps per Section 2A of the TDN
	SCALE	1 inch = 2,000 feet
	DATE	1965, 1972, 1982 and 1983
2C	MAPPING FOR HYDRAULIC STUDY TYPE/SOURCE	2-foot contour interval mapping in digital format Cooper Aerial Surveys Company
	SCALE	1 inch = 400 feet
	DATE	2-18-00

HYDROLOGY

3A	MODEL OR METHOD USED (Including vendor and version description)	HEC-1 version 4.1 dated June 1998
3B	STORM DURATION	6-hour and 24-hour
3C	HYETOGRAPH TYPE	In accordance with Design Manual
3D	FREQUENCIES DETERMINED	100-year
3E	LIST OF GAGES USED IN FREQUENCY ANALYSIS OR CALIBRATION (Location, Years of Record, Gage Ownership)	None used

STUDY DOCUMENTATION ABSTRACT (continued)

HYDROLOGY (continued)

3F	RAINFALL AMOUNTS AND REFERENCE	100-year, 6-hour = 3.35 inches 100-year, 24-hour = 4.20 inches NOAA Atlas II
3G	UNIQUE CONDITIONS AND PROBLEMS	None significant
3H	COORDINATION OF Q'S (Agency, date, comments)	

HYDRAULICS

4A	MODEL OR METHOD USED (including vendor and version description)	HEC-RAS version 3.0
4B	REGIME	Subcritical
4C	FREQUENCIES FOR WHICH PROFILES WERE COMPUTED	100-year
4D	METHOD OF FLOODWAY CALCULATION	Method 1
4E	UNIQUE CONDITIONS AND PROBLEMS	None

1.3 Public Notice

Legal advertisements were placed in the Peoria Times to notify the public of the study. Copies of the legal advertisements are located in Appendix P.

Property owners within the floodplain limits where notified by mail. A copy of the letter and the mailing list are provided in Appendix P.

1.4 Correspondence

Correspondence that transpired during the course of this study that relates to the analyses documented in this report are provided in Appendix P. The correspondence includes notices to proceed, data requests, notices of approval and other general correspondence.

SECTION 2: MAPPING AND SURVEY INFORMATION

2.1 *Description of Mapping*

The base mapping data used to produce exhibits for the hydrologic portion of this study are summarized by exhibit map as follows:

Watershed Map (Plate 1) - The base mapping used for Plate 1 comprises a mosaic of all or portions of the following United States Geological Survey (USGS) 7.5 Minute Quadrangle Maps:

Baldy Mountain:	Revised in 1978, Published in 1983, 20-foot contour interval (CI), National Geodetic Vertical Datum (NGVD) of 1929.
Biscuit Flat:	1965 mapping from 1962 photography, photo revised 1981, 20-foot CI, NGVD of 1929.
Calderwood Butte:	Published 1972, 10-foot CI, NGVD of 1929.
Garfias Mountain:	1965 mapping from 1962 photography, photo revised 1978, 40-foot CI, NGVD of 1929.
Governors Peak:	1965 mapping from 1962 photography, photo revised 1978, 40-foot CI, NGVD of 1929.
Hedgepeth Hills:	Published 1972, 10-foot CI, NGVD of 1929
Hieroglyphic Mnts SW:	Revised 1978, published 1982, 20-foot CI, NGVD of 1929.

Digital images for these USGS Quadrangle Maps were combined into a single file to produce a basemap in AutoCAD format. The horizontal coordinate system of the digital images is the North American Datum of 1983 (NAD83) Arizona State Plane, central zone. The final plotting scale for Plate 1 is 1 inch = 2,000 feet.

Soils Map (Plate 2) - The base mapping data for Plate 2 is derived from the following three sources:

1. Soil Conservation Service, 1986, Soil Survey of Aguila-Carefree, Parts of Maricopa and Pinal Counties, Arizona (herein called Aguila SCS Survey),

2. Soil Conservation Service, 1977, Soil Survey of Maricopa County, Arizona, Central Part (herein called Central SCS Survey),

3. Soil Conservation Service, 1976, Soil Survey of Yavapai County, Arizona, Western Part (herein called Yavapai SCS Survey).

A digital file of both the Maricopa County SCS Survey soil boundaries were provided by the District as an ArcView shape file along with the associated database of the soil properties. Soil boundaries and distribution of soil types for the Yavapai County portion of the watershed were digitized from the detailed soils maps included as part of the Yavapai SCS Survey. The Yavapai County soils boundaries and the associated physical properties were then merged with the Maricopa County soils data to produce a single soils ArcView shape file and associated database for the entire watershed. The final plotting scale for Plate 2 is 1 inch = 2,000 feet.

Existing Conditions Land Use Map (Plate 3) - Existing condition land use boundaries and associated information for the Maricopa County portion of the watershed was supplied by the District digitally in AutoCAD format. The AutoCAD drawing file was then converted into an ArcView shape file and associated to a database of land use properties and zoning information. Land use boundaries and zoning information are based on the Maricopa Association of Governments (MAG) land use plan, in 1995. Corporate boundaries and zoning were checked against current data and revised as necessary. The Yavapai County portion of the watershed is assumed to be undeveloped, unincorporated county land. An ArcView shape file and associated database of land use properties and zoning information is created for the entire watershed. Final plotting scale for Plate 3 is 1 inch = 2,000 feet.

The base mapping data used to produce exhibits for the detailed study reaches of the hydraulic portion of this study were prepared by Cooper Aerial Surveys Company (Cooper). The aerial photography flight date was 18 February 2000 with survey control provided by Valco Surveying Corporation (Valco). The mapping was prepared at a scale of 1 inch = 400 feet with a contour interval of 2 feet. The horizontal and vertical datums are NAD83 and NGVD29. The horizontal projection is Arizona State Plan, central zone. Cartographic features identified by the mapping

company include roadways (both paved and unpaved), buildings and culverts. Base mapping for the approximate method study reaches are the 7.5 Minute Quadrangle Maps which and are the same as those used for the hydrologic portion of this study.

Preparation of the base maps used for the detailed hydraulic analysis includes verification of the map accuracy. Two methods of verification were utilized to determined if the base mapping meets the accuracy standards as set forth in Flood Insurance Study Guidelines and Specifications for Study Contractors, Federal Emergency Management Agency, Date (FEMA 37). The first method is the Root Mean Square Error test (RMSE) as defined in Appendix 4 of FEMA 37. The results of this test are provided in a separate report entitled North Peoria Area Drainage Master Plan, Attachment 1 Filed Survey Report. The second method is a comparison of field survey cross sections to cross sections read from the triangulated irregular network (TIN) prepared from the photogrammetric data provided by Cooper. Sixteen cross sections were prepared and plotted for visual inspection. The plots for each cross section as well as a figure showing the location of the cross sections along the watercourses are provided in Appendix I. The results of these verification methods show that the mapping meets the FEMA 37 accuracy standards.

2.2 Index of Maps

Each hydrology plate (Plates 1 through 3) is a single sheet map, and therefore, does not require a mapping index. The index sheet map for the floodplain and floodway maps is provided at the back of this report along with reduced scale copies of the work maps provided in Appendix N.

2.3 Survey Field Notes

No survey information was used in the hydrologic analysis. Valco provided the horizontal and vertical control used for the detailed mapping. That data is documented in a separate report entitled North Peoria Area Drainage Master Plan, Attachment 1 Filed Survey Report. Also included in that report are descriptions of the elevation reference marks (ERM's) established for this study.

2.4 Watershed Maps, Hydrologic Analysis Maps

Plates 1, 2 and 3 represent the three maps used for the hydrologic analyses that are summarized in this report. Folded copies of each map are provided in pockets in the back of this report.

Plate 1 is a map of the study watershed showing subbasin boundaries, concentration points, time of concentration flow paths, reach route flow paths and cadastral boundaries. The cadastral information includes Township, Range and Section lines, municipal boundaries and associated text. All of this information overlays the USGS quadrangle basemap discussed in Section 2.1.

Plate 2 is a soils map for the study watershed. In addition to the base information discussed in Section 2.1, Plate 2 displays soil type and distribution, subbasin and cadastral boundaries within the watershed.

Plate 3 is a land use map for the study watershed. In addition to the base information discussed in Section 2.1, Plate 3 displays land use type and distribution subbasin and cadastral boundaries within the watershed.

2.5 Hydraulic Analysis Maps

Plates 4 through 7 represent the maps used for the hydraulic analyses that are summarized in this report. Folded copies of each map are provided in pockets in the back of this report. Half size copies of the detail study maps (Plates 4 through 6) are provided in Appendix N.

Plate 4 is a set of 6 sheets covering the study limits for Unnamed Wash 1. In addition to the base information discussed in Section 2.1, this plate shows the floodplain and the floodway limits, base flood elevations, cross section locations and cadastral information. Cadastral information includes Township, Range and Section lines, municipal boundaries and associated text. The final plotting scale for Plate 4 is 1 inch = 200 feet.

Plate 5 is a set of 6 sheets covering the study limits for Unnamed Wash 2. In addition to the base information discussed in Section 2.1, this plate shows the floodplain and the floodway limits, base flood elevations, cross section locations and cadastral information. Cadastral information includes Township, Range and Section lines, municipal boundaries and associated text. The

final plotting scale for Plate 5 is 1 inch = 200 feet.

Plate 6 is a set of 4 sheets covering the study limits for Unnamed Wash 3. In addition to the base information discussed in Section 2.1, this plate shows the floodplain and the floodway limits, base flood elevations, cross section locations and cadastral information. Cadastral information includes Township, Range and Section lines, municipal boundaries and associated text. The final plotting scale for Plate 6 is 1 inch = 200 feet.

Plate 7 is a set of 6 sheets covering the approximate method study limits for several watercourses within the project boundary. This plate shows the floodplain limits, cross section locations and cadastral information. Cadastral information includes Township, Range and Section lines, municipal boundaries and associated text. The final plotting scale for Plate 7 is 1 inch = 400 feet.

2.6 FIRM, FHBM Draft Maps

Annotated FIRM panels showing the proposed floodplain and floodway limits are provided in the back of this report.

2.7 Community Maps

General street and corporate information for the communities are shown on all Plates.

2.8 Miscellaneous Maps

An Existing Facilities Map (Plate 8) has been prepared and included for reference in the back of this report. This map shows the location of hydraulic and other structural features in the watershed that have the potential to impact drainage patterns. Individual structures are located graphically on the basemap described in Section 2.1 and have an associated numeric identifier. A key note table is included on the map that lists each structure identifier along with brief description of the structure. Location and descriptive information for each structure is obtained from the following sources:

1. State Highway, Morristown-New River, Maricopa County: As-Built Plan & Profile.
2. Central Arizona Project, Plan & Profile As-Built plans for the Waddell Canal and Granite Reef Aqueduct.
3. Castle Hot Springs Road, Plan and profile drawings.
4. 1999 Aerial photography.
5. Field Investigations.

SECTION 3: EXISTING CONDITION HYDROLOGIC ANALYSIS

3.1 Method Description

Watershed modeling is performed using the methodology set forth in the Drainage Design Manual for Maricopa County, Volume I, Hydrology (Flood Control District of Maricopa County, 1995), which is herein referred to as the Design Manual. The analytical methods employed for this study are the Rational Method and rainfall-runoff modeling. Rainfall-runoff modeling is accomplished using the US Army Corps of Engineers (COE) HEC-1 Computer Program, version 4.1, dated June 1998. Both the 100-year, 6- and 24-hour duration storms are modeled for the existing condition. Two storm durations are used in order to determine which storm results in the higher magnitude of discharge at the various locations in the watershed. The rainfall depth-duration-frequency statistics for both the 6- and 24-hour storm durations are obtained from the NOAA Atlas II, Arizona. The rainfall distributions used are the SCS Type II for the 24-hour storm and the 6-hour storm patterns suggested in the Design Manual. Rainfall losses are estimated using the Green and Ampt infiltration equation with additional consideration for surface retention losses. The Clark Unit Hydrograph is used for runoff hydrograph development for all subbasins in the watershed. Runoff hydrographs are routed through the watershed using Modified Puls channel storage routing.

The Rational Method relates the rainfall intensity, a runoff coefficient and drainage area to generate a peak discharge. The rainfall intensity is estimated using the rainfall intensity-duration-frequency relation in the Design Manual. Selection of the runoff coefficient is based on the existing condition land use for the 100-year storm.

The purpose of the hydrologic analysis is to estimate peak discharges for the 100-year recurrence interval storm at key flow concentration locations in the watershed. In general, those locations are:

1. Major wash confluences and major culvert crossings of existing facilities.
2. Beginning and ending points in addition to intermediate points of washes designated for floodplain delineation,
3. Sufficient locations along the washes for estimation of erosion hazard setbacks.

The computed peak discharges are then used in the hydraulic and erosion hazard analyses conducted for this study. The combination of results for these analyses will be used in the development of guidelines and policies regarding the management of future development in the watershed.

3.2 Parameter Estimation

3.2.1 Drainage Area Boundaries

The study area encompasses approximately 73 square miles of the Agua Fria River watershed below New Waddell Dam. Approximately 6 square miles of this area is the Agua Fria River floodplain, leaving a study watershed area of approximately 67 square miles. The delineation of the watershed is shown on Plate 1. The eastern boundaries of the study watershed are contiguous with the New River watershed, which generally follows the Lake Pleasant Road alignment. The western boundaries of the study watershed are contiguous with the McMicken Dam watershed, which is also a sub-area of the Agua Fria River watershed. The study watershed is dissected by four major features that impact subbasin delineation:

1. The Agua Fria River, which flows south through the watershed,
2. The Central Arizona Project Canal (CAP), which flows to the east through the southern quarter of the watershed. A portion of the CAP, the Waddell Canal, runs north to south in the upper east side of the watershed,
3. The Beardsley Canal, which flows south from the New Waddell Dam through the eastern portion of the watershed to a point approximately where the CAP crosses the Agua Fria River and then flows southwesterly across the southern portion of the watershed,
4. State Route 74, which generally runs east to west across the central portion of the watershed.

The study watershed is divided into six sub-watersheds to facilitate modeling and to allow for the use of naming conventions that make it easier to follow the logic of the HEC-1 model. Three of these sub-watersheds contain watercourses that are designated for detailed floodplain and floodway delineation. The drainage basins contributing to these study washes are labeled on Plate 1 by S100, S200 and S300 series alpha-numeric identifiers that correspond to Unnamed

Washes 1, 2 and 3, respectively. Floodplain delineations currently exist for washes in the three other sub-watersheds and were estimated by previous flood insurance studies. Hydrology for these areas is revised for the purpose of extending the existing floodplains upstream, using Zone A approximate method delineations. The drainage basins contributing to these watercourses are labeled on Plate 1 by S400 (Caterpillar Tank Wash), S500 (Twin Buttes Wash) and S600 (Morgan City Wash) series alpha-numeric identifiers. Subbasin delineation for this portion of the watershed is appropriate for drainage master planning purposes with subbasins areas limited, in general to 1 square mile.

The remaining portion of the study watershed is drained by numerous small watercourses directly tributary to the Agua Fria River. Many of these watercourses have drainage areas less than 160 acres and are therefore modeled using the Rational Method. Rational Method subbasins are distinguished on Plate 1 from HEC-1 subbasins by alpha-numeric identifiers that begin with "R".

The study watershed can be described as consisting of two distinct physiographic regions. The first region lies to the north of the CAP and west of the Agua Fria River. This region which comprises the majority of the study watershed is characterized by the rugged desert mountain and hillslope terrain of the Hieroglyphic Mountains. The elevations in this region range from a high of 3,651 feet at an unnamed peak in the Morgan City Wash sub-watershed to a low of 1,340 feet along the Agua Fria River. The soils in this region are primarily loams and clay loams with a high percentage of rock outcropping. Sandy loam soils occur mainly in the wash bottoms. The second region lies to the south of the CAP and east of the Agua Fria River. This region is characterized by fan terraces that are dissected by numerous small washes. The elevations in this region range from a high of 2,020 feet at an unnamed peak located near the CAP tunnel to a low of 1,235 feet at the Agua Fria River. The soils in this region are alluvial deposits consisting primarily of loams and clay loams.

Currently there is very little development within the study watershed. Developed parcels occur in the watershed as isolated islands that have little impact on the overall drainage characteristics. The majority of these developed parcels occur within the jurisdictional limits of the City of Peoria. The Peoria City limits are generally bounded on the north by SR 74 and the south by the CAP. Unincorporated Maricopa County makes up the remaining portion of the watershed with the exception of a small section that extends into unincorporated Yavapai County.

3.2.2 Physical Parameters

3.2.2.1 General

Physically based hydrologic parameters for the watershed and modeling subbasins are estimated in conformance with the Design Manual. The procedures used for estimation of those parameters are discussed in the following sections. Pertinent supporting data and calculations are provided in the technical appendices as noted.

3.2.2.2 Watershed Subbasin Delineation and Area Parameters

The watershed and subbasin boundaries are delineated using the topographic basemap discussed in Section 2. Reconnaissance trips to the watershed served as guidance for delineation along the CAP and Beardsley canals and other locations found to be lacking sufficient topographical detail for boundary determination. Subbasin boundaries were digitized directly into the digital topographic basemap in AutoCAD format. The final watershed and subbasin boundaries are plotted on Plates 1 through 3.

Subbasin areas were determined by converting the finalized AutoCAD basin boundary polylines into an ArcView shape file. An application extension of ArcView was then used to perform the necessary area calculations. Data results were spot-checked for errors, as well as cross-checked with soil and land use polygon data obtained by the same software, for each subbasin (soils and land use area calculations are discussed later in Section 3).

3.2.2.3 Rainfall Loss Parameters

General

Rainfall losses for the watershed are estimated using the Green and Ampt infiltration equation method of HEC-1. The variable XKSAT (hydraulic conductivity at natural saturation) is estimated by evaluating natural condition soil properties and textures as they occur on the watershed and assigning values to those soils using the methods in the Design Manual. Variables PSIF (wetting front capillary suction) and DTHETA (antecedent volumetric soil moisture deficit) are functions of soil texture, and therefore, XKSAT. The variable DTHETA is additionally related to the moisture condition of the soil and is categorized as either dry, normal, or saturated. Dry DTHETA is considered typical for natural land and normal DTHETA is considered typical for developed areas where irrigation

and other factors tend to maintain higher moisture content in the soil. Saturated DTHETA conditions are not considered to exist in the watershed for this study. Table A-1 of Appendix A is a tabular summary of PSIF and DTHETA values for a corresponding value of XKSAT. Effective imperviousness, RTIMP, is attributed to rock outcrop in natural areas. Roofs, paving, permanent water surfaces, and compaction associated with gravel roads contribute to RTIMP in developed areas. Surface retention, IA, is an estimate of the initial surface storage that occurs during a storm event.

With the exception of bare ground XKSAT and PSIF, separate composite rainfall loss parameters are calculated for natural and developed land areas within each subbasin. The two composite values are then area averaged to obtain final subbasin Green and Ampt method parameters. The bare ground value of XKSAT is estimated using the soils data and applies to the pervious portion of the entire subbasin for both natural and developed areas. Values for PSIF, DTHETA (dry) and DTHETA (normal) are directly related to the bare ground XKSAT value and are obtained from Figure 4.3 of the Design Manual and shown for reference in Table A-1 of Appendix A. Values of PSIF corresponding to the bare ground XKSAT remain constant for all pervious areas in the subbasin, and DTHETA (dry) and DTHETA (normal) are estimated for natural and developed areas respectively. As a final step, the bare ground XKSAT value is adjusted for vegetation per the Design Manual using the subbasin average vegetative cover percentage.

Soil Parameters

General - Soil properties and texture classifications are used to estimate the bare ground XKSAT variable of the Green and Ampt method. Typically, soils information and studies also identify the presence of rock outcrop and often provide percentage estimates as part of the study.

Data Sources - Three sources of information are used in this study to estimate the type and location of soils occurring on the watershed and are described in Section 2.1. Each source provides mapped soil unit boundaries with soil type and layer depth estimates. Rock outcrop percentages are also provided for map units in which they are significant. Plate 2 is a composite map of all three sources as they occur on the watershed, with map units for each

source delineated and general source boundary limits provided. The watershed and subbasin boundaries and labels are included for reference.

SCS Survey XKSAT and Rock Outcrop - The SCS Survey soil unit mapping for the Maricopa County portion of the study watershed was supplied in digital format by the District. Composite bare ground XKSAT values and rock outcrop percentages are taken directly from the Design Manual and are summarized in Table 3-1 for each soil map unit that occurs within the watershed.

Composite bare ground XKSAT values and rock outcrop percentages for the Yavapai County portion of the study were assigned by comparing the soil map unit boundaries and descriptions from the Yavapai SCS Survey to those of the adjacent soil map units from the Aguila SCS Survey. In general, the soil map unit boundaries and descriptions from the Yavapai SCS Survey were found to closely match those of the Aguila SCS Survey. Therefore the soil texture, XKSAT and rock outcrop percentage for the Aguila SCS Survey soil map units were assigned to the corresponding soil map units of the Yavapai SCS Survey. That data is summarized in Table 3-2.

Table 3-1

Summary of XKSAT and RTIMP values for soil map units within Maricopa County

Soil Class (1)	Bare Ground XKSAT in/hr (2)	RTIMP % (3)	Soil Class (1)	Bare Ground XKSAT in/hr (2)	RTIMP % (3)
10	0.94	0	52	0.16	20
100	0.40	20	55	0.27	0
103	0.10	65	63	0.14	25
104	0.14	60	66	0.23	0
108	0.31	30	68	0.63	0
109	0.35	35	70	0.36	0
110	0.13	0	72	0.09	30
112	0.39	0	77	0.05	0
113	0.39	0	8	0.96	0
118	0.42	0	93	0.33	0
12	0.01	0	95	0.04	0
13	0.01	0	98	0.37	0
16	0.44	15	CF	0.50	0
21	0.38	0	Es	0.25	0
3	0.58	0	LcA	0.25	0
41	0.17	0	MTB	0.15	0
44	0.03	0	PRB	0.28	0
45	0.03	0	PWB	0.38	0
47	0.11	0	PYD	0.20	0
49	0.06	0	TB	0.40	0
51	0.24	0	TSC	0.14	0
			W	0.00	100

Table 3-2

Summary of XKSAT and RTIMP values for soil map units within Yavapai County

Map Unit (1)	Soil Description (2)	Assigned Soil Texture (3)	Corresponding Aguila SCS Survey Map Unit (4)	Log Average Bare Ground XKSAT in/hr (5)	RTIMP % (6)
CmD	Very gravelly sandy loam	Sandy loam	16	0.44	15
Le	Gravelly clay loam	Sandy clay loam	72	0.09	30
Lh	Extremely rocky clay loam	Sandy clay loam	104	0.14	60
Rr	Rock Outcrop	Clay	103	0.01	50

Soil Map Unit Polygon Areas by Subbasin - Areas of soil map unit polygons as they exist within a subbasin were obtained using ArcView by first, intersecting the soil boundaries by the subbasin boundaries. The area of each unique soil map unit contained within each subbasin was then calculated from the intersected soils and subbasin ArcView shape file. Data results for each subbasin were spot-checked for errors and cross-checked with subbasin and land use classification polygon area data obtained by the same software.

IA - Surface retention losses (IA) are assigned to each soil map unit. The basis for this assignment is the establishment of a relation of soil map unit descriptions and average ground slope on which each soil typically occurs, to descriptions for natural surface cover listed in Table 4.1 of the Design Manual. The descriptions and slope data for each map unit were tabulated and checked against the topographic mapping for reasonableness. The soil map units were then grouped into one of the three categories of surface cover for natural conditions listed in Table 4.1 of the Design Manual. Those classifications and corresponding values of IA are:

1. Desert and rangeland, flat slope; IA = 0.35 inches,
2. Hillslopes, Sonoran Desert; IA = 0.15 inches,
3. Mountain, with vegetated surface; IA = 0.25 inches.

Soil map unit descriptions with average ground slopes of 0 to 10% were assigned an IA of

0.35 inches corresponding to desert and rangeland surface covers. Soil map unit descriptions with average ground slopes of 3 to 30% were assigned an IA of 0.15 inches corresponding to hillslope surface cover. Soil map unit descriptions with average ground slopes of 5 to 70% were assigned an IA of 0.25 inches corresponding to mountain surface cover. A listing of the value of IA assigned to each soil map unit along with the soil description and slope is provided in Table 3-3.

Natural Area Parameters for each Subbasin

XKSAT, PSIF, DTHETA (dry), IA and RTIMP - Composite value calculations for natural area XKSAT, PSIF, DTHETA (dry), IA and RTIMP are summarized in the worksheets of Table A-2, Appendix A. Example step-by-step calculations for Subbasin S207 are provided in Appendix A for tracking of the spreadsheet calculation procedures.

Vegetative Cover Density - Six vegetation transects were taken at various locations within the watershed and are used in conjunction with circa 1999 aerial photography to provide a basis for the estimation of the natural condition vegetative cover density (VCD) for each subbasin. Descriptions of each transect location are provided in Appendix B, along with photographs of the general area. Based on the transect data, natural condition VCD values are assigned to each subbasin and summarized by subbasin in Table 3-4. VCD values are used to adjust bare ground XKSAT values.

Land Use Parameters

General - The watershed is subdivided into polygons of common land use elements. Those elements are lumped into two general categories of either "natural" or "developed," with sub-categories labeled as classifications. The natural category includes all undeveloped or generally natural condition land use classifications. All other land use classifications are included in the developed category.

Land Use Mapping – In general, under existing conditions the study watershed is considered to be entirely undeveloped. There are, however, a few isolated pockets of developed parcels of land that occur within the study watershed that are included in the hydrologic analysis. Land use polygons and zoning classifications that occur within the

study watershed were supplied by the District in digital format. This data was check for accuracy using circa 1999 aerial photography and field reconnaissance trips.

Land Use Classifications – Land use classifications and developed conditions are assigned to each parcel based on guidance provided in the Design Manual, inspection of circa 1999 aerial photography, field reconnaissance and descriptive data provided in the land use digital file. Where appropriate, land use classification descriptions provided in the Design Manual are modified or new classifications are added that are representative of the conditions present in the watershed. A summary listing of those identifiers and their descriptions are provided in Table 3-5. The resulting land use classifications and developed conditions are shown on Plate 3.

RTIMP, VCD and IA Values by Land Use Classification – Selection of values of VCD, IA and RTIMP for each land use classification are based on circa 1999 aerial photography, field reconnaissance, topographic maps and guidance provided in the Design Manual. Where appropriate, the values in the Design Manual are modified to be representative of the conditions present in the watershed. The values of VCD and IA reflect typical conditions (for both the pervious and impervious portions of each land use area) associated with each land use classification. The selected values of RTIMP, VCD and IA for each land use classification are summarized in Table 3-5.

Table 3-3

Summary of assigned surface retention losses for each soil map unit

Soil Map Unit (1)	Description (2)	Slope Range % (3)	IA in (4)
10	Floodplains and drainage ways	1 - 5	0.35
100	Mountain slopes and hill slopes	20 - 65	0.25
103	Mountain slopes	5 - 55	0.25
104	Hill slopes and mountain slopes	15 - 65	0.25
108	Mountain slopes and hill slopes	3 - 25	0.15
109	Mountain slopes and hill slopes	25 - 65	0.25
110	Fan terraces	1 - 7	0.35
112	Fan terraces	0 - 3	0.35
113	Fan terraces	0 - 3	0.35
118	Fan terraces	0 - 3	0.35
12	Fan terraces	1 - 8	0.35
13	Fan terraces	0 - 3	0.35
16	Hill slopes and mountain slopes	10 - 70	0.25
18	Hill slopes and mountain slopes	5 - 60	0.25
21	Fan terraces	0 - 3	0.35
3	Floodplains and drainage ways	0 - 3	0.35
31	Mountain slopes and hill slopes	25 - 65	0.25
33	Fan terraces and stream terraces	1 - 8	0.35
41	Fan terraces	20 - 40	0.25
44	Fan terraces and stream terraces	1 - 8	0.35
45	Fan terraces	8 - 20	0.15
47	Fan terraces	3 - 25	0.15
48	Fan terraces	3 - 20	0.15
49	Fan terraces	20 - 40	0.25
51	Hill slopes	8 - 25	0.15
52	Mountain slopes and hill slopes	7 - 55	0.25
55	Floodplains and alluvial fans	0 - 3	0.35
63	Pediments, hill slopes and mountain slopes	10 - 65	0.25
66	Fan terraces	1 - 7	0.35
68	Fan terraces	1 - 7	0.35
70	Fan terraces	1 - 25	0.25
72	Hill slopes and mountain slopes	8 - 65	0.25
77	Fan terraces	0 - 3	0.35
8	Floodplains	0 - 3	0.35
93	Fan terraces	8 - 30	0.15
95	Fan terraces and stream terraces	0 - 3	0.35

Table 3-3 (Continued)

Summary of assigned surface retention losses for each soil map unit

Soil Map Unit (1)	Description (2)	Slope Range % (3)	IA in (4)
98	Fan terraces	1 - 10	0.35
CF	Adjacent to channels of the Gila, Salt and Hassayampa Rivers	N/A	0.35
CmD	Hill slopes	8 - 30	0.25
Es	Valley plains and alluvial fans	0 - 1	0.35
LcA	Valley plains and alluvial fans	0 - 1	0.35
Le	Hill slopes and mountain slopes	8 -45	0.25
Lh	Hill slopes and mountain slopes	8 -60	0.25
MTB	Valley plains	0 - 3	0.35
PRB	Valley plains and alluvial fans	0 - 3	0.35
PWB	Valley plains and alluvial fans	0 - 3	0.35
PYD	Alluvial fans	1 - 10	0.35
Rr	Gently sloping to steep hill slopes and mountain slopes	N/A	0.25
TB	Alluvial fans	1 - 5	0.35
TSC	Alluvial fans	0 - 5	0.35
W	Water	N/A	0.35

Notes:

(4): Assigned slope ranges for surface cover types from Table 4.1 of the Design Manual
Desert and Rangeland, flat slope = slope ranges from 0 to 10%
Hillslopes, Sonoran Desert = slope ranges from 3 to 30%
Mountains, with vegetated surface = slope ranges from 5 to 70%

Table 3-4

Summary of vegetative cover densities for the undeveloped portion of each subbasin

Subbasin ID (1)	Vegetative Cover Density % (2)	Subbasin ID (1)	Vegetative Cover Density % (2)	Subbasin ID (1)	Vegetative Cover Density % (2)
S100	32	S505	26	S700	32
S101	32	S506	26	S701	32
S102	32	S507	26	S702	32
S103	32	S508	26	S703	32
S104	32	S509	26	S704	32
S105	32	S510	26	S705	32
S106	32	S511	26	S705AF	15
S107	32	S512	26	S706	26
S200	32	S513	26	S707	26
S201	32	S514	26	S708	15
S202	32	S515	26	S709	15
S203	32	S516	26	S710	15
S204	32	S600	32	S711	15
S205	32	S601	32	S712	15
S206	32	S602	32	S713	15
S207	32	S603	32	S714	15
S208	32	S604	32	S715	15
S209	32	S605	32	S716	15
S210	32	S606	32	S717	15
S211	32	S607	32	S718	15
S300	32	S608	32	S719	15
S301	32	S609	32	S720	15
S302	32	S610	32	S721	15
S303	32	S611	32	S722	15
S304	32	S612	32	S723	15
S400	26	S613	32	S724	15
S401	26	S614	32	S725	15
S402	26	S615	32	S726	15
S403	26	S616	32	S727	15
S404	26	S617	32	S728	15
S500	32	S618	32		
S501	32	S619	32		
S502	26	S620	32		
S503	26	S621	32		
S504	26	S622	32		

Table 3-5

Rainfall loss characteristics for each land use classification

Land-use Class (1)	Base RTIMP % (2)	Veg. Cover % (3)	IA in (4)
LDR	5	25	0.30
COMM	10	15	0.10
IND	10	0	0.15
OPEN	0	0	0.00
ARP	50	5	0.10
DESERT	0	0	0.00
PF	50	0	0.10

Land-use Class	Description
LDR	Low density residential, < 1 dwelling unit per acre
COMM	Commercial
IND	Industrial/Mining
OPEN	Lake Pleasant Regional Park
ARP	Turf Soaring School Airfield
DESERT	Undeveloped Natural Desert
PF	Public Facilities (APS Substation)

Land Use Polygon Areas by Subbasin - Areas of land use polygons, both developed and undeveloped as they exist within a subbasin were obtained using ArcView by first, intersecting the land use boundaries by the subbasin boundaries. The area of each unique land use classification, both developed and undeveloped contained within each subbasin was then calculated from the intersected land use and subbasin ArcView shape file. Data results for each subbasin were spot-checked for errors and cross-checked with subbasin and soil polygon area data obtained by the same software.

Developed Area Parameters for each Subbasin

XKSAT, PSIF and DTHETA (normal) - The bare ground XKSAT and PSIF values remain the same as the natural area values for each subbasin. DTHETA(normal) values for developed areas are taken from Figure 4.3 of the Design Manual and shown for reference in Table A-1 of Appendix A.

RTIMP, VCD and IA - Developed area composite IA and VCD value calculations for each subbasin are summarized in the worksheets of Table A-3, Appendix A. Example step-by-step calculations for Subbasin S207 are provided in Appendix A for tracking of the spreadsheet calculation procedures.

Area Weighted Rainfall Loss Parameters for each Subbasin

Table A-4 of Appendix A summarizes the final area weighting calculations of rainfall loss parameters for each subbasin in the watershed. Table 3-6 is a summary of the final Green and Ampt HEC-1 input parameters for each subbasin.

Table 3-6

Summary of Green and Ampt rainfall loss input parameters

Subbasin ID (1)	Total sq. mi. (2)	IA inches (3)	DTHETA (4)	PSIF inches (5)	XKSAT in/hr (6)	RTIMP % (7)
S100	0.574	0.19	0.35	4.65	0.34	25
S101	0.631	0.26	0.37	5.30	0.25	15
S102	0.449	0.15	0.35	4.45	0.39	30
S103	0.395	0.24	0.38	5.60	0.22	17
S104	0.900	0.22	0.38	5.60	0.22	13
S105	0.594	0.22	0.38	5.60	0.22	13
S106	0.567	0.19	0.37	5.20	0.26	7
S107	0.936	0.15	0.35	4.90	0.30	0
S200	0.959	0.25	0.35	4.25	0.44	35
S201	0.350	0.25	0.35	4.25	0.44	35
S202	0.127	0.25	0.35	4.25	0.44	35
S203	0.373	0.25	0.35	4.25	0.44	35
S204	0.951	0.25	0.35	4.25	0.44	32
S205	0.413	0.21	0.35	4.60	0.35	21
S206	0.853	0.25	0.35	4.65	0.34	27

Table 3-6 (Continued)

Summary of Green and Ampt rainfall loss input parameters

Subbasin ID (1)	Total sq. mi. (2)	IA inches (3)	DTHETA (4)	PSIF inches (5)	XKSAT in/hr (6)	RTIMP % (7)
S207	0.957	0.25	0.35	4.35	0.41	34
S208	1.103	0.23	0.37	5.30	0.25	24
S209	0.650	0.22	0.36	5.00	0.29	15
S210	0.481	0.16	0.36	5.00	0.29	2
S211	0.488	0.19	0.37	5.20	0.26	4
S300	0.615	0.25	0.35	4.55	0.36	25
S301	0.994	0.25	0.35	4.25	0.44	35
S302	0.465	0.24	0.35	4.55	0.36	24
S303	0.708	0.22	0.35	4.60	0.35	10
S304	0.823	0.18	0.36	5.10	0.27	3
S400	1.048	0.23	0.34	5.40	0.21	14
S401	0.646	0.30	0.36	5.10	0.26	7
S402	0.740	0.31	0.38	5.60	0.21	3
S403	0.559	0.30	0.30	8.00	0.08	0
S404	0.263	0.27	0.37	6.60	0.14	0
S500	1.054	0.25	0.35	4.25	0.44	35
S501	0.614	0.22	0.35	4.45	0.39	23
S502	0.403	0.27	0.35	4.50	0.35	14
S503	0.994	0.21	0.31	4.65	0.28	17
S504	0.326	0.35	0.35	4.40	0.38	0
S505	0.143	0.25	0.35	4.40	0.38	14
S506	0.151	0.29	0.39	5.70	0.20	9
S507	0.666	0.34	0.39	5.70	0.20	1
S508	0.295	0.33	0.37	5.30	0.24	0
S509	0.170	0.28	0.35	4.65	0.32	23
S510	0.127	0.32	0.33	7.30	0.11	6
S511	0.385	0.29	0.39	5.70	0.20	19
S512	0.214	0.35	0.30	8.00	0.08	0
S513	0.778	0.32	0.38	5.40	0.22	1
S514	0.650	0.28	0.32	7.60	0.09	0
S515	1.102	0.32	0.27	8.80	0.06	0
S516	0.540	0.35	0.35	4.80	0.29	0
S600	2.018	0.25	0.35	4.00	0.49	22
S601	0.901	0.25	0.39	5.70	0.21	44
S602	1.883	0.25	0.35	4.35	0.41	35
S603	0.665	0.25	0.39	5.80	0.20	41
S604	2.656	0.25	0.35	4.35	0.41	35

Table 3-6 (Continued)

Summary of Green and Ampt rainfall loss input parameters

Subbasin ID (1)	Total sq. mi. (2)	IA inches (3)	DTHETA (4)	PSIF inches (5)	XKSAT in/hr (6)	RTIMP % (7)
S605	1.085	0.25	0.35	4.35	0.41	35
S606	0.660	0.26	0.35	4.50	0.37	35
S607	0.822	0.25	0.36	5.10	0.27	34
S608	0.508	0.25	0.39	5.80	0.20	37
S609	0.560	0.27	0.35	4.10	0.47	27
S610	0.603	0.26	0.36	5.10	0.27	39
S611	0.569	0.25	0.35	4.35	0.41	35
S612	0.808	0.25	0.38	6.40	0.16	31
S613	1.797	0.25	0.35	4.55	0.36	34
S614	1.079	0.24	0.35	4.40	0.40	34
S615	1.055	0.25	0.39	6.20	0.17	55
S616	0.505	0.22	0.37	5.20	0.26	19
S617	0.675	0.23	0.35	4.80	0.31	23
S618	0.958	0.20	0.37	5.20	0.26	22
S619	0.827	0.27	0.36	6.80	0.14	39
S620	0.444	0.23	0.38	6.40	0.16	37
S621	0.923	0.17	0.35	4.80	0.31	3
S622	0.897	0.18	0.35	4.90	0.30	4
S700	0.610	0.17	0.36	5.10	0.27	5
S701	0.720	0.22	0.38	5.60	0.22	14
S702	0.257	0.17	0.36	5.10	0.27	4
S703	0.257	0.15	0.35	4.90	0.30	0
S704	0.408	0.26	0.35	4.90	0.30	11
S705	0.754	0.22	0.38	6.40	0.16	7
S705AF	0.183	0.31	0.22	10.10	0.03	0
S706	0.713	0.29	0.39	5.70	0.20	7
S707	0.638	0.28	0.39	6.20	0.16	8
S708	0.706	0.22	0.25	9.70	0.04	0
S709	0.441	0.30	0.19	11.20	0.02	0
S710	0.112	0.15	0.22	10.10	0.03	0
S711	0.159	0.28	0.19	11.20	0.02	0
S712	0.068	0.17	0.22	10.10	0.03	0
S713	0.107	0.15	0.22	10.10	0.03	0

Table 3-6 (Continued)

Summary of Green and Ampt rainfall loss input parameters

Subbasin ID (1)	Total sq. mi. (2)	IA inches (3)	DTHETA (4)	PSIF inches (5)	XKSAT in/hr (6)	RTIMP % (7)
S714	0.060	0.35	0.29	8.40	0.06	0
S715	0.220	0.31	0.19	11.20	0.02	0
S716	1.128	0.27	0.22	10.10	0.03	1
S717	0.286	0.25	0.19	11.20	0.02	0
S718	0.442	0.22	0.18	11.20	0.02	2
S719	0.154	0.23	0.11	12.40	0.01	4
S720	0.370	0.27	0.19	11.20	0.02	1
S721	0.335	0.30	0.33	7.30	0.09	0
S722	0.955	0.30	0.25	9.70	0.04	0
S723	0.085	0.29	0.22	10.10	0.03	0
S724	1.156	0.27	0.19	11.20	0.02	0
S725	1.158	0.30	0.27	8.80	0.05	0
S726	0.334	0.31	0.39	5.70	0.18	7
S727	0.375	0.27	0.25	9.70	0.04	0
S728	0.276	0.35	0.37	5.20	0.22	0

3.2.2.4 Unit Hydrograph Parameters

General

The use of the S-Graph method as prescribed in the Design Manual is primarily for large natural watersheds. Although the total drainage area for this study is approximately 67 square miles, the study area is composed of several smaller sub-watersheds. The average drainage area of the subbasins being modeled is less than one square mile. Given these area constraints the S-Graph method is not appropriate for use in this study. The Clark unit hydrograph is therefore used to model all subbasins in the study watershed.

Clark Unit Hydrograph

Time of Concentration - The time of concentration for use with the Clark unit hydrograph is estimated using Equation 5.5 (Papadakis and Kazan empirical equation) of the Design Manual:

$$T_c = 11.4\, L^{0.50}\, K_b^{\;0.52}\, S^{-0.31}\, i^{-0.38}$$

where: T_c = subbasin time of concentration in hours;

L = length of hydraulically longest flow path in miles;

S = watercourse slope in feet per mile;

K_b = representative watershed resistance coefficient; and

i = average rainfall excess intensity, during the time T_c, in inches/hour.

Solution of the T_c equation is an iterative process dependent on *i*, and is accomplished using a modified version of the Maricopa County Unit Hydrograph Procedure (MCUHP1) computer program provided by the District with the Design Manual.

Table C-1 of Appendix C summarizes the parameter values used to calculate T_c for each subbasin. The length, L, is listed for each subbasin in Column 6. The slope, S, is calculated using top and bottom elevations of the Tc path, listed in Columns 3 and 4 respectively, and L. The calculated slope is shown in Column 7. Steep watercourse slopes are adjusted using Figure 5.4 of the Design Manual. The following expressions are mathematical approximations of the curve plotted on that figure and are used to calculate the adjusted slope, which is listed in Column 8.

$$S_{adj} = b + m(\ln(S))$$

where: S < 225 feet/mile no adjustment is necessary

and: 225 feet/mile < S <400 feet/mile

m = 133.8009

b = -500.865

and: S > 400 feet/mile

m = 61.54998

b = -74.6827

The estimation of K_b for each subbasin is made by classifying it into a category of surface

roughness type. Seven categories of surface roughness are used for this study. The first four types A, B, C and D, are taken directly from Table 5.1 of the Design Manual. Additional intermediate types A/B, B/C and C/D are interpolated to provide definitions for areas of mixed classifications. The interpolated values of m and b for use in the K_b equation for each intermediate type, are summarized as follows:

Type	M	b
A/B	-0.01000	0.060
B/C	-0.01938	0.115
C/D	-0.02750	0.175

Subbasin classifications are assigned by a combination of field reconnaissance observations of surface roughness elements and inspection of the topography. Columns 9 and 10 of Table C-1 in Appendix C summarize the roughness type assigned to each subbasin and the corresponding value of K_b.

The T_c results of the iterative 100-year, 6- and 24-hour calculations are summarized by subbasin in Table 3-7, and Tables C-2 (100-year, 6-hour) and C-3 (100-year, 24-hour) of Appendix C. A key assumption for the Clark unit hydrograph is that the T_c be less than the duration of the most intense portion of rainfall excess. The validity of the calculated T_c values, based on this assumption, can be verified by inspection of Tables C-2 and C-3. The rainfall excess values, listed in order by decreasing rank, for the most intense 90 minute period of each storm, are respectively shown in Columns 2 through 19 of each table. The total excess rainfall for that 90 minute period and associated subbasin, is listed in Column 20. The calculated T_c (in minutes) is listed in Column 21. These values are compared to the duration of rainfall excess (represented in Columns 2 through 19). Subbasins that have a T_c longer than the duration of rainfall excess are potentially inappropriate for the application of the Clark unit hydrograph. Those subbasins are S107, S504, S513, S516, S616, and S622. Inspection of the duration of rainfall excess for each of these subbasins shows that, in general, the length of time beyond the duration of rainfall excess is relatively small compared

to T_c. This small over estimation is considered to be insignificant when compared to the potential impact of these individual subbasins on the overall results of the watershed analysis. The application of the Clark unit hydrograph for these subbasins is therefore considered reasonable and that, as already stated, the S-Graph method is not considered appropriate.

Storage Coefficient - The Clark unit hydrograph storage coefficient, R, is estimated using the calculated T_c values and equation 5.6 of the Design Manual. The results of the R value calculations are summarized in Table 3-7 and in Tables C-2 and C-3 of Appendix C.

Table 3-7

Summary of Clark unit hydrograph input parameters

Sub-Basin ID (1)	Area sq. mi. (2)	Flow Path miles (3)	Kb (4)	Adjusted Slope ft/mile (5)	Time-Area Relation (6)	100-year, 6-hour Tc hrs (7)	100-year, 6-hour R hrs (8)	100-year, 24-hour Tc hrs (9)	100-year, 24-hour R hrs (10)
S100	0.574	1.811	0.09	149.13	Natural	0.646	0.503	0.692	0.542
S101	0.631	1.544	0.08	155.42	Natural	0.521	0.330	0.542	0.345
S102	0.449	1.487	0.11	107.63	Natural	0.746	0.579	0.813	0.637
S103	0.395	1.321	0.11	75.68	Natural	0.796	0.609	0.871	0.673
S104	0.900	1.624	0.10	110.84	Natural	0.754	0.423	0.792	0.447
S105	0.594	1.976	0.10	96.15	Natural	0.917	0.780	0.988	0.847
S106	0.567	1.770	0.10	158.20	Natural	0.679	0.525	0.729	0.569
S107	0.936	2.593	0.10	204.43	Natural	0.858	0.695	0.896	0.729
S200	0.959	1.665	0.10	192.21	Natural	0.621	0.336	0.629	0.341
S201	0.350	1.182	0.11	194.59	Natural	0.483	0.343	0.517	0.370
S202	0.127	0.689	0.12	270.63	Natural	0.308	0.241	0.367	0.292
S203	0.373	1.683	0.11	154.47	Natural	0.696	0.658	0.758	0.724
S204	0.951	1.959	0.10	173.58	Natural	0.729	0.459	0.750	0.474
S205	0.413	1.485	0.11	175.11	Natural	0.604	0.480	0.654	0.525
S206	0.853	2.296	0.10	117.61	Natural	0.954	0.748	1.008	0.795
S207	0.957	2.315	0.10	116.65	Natural	0.967	0.715	1.017	0.756
S208	1.103	2.205	0.10	92.96	Natural	1.033	0.683	1.079	0.717
S209	0.650	1.358	0.12	132.55	Natural	0.700	0.407	0.746	0.436
S210	0.481	1.274	0.11	180.56	Natural	0.538	0.342	0.579	0.372
S211	0.488	1.359	0.13	161.87	Natural	0.671	0.457	0.729	0.501
S300	0.615	1.776	0.10	129.49	Natural	0.746	0.558	0.800	0.603
S301	0.994	2.001	0.10	189.93	Natural	0.708	0.441	0.725	0.453
S302	0.465	1.095	0.13	137.00	Natural	0.613	0.357	0.663	0.390
S303	0.708	1.539	0.12	188.47	Natural	0.679	0.414	0.713	0.437
S304	0.823	2.314	0.10	185.81	Natural	0.796	0.628	0.842	0.668
S400	1.048	1.864	0.10	110.00	Natural	0.833	0.484	0.867	0.506
S401	0.646	1.349	0.10	74.10	Natural	0.804	0.473	0.858	0.509
S402	0.740	1.468	0.08	74.91	Natural	0.717	0.413	0.750	0.434
S403	0.559	1.638	0.09	51.88	Natural	0.908	0.688	0.971	0.740
S404	0.263	0.773	0.09	181.17	Natural	0.317	0.180	0.371	0.214
S500	1.054	2.399	0.10	116.72	Natural	1.004	0.726	1.046	0.760
S501	0.614	1.486	0.10	134.59	Natural	0.650	0.416	0.692	0.445
S502	0.403	1.053	0.13	208.99	Natural	0.500	0.300	0.533	0.322
S503	0.994	1.891	0.08	116.33	Natural	0.700	0.416	0.721	0.430
S504	0.326	1.571	0.09	63.65	Natural	0.963	0.964	1.025	1.034

Table 3-7 (Continued)

Summary of Clark unit hydrograph input parameters

Sub-basin ID (1)	Area sq. mi. (2)	Flow Path miles (3)	Kb (4)	Adjusted Slope ft/mile (5)	Time-Area Relation (6)	100-year, 6-hour Tc hrs (7)	100-year, 6-hour R hrs (8)	100-year, 24-hour Tc hrs (9)	100-year, 24-hour R hrs (10)
S505	0.143	0.472	0.14	364.69	Natural	0.242	0.127	0.304	0.164
S506	0.151	0.726	0.14	307.29	Natural	0.338	0.252	0.392	0.297
S507	0.666	1.467	0.08	68.17	Natural	0.746	0.458	0.788	0.486
S508	0.295	1.082	0.09	92.41	Natural	0.563	0.417	0.596	0.445
S509	0.170	0.721	0.10	304.18	Natural	0.267	0.180	0.329	0.228
S510	0.127	0.803	0.10	74.74	Natural	0.500	0.466	0.529	0.497
S511	0.385	1.319	0.09	270.33	Natural	0.388	0.278	0.433	0.314
S512	0.214	0.974	0.10	61.62	Natural	0.617	0.510	0.667	0.556
S513	0.778	2.301	0.08	52.15	Natural	1.246	1.061	1.300	1.113
S514	0.650	2.147	0.08	65.19	Natural	0.929	0.803	0.983	0.855
S515	1.102	1.948	0.08	53.91	Natural	0.942	0.558	0.975	0.580
S516	0.540	1.747	0.09	65.81	Natural	0.988	0.810	1.058	0.875
S600	2.018	2.796	0.09	270.99	Natural	0.796	0.438	0.763	0.418
S601	0.901	1.840	0.10	231.94	Natural	0.575	0.346	0.588	0.354
S602	1.883	3.035	0.09	257.76	Natural	0.800	0.489	0.788	0.481
S603	0.665	1.377	0.10	325.69	Natural	0.400	0.218	0.433	0.238
S604	2.656	4.105	0.09	207.08	Natural	1.121	0.745	1.100	0.729
S605	1.085	2.322	0.10	229.45	Natural	0.725	0.485	0.742	0.497
S606	0.660	2.111	0.10	300.02	Natural	0.575	0.461	0.600	0.484
S607	0.822	2.567	0.10	256.98	Natural	0.700	0.592	0.738	0.627
S608	0.508	1.398	0.11	230.21	Natural	0.483	0.318	0.517	0.342
S609	0.560	2.239	0.10	214.40	Natural	0.721	0.682	0.767	0.731
S610	0.603	1.869	0.10	117.74	Natural	0.763	0.603	0.829	0.661
S611	0.569	1.286	0.12	270.40	Natural	0.479	0.276	0.504	0.292
S612	0.808	2.531	0.10	229.69	Natural	0.713	0.603	0.750	0.638
S613	1.797	2.525	0.11	130.67	Natural	1.088	0.610	1.096	0.615
S614	1.079	2.285	0.11	148.80	Natural	0.929	0.633	0.963	0.658
S615	1.055	2.059	0.12	136.01	Natural	0.867	0.546	0.913	0.578
S616	0.505	1.738	0.11	46.04	Natural	1.258	1.097	1.375	1.210
S617	0.675	1.362	0.10	80.77	Natural	0.754	0.433	0.808	0.468
S618	0.958	2.364	0.10	198.84	Natural	0.763	0.559	0.796	0.586
S619	0.827	1.212	0.12	99.03	Natural	0.688	0.317	0.721	0.334
S620	0.444	1.763	0.13	228.26	Natural	0.642	0.565	0.696	0.619
S621	0.923	1.470	0.10	170.09	Natural	0.613	0.306	0.621	0.311

Table 3-7 (Continued)

Summary of Clark unit hydrograph input parameters

Sub-basin ID (1)	Area sq. mi. (2)	Flow Path miles (3)	Kb (4)	Adjusted Slope ft/mile (5)	Time-Area Relation (6)	100-year, 6-hour Tc hrs (7)	100-year, 6-hour R hrs (8)	100-year, 24-hour Tc hrs (9)	100-year, 24-hour R hrs (10)
S622	0.897	2.004	0.12	152.22	Natural	0.929	0.633	0.971	0.664
S700	0.610	1.923	0.10	184.61	Natural	0.675	0.535	0.725	0.579
S701	0.720	2.821	0.10	136.46	Natural	1.029	1.056	1.100	1.137
S702	0.257	1.395	0.11	215.09	Natural	0.525	0.512	0.563	0.553
S703	0.257	1.126	0.11	204.32	Natural	0.467	0.379	0.496	0.405
S704	0.408	1.266	0.11	300.27	Natural	0.425	0.288	0.463	0.316
S705	0.754	2.145	0.10	252.91	Natural	0.625	0.475	0.650	0.496
S705AF	0.183	0.933	0.05	33.61	Natural	0.454	0.384	0.488	0.415
S706	0.713	2.022	0.10	185.49	Natural	0.700	0.530	0.738	0.562
S707	0.638	2.256	0.10	217.22	Natural	0.683	0.601	0.725	0.641
S708	0.706	1.594	0.10	194.49	Natural	0.529	0.323	0.550	0.337
S709	0.441	1.417	0.09	155.21	Natural	0.479	0.345	0.508	0.368
S710	0.112	0.633	0.10	197.59	Natural	0.275	0.213	0.333	0.264
S711	0.159	0.520	0.10	153.85	Natural	0.267	0.144	0.325	0.180
S712	0.068	0.312	0.08	271.31	Natural	0.154	0.085	0.188	0.105
S713	0.107	0.545	0.08	220.00	Natural	0.217	0.149	0.267	0.188
S714	0.060	0.428	0.08	128.56	Natural	0.229	0.182	0.283	0.230
S715	0.220	0.959	0.07	62.59	Natural	0.450	0.350	0.483	0.378
S716	1.128	2.353	0.06	87.12	Natural	0.692	0.455	0.708	0.467
S717	0.286	0.727	0.07	130.66	Natural	0.279	0.142	0.333	0.173
S718	0.442	2.103	0.07	45.17	Natural	0.879	0.926	0.971	1.034
S719	0.154	1.221	0.08	81.93	Natural	0.508	0.595	0.554	0.655
S720	0.370	1.516	0.07	85.73	Natural	0.533	0.453	0.579	0.496
S721	0.335	0.832	0.07	114.15	Natural	0.333	0.176	0.383	0.205
S722	0.955	2.334	0.06	79.25	Natural	0.717	0.517	0.742	0.537
S723	0.085	0.562	0.11	177.89	Natural	0.283	0.235	0.342	0.289
S724	1.156	2.319	0.06	97.05	Natural	0.650	0.414	0.663	0.423
S725	1.158	3.038	0.06	70.78	Natural	0.917	0.752	0.950	0.782
S726	0.334	1.036	0.07	295.36	Natural	0.267	0.164	0.329	0.207
S727	0.375	1.815	0.07	85.40	Natural	0.621	0.614	0.671	0.669
S728	0.276	1.550	0.07	77.44	Natural	0.646	0.674	0.696	0.732

Time-Area Relation - A dimensionless time-area relation of contributing area versus travel time to subbasin outlet, is required for the Clark unit hydrograph procedure. It is impractical to develop individual time-area relations for each subbasin of a numerous subbasin model, therefore, synthetic time-area relations are used in this study. The Natural time-area relation, shown as N-D in Figure 5.7 of the Design Manual is used for all subbasins in the study watershed.

3.2.2.5 Reach Route Parameters

General

Routing of subbasin hydrographs is performed using the normal depth option of the Modified Puls channel storage method of HEC-1. Routing reach paths are shown on Plate 1, with each route identified by a name that consists of the upper and lower concentration point numbers that define the reach. For example, Reach 102103 is the reach with concentration point 102 at the upstream and concentration point 103 at the downstream.

Physical Parameters

Cross Section Geometry - Representative cross section geometry for each reach route was obtained during field reconnaissance trips for the portions of the watershed that are currently unstudied. Cross sectional geometry was measured using a hand level, graduated range pole, and a 100 foot measuring tape. For watercourses that have been previously studied (Morgan City Wash, Caterpillar Tank Wash, Twin Buttes Wash and tributaries), routing reach section geometry was determined from the detailed mapping associated with those studies. A listing of the data source for each routing reach is provided in Table 3-8.

Manning's n Estimates - The normal depth option of the Modified Puls channel storage routing method requires a Manning's n-value estimate for the main channel and both the left and right overbank. Representative Manning's n-value estimates for each routing reach were made based on photographs taken during the field reconnaissance and judgement. Field reconnaissance photographs taken for each routing reach are provided in Appendix D. For the routing reaches within the limits of the detail study watercourse (Unnamed Washes 1, 2 and 3), the Manning's n-values estimated as part of the hydraulic analysis are used. Representative routing reach Manning's n-values are determined by selection of the

predominant values for all cross sections located within each routing reach. In general all routing reaches are characterized by a well defined main channel with the bed material consisting primarily of gravel and course gravel. Overbank areas are typically steep with either dense vegetation or rocky abutments.

Table 3-8

Summary of reach route physical data

Reach Route Concentration Points		In		Length		Elevation (feet)		Slope
Top	Bottom	Subbasin	Cross Section Source	Feet	Miles	Top	Bottom	(ft/ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
100	102	S101	Hydrology Field Reconnaissance	6535	1.2377	1770	1680	0.0138
101	102	S103	Hydrology Field Reconnaissance	7254	1.3738	1780	1680	0.0138
102	103	S104	Hydrology Field Reconnaissance	8068	1.5280	1680	1580	0.0124
103	104	S106	Hydrology Field Reconnaissance	8625	1.6336	1580	1440	0.0162
104	105	S107	Hydrology Field Reconnaissance	6956	1.3174	1440	1360	0.0115
200	201	S201	Hydrology Field Reconnaissance	3952	0.7485	1940	1850	0.0228
201	203	S203	Hydrology Field Reconnaissance	3233	0.6123	1850	1800	0.0155
202	203	S203	Hydrology Field Reconnaissance	2353	0.4457	1840	1800	0.0170
203	204	S205	Hydrology Field Reconnaissance	1325	0.2510	1800	1780	0.0151
204	205	S206	Hydrology Field Reconnaissance	5007	0.9484	1780	1710	0.0140
205	206	S208	Hydrology Field Reconnaissance	11893	2.2526	1710	1635	0.0063
206	207	S209	Hydrology Field Reconnaissance	4972	0.9416	1635	1480	0.0312
207	105	S211	Hydrology Field Reconnaissance	7176	1.3591	1480	1360	0.0167
300	301	S302	Hydrology Field Reconnaissance	5117	0.9692	1620	1550	0.0137
301	302	S303	Hydrology Field Reconnaissance	8124	1.5387	1550	1480	0.0086
302	303	S304	Hydrology Field Reconnaissance	7304	1.3834	1480	1340	0.0192
400	401	S401	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	7424	1.4060	1525	1450	0.0101
401	402	S402	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	8029	1.5206	1450	1360	0.0112
402	403	S403	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	6138	1.1625	1360	1330	0.0049
403	404	S404	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	4256	0.8061	1330	1260	0.0164
500	501	S501	Hydrology Field Reconnaissance	5972	1.1311	1660	1580	0.0134
501	502	S502	Hydrology Field Reconnaissance	5021	0.9509	1580	1500	0.0159
502	505	S504	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	8775	1.6619	1500	1420	0.0091
503	505	S507	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	9136	1.7304	1525	1420	0.0115
504	505	S507	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	7754	1.4685	1520	1420	0.0129

Table 3-8 (Continued)

Summary of reach route physical data

Reach Route Concentration Points		In		Length		Elevation (feet)		Slope
Top	Bottom	Subbasin	Cross Section Source	Feet	Miles	Top	Bottom	(ft/ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
505	509	S508	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	6213	1.1767	1420	1380	0.0064
506	508	S510	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	4023	0.7619	1520	1460	0.0149
507	508	S512	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	5400	1.0227	1520	1460	0.0111
508	509	S513	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	10349	1.9601	1460	1380	0.0077
509	510	S514	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	1958	0.3709	1380	1360	0.0102
510	511	S515	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	6722	1.2731	1360	1315	0.0067
511	512	S516	C.A.P. Overchutes, Agua Fria FDS, FCD 90-09	9226	1.7473	1315	1240	0.0081
600	601	S601	Morgan City Wash FDS, FCD 90-09	3190	0.6042	2555	2440	0.0361
601	602	S603	Morgan City Wash FDS, FCD 90-09	6017	1.1395	2440	2280	0.0266
602	603	S606	Morgan City Wash FDS, FCD 90-09	7614	1.4420	2280	2150	0.0171
603	604	S609	Morgan City Wash FDS, FCD 90-09	7830	1.4830	2150	2000	0.0192
604	605	S608	Morgan City Wash FDS, FCD 90-09	1543	0.2922	2000	1990	0.0065
605	606	S610	Morgan City Wash FDS, FCD 90-09	5520	1.0455	1990	1880	0.0199
606	608	S613	Morgan City Wash FDS, FCD 90-09	1141	0.2160	1880	1860	0.0175
607	608	S613	Hydrology Field Reconnaissance	11167	2.1149	2130	1860	0.0242
608	609	S614	Morgan City Wash FDS, FCD 90-09	6518	1.2344	1860	1780	0.0123
609	611	S617	Morgan City Wash FDS, FCD 90-09	6519	1.2346	1780	1760	0.0031
610	611	S616	Hydrology Field Reconnaissance	7981	1.5115	1840	1760	0.0100
611	613	S618	Morgan City Wash FDS, FCD 90-09	4445	0.8418	1760	1590	0.0382
612	613	S620	Hydrology Field Reconnaissance	8752	1.6576	1880	1590	0.0331
613	614	S621	Morgan City Wash FDS, FCD 90-09	5557	1.0525	1590	1530	0.0108
614	615	S622	Morgan City Wash FDS, FCD 90-09	7995	1.5142	1530	1415	0.0144
704	705O	S705	Hydrology Field Reconnaissance	7534	1.4269	1480	1340	0.0186
705O	705AF	S705AF	Agua Fria FIS, FCD 95-05	2254	0.4269	1338	1320	0.0082
709	710	S710	Agua Fria FIS, FCD 95-05	2683	0.5082	1490	1420	0.0261

Table 3-8 (Continued)
Summary of reach route physical data

Reach Route Concentration Points		In		Length		Elevation (feet)		Slope
Top	Bottom	Subbasin	Cross Section Source	Feet	Miles	Top	Bottom	(ft/ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
711	712	S712	Agua Fria FIS, FCD 95-05	1586	0.3004	1490	1420	0.0441
712	714	S714	Agua Fria FIS, FCD 95-05	2032	0.3848	1420	1385	0.0172
713	714	S714	Agua Fria FIS, FCD 95-05	831	0.1575	1420	1385	0.0421
716	717	S717	Agua Fria FIS, FCD 95-05	4232	0.8015	1495	1420	0.0177
717	718	S718	Agua Fria FIS, FCD 95-05	7146	1.3534	1420	1345	0.0105
721	722	S722	Agua Fria FIS, FCD 95-05	8812	1.6690	1480	1330	0.0170
726	727	S727	Agua Fria FIS, FCD 95-05	6228	1.1796	1395	1280	0.0185

Routing Reach Length and Slope - The normal depth option parameters of reach length and energy slope (assumed to be the channel slope) are measured either from Plate 1 or the detailed mapping associated with the previously studied watercourses. Table 3-8 summarizes those values for each routing reach.

Channel Infiltration Losses - Channel infiltration losses are estimated for select routing reaches using the steady state loss rate option of HEC-1. There is no stream flow gage data available for this watershed to provide guidance in selection of loss rates. However, it is expected that some losses due to infiltration exist within the routing reaches. Steady state loss rates for each reach are estimated by inspection of Plate 2.

Channel infiltration losses are estimated only for those routing reaches for which a unique soil map unit is determined for the watercourse. The XKSAT value for that soil map unit is then assigned as the steady state loss rate. For the routing reaches that do not have a unique soil map unit associated with the watercourse, it is assumed, based on field reconnaissance that the soil characteristics of the watercourse are sufficiently different from the surrounding land surface such that the assignment of a steady state loss rate based on data other than what is representative of the actual watercourse soil characteristics is unwarranted. The resulting routing reaches for which channel infiltration losses are estimated are summarized in Table 3-9.

Table 3-9

Transmission losses

Reach Route ID (1)	XKSAT in/hr (2)
402403	0.03
403404	0.03
501502	0.94
502505	0.94
503505	0.63
505509	0.94
507508	0.39
508509	0.94
509510	0.38
510511	0.38
511512	0.4
602603	0.96
603604	0.96
605606	0.96
606608	0.96
608609	0.94
609611	0.94
611613	0.94
613614	0.94
614615	0.94
717718	0.03
721722	0.03

Computational Parameters

General – Other than the physical parameters that describe the routing reaches, the normal depth option of the Modified Puls channel storage routing method is a function of two computational parameters. Those parameters are the model computational time interval (NMIN) and the number of routing computation steps (NSTPS).

Computational Time Interval - The modeling computational time interval directly impacts the hydrologic routing of a flood hydrograph and the minimum allowable reach length. Values of NMIN are typically selected to provide adequate definition of the unit hydrograph

and should lie within the range of 0.1 to 0.25 times the minimum T_c occurring in the watershed. For the 100-year, 6-hour model, the shortest T_c is 0.154 hours (9 minutes), resulting in a range of 1 to 2.5 minutes. For the 100-year, 24-hour model, the shortest T_c is 0.188 hours (11 minutes), resulting in a range of 1.1 to 2.8 minutes. The selected NMIN value for both the 6- and 24-hour models is 2 minutes.

Assuming an average travel velocity of 8 feet per second, the minimum length of routing reach required for the floodwave to travel one time step (NMIN = 2 minutes) is:

$$L_{min} = (2 \text{ min})(60)(8 \text{ fps}) = 960 \text{ feet.}$$

Initially, hydrologic routing was performed for all travel reaches regardless of reach length. Those reaches that did not lag the hydrograph one time step and provide attenuation, were subsequently removed from the model and replaced with a KM record commenting that reach is too short to route.

Reach Route Step Estimation - Estimation of the number of routing steps for input to the HEC-1 models is an iterative process. The number of routing steps for each reach may vary with the storm duration being considered. The process for estimating the number of steps is as follows:

Step 1: An initial estimate of the number of steps (NSTPS) for each reach is made assuming an average velocity of 10 feet per second. The HEC-1 models are run using the assumed values.

Step 2: The reach travel time is calculated by subtracting the time-to-peak (T_p) at the beginning of the routing operation from the T_p at the end of the routing operation.

Step 3: The travel time from Step 2 is then divided by the computational time interval (NMIN), to obtain a check NSTPS value.

Step 4: The result from Step 3 is compared with the NSTPS value currently coded in HEC-1 model. If the two values are not equal, the check NSTPS value is re-coded into the HEC-1 model as the new NSTPS value and the model is rerun.

Step 5: Repeat Steps 2 through 5 until the current NSTPS value and the check NSTPS value are equal. Convergence normally occurs within three iterations.

Summary of Routing Results – Tables D-1 and D-2 of Appendix D, summarize reach route hydraulic data and checking calculations for the 100-year, 6- and 24-hour models, respectively. Data represented in those tables include average physical parameters, normal depth calculation results, minimum and maximum check velocities that are based on the HEC-1 calculated wave celerity and numerics relating flood wave velocity to normal depth velocity, travel time through the reaches in increments of NMIN, and final NSTPS values. A summary describing the calculations performed to obtain those values for each column of Tables D-1 and D-2, is provided in Appendix D following the tables. Examination of the data summarized in those tables provides confirmation of the reasonableness of each reach route.

3.2.2.6 Reservoir Route Parameters

There are numerous locations within the study watershed both at culvert crossings and stock tanks where there is a potential for some degree of ponding to occur. The significance of the potential ponding in regard to the overall modeling results has been evaluated on a case by case basis. The results of that evaluation are summarized into the following categories:

- Storage routing is not justified due to the combination of channel slope and geometry resulting in insignificant storage volume in comparison to the inflow volume. Moreover, the best available source for estimation of storage volume is from 20-foot contour interval (CI) mapping. This category is typified by many of the culvert crossings of State Route (SR) 74.
- Storage routing is justified in that the culvert does not have sufficient capacity to convey the inflow volume and there is sufficient storage volume in comparison to the inflow volume. However, there is insufficient data to develop a stage-storage-discharge relation, particularly a state-storage relation. This category is typified by culvert crossings of the Beardsley Canal, west of the Agua Fria River and at select locations along the Waddell and Hayden-Rhodes reaches of the CAP.
- Storage routing at the stock tanks is not justified given the uncertainty associated with the structural stability and long term maintenance program.

- Storage routing is justified and there is sufficient data to develop stage-storage-discharge relations. This category is typified by culvert crossings of the Waddell and Hayden-Rhodes reaches of the CAP and the Beardsley Canal east of the Agua Fria River.

The evaluation of each potential storage routing location was based on a hydraulic analysis of the culvert using the HY-8 computer program and inspection of any available mapping. Input data to HY-8 was obtained from various as-built plan sets and field reconnaissance. The locations where storage routing is warranted are listed both by HEC-1 operational identifiers and structure number in Table 3-10. Stage-storage and stage-discharge rating curves input into the HEC-1 models are included for reference in Appendix E, along with the HY-8 program output.

Table 3-10

Storage routing locations

HEC-1 ID	Structure No.
(1)	(2)
S400	78
C502	81
S503	94
S504	93
S506	84
S507	82
C705	63
S709	95
C710	58
S711	71
C712	60
C713	59
S716	74
S721	75

3.2.3 Statistical Parameters

3.2.3.1 Precipitation Statistics

There are no statistical data of significant record available for this watershed other than the

regional precipitation data published by the National Oceanic and Atmospheric Administration (NOAA). The precipitation depth-duration-frequency statistics used for this study are derived from the NOAA Atlas 2 for Arizona.

3.2.3.2 Discharge Statistics

There are no statistical data available for the study watershed.

3.2.4 Precipitation Data

3.2.4.1 *Rainfall Distributions*

The storm frequencies specified for analysis in this study are the 100-year, 6- and 24-hour duration storms. The rainfall distributions for the 6-hour duration storm are based on watershed area. Those distributions are listed in the Design Manual with each precipitation pattern valid for a certain watershed area and are automatically coded into the model by the modified version of the MCUHP1 program. The 24-hour rainfall distribution used for this study is the SCS Type II.

3.2.4.2 Point Precipitation Data

Point precipitation values used for this study are derived from the isopluvial maps in the Design Manual. Refer to Figures 3-1 and 3-2 for a depiction of the study watershed overlaid by isopluvials for the 100-year, 6- and 24-hour storms, respectively. Average 100-year, 6- and 24-hour point precipitation values of 3.35 and 4.2 inches, respectively are used for modeling of the study watershed.

Figure 3-1

Isopluvial Map for the 100-year, 6-hour storm.

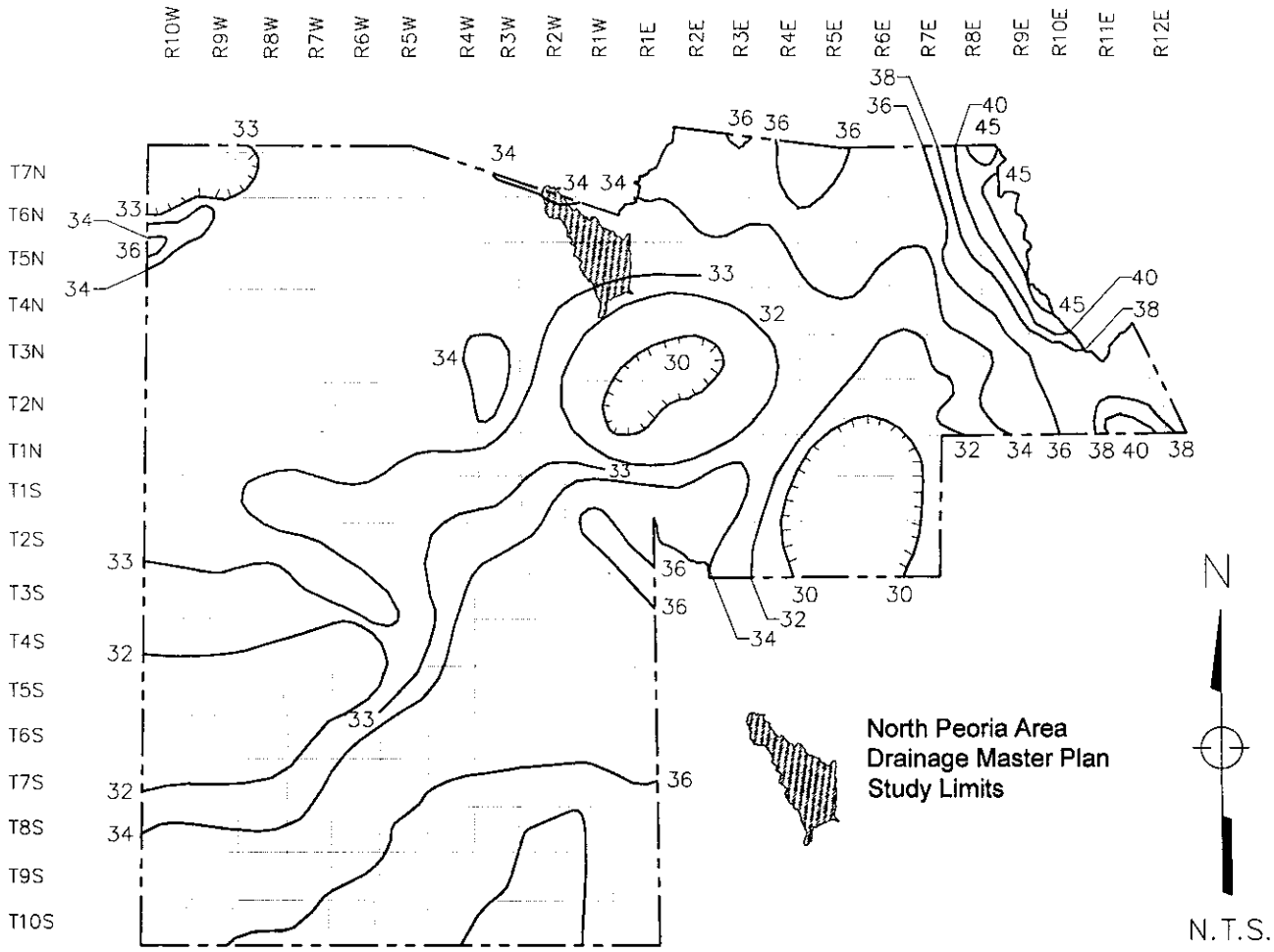
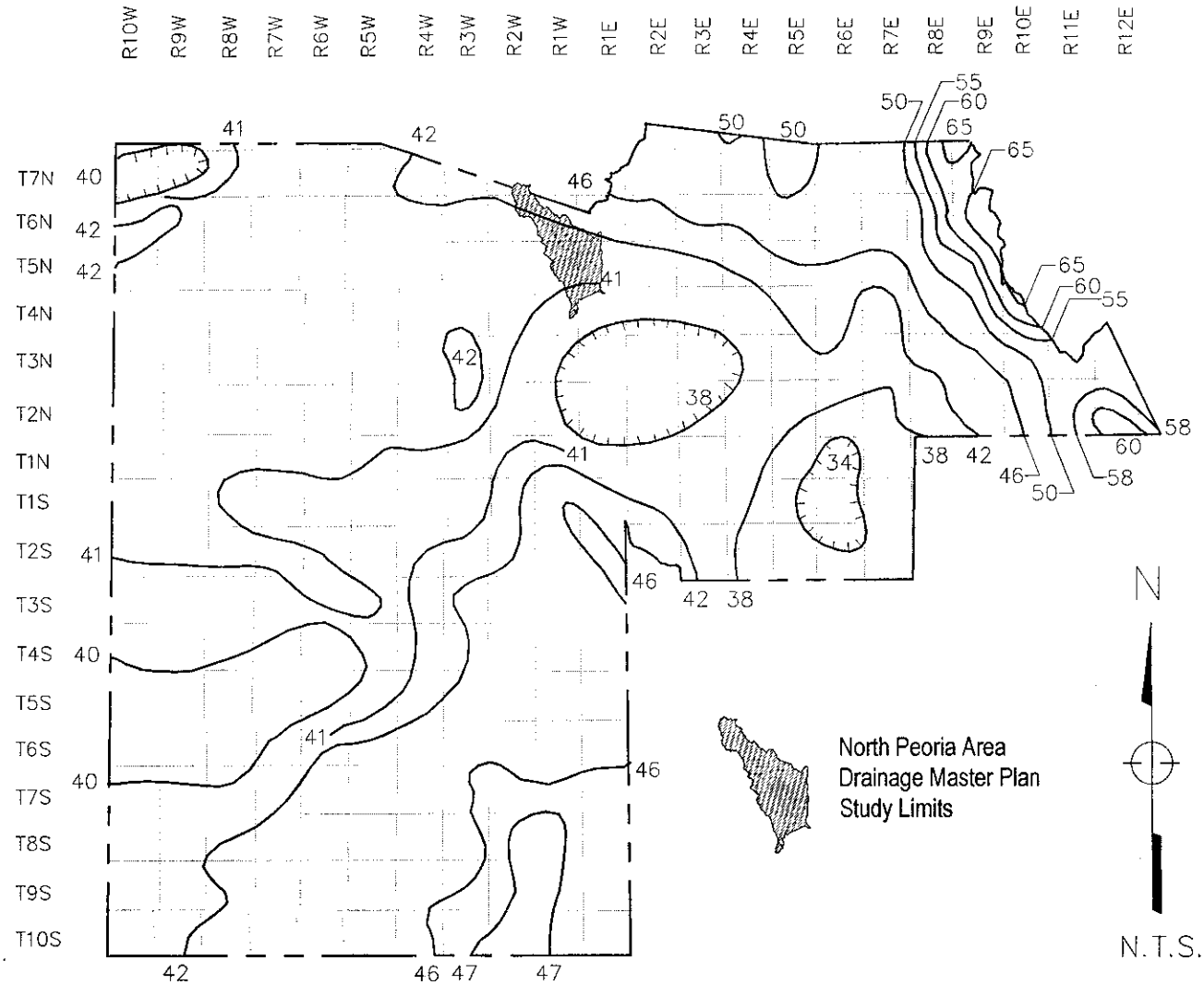


Figure 3-2

Isopluvial Map for the 100-year, 24 hour storm



3.2.4.3 Areal Precipitation Reduction

Precipitation reduction for the 6-hour storm is based upon the depth-area curve developed for the historic storm of 1954 over the Queen Creek, Arizona area, as developed by the U.S. Army Corps of Engineers in 1974. That depth-area curve is listed in the Design Manual. The precipitation patterns and corresponding areal reduction factors are selected automatically by the enhanced version of the MCUHP1 program.

The precipitation reduction factors used for the 24-hour storms are listed in the Design Manual and those values were derived from information contained in the NOAA Technical Memorandum NWS HYDRO-40 (NWS, 1984). Appropriate depth-area reduction for all storms and accumulated drainage areas is simulated in HEC-1 using the JD record option. Table 3-11 summarizes the basin areas, reduction factors and areally reduced point precipitation values used for the 24-hour HEC-1 model.

Table 3-11

Summary of 100-year, 24-hour JD areal reduction factors and corresponding drainage areas

Basin Area sq. miles (1)	Areal Reduction Factor (2)	Areally Reduced Point Precip. inches (3)
0.01	1.00	4.20
1	0.994	4.17
5	0.97	4.07
10	0.94	3.95
25	0.905	3.80
70	0.856	3.59

3.2.5 Gage Data

3.2.5.1 Streamflow Gaging Stations

There are no stream steam gages located within or sufficiently close to the study watershed to be of use.

3.2.5.2 Precipitation Gages

There are six continuous recording precipitation gages located in or near the study watershed. All six gages are owned, operated, and monitored by the District and are located as follows:

Chrysler Proving Grounds: Established 31 October 1990. Located 3.0 miles ESE Circle City, 1.5 miles N. of Whittmann in Section 7, Township 5 N., Range 2 W., at Latitude 33° 47' 04" and Longitude 112° 30' 03". The gage is at elevation 1,720 feet.

Castle Hot Springs: Established 20 October 1981. Located 6.1 miles NE from US 60/93 on Castle Hot Springs Road in Section 24, Township 7 N., Range 3 W., at Latitude 33° 55' 42" and Longitude 112° 31' 42". The gage is at elevation 2,683 feet.

Sun City West: Established 30 March 1995. Located 0.25 miles SE of the Beardsley Rd. and Litchfield Rd. alignments in Section 27, Township 4 N., Range 1 W., at Latitude 33° 39' 54" and Longitude 112° 21' 25". The gage is at elevation 1,335 feet.

New River Dam: Established 01 May 1986. Located 0.5 miles NE of Jomax Rd. and 83rd Ave. in Section 35, Township 5 N., Range 1 E., at Latitude 33° 44' 09" and Longitude 112° 13' 31". The gage is at elevation 1,498 feet.

Lake Pleasant: Established 10 December 1991. Located on New Waddell Dam at Lake Pleasant in Section 21, Township 6 N., Range 1 E., at Latitude 33° 51' 10" and Longitude 112° 16' 31". The gage is at elevation 1,820 feet.

Garfias Mountain: Established 14 April 1981. Located 6.0 miles WSW of Castle Hot Springs off Castle Hot Springs Rd. in Section 1, Township 7 N., Range 2 W., at Latitude 33° 57' 55" and Longitude 112° 25' 42". The gage is at elevation 2,645 feet.

All six gages have an insufficient period of record for statistical analysis of a 100-year recurrence interval precipitation depth, therefore, data from these gages are not used in this study.

3.3 Calibration

3.3.1 General

Calibration of the HEC-1 models is not possible because of the lack of available physical data. In lieu of calibration, indirect methods of model verification are performed and compared to the modeling results. The indirect verification methods used are:

1. Comparison of HEC-1 results with regional data;
2. Comparison of HEC-1 results with USGS data and;
3. Comparison of HEC-1 results with estimates made using a USGS regional regression equation

3.3.2 Comparison with Regional Data

The Arizona Department of Water Resources (ADWR) has adopted State Standard SS2-96 which includes ten envelope curves of various data sets from the entire State of Arizona as well as surrounding regions. The data in SS2-96 is adopted from the Arizona Department of Transportation Drainage Design Manual (1994). The envelope curves are shown in Figure 10-1 of the ADOT Manual. That figure is included in Appendix F. Seven of the curves represent envelopes of maximum observed flood discharges (Curves A, B, D, E, F, I and J), one is a 100-year discharge envelope (Curve H), and two are 100-year discharge relations (Curves C and G).

Peak 100-year discharge results of this study are selected for comparison and are summarized in Table F-1 of Appendix F. The results listed in this table are the larger of the 6- or 24-hour storm. The 100-year unit peak discharges are plotted for comparison on Figure 10-1. The curves of most interest in evaluating 100-year peak discharges in Arizona are C, G and H. In summary, the modeled results plot favorably with curves C, G and H.

3.3.3 Comparison with USGS Data

Representative watersheds and their corresponding data are selected from the Basin Characteristics and Streamflow Statistics in Arizona as of 1989 (USGS, WR, 91-4041) and summarized in Table F-2 of Appendix F. The HEC-1 modeling results selected for comparison are summarized in Table F-1 of Appendix F. Data from Tables F-1 and F-2 are plotted in Figure F-1 of Appendix F. The locations of the representative USGS gages are shown in relation to the study watershed in Figure F-2 of Appendix F. The USGS data selected are for watersheds ranging in size from 0.5 to 144.0 square miles. Unit peak 100-year discharge estimates for those basins range from 136 to 1,840 cfs per square mile. The HEC-1 model results selected for comparison range in size from 0.71 to 22.90 square miles, with unit peak 100-year discharges ranging from 572 to 1,882 cfs per square mile. As can be seen from Figure F-1, the HEC-1 model data points plot favorably within the scatter limits of the USGS gage data. In addition, gage data (Log-Pearson Type 3 (LP3) analyses and maximum recorded discharge (Q_{max})) for 240 gages throughout the state have been tabulated in the ADOT Manual. A regression analysis was performed for both the LP3 and Q_{max} data sets. Plots of this data along with 75% tolerance limits lines about the 100-year discharge line are shown of Figures 10-3 through 10-5 of the ADOT Manual and have been included in Appendix F. These data sets have also been adopted by ADWR in the State Standards SS2-96. Discharge data from Table F-1 is plotted for comparison in Figures 10-3 through 10-5. In summary, the modeled results plot within the tolerance limits.

3.3.4 Comparison with USGS Regional Regression Equation

Table F-3 provides a comparison of the HEC-1 modeling results to 100-year peak discharge estimates calculated using regional regression equations developed for Arizona, and published in the USGS Open-File Report 93-419 entitled Methods for estimating Magnitude and Frequency of Floods in the Southwestern United States. According to that report, Arizona is characterized by flood regions, with the study watershed being located in Flood Region 12. Applicable excerpts from that report for Flood Region 12, that are used for this comparison are provided in Appendix F. Included in those excerpts are a map (Figure F-3) showing the regional flood boundaries of the state in relation to the study watershed, a Flood Region 12 scatter diagram taken from the ADOT Manual of mean basin elevation versus drainage area for gage sites used to perform regression analysis, a tabulation taken from the ADOT Manual of regional regression

equations for estimation of peak discharges and the corresponding error percentages, and a scatter diagram and envelope curve taken from the ADOT Manual of 100-year peak discharges versus drainage area for gaged sites used for regression analysis. In summary, the HEC-1 modeled results are lower than the regression equation results, but are generally within the error range of the equation.

3.4 Special Problems and Solutions

3.4.1 HEC-1 Warnings and Errors

The only warning messages encountered in either of the two hydrologic models summarized in this report are as follows:

1. *** WARNING *** MODIFIED PULS ROUTING MAY BE NUMERICALLY UNSTABLE FOR OUTFLOWS BETWEEN XXXX. TO XXXX.

2. XXXX * WARNING EXCESS AT PONDING LESS THAN ZERO FOR PERIOD EXCESS SET TO ZERO

The first warning listed above specifies a range of peak flows for which the routing numerics may be unstable. Each routing reach for which a warning message is issued was checked for the following:

1. The routed peak discharge was compared to the range listed in the warning message;

2. The routed peak discharge was compared with the inflow peak discharge to determine if an increase resulted due to the routing computations; and

3. The routed hydrograph was plotted and checked for oscillations if either item 1 or 2 above was a concern.

Hydrograph plots for the reaches that required analyzing by the third step are provided in Appendix D. Examination of those plots does not give any cause to suspect the routing calculations, therefore the warning messages are considered inconsequential.

The second warning message listed above is in regard to the rainfall loss calculations performed

by HEC-1 using the Green and Ampt methodology. After satisfying the surface retention loss requirement, HEC-1 then performs check calculations for each modeling time period to determine when a combination of accumulated rainfall and sufficient rainfall intensity occur to begin ponding (rainfall excess generation). All rainfall is infiltrated to that point and accounted for in the calculations. Once the program determines that ponding has occurred, an infiltration rate is then calculated for each time period and subtracted from the rainfall intensity for that same period to obtain the rate of rainfall excess. Due to imperfect numerics, it is possible to have a rainfall intensity for the modeling time period that results in the calculation of a ponding condition, yet that ponded depth is less than the calculated infiltration capacity of the soil for that time period. This results in a negative value for the rainfall excess calculation. HEC-1 issues its message and sets the loss to zero. This message is not an indication of model instability and can be disregarded.

3.5 Rational Method

3.5.1 General

The Rational Method is used for determination of the 100-year peak discharge for subbasins that are less than 160 acres in size and that drain directly to the Agua Fria River or that drain to or are impounded by the Beardsley Canal. The Rational Method equation is as follows:

$$Q = CiA$$

where:
- Q = peak discharge for a selected recurrence interval, in cfs;
- C = coefficient relating rainfall to runoff;
- i = average rainfall intensity, in inches/hour, of calculated rainfall duration, T_c;
- T_c = time of concentration, in hours; and
- A = contributing drainage area, in acres.

In general, the physical parameters required for the estimation of peak discharge are the same as those for rainfall-runoff (HEC-1) modeling.

3.5.2. Rational Method Runoff Coefficient

The runoff coefficient, (C) is a representation of rainfall losses and is primarily associated with land use. Selection of values for C for each land use class present in the watershed is based on guidance provided in the Design Manual. These values are listed in Table 3-12. The area associated with each land use class as they occur within the subbasin is used to calculate a weighted value of C. These areas and C values are listed in Table G-1, of Appendix G. The weighted C value for each Rational Method subbasin is summarized in Table 3-13.

Table 3-12

Summary of land use classifications for the Rational Method

Land Use Classification (1)	Runoff Coefficients 10-Year (2)	100-Year (3)
COMM	0.70	0.88
DESERT	0.40	0.50
LDR	0.55	0.69
OPEN	0.40	0.50
PF	0.70	0.88

Where:

DESERT	=	Undeveloped Desert
LDR	=	Residential Areas, Single Family
OPEN	=	Lake Pleasant Regional Park
COMM	=	Commercial Areas
PF	=	Public Facilities (APS Substation)

Table 3-13

Summary of input parameters for the Rational Method

Subbasin ID (1)	Weighted C (2)	Average Intensity in/hr (3)	Drainage Area acres (4)
R100	0.40	7.3	61.4
R101	0.40	7.3	53.9
R102	0.40	6.9	64.0
R103	0.40	6.4	114.3
R104	0.40	6.5	86.1
R105	0.40	7.3	26.0
R106	0.40	6.9	84.0
R107	0.40	5.6	191.7
R108	0.40	6.5	196.6
R109	0.40	5.9	84.4
R110	0.40	7.3	63.1
R111	0.44	4.6	151.2
R112	0.40	4.3	165.6
R113	0.40	6.4	47.8
R114	0.40	4.2	145.7
R115	0.40	4.3	181.7
R116	0.40	7.3	37.1
R117	0.40	7.3	16.9
R118	0.40	7.3	26.4
R119	0.40	7.3	31.0
R120	0.40	7.0	58.6
R121	0.40	7.3	87.9
R122	0.40	6.1	71.1
R123	0.40	7.3	31.0
R124	0.40	7.0	37.3
R125	0.40	7.3	47.5

3.5.3. Average Intensity

The peak discharge corresponding to a given intensity occurs only if the rainfall duration is at least equal to T_c. The equation that describes the relation of intensity to T_c is the same as that used for the Clark unit hydrograph. Refer to Section 3.2.2.4. for a detailed discussion of this

relation. The physical characteristics of each Rational Method subbasin (length, slope and K_b) required for the calculation of T_c are summarized in Table G-1 of Appendix G. Solution of the T_c equation is an iterative process that requires the use of an Intensity-Duration-Frequency (IDF) graph. An IDF graph appropriate for use in Maricopa County is provided in the Design Manual. The procedure involves making an initial estimate of the duration for which the corresponding intensity is determined from the IDF graph. The intensity is then used to calculate the actual T_c. This process is repeated until the estimated duration and the calculated T_c are equivalent. The resulting average intensity for each Rational Method subbasin are summarized in Table 3-13.

3.5.4. Contributing Drainage Area

The drainage area of each Rational Method subbasin is calculated by the same approach as described for the HEC-1 modeled subbasins. These areas are summarized in Table 3-13.

3.6 Final Results

3.6.1 General

HEC-1 models for both the 100-year, 6- and 24-hour storms are developed for this study. Both models are run with a computational interval of 2 minutes. Differences in the point precipitation values are summarized in Section 3.2.4.2. The results for each model are summarized in Tables 3-14 and 3-15 for the 6- and 24-hour storms, respectively. Table 3-16 compares the 100-year, 6-hour to 100-year, 24-hour results and summarizes the controlling storm duration for each HEC-1 operation. In general, the 6-hour storm produces higher peak discharges for all locations except in the Morgan City Wash sub-watershed. The resulting 100-year peak discharge for each of the Rational Method subbasins is summarized in Table 3-17. HEC-1 model output files for the 6- and 24-hour storms are provided in Appendix H.

Table 3-14

Summary of HEC-1 model results for the 100 year, 6-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
S100	746	4.43	0.57	1309
100102	702	4.67	0.57	1232
S101	1034	4.33	0.63	1641
C102R	1185	4.53	1.20	988
S102	540	4.50	0.45	1200
101102	517	4.73	0.45	1149
S103	455	4.57	0.40	1138
C102L	856	4.67	0.84	1019
C102	1769	4.60	2.05	863
102103	1725	4.83	2.05	841
S104	1137	4.50	0.90	1263
C103R	2330	4.77	2.95	790
S105	547	4.67	0.59	927
C103	2671	4.77	3.54	755
103104	2630	4.93	3.54	743
S106	686	4.47	0.57	1204
C104	2892	4.87	4.11	704
104105	2854	5.07	4.11	694
S107	789	4.60	0.94	839
C105L	3193	5.03	5.05	632
S200	1379	4.40	0.96	1436
200201	1344	4.43	0.96	1400
S201	603	4.30	0.35	1723
C201	1669	4.43	1.31	1274
201203	1629	4.50	1.31	1244
S202	274	4.17	0.13	2108
202203	263	4.27	0.13	2023
S203	417	4.50	0.37	1127
C203R	1954	4.50	1.81	1080
S204	1126	4.50	0.95	1185
C203	2627	4.53	2.76	952
203204	2617	4.57	2.76	948
S205	561	4.40	0.41	1368
C204	2913	4.53	3.17	919
204205	2883	4.67	3.17	909

Table 3-14 (continued)

Summary of HEC-1 model results for the 100 year, 6-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
S206	760	4.70	0.85	894
C205L	3345	4.67	4.03	830
S207	863	4.70	0.96	899
C205	3870	4.70	4.98	777
205206	3747	5.03	4.98	752
S208	1004	4.73	1.10	913
C206	4325	5.00	6.09	710
206207	4291	5.07	6.09	705
S209	888	4.47	0.65	1366
C207R	4471	5.07	6.74	663
S210	774	4.33	0.48	1613
C207	4528	5.07	7.22	627
207105	4466	5.13	7.22	619
S211	650	4.43	0.49	1327
C105R	4567	5.13	7.70	593
C105	6840	5.13	12.75	536
S300	710	4.50	0.62	1145
S301	1216	4.47	0.99	1228
C300	1665	4.50	1.61	1034
300301	1631	4.60	1.61	1013
S302	742	4.40	0.47	1579
C301	1985	4.57	2.07	959
301302	1915	4.90	2.07	925
S303	901	4.43	0.71	1269
C302	2203	4.83	2.78	792
302303	2180	4.97	2.78	784
S304	791	4.57	0.82	965
C303	2567	4.90	3.60	713
WEST-1	8330	5.10	16.36	509
S400	1212	4.57	1.05	1154
C400O	500	5.20	1.05	476
400401	498	5.50	1.05	474
S401	769	4.53	0.65	1183
C401	913	4.70	1.69	540
401402	895	5.00	1.69	530
S402	951	4.47	0.74	1285

Table 3-14 (continued)

Summary of HEC-1 model results for the 100 year, 6-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
C402	1292	4.83	2.43	532
402403	1256	5.20	2.43	517
S403	617	4.63	0.56	1102
C403	1572	5.17	2.99	526
403404	1557	5.27	2.99	521
S404	651	4.17	0.26	2504
C404	1556	5.27	3.26	477
WEST-2	9010	5.13	19.61	459
S500	914	4.73	1.05	870
500501	901	4.87	1.05	858
S501	844	4.43	0.61	1384
C501	1250	4.77	1.67	749
501502	1235	4.83	1.67	740
S502	704	4.30	0.40	1760
C502L	1392	4.73	2.07	672
S503	1285	4.47	0.99	1298
C502I	2246	4.60	3.07	732
C502O	1982	4.87	3.07	646
502505	1953	5.10	3.07	636
S504	219	4.70	0.33	664
C505L	2057	5.07	3.39	607
S505	382	4.13	0.14	2729
C503O	97	4.37	0.14	693
503505	95	4.87	0.14	679
S506	318	4.20	0.15	2120
C504O	93	4.60	0.15	620
504505	93	4.97	0.15	620
S507	811	4.50	0.67	1210
C505R	876	4.53	0.96	913
C505	2513	4.90	4.35	578
505509	2459	5.17	4.35	565
S508	418	4.37	0.29	1441
C509L	2509	5.17	4.65	540
S509	420	4.13	0.17	2471
C506O	93	4.50	0.17	547
506508	93	4.70	0.17	547

Table 3-14 (continued)

Summary of HEC-1 model results for the 100 year, 6-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
S510	195	4.33	0.13	1500
C508R	279	4.33	0.30	930
S511	777	4.23	0.38	2045
C507O	98	4.93	0.38	258
507508	98	5.20	0.38	258
S512	306	4.43	0.21	1457
C508L	372	4.43	0.60	620
C508	601	4.40	0.90	668
508509	557	4.87	0.90	619
S513	487	4.93	0.78	624
C509R	945	4.97	1.67	566
C509	3191	5.13	6.32	505
509510	3175	5.23	6.32	502
S514	626	4.70	0.65	963
C510	3486	5.20	6.97	500
510511	3413	5.53	6.97	490
S515	1268	4.67	1.10	1153
C511	3779	5.50	8.07	468
511512	3711	5.80	8.07	460
S516	429	4.70	0.54	794
C512	3775	5.80	8.61	438
WEST-3	9962	5.23	28.22	353
S600	1843	4.53	2.02	912
600601	1823	4.60	2.02	902
S601	1460	4.37	0.90	1622
C601	2625	4.57	2.92	899
601602	2597	4.67	2.92	889
S603	1467	4.23	0.67	2190
C602L	3040	4.57	3.58	849
S602	1882	4.57	1.88	1001
C602	4393	4.57	5.47	803
602603	4278	4.80	5.47	782
S606	910	4.37	0.66	1379
C603L	4628	4.77	6.13	755
S605	1250	4.50	1.09	1147
S604	1924	4.87	2.66	723

Table 3-14 (continued)

Summary of HEC-1 model results for the 100 year, 6-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
C603	6527	4.77	9.87	661
603604	6391	4.90	9.87	648
S609	564	4.50	0.56	1007
C604R	6592	4.90	10.43	632
S607	947	4.50	0.82	1155
C604	6994	4.90	11.25	622
604605	6964	4.93	11.25	619
S608	976	4.30	0.51	1914
C605	7133	4.93	11.76	607
605606	7049	5.03	11.76	599
S610	730	4.53	0.60	1217
C606L	7321	5.03	12.36	592
S612	954	4.50	0.81	1178
C606	7694	5.00	13.17	584
606608	7687	5.03	13.17	584
S611	1068	4.30	0.57	1874
607608	968	4.47	0.57	1698
S613	1579	4.80	1.80	877
C608	8797	5.00	15.53	566
608609	8718	5.13	15.53	561
S614	1033	4.67	1.08	956
C609	9109	5.10	16.61	548
609611	8980	5.30	16.61	541
S617	896	4.50	0.68	1318
C611R	9093	5.27	17.29	526
S615	1313	4.60	1.05	1250
610611	1286	4.77	1.05	1225
S616	360	4.93	0.50	720
C611L	1491	4.83	1.56	956
C611	9785	5.27	18.85	519
611613	9764	5.30	18.85	518
S618	1048	4.53	0.96	1092
C613R	9959	5.27	19.81	503
S619	1395	4.43	0.83	1681
612613	1333	4.57	0.83	1606
S620	613	4.43	0.44	1393

Table 3-14 (continued)

Summary of HEC-1 model results for the 100 year, 6-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
C613L	1716	4.57	1.27	1351
C613	10389	5.23	21.08	493
613614	10352	5.33	21.08	491
S621	1316	4.40	0.92	1430
C614	10339	5.30	22.00	470
614615	10264	5.43	22.00	467
S622	808	4.67	0.90	898
C615	10371	5.43	22.90	453
WEST-4	16726	5.43	51.12	327
S700	716	4.47	0.61	1174
S701	518	4.80	0.72	719
S702	335	4.37	0.26	1288
S703	400	4.30	0.26	1538
S704	757	4.27	0.41	1846
704705	668	4.50	0.41	1629
S705	980	4.43	0.75	1307
C705	1418	4.47	1.16	1222
C705O	689	4.97	1.16	594
705OAF	688	5.13	1.16	593
S705AF	351	4.30	0.18	1950
C705AF	772	4.90	1.34	576
WEST-5	1882	4.67	3.19	590
S706	825	4.47	0.71	1162
S707	728	4.47	0.64	1138
S728	286	4.47	0.28	1021
WEST	17327	5.40	55.94	310
S708	1336	4.33	0.71	1882
S709	903	4.30	0.44	2052
C709O	411	4.70	0.44	934
709710	410	4.77	0.44	932
S710	298	4.17	0.11	2709
C710I	524	4.20	0.55	953
C710O	408	5.03	0.55	742
S711	483	4.13	0.16	3019
C711O	181	4.40	0.16	1131
711712	181	4.43	0.16	1131

Table 3-14 (continued)

Summary of HEC-1 model results for the 100 year, 6-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
S712	238	4.03	0.07	3400
C712I	371	4.07	0.23	1613
C712O	245	4.27	0.23	1065
712714	244	4.33	0.23	1061
S713	326	4.10	0.11	2964
C713O	179	4.27	0.11	1627
713714	179	4.30	0.11	1627
S714	163	4.13	0.06	2717
C714	543	4.17	0.39	1392
S715	450	4.30	0.22	2045
S716	1625	4.47	1.13	1438
C716O	618	5.17	1.13	547
716717	617	5.30	1.13	546
S717	867	4.13	0.29	2990
C717	881	4.17	1.41	625
717718	785	4.53	1.41	557
S718	476	4.67	0.44	1082
C718	1158	4.60	1.86	623
S719	242	4.37	0.15	1613
EAST-1	3044	4.53	3.88	785
S720	652	4.37	0.37	1762
S721	866	4.20	0.34	2547
C721O	253	4.50	0.34	744
721722	251	4.80	0.34	738
S722	1279	4.50	0.95	1346
C722	1384	4.57	1.29	1073
S723	216	4.17	0.09	2400
S724	1788	4.43	1.16	1541
S725	1153	4.70	1.16	994
EAST-2	3954	4.60	4.06	974
S726	860	4.13	0.33	2606
726727	772	4.30	0.33	2339
S727	519	4.43	0.38	1366
C727	1132	4.33	0.71	1594
TOTAL	19685	5.30	64.59	305

Table 3-15

Summary of HEC-1 model results for the 100-year, 24-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
S100	512	12.43	0.57	898
100102	488	12.70	0.57	856
S101	717	12.30	0.63	1138
C102R	967	12.37	1.20	806
S102	360	12.53	0.45	800
101102	345	12.73	0.45	767
S103	307	12.57	0.40	768
C102L	627	12.67	0.84	746
C102	1464	12.57	2.05	714
102103	1435	12.80	2.05	700
S104	870	12.47	0.90	967
C103R	2058	12.63	2.95	698
S105	387	12.67	0.59	656
C103	2424	12.63	3.54	685
103104	2394	12.83	3.54	676
S106	470	12.47	0.57	825
C104	2682	12.77	4.11	653
104105	2643	13.00	4.11	643
S107	618	12.57	0.94	657
C105L	3031	12.93	5.05	600
S200	1067	12.37	0.96	1111
200201	1048	12.40	0.96	1092
S201	387	12.30	0.35	1106
C201	1396	12.37	1.31	1066
201203	1373	12.47	1.31	1048
S202	159	12.20	0.13	1223
202203	156	12.27	0.13	1200
S203	280	12.50	0.37	757
C203R	1746	12.47	1.81	965
S204	880	12.47	0.95	926
C203	2589	12.47	2.76	938
203204	2574	12.47	2.76	933
S205	369	12.40	0.41	900
C204	2913	12.47	3.17	919
204205	2844	12.57	3.17	897
S206	581	12.67	0.85	684

Table 3-15 (continued)

Summary of HEC-1 model results for the 100-year, 24-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
C205L	3378	12.60	4.03	838
S207	674	12.67	0.96	702
C205	3995	12.60	4.98	802
205206	3802	12.93	4.98	763
S208	804	12.70	1.10	731
C206	4421	12.93	6.09	726
206207	4372	13.00	6.09	718
S209	624	12.43	0.65	960
C207R	4573	13.00	6.74	678
S210	496	12.33	0.48	1033
C207	4651	13.00	7.22	644
207105	4562	13.07	7.22	632
S211	428	12.43	0.49	873
C105R	4684	13.07	7.70	608
C105	7297	13.07	12.75	572
S300	499	12.50	0.62	805
S301	959	12.43	0.99	969
C300	1433	12.47	1.61	890
300301	1401	12.57	1.61	870
S302	481	12.40	0.47	1023
C301	1787	12.53	2.07	863
301302	1708	12.83	2.07	825
S303	651	12.43	0.71	917
C302	2042	12.77	2.78	735
302303	2017	12.90	2.78	726
S304	596	12.53	0.82	727
C303	2414	12.83	3.60	671
WEST-1	9221	13.03	16.36	564
S400	967	12.53	1.05	921
C400O	453	13.10	1.05	431
400401	452	13.40	1.05	430
S401	549	12.53	0.65	845
C401	808	12.60	1.69	478
401402	789	12.97	1.69	467
S402	705	12.43	0.74	953
C402	1115	12.83	2.43	459

Table 3-15 (continued)

Summary of HEC-1 model results for the 100-year, 24-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
402403	1077	13.17	2.43	443
S403	444	12.63	0.56	793
C403	1362	13.13	2.99	456
403404	1351	13.23	2.99	452
S404	383	12.17	0.26	1473
C404	1352	13.23	3.26	415
WEST-2	10222	13.03	19.61	521
S500	731	12.70	1.05	696
500501	718	12.83	1.05	684
S501	582	12.40	0.61	954
C501	1041	12.73	1.67	623
501502	1028	12.80	1.67	616
S502	449	12.30	0.40	1123
C502L	1174	12.67	2.07	567
S503	1009	12.43	0.99	1019
C502I	2088	12.47	3.07	680
C502O	1829	12.70	3.07	596
502505	1800	12.93	3.07	586
S504	154	12.70	0.33	467
C505L	1927	12.90	3.39	568
S505	202	12.10	0.14	1443
C503O	89	12.33	0.14	636
503505	87	12.83	0.14	621
S506	190	12.20	0.15	1267
C504O	84	12.53	0.15	560
504505	83	12.97	0.15	553
S507	590	12.50	0.67	881
C505R	712	12.50	0.96	742
C505	2420	12.77	4.35	556
505509	2368	13.10	4.35	544
S508	279	12.37	0.29	962
C509L	2425	13.07	4.65	522
S509	235	12.17	0.17	1382
C506O	87	12.47	0.17	512
506508	87	12.67	0.17	512
S510	133	12.33	0.13	1023

Table 3-15 (continued)

Summary of HEC-1 model results for the 100-year, 24-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
C508R	214	12.33	0.30	713
S511	484	12.23	0.38	1274
C507O	95	12.90	0.38	250
507508	95	13.20	0.38	250
S512	211	12.43	0.21	1005
C508L	286	12.43	0.60	477
C508	493	12.40	0.90	548
508509	463	12.93	0.90	514
S513	376	12.90	0.78	482
C509R	830	12.90	1.67	497
C509	3160	13.03	6.32	500
509510	3145	13.13	6.32	498
S514	462	12.67	0.65	711
C510	3455	13.10	6.97	496
510511	3379	13.47	6.97	485
S515	1040	12.63	1.10	945
C511	3737	13.43	8.07	463
511512	3662	13.77	8.07	454
S516	303	12.70	0.54	561
C512	3744	13.73	8.61	435
WEST-3	11731	13.10	28.22	416
S600	1804	12.47	2.02	893
600601	1778	12.53	2.02	880
S601	1116	12.33	0.90	1240
C601	2687	12.43	2.92	920
601602	2651	12.53	2.92	908
S603	972	12.20	0.67	1451
C602L	3097	12.47	3.58	865
S602	1738	12.50	1.88	924
C602	4746	12.47	5.47	868
602603	4583	12.70	5.47	838
S606	651	12.37	0.66	986
C603L	4966	12.67	6.13	810
S605	1008	12.47	1.09	925
S604	1851	12.73	2.66	696
C603	7308	12.67	9.87	740

Table 3-15 (continued)

Summary of HEC-1 model results for the 100-year, 24-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
603604	7114	12.83	9.87	721
S609	393	12.50	0.56	702
C604R	7372	12.80	10.43	707
S607	713	12.47	0.82	870
C604	7817	12.80	11.25	695
604605	7773	12.83	11.25	691
S608	638	12.30	0.51	1251
C605	7954	12.83	11.76	676
605606	7845	12.93	11.76	667
S610	510	12.53	0.60	850
C606L	8146	12.93	12.36	659
S612	719	12.47	0.81	888
C606	8535	12.93	13.17	648
606608	8520	12.93	13.17	647
S611	699	12.27	0.57	1226
607608	662	12.47	0.57	1161
S613	1406	12.70	1.80	781
C608	9840	12.90	15.53	634
608609	9748	13.03	15.53	628
S614	831	12.63	1.08	769
C609	10248	13.00	16.61	617
609611	10067	13.17	16.61	606
S617	635	12.50	0.68	934
C611R	10241	13.17	17.29	592
S615	1027	12.60	1.05	978
610611	1001	12.77	1.05	953
S616	248	12.97	0.50	496
C611L	1210	12.80	1.56	776
C611	11048	13.17	18.85	586
611613	11000	13.20	18.85	584
S618	818	12.50	0.96	852
C613R	11263	13.20	19.81	569
S619	1040	12.40	0.83	1253
612613	1007	12.57	0.83	1213
S620	414	12.43	0.44	941
C613L	1389	12.53	1.27	1094

Table 3-15 (continued)

Summary of HEC-1 model results for the 100-year, 24-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
C613	11746	13.17	21.08	557
613614	11667	13.23	21.08	553
S621	1009	12.33	0.92	1097
C614	11709	13.23	22.00	532
614615	11625	13.33	22.00	528
S622	628	12.63	0.90	698
C615	11824	13.33	22.90	516
WEST-4	21626	13.27	51.12	423
S700	497	12.47	0.61	815
S701	382	12.77	0.72	531
S702	222	12.33	0.26	854
S703	257	12.30	0.26	988
S704	472	12.27	0.41	1151
704705	438	12.50	0.41	1068
S705	733	12.40	0.75	977
C705	1146	12.43	1.16	988
C705O	622	12.83	1.16	536
705OAF	621	13.03	1.16	535
S705AF	237	12.30	0.18	1317
C705AF	712	12.83	1.34	531
WEST-5	1681	12.63	3.19	527
S706	610	12.47	0.71	859
S707	528	12.47	0.64	825
S728	196	12.47	0.28	700
WEST	22813	13.23	55.94	408
S708	969	12.30	0.71	1365
S709	609	12.30	0.44	1384
C709O	362	12.63	0.44	823
709710	361	12.73	0.44	820
S710	179	12.17	0.11	1627
C710I	433	12.50	0.55	787
C710O	376	13.00	0.55	684
S711	282	12.13	0.16	1763
C711O	156	12.37	0.16	975
711712	156	12.43	0.16	975
S712	132	12.03	0.07	1886

Table 3-15 (continued)

Summary of HEC-1 model results for the 100-year, 24-hour storm

HEC-1 ID (1)	Peak Discharges cfs (2)	Time to Peak hrs (3)	Drainage Area sq. miles (4)	Unit Discharge cfs (5)
C712I	259	12.07	0.23	1126
C712O	206	12.23	0.23	896
712714	206	12.30	0.23	896
S713	189	12.10	0.11	1718
C713O	131	12.27	0.11	1191
713714	131	12.30	0.11	1191
S714	96	12.13	0.06	1600
C714	416	12.20	0.39	1067
S715	302	12.27	0.22	1373
S716	1328	12.43	1.13	1175
C716O	572	13.10	1.13	506
716717	572	13.23	1.13	506
S717	511	12.13	0.29	1762
C717	739	12.20	1.41	524
717718	670	12.57	1.41	475
S718	333	12.70	0.44	757
C718	989	12.63	1.86	532
S719	165	12.37	0.15	1100
EAST-1	2732	12.40	3.88	704
S720	443	12.37	0.37	1197
S721	521	12.17	0.34	1532
C721O	214	12.50	0.34	629
721722	212	12.80	0.34	624
S722	1019	12.47	0.95	1073
C722	1123	12.50	1.29	871
S723	131	12.17	0.09	1456
S724	1462	12.40	1.16	1260
S725	946	12.63	1.16	816
EAST-2	3751	12.47	4.06	924
S726	484	12.17	0.33	1467
726727	454	12.33	0.33	1376
S727	361	12.43	0.38	950
C727	796	12.37	0.71	1121
TOTAL	25792	13.20	64.59	399

Table 3-16

Summary of HEC-1 model results of the controlling storm duration

HEC-1 ID (1)	100-Year Peak Discharge 6-Hour cfs (2)	100-Year Peak Discharge 24-Hour cfs (3)	Controlling Storm Duration (4)
S100	746	512	6-Hour Controls
100102	702	488	6-Hour Controls
S101	1034	717	6-Hour Controls
C102R	1185	967	6-Hour Controls
S102	540	360	6-Hour Controls
101102	517	345	6-Hour Controls
S103	455	307	6-Hour Controls
C102L	856	627	6-Hour Controls
C102	1769	1464	6-Hour Controls
102103	1725	1435	6-Hour Controls
S104	1137	870	6-Hour Controls
C103R	2330	2058	6-Hour Controls
S105	547	387	6-Hour Controls
C103	2671	2424	6-Hour Controls
103104	2630	2394	6-Hour Controls
S106	686	470	6-Hour Controls
C104	2892	2682	6-Hour Controls
104105	2854	2643	6-Hour Controls
S107	789	618	6-Hour Controls
C105L	3193	3031	6-Hour Controls
S200	1379	1067	6-Hour Controls
200201	1344	1048	6-Hour Controls
S201	603	387	6-Hour Controls
C201	1669	1396	6-Hour Controls
201203	1629	1373	6-Hour Controls
S202	274	159	6-Hour Controls
202203	263	156	6-Hour Controls
S203	417	280	6-Hour Controls
C203R	1954	1746	6-Hour Controls
S204	1126	880	6-Hour Controls
C203	2627	2589	6-Hour Controls
203204	2617	2574	6-Hour Controls
S205	561	369	6-Hour Controls

Table 3-16 (continued)

Summary of HEC-1 model results of the controlling storm duration

HEC-1 ID (1)	100-Year Peak Discharge 6-Hour cfs (2)	100-Year Peak Discharge 24-Hour cfs (3)	Controlling Storm Duration (4)
C204	2913	2913	6-Hour Controls
204205	2883	2844	6-Hour Controls
S206	760	581	6-Hour Controls
C205L	3345	3378	24-Hour Controls
S207	863	674	6-Hour Controls
C205	3870	3995	24-Hour Controls
205206	3747	3802	24-Hour Controls
S208	1004	804	6-Hour Controls
C206	4325	4421	24-Hour Controls
206207	4291	4372	24-Hour Controls
S209	888	624	6-Hour Controls
C207R	4471	4573	24-Hour Controls
S210	774	496	6-Hour Controls
C207	4528	4651	24-Hour Controls
207105	4466	4562	24-Hour Controls
S211	650	428	6-Hour Controls
C105R	4567	4684	24-Hour Controls
C105	6840	7297	24-Hour Controls
S300	710	499	6-Hour Controls
S301	1216	959	6-Hour Controls
C300	1665	1433	6-Hour Controls
300301	1631	1401	6-Hour Controls
S302	742	481	6-Hour Controls
C301	1985	1787	6-Hour Controls
301302	1915	1708	6-Hour Controls
S303	901	651	6-Hour Controls
C302	2203	2042	6-Hour Controls
302303	2180	2017	6-Hour Controls
S304	791	596	6-Hour Controls
C303	2567	2414	6-Hour Controls
WEST-1	8330	9221	24-Hour Controls
S400	1212	967	6-Hour Controls
C400O	500	453	6-Hour Controls
400401	498	452	6-Hour Controls

Table 3-16 (continued)

Summary of HEC-1 model results of the controlling storm duration

HEC-1 ID (1)	100-Year Peak Discharge 6-Hour cfs (2)	24-Hour cfs (3)	Controlling Storm Duration (4)
S401	769	549	6-Hour Controls
C401	913	808	6-Hour Controls
401402	895	789	6-Hour Controls
S402	951	705	6-Hour Controls
C402	1292	1115	6-Hour Controls
402403	1256	1077	6-Hour Controls
S403	617	444	6-Hour Controls
C403	1572	1362	6-Hour Controls
403404	1557	1351	6-Hour Controls
S404	651	383	6-Hour Controls
C404	1556	1352	6-Hour Controls
WEST-2	9010	10222	24-Hour Controls
S500	914	731	6-Hour Controls
500501	901	718	6-Hour Controls
S501	844	582	6-Hour Controls
C501	1250	1041	6-Hour Controls
501502	1235	1028	6-Hour Controls
S502	704	449	6-Hour Controls
C502L	1392	1174	6-Hour Controls
S503	1285	1009	6-Hour Controls
C502I	2246	2088	6-Hour Controls
C502O	1982	1829	6-Hour Controls
502505	1953	1800	6-Hour Controls
S504	219	154	6-Hour Controls
C505L	2057	1927	6-Hour Controls
S505	382	202	6-Hour Controls
C503O	97	89	6-Hour Controls
503505	95	87	6-Hour Controls
S506	318	190	6-Hour Controls
C504O	93	84	6-Hour Controls
504505	93	83	6-Hour Controls
S507	811	590	6-Hour Controls
C505R	876	712	6-Hour Controls
C505	2513	2420	6-Hour Controls

Table 3-16 (continued)

Summary of HEC-1 model results of the controlling storm duration

HEC-1 ID (1)	100-Year Peak Discharge 6-Hour cfs (2)	100-Year Peak Discharge 24-Hour cfs (3)	Controlling Storm Duration (4)
505509	2459	2368	6-Hour Controls
S508	418	279	6-Hour Controls
C509L	2509	2425	6-Hour Controls
S509	420	235	6-Hour Controls
C506O	93	87	6-Hour Controls
506508	93	87	6-Hour Controls
S510	195	133	6-Hour Controls
C508R	279	214	6-Hour Controls
S511	777	484	6-Hour Controls
C507O	98	95	6-Hour Controls
507508	98	95	6-Hour Controls
S512	306	211	6-Hour Controls
C508L	372	286	6-Hour Controls
C508	601	493	6-Hour Controls
508509	557	463	6-Hour Controls
S513	487	376	6-Hour Controls
C509R	945	830	6-Hour Controls
C509	3191	3160	6-Hour Controls
509510	3175	3145	6-Hour Controls
S514	626	462	6-Hour Controls
C510	3486	3455	6-Hour Controls
510511	3413	3379	6-Hour Controls
S515	1268	1040	6-Hour Controls
C511	3779	3737	6-Hour Controls
511512	3711	3662	6-Hour Controls
S516	429	303	6-Hour Controls
C512	3775	3744	6-Hour Controls
WEST-3	9962	11731	24-Hour Controls
S600	1843	1804	6-Hour Controls
600601	1823	1778	6-Hour Controls
S601	1460	1116	6-Hour Controls
C601	2625	2687	24-Hour Controls
601602	2597	2651	24-Hour Controls

Table 3-16 (continued)

Summary of HEC-1 model results of the controlling storm duration

HEC-1 ID (1)	100-Year Peak Discharge 6-Hour cfs (2)	24-Hour cfs (3)	Controlling Storm Duration (4)
S603	1467	972	6-Hour Controls
C602L	3040	3097	24-Hour Controls
S602	1882	1738	6-Hour Controls
C602	4393	4746	24-Hour Controls
602603	4278	4583	24-Hour Controls
S606	910	651	6-Hour Controls
C603L	4628	4966	24-Hour Controls
S605	1250	1008	6-Hour Controls
S604	1924	1851	6-Hour Controls
C603	6527	7308	24-Hour Controls
603604	6391	7114	24-Hour Controls
S609	564	393	6-Hour Controls
C604R	6592	7372	24-Hour Controls
S607	947	713	6-Hour Controls
C604	6994	7817	24-Hour Controls
604605	6964	7773	24-Hour Controls
S608	976	638	6-Hour Controls
C605	7133	7954	24-Hour Controls
605606	7049	7845	24-Hour Controls
S610	730	510	6-Hour Controls
C606L	7321	8146	24-Hour Controls
S612	954	719	6-Hour Controls
C606	7694	8535	24-Hour Controls
606608	7687	8520	24-Hour Controls
S611	1068	699	6-Hour Controls
607608	968	662	6-Hour Controls
S613	1579	1406	6-Hour Controls
C608	8797	9840	24-Hour Controls
608609	8718	9748	24-Hour Controls
S614	1033	831	6-Hour Controls
C609	9109	10248	24-Hour Controls
609611	8980	10067	24-Hour Controls
S617	896	635	6-Hour Controls

Table 3-16 (continued)

Summary of HEC-1 model results of the controlling storm duration

HEC-1 ID (1)	100-Year Peak Discharge 6-Hour cfs (2)	100-Year Peak Discharge 24-Hour cfs (3)	Controlling Storm Duration (4)
C611R	9093	10241	24-Hour Controls
S615	1313	1027	6-Hour Controls
610611	1286	1001	6-Hour Controls
S616	360	248	6-Hour Controls
C611L	1491	1210	6-Hour Controls
C611	9785	11048	24-Hour Controls
611613	9764	11000	24-Hour Controls
S618	1048	818	6-Hour Controls
C613R	9959	11263	24-Hour Controls
S619	1395	1040	6-Hour Controls
612613	1333	1007	6-Hour Controls
S620	613	414	6-Hour Controls
C613L	1716	1389	6-Hour Controls
C613	10389	11746	24-Hour Controls
613614	10352	11667	24-Hour Controls
S621	1316	1009	6-Hour Controls
C614	10339	11709	24-Hour Controls
614615	10264	11625	24-Hour Controls
S622	808	628	6-Hour Controls
C615	10371	11824	24-Hour Controls
WEST-4	16726	21626	24-Hour Controls
S700	716	497	6-Hour Controls
S701	518	382	6-Hour Controls
S702	335	222	6-Hour Controls
S703	400	257	6-Hour Controls
S704	757	472	6-Hour Controls
704705	668	438	6-Hour Controls
S705	980	733	6-Hour Controls
C705	1418	1146	6-Hour Controls
C705O	689	622	6-Hour Controls
705OAF	688	621	6-Hour Controls
S705AF	351	237	6-Hour Controls
C705AF	772	712	6-Hour Controls

Table 3-16 (continued)

Summary of HEC-1 model results of the controlling storm duration

HEC-1 ID (1)	100-Year Peak Discharge 6-Hour cfs (2)	100-Year Peak Discharge 24-Hour cfs (3)	Controlling Storm Duration (4)
WEST-5	1882	1681	6-Hour Controls
S706	825	610	6-Hour Controls
S707	728	528	6-Hour Controls
S728	286	196	6-Hour Controls
WEST	17327	22813	24-Hour Controls
S708	1336	969	6-Hour Controls
S709	903	609	6-Hour Controls
C709O	411	362	6-Hour Controls
709710	410	361	6-Hour Controls
S710	298	179	6-Hour Controls
C710I	524	433	6-Hour Controls
C710O	408	376	6-Hour Controls
S711	483	282	6-Hour Controls
C711O	181	156	6-Hour Controls
711712	181	156	6-Hour Controls
S712	238	132	6-Hour Controls
C712I	371	259	6-Hour Controls
C712O	245	206	6-Hour Controls
712714	244	206	6-Hour Controls
S713	326	189	6-Hour Controls
C713O	179	131	6-Hour Controls
713714	179	131	6-Hour Controls
S714	163	96	6-Hour Controls
C714	543	416	6-Hour Controls
S715	450	302	6-Hour Controls
S716	1625	1328	6-Hour Controls
C716O	618	572	6-Hour Controls
716717	617	572	6-Hour Controls
S717	867	511	6-Hour Controls
C717	881	739	6-Hour Controls
717718	785	670	6-Hour Controls
S718	476	333	6-Hour Controls
C718	1158	989	6-Hour Controls

Table 3-16 (continued)

Summary of HEC-1 model results of the controlling storm duration

HEC-1 ID (1)	100-Year Peak Discharge 6-Hour cfs (2)	100-Year Peak Discharge 24-Hour cfs (3)	Controlling Storm Duration (4)
S719	242	165	6-Hour Controls
EAST-1	3044	2732	6-Hour Controls
S720	652	443	6-Hour Controls
S721	866	521	6-Hour Controls
C721O	253	214	6-Hour Controls
721722	251	212	6-Hour Controls
S722	1279	1019	6-Hour Controls
C722	1384	1123	6-Hour Controls
S723	216	131	6-Hour Controls
S724	1788	1462	6-Hour Controls
S725	1153	946	6-Hour Controls
EAST-2	3954	3751	6-Hour Controls
S726	860	484	6-Hour Controls
726727	772	454	6-Hour Controls
S727	519	361	6-Hour Controls
C727	1132	796	6-Hour Controls
TOTAL	19685	25792	24-Hour Controls

Table 3-17

Summary of peak discharges for the Rational Method subbasins

Subbasin ID (1)	100-yr Peak Discharge cfs (2)
R100	158
R101	198
R102	220
R103	363
R104	282
R105	95
R106	288
R107	427
R108	638
R109	249
R110	231
R111	378
R112	352
R113	152
R114	304
R115	391
R116	135
R117	62
R118	97
R119	114
R120	205
R121	322
R122	217
R123	114
R124	131
R125	174

3.6.2 Comparison with Previous Studies within the Watershed

Two studies establishing the current FIS peak discharges along Morgan City Wash, Caterpillar Tank Wash and Twin Buttes Wash including tributaries are briefly summarized as follows:

1. Morgan City Wash FDS, FCD 89-15, conducted by Michael Baker Jr, Inc. 1989. Peak

discharges were computed for the 100-year, 2-, 6- and 24-hour storms using the SCS Type II rainfall distribution, with rainfall depths for the 6- and 24-hour durations of 3.4 and 4.5 inches, respectively. The SCS dimensionless hydrograph in combination with the initial loss and uniform loss rate method was used for runoff hydrograph development. Runoff hydrographs were routed using the Muskingum method.

2. C.A.P. Overchutes, Agua Fria River Floodplain Delineation Study; Maricopa County, Arizona, FCD 90-09, conducted by AGK Engineers, Inc., 1991. Peak discharges were computed for the 100-year, 6- and 24-hour storms. Rainfall depths of 3.32 and 4.14 inches for the 6- and 24-hour durations, respectively were modeled with the distributions prescribed by the Design Manual. The Clark Unit Hydrograph in combination with the Green and Ampt infiltration equation were used for runoff hydrograph development. Runoff hydrographs were routed using the normal depth option of the Modified Puls channel storage routing method.

The extents of these studies are shown in relation to the NPADMP watershed limits in Figure 3-3. Also shown on this figure are the floodplain limits established as part of those studies. Table 3-18 summarizes and compares the 100-year peak discharges estimated as part of the previous studies to the results of this study at common locations. Column 1of Table 3-18 is the HEC-1 identifier for this study. Column 2 is the corresponding identifier from either the Morgan City Wash FDS or the C.A.P. Overchutes, Agua Fria River FDS. HEC-1 identifiers relating to the Morgan City Wash FDS are within the S600 series alpha-numeric range. The remaining identifiers correspond to the C.A.P. Overchutes, Agua Fria River FDS. In general, the 100-year peak discharges estimated for this study are less than those for the Morgan City Wash study and greater than those for the C.A.P. Overchutes study. The following discussion summarizes reasons for these differences.

Figure 3-3

Watershed Map

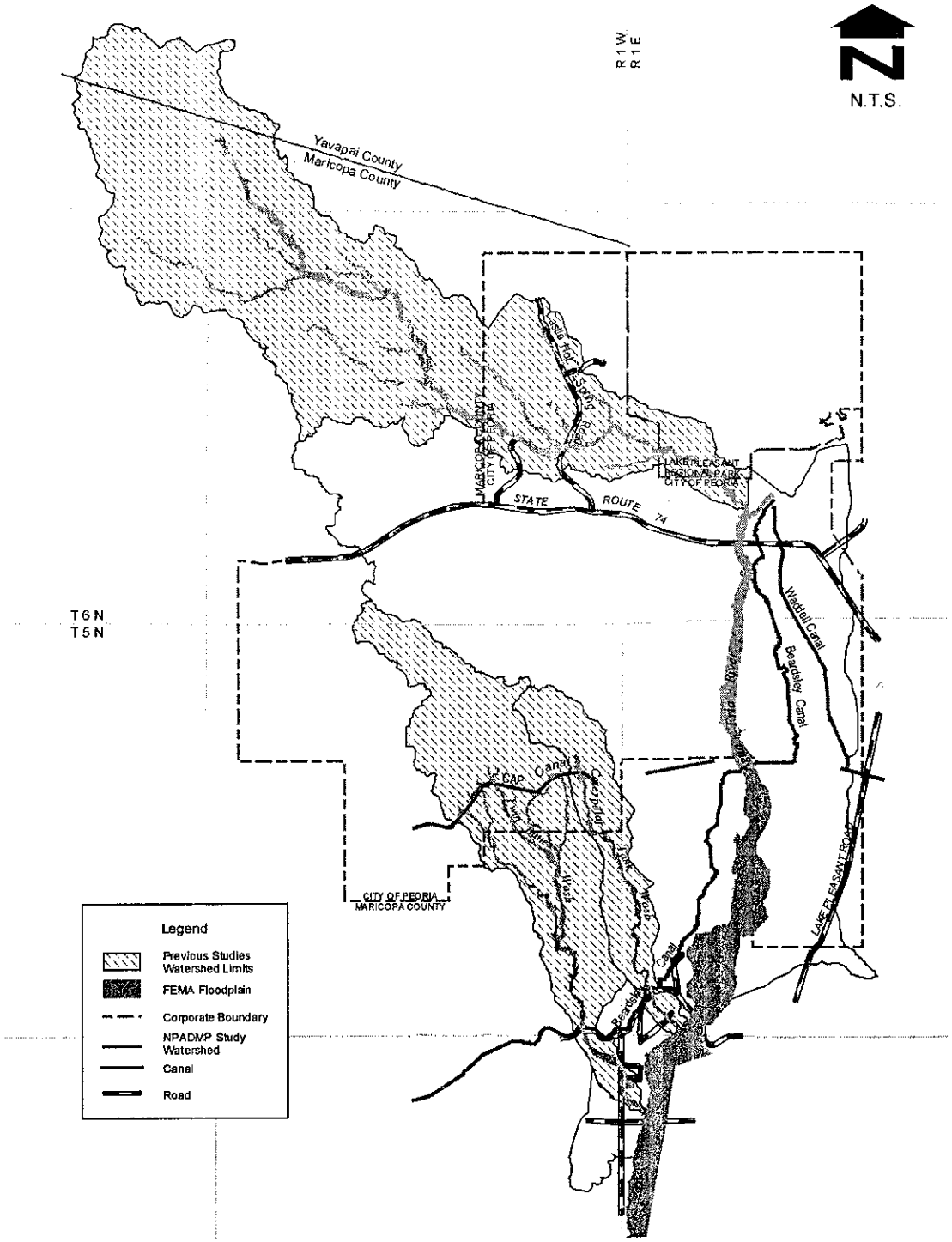


Table 3-18

Comparison with previous studies

HEC-1 ID		100-Year Peak Discharges, in cfs	
This Study (1)	Previous Study (2)	This Study (3)	Previous Study (4)
S400	SA19	1,212	1,446
C400O	EACAP	500	489
C401	EB	913	970
C402	EC	1,292	1,295
C403	ED	1,572	1,375
C404	EE	1,556	1,315
S500	SA01	914	1,176
C501	B	1,250	1,752
C502I	C	2,246	2,659
C502O	CCAP	1,982	2,154
C505	E	2,513	2,462
C509	J	3,191	2,776
C510	K	3,486	2,826
C511	M	3,779	2,779
C512	N	3,775	2,746
S600	M1	1,804	3,173
C602	CO-2	4,746	4,817
C603	CO-4	7,308	10,868
C608	CO-7	9,840	13,863
C611	CO-9	11,048	14,155
C613	CO-11	11,746	14,441
C614	CO-12	11,709	14,168

The reductions in the 100-year peak discharges estimated by this study, as compared to those of the Morgan City Wash study, are due to differences in modeling techniques. The increases in the 100-year peak discharges estimated by this study, as compared to those of the C.A.P. Overchutes FIS, are primarily due to differences in the interpretation of the soils report, particularly in regard to the XKSAT variable. In the previous study, selection of the XKSAT variable is primarily based on the general description of the individual soil map units without consideration for the horizon depth of the separate sub units. For example, soil map unit 45 has

a general description of gravelly loam, however, the soil description for the first 10 inches of the horizon is a clay soil.

3.6.3 Conclusion

In general, the modeled results compare favorably to the various indirect verification methods. The results are also considered reasonable in comparison to the two previous studies given the changes in modeling techniques and data interpretation. Therefore, there is no reason to doubt the results of this study.

The purpose of the hydrologic phase of this study is to compute 100-year discharges at key locations in the watershed for floodplain/floodway delineation, erosion hazard boundary delineation and to provide general baseline data for the anticipation of potential flooding problems that can be expected as a result of future development within the watershed. Secondary uses of the hydrologic results, such as for development projects and drainage improvement designs should consider that the modeling input parameters may not be appropriate for storm frequencies other than the 100-year event.

3.7 Final Modeling Results on Diskette

The CD containing the HEC-1 files for this project is provided in Appendix O. An ASCII text file named README.DOC is included on the CD and summarizes the files and filenames provided.

SECTION 4: HYDRAULIC ANALYSIS

4.1 Method Description

Hydraulic analysis is performed in accordance with the guidelines and specifications set forth in FEMA 37, Flood Insurance Study Guidelines and Specifications for study contractors and State Standards 2-91, Requirement for Floodplain Delineation in Riverine Environmentalists. Detailed floodplain and floodway limits are determined for three separate unnamed watercourses totaling approximately 18 miles. The flooding limits for these watercourses are determined using the COE HEC-RAS Computer Program, version 3.0, dated January 2001. Approximate method floodplains are determined for several unnamed watercourses totaling approximately 18 miles. The flooding limits for these watercourses are based on a normal depth analysis using the Manning's equation. Re-delineation is not performed for the existing Flood Insurance Study limits, Twin Buttes Wash, Caterpillar Wash and Morgan City Wash.

With the exception of Morgan City Wash, Twin Buttes Wash and Caterpillar Tank Wash all of the study watercourses are currently unnamed, therefore arbitrary names are assigned for documentation purposes. The location of these watercourses and the assigned names are shown in Figure 1-3.

Starting water surface elevations for both the floodplain and floodway profiles for the detailed study reaches of Unnamed Washes 2 and 3 are computed using the normal depth option of HEC-RAS. This method requires the input of the energy slope downstream of the first cross section. The input values for these two watercourses was determined by first running the model with the starting water surface elevation set to critical depth. The resulting slope of the energy grade line for the first three cross sections of each wash were averaged to obtain the input values for the normal depth option. The normal depth option is used as the starting condition for Unnamed Washes 2 and 3 as they are tributary to the Agua Fria River and the hydrologic conditions are such that peak discharges are not coincident. The starting water surface elevation for both the floodplain and floodway profiles of Unnamed Wash 1 are interpolated from the bounding cross sections of

Unnamed Wash 2 immediately upstream and downstream of the confluence with Unnamed Wash 1.

Floodway limits are initially determined using the Method 4, equal conveyance encroachment option of HEC-RAS. Those floodway limits are converted to the Method 1 encroachment option and refined as necessary.

4.2 Parameter Estimation

4.2.1 Manning's n-Value

4.2.1.1 General

Detailed and approximate method hydraulic analyses are conducted for several washes within the project area. Each wash is divided into reaches that have similar hydraulic characteristics, and therefore have similar Manning's n-values. The "Manning's n-Value Photo Location Map for Detailed and Zone A Delineations" (located in Appendix J) shows the location and limit of each wash, wash reach and locations of photographs representing typical reach characteristics. Photographs, and Manning's n-value calculation sheets are also provided in Appendix J.

4.2.1.2 Methodology

In order to estimate Mannings n-values for the study watercourses physical characteristics for each watercourse are identified through field observations and examination of ground and aerial photographs as well as examination of topographic mapping. The discerning characteristics recorded are channel size and shape, bed material, vegetation density, presence of meanders or channel bends and the presence or absence of channel obstructions. Detail and approximate method study watercourses were viewed on foot during field reconnaissance and each reach was photographed at representative locations.

Manning's n-values are estimated using the methods set forth in the U.S. Geological Survey (USGS) publication Estimated Manning's n-Values for Stream Channels and Flood Plains in Maricopa County Arizona (USGS, 1991) and Channel Subdivision and Bank Selection In Open Channels (draft April 23, 1999). The method cited in the

USGS publication and the method used for this study involves the selection of an initial value of Manning's n-value based upon the channel bed material and then adjusting that value for channel irregularities, effects of obstructions, vegetation and channel cross sectional variations. If the channel has sufficient meander to increase roughness, then the sum of the base n-value plus subsequent adjustments is multiplied by a meander value, m.

4.2.1.3 Manning's n-Value Determination

The base n-value for the bed material roughness is estimated from field investigations. A 1-foot square grid (grid on 1-inch centers) is utilized for the estimation of the average size of bed material. Adjustment of the base n-value is then made based on vegetation present in the channel and the overbanks, field assessment of the channel bank conditions and the impact of any obstructions as well as a review of the cross sectional plots for variations in channel geometry.

The study watercourses are characterized by channels with little or no vegetation within the bottom width of the channel. Bottom width dimensions range from 20 to 50 feet for the detailed study reaches and 15 to 25 feet for the approximate method reaches. The study watercourses are also characterized by steep channel side slopes (2:1 (horizontal to vertical) or greater) that typically are lined with vegetation. The average channel bed material size ranges from gravel to cobbles. At some locations bed material will also consist of a boulder component. In general, the watercourses are deeply incised with well defined banks. Overbank areas are either ill defined or are nonexistent. Where overbank areas are present, the area can be characterized as having bed material ranging in size from firm soil to course sand and in some cases a gravel and cobble component exists. Overbank areas are typically vegetated with the canopy of the larger trees and bushes extending to the ground.

Base n-values for each watercourse and/or reach of each watercourse are estimated from the average size of the channel bed and overbank bed material. Adjustments to the channel base n-value are then made to account for channel irregularity, effects of obstruction, effects of vegetation, variations in channel cross section and degree of

meandering. The greatest adjustment to the base n-value is from the effect of vegetation. For overbank areas an adjustment of 0.025 is made to the base n-value to account for the effects of vegetation. Vegetation within the channel generally occurs along the side slopes, therefore a composite n-value is estimated for channel segment that is representative of the vegetated side slopes and the non-vegetated bottom width. The difference between the composite n-value and the base n-value is then coded as the channel vegetation adjustment in the calculation sheets. Composite n-values are estimated for a typical channel section using Equation 6-17 from Open Channel Hydraulics (1959). That equation is:

$$n = \left[\frac{(P_1 n_1 + P_2 n_2 + P_3 n_3)^{1.5}}{P} \right]^{2/3}$$

where: P = total wetted perimeter of the channel;

P_1 = wetted perimeter of the channel bottom;

$P_{2,3}$ = wetted perimeter of the channel side slopes;

n_1 = Manning's n-value of the channel bottom; and

$P_{2,3}$ = Manning's n-value of the channel side slopes.

The typical channel section is estimated for both the detailed and approximate method reaches based on an inspection of the cross section plots. The typical section is determined to be trapezoidal with 2:1 (horizontal to vertical) side slopes with average channel bottom widths of 35 feet for the detailed method reaches and 20 feet for the approximate method reaches. Average depths of flow for the estimation of the wetted perimeter are assumed to be 5 feet for the detail study reaches and 3 feet for the approximate method study reaches. A channel side slope n-value of 0.050 is used along with the base n-value estimated for each watercourse reach to determine a composite n-value.

The degree of channel irregularity (physical characteristics of the side slopes) ranges between smooth and moderate, adjustments of 0.001 and 0.005 are made for the smooth and moderate reaches, respectively. The effects of obstructions category is

used to adjust the base n-value for the presence of boulders in the channel. An adjustment value of 0.005 is used for all reaches that are characterized with a bolder component to the channel bed material size. Variations in channel cross section are typically gradual therefore no adjustment is made. At a number of locations for each wash appreciable and severe meanders occur. The sum of the base n-value plus subsequent n-value adjustments is multiplied by a value of 1.15 or 1.3 for appreciable and severe meanders, respectively.

Calculation sheets listing the estimated base n-values and adjustments to that value for each reach of each study watercourse are provided in Appendix J. Manning's n-values determined for Unnamed Washes 1, 2 and 3 are listed in Tables 4-1, 4-2 and 4-3, receptively. Manning's n-values for the approximate method study reaches are listed in Table 4-4.

Table 4-1

Manning's n-values for Unnamed Wash 1

Reach	River Station miles	Manning's n-Value Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
Reach 3	6.311	0.050	0.040	0.060	
	6.216	0.050	0.040	0.060	
	6.100	0.050	0.040	0.060	
	6.015	0.050	0.040	0.060	
	5.969	0.060	0.045	0.070	Appreciable Meander
	5.917	0.060	0.045	0.070	Appreciable Meander
	5.862	0.050	0.040	0.060	
	5.746	0.050	0.040	0.060	
	5.632	0.050	0.040	0.060	
	5.505	0.050	0.040	0.060	
	5.439	0.060	0.045	0.070	Appreciable Meander
	5.380	0.050	0.040	0.060	
	5.310	0.050	0.040	0.060	
	5.227	0.060	0.045	0.070	Appreciable Meander
	5.207	0.060	0.045	0.070	Appreciable Meander
	5.176	0.050	0.040	0.060	
	5.096	0.050	0.040	0.060	
	5.007	0.050	0.040	0.060	
	4.920	0.050	0.040	0.060	
	4.879	0.060	0.045	0.070	
	4.839	0.050	0.040	0.060	
	4.725	0.050	0.040	0.060	
	4.628	0.050	0.040	0.060	
	4.613	0.050	0.040	0.060	
	4.536	0.060	0.040	0.060	
	4.436	0.050	0.040	0.060	
	4.412	0.050	0.040	0.060	
	4.361	0.050	0.040	0.060	
	4.256	0.050	0.040	0.060	
	3.671	0.050	0.040	0.060	
	3.643	0.050	0.040	0.060	
	3.631	N/A	N/A	N/A	Inline Weir
	3.617	0.050	0.040	0.060	
	3.577	0.050	0.040	0.060	

Table 4-1 (continued)

Manning's n-values for Unnamed Wash 1

Reach	River Station miles	Manning's n-Value Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
	3.515	0.050	0.040	0.060	
	3.453	0.050	0.040	0.060	
	3.366	0.050	0.040	0.060	
	3.274	0.050	0.040	0.060	
	3.186	0.050	0.040	0.060	
Reach 2	3.121	0.060	0.065	0.070	Appreciable Meander
	3.073	0.060	0.065	0.070	Appreciable Meander
	3.015	0.055	0.055	0.055	
	2.923	0.055	0.055	0.055	
	2.880	0.060	0.060	0.060	Appreciable Meander
	2.848	0.060	0.060	0.060	Appreciable Meander
	2.813	0.060	0.060	0.060	Appreciable Meander
	2.770	0.055	0.055	0.055	
	2.674	0.060	0.060	0.060	Appreciable Meander
	2.611	0.060	0.060	0.060	Appreciable Meander
	2.557	0.055	0.055	0.055	
	2.467	0.055	0.055	0.055	
	2.390	0.070	0.070	0.070	Severe Meander
	2.347	0.070	0.070	0.070	Severe Meander
	2.312	0.050	0.055	0.060	
	2.230	0.050	0.055	0.060	
	2.134	0.055	0.055	0.055	
	2.047	0.055	0.055	0.055	
	1.992	0.060	0.060	0.060	Appreciable Meander
	1.928	0.060	0.060	0.060	Appreciable Meander
	1.862	0.060	0.060	0.060	Appreciable Meander
	1.768	0.060	0.060	0.060	Appreciable Meander
	1.709	0.060	0.060	0.060	Appreciable Meander
	1.675	0.060	0.060	0.060	Appreciable Meander
	1.637	0.060	0.060	0.060	Appreciable Meander
	1.621	0.055	0.055	0.055	
	1.590	0.055	0.055	0.055	
	1.479	0.055	0.055	0.055	
	1.398	0.055	0.055	0.055	
	1.374	0.055	0.055	0.055	
	1.367	0.055	0.055	0.055	

Table 4-1 (continued)

Manning's n-values for Unnamed Wash 1

Reach	River Station miles	Manning's n-Value Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
	1.286	0.055	0.055	0.055	
	1.208	0.055	0.055	0.055	
	1.116	0.055	0.055	0.055	
	1.010	0.055	0.055	0.055	
	0.914	0.055	0.055	0.055	
	0.850	0.055	0.055	0.055	
	0.819	0.055	0.055	0.055	
	0.724	0.055	0.055	0.055	
	0.644	0.055	0.055	0.055	
Reach 1	0.575	0.060	0.045	0.060	Appreciable Meander
	0.547	0.060	0.045	0.060	Appreciable Meander
	0.523	0.060	0.045	0.060	Appreciable Meander
	0.484	0.050	0.040	0.050	
	0.453	0.050	0.040	0.050	
	0.414	0.065	0.050	0.065	Severe Meander
	0.356	0.050	0.040	0.050	
	0.323	0.050	0.040	0.050	
	0.238	0.050	0.040	0.050	
	0.190	0.050	0.040	0.050	
	0.141	0.050	0.040	0.050	
	0.046	0.050	0.040	0.050	

Table 4-2

Manning's n-values for Unnamed Wash 2

Reach	River Station miles	Manning's n-Value: Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
Reach 3	6.789	0.055	0.040	0.055	
	6.765	0.055	0.040	0.055	
	6.714	0.055	0.040	0.055	
	6.669	0.055	0.040	0.055	
	6.643	0.055	0.040	0.055	
	6.595	0.055	0.040	0.055	
	6.570	0.055	0.040	0.055	
	6.501	0.055	0.040	0.055	
	6.451	0.055	0.040	0.055	
	6.418	0.055	0.040	0.055	
	6.392	0.055	0.040	0.055	
	6.318	0.055	0.040	0.055	
	6.271	0.055	0.040	0.055	
	6.218	0.055	0.040	0.055	
	6.161	0.055	0.040	0.055	
	6.058	0.055	0.040	0.055	
	5.974	0.055	0.040	0.055	
	5.927	0.055	0.040	0.055	
	5.865	0.055	0.040	0.055	
	5.845	0.070	0.050	0.070	Severe Meander
	5.759	0.055	0.040	0.055	
	5.702	0.055	0.040	0.055	
	5.624	0.055	0.040	0.055	
Reach 2	5.551	0.050	0.040	0.050	
	5.508	0.050	0.040	0.050	
	5.460	0.050	0.040	0.050	
	5.364	0.050	0.040	0.050	
	5.304	0.050	0.040	0.050	
	5.266	0.050	0.040	0.050	
	5.172	0.050	0.040	0.050	
	5.114	0.050	0.040	0.050	
	5.079	0.050	0.040	0.050	
	4.974	0.060	0.045	0.060	Appreciable Meander
	4.939	0.050	0.040	0.050	
	4.884	0.050	0.040	0.050	
	4.784	0.050	0.040	0.050	

Table 4-2 (continued)

Manning's n-values for Unnamed Wash 2

Reach	River Station miles	Manning's n-Value: Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
	4.692	0.050	0.040	0.050	
	4.640	0.050	0.040	0.050	
	4.600	0.050	0.040	0.050	
	4.502	0.065	0.050	0.065	Severe Meander
	4.430	0.065	0.050	0.065	Severe Meander
	4.391	0.065	0.050	0.065	Severe Meander
	4.365	0.065	0.050	0.065	Severe Meander
	4.332	0.050	0.040	0.050	
	4.286	0.050	0.040	0.050	
	4.199	0.050	0.040	0.050	
	4.102	0.050	0.040	0.050	
	4.072	0.050	0.040	0.050	
	4.013	0.050	0.040	0.050	
	3.961	0.050	0.040	0.050	
	3.923	0.050	0.040	0.050	
	3.874	0.050	0.040	0.050	
	3.825	0.050	0.040	0.050	
	3.770	0.050	0.040	0.050	
	3.725	0.065	0.050	0.065	Severe Meander
	3.698	0.065	0.050	0.065	Severe Meander
	3.660	0.065	0.050	0.065	Severe Meander
	3.643	0.065	0.050	0.065	Severe Meander
	3.618	0.050	0.040	0.050	
	3.590	0.050	0.040	0.050	
	3.523	0.050	0.040	0.050	
	3.426	0.050	0.040	0.050	
	3.311	0.050	0.040	0.050	
	3.211	0.050	0.040	0.050	
	3.122	0.050	0.040	0.050	
	3.053	0.050	0.040	0.050	
	3.033	0.050	0.040	0.050	
	3.007	0.050	0.040	0.050	
	2.976	0.050	0.040	0.050	
	2.934	0.050	0.040	0.050	
	2.903	0.050	0.040	0.050	
Reach 1	2.892	0.055	0.040	0.055	

Table 4-2 (continued)

Manning's n-values for Unnamed Wash 2

Reach	River Station miles	Manning's n-Value Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
	2.856	0.055	0.040	0.055	
	2.813	0.055	0.040	0.055	
	2.718	0.055	0.040	0.055	
	2.683	0.060	0.045	0.060	Appreciable Meander
	2.656	0.055	0.040	0.055	
	2.625	0.055	0.040	0.055	
	2.603	0.055	0.040	0.055	
	2.521	0.055	0.040	0.055	
	2.424	0.055	0.040	0.055	
	2.401	0.055	0.040	0.055	
	2.319	0.055	0.040	0.055	
	2.225	0.055	0.040	0.055	
	2.131	0.055	0.040	0.055	
	2.034	0.055	0.040	0.055	
	1.940	0.055	0.040	0.055	
	1.846	0.055	0.040	0.055	
	1.818	0.055	0.040	0.055	
	1.781	0.055	0.040	0.055	
	1.742	0.065	0.045	0.065	Appreciable Meander
	1.677	0.055	0.040	0.055	
	1.629	0.055	0.040	0.055	
	1.535	0.055	0.040	0.055	
	1.481	0.055	0.040	0.055	
	1.438	0.055	0.040	0.055	
	1.419	0.055	0.040	0.055	
	1.363	0.055	0.040	0.055	
	1.261	0.055	0.040	0.055	
	1.168	0.055	0.040	0.055	
	1.092	0.055	0.040	0.055	
	1.052	0.055	0.040	0.055	
	0.995	0.055	0.040	0.055	
	0.957	0.055	0.040	0.055	
	0.916	0.055	0.040	0.055	
	0.864	0.055	0.040	0.055	
	0.769	0.065	0.045	0.065	Appreciable Meander
	0.745	0.065	0.045	0.065	Appreciable Meander

Table 4-2 (continued)

Manning's n-values for Unnamed Wash 2

Reach	River Station miles	Manning's n-Value Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
	0.734	0.065	0.045	0.065	Appreciable Meander
	0.703	0.055	0.040	0.055	
	0.650	0.055	0.040	0.055	
	0.625	0.055	0.040	0.055	
	0.610	0.055	0.040	0.055	
	0.589	0.055	0.040	0.055	
	0.537	0.055	0.040	0.055	
	0.441	0.055	0.040	0.055	
	0.348	0.055	0.040	0.055	
	0.309	0.055	0.040	0.055	
	0.252	0.055	0.040	0.055	
	0.205	0.055	0.040	0.055	

Table 4-3

Manning's n-values for Unnamed Wash 3

Reach	River Station miles	Manning's n-Value Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
Reach 5	4.540	0.050	0.045	0.050	
	4.464	0.050	0.045	0.050	
	4.428	0.060	0.050	0.060	Appreciable Meander
	4.417	0.060	0.050	0.060	Appreciable Meander
	4.399	0.060	0.050	0.060	Appreciable Meander
	4.379	0.050	0.045	0.050	
	4.338	0.050	0.045	0.050	
	4.289	0.050	0.045	0.050	
	4.229	0.060	0.050	0.060	Appreciable Meander
	4.197	0.060	0.050	0.060	Appreciable Meander
	4.177	0.060	0.050	0.060	Appreciable Meander
	4.145	0.050	0.045	0.050	
	4.110	0.050	0.045	0.050	
	4.013	0.050	0.045	0.050	
	3.921	0.050	0.045	0.050	
	3.826	0.050	0.045	0.050	
	3.731	0.050	0.045	0.050	
	3.649	0.050	0.045	0.050	
	3.561	0.050	0.045	0.050	
Reach 4	3.520	0.065	0.050	0.065	Severe Meander
	3.509	0.065	0.050	0.065	Severe Meander
	3.497	0.065	0.050	0.065	Severe Meander
	3.487	0.065	0.050	0.065	Severe Meander
	3.460	0.050	0.040	0.050	
	3.426	0.050	0.040	0.050	
	3.412	0.060	0.045	0.060	Appreciable Meander
	3.370	0.060	0.045	0.060	Appreciable Meander
	3.351	0.060	0.045	0.060	Appreciable Meander
	3.319	0.060	0.045	0.060	Appreciable Meander
	3.309	0.050	0.040	0.050	
	3.257	0.050	0.040	0.050	
	3.168	0.060	0.045	0.060	Appreciable Meander
	3.144	0.060	0.045	0.060	Appreciable Meander
	3.114	0.050	0.040	0.050	
	3.061	0.065	0.050	0.065	Severe Meander
	3.042	0.065	0.050	0.065	Severe Meander
	3.015	0.065	0.050	0.065	Severe Meander

Table 4-3 (continued)

Manning's n-values for Unnamed Wash 3

Reach	River Station miles	Manning's n-Value: Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
	2.984	0.050	0.040	0.050	
	2.916	0.050	0.040	0.050	
	2.850	0.050	0.040	0.050	
	2.779	0.050	0.040	0.050	
	2.677	0.050	0.040	0.050	
	2.581	0.050	0.040	0.050	
	2.522	0.050	0.040	0.050	
	2.471	0.050	0.040	0.050	
	2.421	0.050	0.040	0.050	
	2.315	0.050	0.040	0.050	
	2.233	0.050	0.040	0.050	
	2.118	0.060	0.045	0.060	Appreciable Meander
	2.050	0.060	0.045	0.060	Appreciable Meander
	2.011	0.060	0.045	0.060	Appreciable Meander
	1.973	0.060	0.045	0.060	Appreciable Meander
	1.944	0.050	0.040	0.050	
	1.872	0.050	0.040	0.050	
	1.784	0.050	0.040	0.050	
	1.690	0.050	0.040	0.050	
	1.641	0.050	0.040	0.050	
	1.600	0.050	0.040	0.050	
	1.563	0.050	0.040	0.050	
	1.537	0.050	0.040	0.050	
	1.519	0.050	0.040	0.050	
	1.497	0.050	0.040	0.050	
	1.481	0.050	0.040	0.050	
Reach 3	1.425	0.070	0.070	0.070	Appreciable Meander
	1.385	0.070	0.070	0.070	Appreciable Meander
	1.356	0.070	0.070	0.070	Appreciable Meander
	1.331	0.070	0.070	0.070	Appreciable Meander
	1.304	0.060	0.060	0.060	
	1.259	0.060	0.060	0.060	
	1.222	0.060	0.060	0.060	
	1.171	0.060	0.060	0.060	
	1.152	0.060	0.060	0.060	
Reach 2	1.088	0.055	0.040	0.055	
	1.008	0.065	0.055	0.065	Appreciable Meander

Table 4-3 (continued)

Manning's n-values for Unnamed Wash 3

Reach	River Station miles	Manning's n-Value: Left Overbank	Channel	Right Overbank	Description
(1)	(2)	(3)	(4)	(5)	(6)
	0.986	0.065	0.055	0.065	Appreciable Meander
	0.960	0.065	0.055	0.065	Appreciable Meander
	0.928	0.055	0.040	0.055	
	0.852	0.055	0.040	0.055	
	0.761	0.065	0.045	0.065	Appreciable Meander
	0.734	0.065	0.045	0.065	Appreciable Meander
	0.716	0.065	0.045	0.065	Appreciable Meander
	0.695	0.065	0.045	0.065	
	0.658	0.055	0.040	0.055	
	0.625	0.070	0.050	0.070	Severe Meander
	0.598	0.070	0.050	0.070	Severe Meander
	0.583	0.070	0.050	0.070	Severe Meander
	0.565	0.055	0.040	0.055	
	0.520	0.055	0.040	0.055	
	0.481	0.055	0.040	0.055	
	0.386	0.055	0.040	0.055	
Reach 1	0.306	0.055	0.040	0.050	
	0.185	0.055	0.040	0.050	
	0.144	0.055	0.040	0.050	

Table 4-4

Mannings n-values for the approximate method study reaches

Wash Identification	Manning's n- Value Left Overbank[1]	Channel	Right Overbank[1]	Remarks
Tributary 1 to Unnamed Wash 1	N/A	0.040	N/A	
Unnamed Wash 2 Approximate Methods Reach	N/A	0.040	N/A	
Tributary 1 to Unnamed Wash 2	N/A	0.050	N/A	
Tributary 2 to Unnamed Wash 2	N/A	0.040	N/A	
Twin Buttes Approximate Methods Reach	N/A	0.040	0.050	Photo location PZA9
Twin Buttes Approximate Methods Reach	N/A	0.050	N/A	Photo location PZA8
Twin Buttes Approximate Methods Reach	N/A	0.040	0.055	Photo location PZA7
Caterpillar Tank Wash Approximate Method Reach	N/A	0.040	N/A	
Unnamed Wash 4 Reach 1	0.035	0.045	N/A	Photo location PZA17
Unnamed Wash 4 Reach 2	N/A	0.040	N/A	Photo location PZA11
Unnamed Wash 5	0.070	0.045	0.070	Photo location PZA12
Unnamed Wash 6	N/A	0.040	N/A	Photo location PZA13
Unnamed Wash 7	N/A	0.040	N/A	
Unnamed Wash 8	N/A	0.040	N/A	
Unnamed Wash 9	N/A	0.040	N/A	

Note:
1. N/A = Overbank is poorly defined, 0.050 is utilized when flow is not contained in the channel.

4.2.2 *Expansion and Contraction Coefficients*

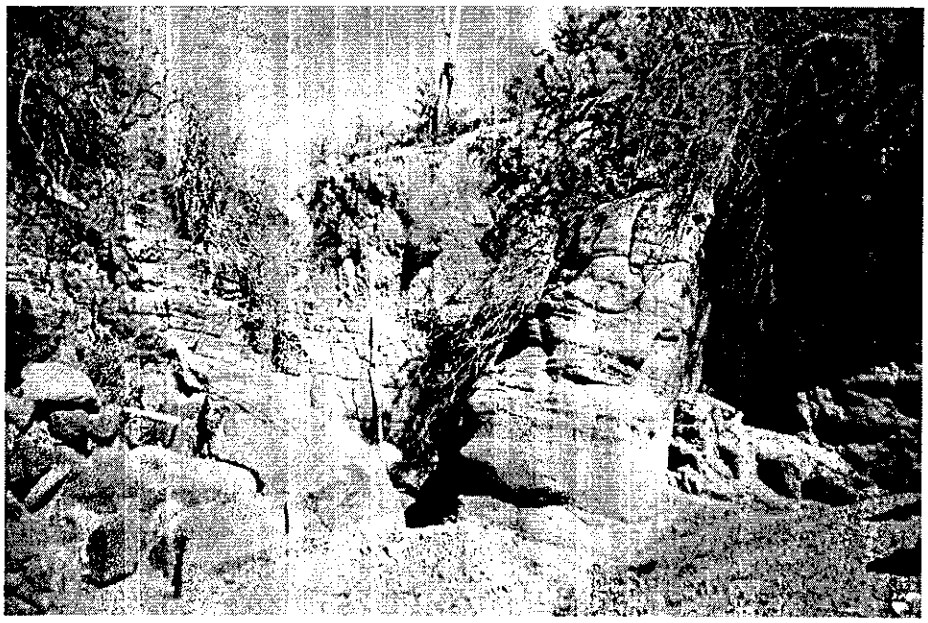
With the exception of a stock tank located at River Station (R.S.) 3.361 of Unnamed Wash 1, there are no culverts or other hydraulic structures located within the limits of the three detailed study reaches and, in general, the study reaches are relatively free of any abrupt transitions. Therefore, gradual contraction and expansion coefficients of 0.1 and 0.3, respectively, are used for the majority of this study. For the locations where the washes naturally contract and expand more severely, larger coefficients for contraction and expansion are selected. Guidance for the selection of appropriate coefficients is obtained from the HEC-RAS Hydraulic Reference Manual (January 2001). Tables summarizing the contraction and expansion coefficients for all river stations for each wash are included as part of the HEC-RAS model output provided in Appendix L.

4.2.3 Hydraulic Jump Analysis

There are several abrupt changes in channel slope along both the detailed and approximate method study watercourses. Figure 4-1 is a photograph of one of the more severe drops which is located on Unnamed Wash 1. For the detailed study reaches an evaluation was performed at each location where there may be a potential for a hydraulic jump. The evaluation involved modeling the study reaches in a mixed flow regime with interpolated cross sections between the cross sections where there is a potential for a hydraulic jump. The results of this evaluation indicate that the hydraulic conditions are not sufficient to form a hydraulic jump for the flows associated with the 100-year event. The potential for the occurrence of hydraulic jumps along the approximate method study reaches is not warranted for that level of study and is therefore not evaluated.

Figure 4- 1

Vertical drop on Unnamed Wash 1



4.3 Modeling Discharges

The watershed area contributing runoff to the study watercourses is only a portion of the total study watershed area for the NPADMP project. This area is shown in relation to the

total watershed study area on Figure 1-3 and Plate 1. The following tables summarize the peak discharges used in the hydraulic analysis of each study watercourse. A detailed discussion of the development of these discharges is provided in Section 3.

Table 4-5

100-year modeling discharges for Unnamed Wash 1

Flow Change Location	Modeling Peak Discharge cfs	HEC-1 Station Identifier	100-Year Peak Discharge 6-Hour cfs	100-Year Peak Discharge 24-Hour cfs
6.311	750	S100	746	512
5.862	1,190	C102R	1,185	967
4.613	2,330	C103R	2,330	2,058
3.015	2,890	C104	2,892	2,682
1.286	3,190	C105L	3,193	3,031

Table 4-6

100-year modeling discharges for Unnamed Wash 2

Flow Change Location	Modeling Peak Discharge cfs	HEC-1 Station Identifier	100-Year Peak Discharge 6-Hour cfs	100-Year Peak Discharge 24-Hour cfs
6.789	1,750*	C203R	1,954	1,746
6.161	2,910	C204	2,913	2,913
5.927	3,380	C205L	3,345	3,378
4.939	4,420	C206	4,325	4,421
2.625	4,570	C207R	4,471	4,573
1.629	4,680	C105R	4,567	4,687
0.252	7,300	C105	6,847	7,297

Note: * 24-hour peak discharge is used for consistency.

Table 4-7

100-year modeling discharges for Unnamed Wash 3

Flow Change Location	Modeling Peak Discharge cfs	HEC-1 Station Identifier	100-Year Peak Discharge 6-Hour cfs	24-Hour cfs
4.540	1,220	S301	1,216	959
4.197	1,990	C301	1,985	1,787
3.168	2,200	C302	2,203	2,042
1.641	2,570	C303	2,567	2,414

Table 4-8

100-year modeling discharges for the approximate method study reaches

River Reach	Flow Change Location	Modeling Peak Discharge	HEC-1 Station Identifier	100-Year Peak Discharge 6-Hour cfs	24-hour cfs
Tributary 1 to Unnamed Wash 1	A-A	860	C102L	856	627
Unnamed Wash 2	F-F	1380	S200	1379	1067
Unnamed Wash 2	A-A	1670	C201	1669	1396
Tributary 1 to Unnamed Wash 2	A-A	860	S207	863	674
Tributary 2 to Unnamed Wash 2	A-A	1130	S204	1126	880
Twin Buttes Wash	F-F	1250	C501	1250	1041
Twin Buttes Wash	A-A	1390	C502L	1392	1174
Caterpillar Tank Wash	A-A	1210	S400	1212	967
Unnamed Wash 4	A-A	1420	C705	1418	1146
Unnamed Wash 4	F-F	772	C705AF	772	712
Unnamed Wash 4	I-I	689	C705O	689	622
Tributary 1 to Unnamed Wash 4	A-A	772	C705AF	772	712
Unnamed Wash 5	N-N	1630	S716	1625	1328
Unnamed Wash 5	J-J	880	C717	881	739
Unnamed Wash 5	A-A	1160	C718	1158	989
Unnamed Wash 6	A-A	1380	C722	1384	1123
Unnamed Wash 7	A-A	1790	S724	1788	1462
Unnamed Wash 8	A-A	1150	S725	1153	946
Unnamed Wash 9	H-H	860	S726	860	484
Unnamed Wash 9	A-A	1130	C727	1132	796

4.4 Cross Section Description

4.4.1 General

Cross sectional geometry for the detailed study watercourses is determined from a triangulated irregular network (TIN). The TIN is developed from a digital terrain model (DTM) supplied by Cooper using the 3D Analyst extension of ArcView GIS v3.2. Cross sections are located at approximately 500 foot intervals as well at significant changes in channel slope and cross sectional area. Cross section numbering is expressed in river miles above the confluence with the Agua Fria River for Unnamed Washes 2 and 3 and the confluence with Unnamed Wash 2 for Unnamed Wash 1. Cross section stationing is from left to right looking downstream with the location of the hydraulic baseline set to station 10,000.

Cross sectional geometry for the approximate method study watercourses is determined from three sources:

1. Detailed mapping prepared for the Agua Fria River Floodplain Delineation Study Re-Study, FCD 95-5, aerial photography flight date September 1987. Mapping scale is 1 inch = 400 feet with a contour interval of 4 feet.
2. Detailed mapping prepared for CMX from aerial photography ranging from 1993 to 1998 at a contour interval of 2 feet.
3. Field survey

Cross sections are located at approximately 1,000 feet intervals. Cross sections are identified alphabetically starting at the downstream most cross section. Cross section stationing is from left to right looking downstream.

4.4.2 Channel and Overbanks

For the detailed study watercourses, cross section reach lengths and channel bank stations are determined using the HEC-GeoRAS extension for ArcView GIS. The process involves the initial layout of line work representing the hydraulic baseline (channel reach length), flow paths (overbank reach lengths) and bank stations. This data, along with cross sectional geometry is exported into a format required by HEC-RAS to get an initial

estimation of the flooding limits. Based on the initial results, this data is refined to be representative of the hydraulic conditions of the 100-year event.

For both the detailed and approximate method study watercourses, bank stations are located at the natural channel bank or at major grade breaks, in part, based on the 100-year water surface elevation such that the channel area remains relatively consistent throughout the reach. For locations where there is no identifiable overbank area, channel bank stations are located just below the 100-year water surface elevations or where there is a significant change in roughness to warrant a separation in Manning's n-values. The final locations of the channel bank stations are shown on the cross section plots provided in Appendix L and M for the detailed and approximate method reaches, respectively.

Overbank reach lengths for the detailed study watercourses are defined as extending from the centroid of the overbank flow area from the upstream cross section to that of the downstream cross section. The overbank reach lengths are therefore directly effected by the location of the channel bank stations. For the cross sections where there is no identifiable overbank area, overbank reach lengths are measured along the channel bank. Overbank reach lengths are not required for the approximate methods analysis.

4.4.3 Bridges, Culverts and Constrictions

There are no bridges, culverts or other significant constrictions located within the limits of the detailed study watercourses. There are numerous natural constrictions and these are discussed in Section 4.2.2.

Within the approximate method study limits there is a canal overchute and several culverts. The locations of these structures are shown on Plate 7. In general, the flooding limits at the culverts are based on the headwater elevation for the culvert as determined using the HY-8 computer program. Input data to the program are determined from the detailed mapping, as-built drawings or from field survey. That data as well as the program output are included for reference in Appendix K. Some of the culverts do not have the capacity to convey the 100-year discharge without taking into consideration potential storage upstream of a culvert. At locations where storm water storage is taken into

consideration, ponding conditions are modeled using the Modified Puls, level pool storage routing option of the HEC-1 computer program. This analysis is discussed in Section 3.2.2.6. Flooding limits for these locations are based on the ponded water surface elevation as determined by the HEC-1 compute program. Associated technical calculations for these locations are provided in Appendix E.

4.4.4 Grade Control Structures

There are no engineered grade control structures located within the study limits. There are, however, numerous locations of significant change in grade with exposed bedrock that function as natural grade control structures. These locations are discussed in Section 4.2.3.

4.5 Calibration

There are no stream gage data available within the study limits to use for HEC-RAS model calibration. The mapped floodplain limits have been inspected for reasonableness and found to be appropriate.

4.6 Special Problems

4.6.1 Stock Tanks

There are four stock tanks located within the hydraulic study limits. One of these is located within the study limits of Unnamed Wash 1 at approximately river station 3.631. The stock tank is an earthen embankment approximately 12 feet in height from the crest of the overflow section to the downstream toe of slope. The upstream face of the embankment is moderately vegetated with Palo Verde and Mesquite Trees and there is exposed bedrock at both the right and left "abutments". Figure 4-2 is a photo of the embankment and impoundment area.

Figure 4- 2

Stock tank on Unnamed Wash 1

At the time of this report, it appears that the area is no longer used for grazing and as a consequence it is more than likely that long term maintenance of the stock tanks will not occur. Despite this, the structural integrity of the embankment during a 100-year event is unknown and therefore, for modeling purposes it is assumed that this structure will remain in tact during such an event. This assumption results in a very conservative estimation for the flooding limits upstream of this structure. For the hydrologic portion of the study, this structure was not considered in the analysis and thus there is no reduction in peak discharge downstream due to storage behind the embankment. The resulting floodplain and floodway limits downstream of this structure are also considered to be conservative.

The second stock tank is located on the approximate method study watercourse Unnamed Wash 7 immediately upstream of river station "F". The stock tank is an earthen embankment approximately 11.5 feet in height. Inspection of the surrounding topography indicates that there is a potential for break-out once the pond is filled. Given the

uncertainty of the structural integrity during the 100-year event, two scenarios where used to map the floodplain limits.

The first scenario assumes that the structure can withstand the 100-year event. Once the stock tank fills, runoff will begin to bypass the impoundment area to be conveyed in a small wash southeast of the stock tank. This bypass wash, identified as Tributary 1 to Unnamed Wash 7, is tributary to Unnamed Wash 7 just downstream of river station "C" as shown on sheet 5 of Plate 7. Storage routing through the stock tank and split flow analyses are not performed for this location, therefore the floodplain limits for this tributary are based on the entire peak discharge entering the stock tank. The second scenario assumes that the stock tank fails during the 100-year event and that the runoff continues downstream without spilling into Tributary 1 of Unnamed Wash 7. Both scenarios are used to map the floodplain limits.

The third stock tank is located on the approximate method watercourse Unnamed Wash 8 between river station F and G. The stock tank is an earthen embankment approximately 6 feet high. The structural integrity during a 100-year event is uncertain, however the worst case scenario concerning flooding depths would be if the structure did not fail and runoff overtopped the crest of the earthen embankment. The worst case scenario was used to map the approximate method flood zone.

The fourth tank is located on the approximate method watercourse Unnamed Wash 5. The stock tank is an earthen embankment approximately 6 feet high. As with the stock tank on Unnamed Wash 8 the worst case scenario was used to map the approximate method flood zone.

4.6.2 Berms

Downstream of the Beardsley Canal crossing of Unnamed Wash 4, a small berm and drainage channel was constructed that diverts flow around a citrus orchard. The construction date of this drainage way is uncertain, however the berm is identified on the U.S.G.S. 7.5 Minute Series Baldy Mountain Quadrangle Map which has a photo revision date of 1978. The berm varies in height and is approximately 2,600 feet in length. The

channel depth ranges from approximately 3 to 5 feet and the bottom width ranges from approximately 5 to 15 feet. Typical photos of the berm and channel are provided in Appendix J.

Starting approximately 650 feet downstream of the Beardsley Canal culvert crossing the berm does not have sufficient conveyance capacity to contain the flow and is overtopped. Because of the uncertainties of long term maintenance and structural stability, two scenarios are used to map the floodplain for this portion of Unnamed Wash 4. The first scenario assumes that the berm fails at the first point of overtopping and all the flow breaks-out through the orchard to the Agua Fria River. The second scenario assumes that the berms does not fail, but is still overtopped. The constructed berm and channel downstream of the point of overtopping is identified as Tributary 1 of Unnamed Wash 4. The area between the berm and the limits of flooding for scenario 1 is included as part of the total flooding limits, but is called out on the map as having flow depths less that 1 foot.

4.6.3 Tie-In to Existing Floodplain Delineations

Detailed study watercourses, Unnamed Washes 2 and 3, are tributary to the Agua Fria River. Floodplain and floodway limits for the Agua Fria River were established in the Agua Fria River Floodplain Delineation Study Re-Study, FCD 95-5. Those delineations were performed on scanned images of 4 foot contour interval mapping prepared in 1987. The geometry at these confluences made it difficult to locate a cross section at the Agua Fria River floodplain limits. Because of this and the differences in mapping resolution between these two studies, the floodplain and floodway limits at the last cross section of Unnamed Washes 2 and 3 were projected at a 4:1 expansion until they intersected with the Agua Fria River floodplain and floodway limits.

4.7 Floodway Modeling

Floodway encroachments for the detailed study watercourses were initially established using the Method 4, equal conveyance encroachment option with a target rise in water surface elevation of 1 foot. The target rise was then adjusted at various river stations as necessary to eliminate all rises greater than 1 foot and to eliminate as much as possible

reductions in water surface elevations. The encroachment stations obtained from the results of the Method 4 option were then converted to the Floodway Method 1 option for the final HEC-RAS model.

Reductions in water surface elevation occurred at numerous locations as a result of encroachment due to either a change in flow regime (subcritical to supercritical) or the failure of the model to determine a valid subcritical answer, thus the model defaults to critical depth. In addition to this, the model defaulted to critical depth at a sufficient number of other river stations such that a floodway based on the rise in energy grade line was warranted as per State Standards 3-94, Floodway Modeling Standards for Supercritical Flow. Therefore, the Method 1 floodway encroachments stations were adjusted were necessary so that there were no rises in on the energy grade line greater than 1 foot. Despite the use of the energy grade line for the floodway, there were still locations at which a reduction in water surface elevation occurs. The locations that this occurs can be seen in Tables 4-12 through 4-14 for Unnamed Washes 1, 2 and 3, respectively. For the mapping, the floodway water surface elevations at these locations are set equal to the floodplain water surface elevation.

4.8 Model Warning and Error Messages

The HEC-RAS models for each of the detailed study watercourses execute without error messages for both the floodplain and floodway profiles. However, the model does report several different warning messages. In general, the majority of these messages are to be expected given the hydraulic characteristics of these watercourses.

The only message that was not expected, occurred only for the Method 1 floodway profile. That message is, "The cross section had to be extended vertically during critical depth computations". This warning message occurs at numerous river stations. The exact cause of this message is due to the fact that encroachment limits are treated as vertical walls within the limits of the cross section and that these walls are extended vertically to whatever height is required to contain the flow.

4.9 Final Results

Printouts from the HEC-RAS models for each detailed study watercourse are provided in Appendix L. Summary output for the floodplain profiles are provided in Tables 4-9 through 4-11. Summary output for the Method 1 floodway profiles are provided in Tables 4-12 through 4-14. The HEC-RAS model data files, both input and output, for each detailed watercourse are provided digitally on CD as Appendix O. The normal depth calculations used for the approximate method floodplains are provided in Appendix M. The results of those calculations are provided in Table 4-15.

Table 4-9

Summary of results for the natural floodplain profile for Unnamed Wash 1

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
6.311	750	1793.8	1797.4	1797.35	1798.65	0.0175	9.2	82.6	34.5	1.00	9986.8	10021.3
6.216	750	1786.4	1789.9	1789.67	1790.47	0.0109	6.2	134.5	96.9	0.77	9943.0	10043.0
6.100	750	1777.3	1780.4	1780.42	1781.27	0.0219	8.4	112.0	66.8	1.07	9978.6	10045.5
6.015	750	1767.6	1771.0	1770.98	1772.09	0.0179	8.5	89.1	42.0	0.99	9976.8	10018.8
5.969	750	1764.4	1768.4	1767.29	1768.61	0.0056	4.4	276.2	214.9	0.50	9804.5	10019.4
5.917	750	1760.8	1765.2	1764.93	1766.23	0.0154	8.4	95.3	40.4	0.85	9987.8	10028.2
5.862	1190	1756.1	1760.1	1760.10	1761.45	0.0172	9.3	127.9	48.6	1.00	9974.8	10023.4
5.746	1190	1748.4	1751.9	1751.56	1752.45	0.0085	6.4	231.0	141.8	0.70	9889.4	10031.2
5.632	1190	1741.0	1745.9	1745.45	1746.89	0.0099	8.0	154.0	58.6	0.78	9966.1	10024.8
5.505	1190	1734.0	1737.6	1737.45	1738.71	0.0152	8.5	139.7	55.7	0.94	9980.0	10035.7
5.439	1190	1726.5	1731.4	1731.41	1732.73	0.0192	9.5	141.2	60.0	0.95	9980.7	10157.7
5.380	1190	1721.9	1725.7	1724.67	1726.03	0.0063	5.8	298.5	120.7	0.60	9987.7	10108.4
5.310	1190	1716.1	1720.7	1720.66	1722.21	0.0159	9.7	122.2	40.6	0.97	9981.8	10022.3
5.227	1190	1711.4	1715.8	1715.59	1716.47	0.0103	7.0	220.2	116.9	0.70	9910.3	10027.2
5.207	1190	1710.4	1715.3	1713.98	1715.70	0.0045	5.4	259.9	99.2	0.48	9952.7	10051.8
5.176	1190	1708.4	1712.9	1712.93	1714.40	0.0143	10.0	132.8	50.2	0.94	9983.5	10033.7
5.096	1190	1702.4	1707.1	1706.76	1708.20	0.0118	8.4	142.2	48.4	0.84	9980.2	10028.7
5.007	1190	1697.4	1702.8	1702.38	1703.74	0.0077	8.3	183.8	82.3	0.71	9975.4	10057.7
4.920	1190	1693.6	1698.2	1698.20	1699.33	0.0121	9.0	156.9	71.1	0.86	9947.2	10018.3
4.879	1190	1692.3	1696.8	1696.05	1697.21	0.0062	6.0	322.0	166.3	0.55	9946.0	10112.3
4.839	1190	1690.2	1694.8	1694.60	1695.69	0.0103	8.1	195.2	102.0	0.79	9978.3	10099.0
4.725	1190	1684.1	1687.6	1687.65	1688.52	0.0140	8.5	185.6	101.4	0.91	9930.2	10031.5
4.628	1190	1676.2	1681.8	1679.57	1682.07	0.0016	3.8	318.8	88.4	0.33	9957.1	10045.5
4.613	2330	1675.0	1680.8	1679.84	1681.72	0.0060	8.1	352.4	114.8	0.66	9952.2	10067.1
4.536	2330	1670.3	1676.2	1676.20	1678.15	0.0130	11.4	222.5	62.6	0.94	9983.3	10045.9

Table 4-9 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 1

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
4.436	2330	1665.7	1669.7	1669.73	1670.76	0.0144	9.5	323.6	149.7	0.95	9880.2	10029.9
4.412	2330	1660.6	1666.7	1665.89	1667.43	0.0062	7.5	387.4	119.3	0.65	9970.3	10089.7
4.361	2330	1658.1	1663.6	1663.63	1665.06	0.0125	10.0	269.1	99.9	0.91	9932.7	10032.6
4.256	2330	1653.7	1659.0	1658.52	1659.76	0.0071	7.9	407.7	152.2	0.69	9974.6	10126.8
4.170	2330	1648.6	1654.0	1654.01	1655.47	0.0127	11.0	291.1	100.3	0.92	9983.6	10083.9
4.077	2330	1644.2	1649.7	1649.36	1650.50	0.0068	8.3	401.7	152.9	0.69	9877.0	10030.0
3.987	2330	1640.1	1645.1	1645.12	1646.34	0.0117	10.0	321.6	131.5	0.89	9952.1	10083.6
3.895	2330	1637.3	1642.9	1641.49	1643.20	0.0029	5.7	599.0	186.4	0.46	9935.8	10122.2
3.803	2330	1634.2	1642.1	1638.67	1642.34	0.0012	4.3	595.8	122.3	0.30	9961.9	10084.2
3.706	2330	1630.6	1642.1	1634.31	1642.17	0.0001	1.5	1923.4	269.9	0.08	9770.8	10040.6
3.671	2330	1629.0	1642.1	1631.23	1642.15	0.0000	0.9	3304.3	368.0	0.04	9752.1	10120.1
3.643	2330	1627.4	1642.1	1629.71	1642.15	0.0000	0.7	4019.3	389.4	0.03	9749.8	10157.3
3.631	Inline Weir											
3.617	2330	1623.9	1626.2	1626.18	1627.09	0.0193	7.6	306.2	174.7	1.00	9838.8	10013.5
3.577	2330	1619.0	1623.6	1623.01	1624.43	0.0084	8.1	356.1	129.7	0.74	9921.0	10050.7
3.515	2330	1614.4	1619.6	1619.61	1621.09	0.0125	10.4	272.3	99.8	0.92	9945.8	10045.6
3.453	2330	1609.8	1616.2	1615.19	1617.09	0.0056	7.9	345.9	111.7	0.63	9973.4	10085.1
3.366	2330	1605.9	1611.3	1611.28	1613.03	0.0154	10.6	220.9	66.3	0.99	9961.7	10028.0
3.274	2330	1597.9	1604.7	1604.28	1606.38	0.0106	10.3	228.9	54.5	0.85	9973.7	10028.3
3.186	2330	1595.4	1601.1	1600.83	1602.05	0.0073	8.5	366.7	152.8	0.71	9895.5	10048.3
3.121	2330	1592.2	1597.8	1597.21	1598.52	0.0154	7.4	373.3	143.6	0.63	9892.1	10035.8
3.015	2890	1581.4	1588.4	1587.77	1589.76	0.0177	9.4	310.9	82.4	0.80	9951.5	10033.8
3.073	2330	1588.3	1594.1	1592.94	1594.62	0.0156	6.4	406.3	152.4	0.61	9969.5	10158.9
2.923	2890	1573.7	1581.8	1580.37	1582.93	0.0114	8.7	334.4	66.2	0.66	9969.1	10035.3
2.880	2890	1570.7	1577.9	1577.34	1579.46	0.0209	10.6	297.5	69.9	0.80	9988.0	10058.0

Table 4-9 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 1

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
2.848	2890	1567.8	1574.8	1573.99	1576.14	0.0180	9.5	313.6	88.6	0.75	9974.1	10082.8
2.813	2890	1563.9	1571.4	1570.72	1572.83	0.0181	10.5	314.9	71.2	0.75	9938.2	10009.4
2.770	2890	1561.9	1568.7	1567.54	1569.71	0.0103	8.5	375.1	84.2	0.64	9967.0	10051.2
2.674	2890	1553.8	1561.8	1560.63	1563.19	0.0163	9.6	303.5	59.7	0.72	9953.2	10012.9
2.611	2890	1547.5	1555.7	1555.36	1557.34	0.0194	10.7	300.8	75.4	0.78	9944.7	10020.1
2.557	2890	1543.2	1550.6	1549.81	1552.38	0.0156	10.9	279.7	54.3	0.77	9977.1	10031.5
2.467	2890	1538.4	1545.4	1543.85	1546.33	0.0098	7.9	368.0	75.0	0.61	9960.1	10035.1
2.390	2890	1534.0	1539.9	1539.09	1540.85	0.0197	8.0	396.4	116.1	0.67	9927.8	10043.9
2.347	2890	1530.1	1537.1	1535.94	1537.59	0.0113	6.2	551.2	168.4	0.50	9994.7	10163.1
2.312	2890	1527.9	1533.5	1533.52	1534.78	0.0237	9.7	336.7	131.1	0.90	9865.9	10035.2
2.230	2890	1521.3	1527.8	1526.51	1528.36	0.0084	6.4	481.5	141.7	0.55	9883.7	10030.3
2.134	2890	1513.5	1520.2	1519.77	1521.86	0.0208	10.5	278.6	67.0	0.86	9945.6	10012.6
2.047	2890	1503.2	1509.8	1509.81	1511.86	0.0227	11.7	262.9	70.0	0.92	9970.4	10040.4
1.992	2890	1493.8	1504.0	1502.16	1504.77	0.0066	7.5	464.1	96.0	0.47	9958.4	10054.5
1.928	2890	1491.5	1499.2	1498.48	1501.00	0.0213	10.6	273.0	52.5	0.80	9981.5	10034.1
1.862	2890	1485.5	1494.4	1492.48	1495.65	0.0113	9.2	321.7	53.1	0.62	9976.4	10029.5
1.768	2890	1479.1	1486.7	1485.86	1488.22	0.0204	10.0	287.8	58.7	0.79	9964.0	10022.7
1.709	2890	1476.0	1484.0	1481.64	1484.75	0.0062	7.4	455.9	86.4	0.47	9968.0	10054.4
1.675	2890	1471.9	1482.4	1479.73	1483.41	0.0087	8.1	368.5	73.1	0.53	9979.7	10052.8
1.637	2890	1466.8	1476.8	1476.83	1480.03	0.0352	14.4	202.1	33.3	0.99	9983.7	10017.0
1.621	2890	1467.3	1474.6	1473.82	1476.26	0.0146	10.9	292.2	57.6	0.76	9967.8	10025.4
1.590	2890	1464.7	1473.3	1471.38	1474.33	0.0084	8.4	358.7	66.1	0.58	9968.5	10034.5
1.479	2890	1459.2	1465.7	1464.98	1467.37	0.0174	10.4	280.2	57.5	0.80	9983.4	10040.8
1.398	2890	1440.9	1454.0	1454.04	1457.57	0.0299	15.2	196.6	30.2	0.95	9988.2	10018.4
1.374	2890	1438.2	1449.4	1449.36	1452.26	0.0287	13.7	213.5	39.8	0.97	9990.8	10030.6

Table 4-9 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 1

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
1.367	2890	1425.1	1441.2	1441.18	1444.39	0.0348	14.8	206.8	31.5	0.88	9981.1	10012.6
1.286	3190	1418.8	1428.4	1426.95	1430.30	0.0145	11.2	287.2	42.0	0.73	9976.4	10018.4
1.208	3190	1413.3	1419.9	1419.87	1422.44	0.0258	12.7	253.8	50.8	0.97	9970.5	10021.4
1.116	3190	1404.1	1414.8	1411.91	1416.06	0.0073	9.0	361.8	47.1	0.54	9982.0	10029.1
1.010	3190	1393.5	1405.9	1404.90	1409.15	0.0236	14.4	225.1	26.4	0.83	9986.8	10013.1
0.914	3190	1388.2	1399.5	1397.32	1401.09	0.0103	10.3	318.4	45.3	0.63	9976.1	10021.4
0.850	3190	1386.8	1396.0	1394.19	1397.41	0.0110	9.7	334.5	54.3	0.65	9978.1	10032.3
0.819	3190	1386.2	1394.7	1392.64	1395.66	0.0088	8.1	396.4	70.5	0.59	9966.2	10036.7
0.724	3190	1382.7	1390.2	1388.58	1391.17	0.0091	7.9	408.8	80.3	0.59	9954.6	10034.9
0.644	3190	1378.9	1386.5	1385.14	1387.43	0.0087	8.2	426.3	88.7	0.59	9976.2	10064.9
0.575	3190	1376.4	1383.8	1382.44	1384.76	0.0063	8.4	454.9	97.6	0.61	9978.3	10075.9
0.547	3190	1374.7	1381.4	1381.04	1383.32	0.0143	11.0	291.0	63.2	0.88	9974.2	10037.4
0.523	3190	1371.9	1379.8	1379.78	1381.64	0.0132	11.9	341.3	92.7	0.86	9976.6	10069.3
0.484	3190	1369.2	1378.9	1377.69	1379.81	0.0044	8.1	479.9	110.7	0.56	9907.0	10017.7
0.453	3190	1370.6	1378.0	1377.00	1379.02	0.0052	8.8	462.7	115.4	0.62	9904.2	10019.6
0.414	3190	1368.2	1377.3	1375.36	1377.90	0.0054	7.6	554.1	117.4	0.51	9895.5	10023.6
0.356	3190	1367.7	1376.0	1374.47	1376.61	0.0034	7.2	613.3	152.3	0.50	9970.0	10122.3
0.323	3190	1366.8	1373.2	1373.18	1375.13	0.0145	12.2	303.7	79.7	1.00	9958.1	10037.9
0.238	3190	1363.1	1370.2	1368.68	1370.53	0.0031	5.8	740.8	199.0	0.46	9985.3	10184.3
0.190	3190	1362.7	1369.7	1367.14	1369.98	0.0018	4.7	782.0	164.6	0.36	9966.4	10131.1
0.141	3190	1361.5	1368.3	1367.60	1369.15	0.0080	9.3	460.5	126.8	0.73	9884.9	10011.7
0.046	3190	1359.5	1367.6	1364.38	1367.82	0.0011	4.4	933.0	176.2	0.30	9868.6	10044.8

Table 4-10

Summary of results for the natural floodplain profile for Unnamed Wash 2

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
6.789	1750	1839.9	1845.2	1844.0	1846.1	0.0079	9.0	248.4	63.1	0.74	9974.7	10037.7
6.765	1750	1837.8	1843.6	1842.8	1845.0	0.0084	9.3	192.6	44.6	0.75	9971.1	10015.7
6.714	1750	1832.0	1839.3	1839.3	1841.9	0.0153	13.0	141.4	30.4	0.97	9984.3	10014.7
6.669	1750	1827.7	1833.2	1833.2	1834.9	0.0155	11.6	187.0	55.3	0.98	9987.5	10042.8
6.643	1750	1825.3	1830.5	1830.5	1831.7	0.0106	9.4	241.2	106.0	0.84	9922.9	10028.9
6.595	1750	1821.4	1826.9	1826.7	1828.0	0.0099	9.4	241.3	84.6	0.80	9984.4	10069.0
6.570	1750	1818.8	1824.0	1824.0	1825.9	0.0170	10.9	160.3	43.6	1.00	9971.0	10014.6
6.501	1750	1813.4	1817.8	1817.8	1819.0	0.0136	9.7	221.8	87.2	0.92	9982.9	10070.1
6.451	1750	1810.0	1813.9	1813.9	1814.9	0.0122	8.9	266.5	131.9	0.87	9886.9	10018.8
6.418	1750	1807.4	1810.5	1810.5	1811.6	0.0189	9.1	218.7	103.5	1.04	9926.4	10029.9
6.392	1750	1805.0	1808.1	1807.9	1809.0	0.0166	8.4	246.7	117.0	0.97	9909.1	10026.1
6.318	1750	1800.0	1803.0	1802.6	1803.5	0.0117	7.3	326.9	162.8	0.82	9851.5	10014.3
6.271	1750	1796.7	1800.6	1799.7	1801.2	0.0076	6.8	307.9	99.5	0.68	9921.1	10020.6
6.218	1750	1792.1	1796.4	1796.4	1798.0	0.0148	10.2	181.0	61.1	0.96	9969.9	10031.0
6.161	2910	1788.5	1792.9	1792.0	1793.5	0.0085	7.7	532.0	220.2	0.74	9792.5	10012.7
6.058	2910	1781.2	1786.3	1786.3	1787.7	0.0145	11.1	358.9	125.8	0.97	9896.2	10022.1
5.974	2910	1775.5	1781.6	1780.8	1782.5	0.0064	8.1	423.0	125.6	0.67	9956.4	10082.0
5.927	3380	1772.8	1778.3	1778.3	1780.2	0.0129	11.5	334.8	93.5	0.94	9984.1	10077.6
5.865	3380	1767.4	1773.6	1773.6	1775.2	0.0114	12.0	403.2	125.2	0.91	9948.8	10074.0
5.845	3380	1758.6	1768.2	1768.2	1770.2	0.0177	12.9	360.4	87.0	0.84	9990.0	10077.0
5.759	3380	1752.4	1758.8	1758.8	1761.1	0.0155	12.2	276.2	60.6	1.01	9972.4	10033.0
5.702	3380	1749.1	1756.0	1754.9	1756.9	0.0055	8.2	495.1	130.1	0.63	9902.9	10033.0
5.624	3380	1745.5	1751.3	1751.3	1753.4	0.0143	12.3	317.0	78.7	0.99	9939.8	10018.5
5.551	3380	1740.9	1746.3	1746.0	1747.4	0.0102	9.9	437.2	135.5	0.83	9892.2	10027.7
5.508	3380	1736.8	1743.2	1743.2	1744.9	0.0108	10.8	357.1	113.4	0.86	9967.1	10080.5

Table 4-10 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 2

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
5.460	3380	1734.0	1740.4	1739.7	1741.5	0.0075	8.8	417.9	133.9	0.72	9945.6	10079.6
5.364	3380	1729.3	1734.4	1734.4	1736.2	0.0155	10.7	317.1	92.3	1.00	9960.9	10053.2
5.304	3380	1725.0	1731.9	1730.4	1732.6	0.0044	7.3	562.6	148.0	0.56	9895.1	10043.1
5.266	3380	1722.8	1729.1	1729.1	1731.1	0.0126	11.9	321.7	85.5	0.94	9930.9	10016.4
5.172	3380	1717.1	1723.1	1723.1	1724.7	0.0123	10.7	355.7	116.0	0.91	9967.9	10083.9
5.114	3380	1713.7	1720.3	1719.5	1721.5	0.0075	9.6	409.0	98.2	0.74	9974.2	10072.3
5.079	3380	1711.6	1717.7	1717.7	1719.7	0.0130	12.1	325.5	84.6	0.95	9976.5	10061.0
4.974	3380	1704.6	1711.3	1708.8	1711.9	0.0032	5.9	575.2	158.2	0.44	9970.6	10128.9
4.939	4420	1701.6	1708.9	1708.9	1710.7	0.0103	11.9	478.1	130.4	0.87	9889.7	10020.1
4.884	4420	1697.1	1703.9	1703.9	1705.9	0.0124	11.9	416.7	106.8	0.93	9909.3	10016.1
4.784	4420	1688.6	1695.6	1695.6	1697.9	0.0131	12.8	390.0	89.5	0.98	9955.1	10044.5
4.692	4420	1681.9	1688.8	1688.8	1691.0	0.0128	12.1	378.8	101.2	0.96	9942.9	10044.1
4.640	4420	1678.9	1686.1	1686.1	1687.9	0.0092	11.4	495.5	151.3	0.83	9880.7	10032.0
4.600	4420	1673.5	1682.7	1682.7	1685.1	0.0103	13.0	416.2	109.4	0.87	9983.8	10093.1
4.502	4420	1667.1	1673.9	1673.1	1675.3	0.0114	10.4	498.7	109.2	0.75	9949.1	10058.4
4.430	4420	1661.7	1668.7	1668.1	1670.4	0.0154	10.3	428.9	96.8	0.83	9923.4	10020.2
4.391	4420	1657.5	1665.0	1664.8	1667.0	0.0159	11.9	416.9	97.6	0.87	9973.4	10071.0
4.365	4420	1656.0	1663.4	1662.8	1665.0	0.0139	10.4	448.7	102.7	0.80	9974.0	10076.7
4.332	4420	1652.7	1660.4	1660.4	1662.6	0.0119	12.9	400.1	93.2	0.95	9948.4	10041.6
4.286	4420	1650.6	1657.0	1656.7	1658.9	0.0104	11.4	419.3	92.0	0.87	9939.8	10031.9
4.199	4420	1645.4	1651.9	1651.9	1653.9	0.0114	11.8	417.8	108.3	0.90	9981.3	10089.6
4.102	4420	1640.3	1646.7	1646.7	1648.1	0.0094	10.1	541.8	197.2	0.81	9973.6	10170.8
4.072	4420	1638.7	1644.9	1644.5	1646.0	0.0080	8.9	572.4	247.7	0.75	9890.8	10138.5
4.013	4420	1634.3	1641.4	1641.4	1643.0	0.0111	10.5	481.4	173.2	0.87	9844.5	10017.7
3.961	4420	1631.7	1637.7	1637.5	1639.2	0.0104	10.0	485.7	161.9	0.85	9864.2	10026.1

Table 4-10 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 2

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
3.923	4420	1629.0	1635.8	1635.2	1637.2	0.0088	9.6	479.9	142.0	0.78	9928.5	10070.5
3.874	4420	1626.7	1634.4	1633.6	1635.2	0.0055	7.1	701.7	209.9	0.61	9968.9	10178.8
3.825	4420	1621.5	1630.7	1629.8	1632.6	0.0092	12.5	419.9	72.0	0.82	9946.0	10018.0
3.770	4420	1618.1	1626.0	1626.0	1629.2	0.0146	14.4	308.4	50.0	1.00	9977.8	10027.9
3.725	4420	1616.1	1622.2	1622.0	1624.1	0.0231	12.2	420.6	101.7	1.00	9922.1	10023.8
3.698	4420	1613.7	1621.7	1619.7	1622.3	0.0072	7.1	725.7	145.8	0.55	9865.6	10011.4
3.660	4420	1609.8	1619.2	1617.0	1620.6	0.0080	9.4	473.7	69.3	0.60	9947.9	10017.2
3.643	4420	1609.4	1616.8	1616.8	1619.4	0.0193	13.4	355.5	69.3	0.94	9950.6	10019.9
3.618	4420	1605.3	1614.6	1614.6	1617.2	0.0100	13.4	385.3	85.0	0.88	9965.9	10050.9
3.590	4420	1602.9	1611.3	1610.0	1612.6	0.0059	9.2	501.7	99.1	0.66	9961.2	10065.8
3.523	4420	1599.7	1606.9	1606.9	1609.5	0.0139	12.8	345.9	72.5	0.99	9949.6	10031.8
3.426	4420	1593.3	1600.4	1599.2	1601.6	0.0065	8.7	509.8	106.8	0.68	9937.0	10043.8
3.311	4420	1585.1	1592.8	1592.8	1595.7	0.0144	13.8	319.4	54.8	1.00	9967.7	10022.5
3.211	4420	1577.8	1584.8	1584.3	1586.4	0.0082	10.6	467.7	112.0	0.78	9945.1	10057.1
3.122	4420	1574.1	1582.7	1580.6	1583.8	0.0037	8.6	607.0	123.4	0.55	9932.3	10055.7
3.053	4420	1567.5	1582.7	1576.3	1583.0	0.0008	5.1	1010.2	117.9	0.26	9964.1	10082.0
3.033	4420	1565.3	1577.1	1577.1	1580.8	0.0156	15.4	287.1	40.3	1.01	9976.0	10016.3
3.007	4420	1563.5	1577.2	1574.1	1578.4	0.0037	8.9	523.6	78.4	0.53	9947.2	10026.3
2.976	4420	1560.6	1572.9	1572.9	1577.0	0.0161	16.3	272.2	34.6	1.00	9984.2	10018.8
2.934	4420	1558.9	1569.3	1569.3	1572.5	0.0131	14.4	313.8	53.8	0.97	9973.0	10026.8
2.903	4420	1556.3	1566.7	1566.7	1569.6	0.0144	13.7	323.2	57.5	1.01	9973.3	10030.8
2.892	4420	1548.8	1564.1	1564.1	1567.0	0.0156	13.8	324.4	59.7	0.99	9967.6	10027.3
2.856	4420	1547.2	1558.0	1558.0	1561.2	0.0152	14.4	309.0	51.4	1.00	9959.0	10010.4
2.813	4420	1545.5	1553.8	1553.5	1555.4	0.0083	11.5	531.8	144.6	0.80	9968.4	10113.0
2.718	4420	1541.9	1549.0	1548.6	1551.0	0.0095	11.7	434.3	95.9	0.84	9963.5	10059.3

Table 4-10 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 2

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
2.683	4420	1538.2	1548.7	1546.2	1549.4	0.0032	7.0	726.2	191.0	0.45	9957.1	10148.2
2.656	4420	1535.7	1545.2	1545.2	1547.9	0.0124	13.4	344.0	102.8	0.95	9967.2	10084.8
2.625	4570	1533.9	1540.5	1539.3	1541.3	0.0055	8.3	710.6	167.2	0.64	9950.0	10117.3
2.603	4570	1532.6	1538.7	1538.3	1540.3	0.0120	11.7	496.2	118.9	0.92	9983.2	10102.1
2.521	4570	1526.2	1533.2	1533.1	1534.9	0.0131	12.9	511.2	138.7	0.97	9885.4	10024.1
2.424	4570	1520.8	1527.9	1527.1	1529.4	0.0088	10.0	459.3	98.0	0.79	9966.9	10064.8
2.401	4570	1519.5	1526.4	1525.9	1528.2	0.0099	10.8	429.6	92.2	0.84	9967.5	10059.7
2.319	4570	1513.5	1522.0	1521.4	1523.9	0.0098	11.1	411.0	78.2	0.84	9947.7	10025.9
2.225	4570	1509.2	1516.2	1516.2	1518.5	0.0118	12.5	395.8	91.0	0.93	9936.3	10027.3
2.131	4570	1503.1	1509.8	1509.8	1512.1	0.0115	13.3	414.6	90.0	0.94	9964.8	10054.9
2.034	4570	1496.7	1503.9	1503.4	1505.9	0.0095	11.5	424.2	93.1	0.85	9951.6	10044.7
1.940	4570	1491.5	1497.9	1497.8	1500.1	0.0140	12.1	379.3	86.0	0.99	9954.5	10040.5
1.846	4570	1485.7	1493.4	1492.4	1495.1	0.0073	10.3	450.0	86.2	0.74	9961.1	10047.3
1.818	4570	1484.9	1491.2	1491.2	1493.5	0.0145	12.4	369.5	80.1	1.00	9963.5	10043.6
1.781	4570	1482.1	1488.3	1488.3	1490.5	0.0121	12.0	417.5	115.0	0.93	9983.0	10098.0
1.742	4570	1479.5	1485.5	1485.5	1487.3	0.0151	11.5	467.1	233.2	0.92	9802.5	10035.6
1.677	4570	1475.5	1481.7	1481.1	1483.0	0.0093	9.2	498.2	121.8	0.79	9942.0	10063.8
1.629	4680	1471.2	1478.2	1478.2	1480.2	0.0124	11.4	436.9	125.2	0.93	9979.2	10104.5
1.535	4680	1464.8	1471.5	1471.5	1473.6	0.0128	12.0	429.4	107.1	0.96	9926.8	10033.9
1.481	4680	1459.3	1466.2	1466.2	1469.0	0.0148	13.3	351.2	65.6	1.00	9989.4	10055.0
1.438	4680	1457.9	1463.1	1463.1	1465.3	0.0146	11.9	395.0	91.9	1.00	9968.7	10060.6
1.419	4680	1445.6	1458.4	1458.4	1461.6	0.0104	14.6	366.9	73.7	0.83	9958.1	10031.7
1.363	4680	1442.9	1451.4	1451.4	1454.3	0.0141	13.6	343.3	60.9	1.00	9955.3	10016.3
1.261	4680	1431.1	1439.0	1438.7	1441.0	0.0118	11.4	413.0	88.8	0.91	9965.2	10054.0
1.168	4680	1425.1	1433.3	1433.3	1435.6	0.0101	12.6	446.7	119.1	0.87	9915.6	10034.7

Table 4-10 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 2

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
1.092	4680	1420.6	1433.2	1426.8	1433.4	0.0006	4.4	1191.0	147.5	0.24	9938.2	10085.8
1.052	4680	1412.5	1428.2	1428.2	1432.0	0.0146	16.1	326.4	64.3	0.83	9925.8	10009.3
0.995	4680	1409.6	1417.7	1417.4	1420.1	0.0109	12.3	383.9	69.8	0.90	9962.0	10031.9
0.957	4680	1405.6	1414.3	1414.3	1417.5	0.0139	14.3	326.9	53.0	1.00	9981.3	10034.2
0.916	4680	1402.6	1411.1	1411.1	1414.1	0.0138	13.7	344.0	61.3	0.99	9979.5	10040.8
0.864	4680	1398.1	1405.7	1405.7	1408.4	0.0140	13.2	354.7	67.1	1.00	9969.1	10036.2
0.769	4680	1387.9	1400.6	1399.3	1402.4	0.0087	11.7	496.2	81.8	0.70	9980.2	10062.0
0.745	4680	1388.0	1401.0	1395.2	1401.7	0.0015	6.4	777.3	115.2	0.33	9946.2	10061.3
0.734	4680	1387.0	1397.0	1397.0	1401.1	0.0202	16.2	288.4	36.0	1.00	9982.7	10018.7
0.703	4680	1382.9	1394.0	1390.6	1394.8	0.0026	7.9	676.8	90.4	0.46	9943.3	10033.7
0.650	4680	1375.2	1389.9	1388.3	1392.9	0.0100	13.9	338.5	37.2	0.78	9981.5	10018.7
0.625	4680	1373.6	1389.5	1386.6	1391.6	0.0063	11.7	402.7	41.7	0.64	9984.7	10026.4
0.610	4680	1373.2	1386.4	1386.4	1390.6	0.0162	16.5	283.9	35.2	1.00	9984.6	10019.8
0.589	4680	1371.0	1379.7	1379.7	1382.4	0.0142	13.0	360.5	70.5	1.00	9951.7	10022.2
0.537	4680	1368.7	1377.3	1376.2	1379.0	0.0075	10.6	447.5	76.8	0.75	9974.3	10051.1
0.441	4680	1365.4	1371.8	1371.8	1373.8	0.0148	12.5	448.1	111.4	1.02	9966.8	10078.2
0.348	4680	1362.0	1368.6	1367.3	1369.4	0.0047	8.0	725.8	162.9	0.59	9882.3	10045.1
0.309	4680	1360.7	1367.0	1366.0	1368.2	0.0070	9.3	553.8	118.7	0.72	9929.1	10047.8
0.252	7300	1357.8	1363.9	1363.9	1365.4	0.0106	11.3	940.3	304.4	0.88	9810.5	10114.9
0.205	7300	1356.6	1360.4	1360.2	1361.3	0.0106	7.9	1111.1	545.2	0.81	9801.6	10376.7

Table 4-11

Summary of results for the natural floodplain profile for Unnamed Wash 3

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
4.540	1220	1636.7	1641.1	1640.7	1642.2	0.0129	8.5	147.2	48.8	0.80	9976.8	10025.5
4.464	1220	1631.9	1636.6	1636.2	1637.4	0.0105	7.7	181.5	75.7	0.72	9979.4	10055.1
4.428	1220	1630.7	1635.3	1634.4	1635.7	0.0068	5.5	251.1	92.0	0.53	9932.2	10024.2
4.417	1220	1629.3	1634.1	1634.1	1635.1	0.0173	8.3	181.7	96.1	0.82	9918.4	10014.5
4.399	1220	1626.7	1631.8	1631.7	1633.0	0.0185	8.7	154.6	70.4	0.85	9932.3	10014.9
4.379	1220	1625.7	1629.6	1629.6	1631.0	0.0200	9.4	130.7	46.8	0.97	9976.1	10022.9
4.338	1220	1621.4	1626.1	1625.9	1627.3	0.0144	8.7	145.9	52.8	0.84	9978.6	10031.5
4.289	1220	1617.7	1622.4	1622.0	1623.7	0.0132	8.9	141.1	43.5	0.81	9980.1	10023.6
4.229	1220	1613.1	1618.2	1617.9	1619.3	0.0146	8.2	164.8	75.7	0.77	9979.6	10055.3
4.197	1990	1611.3	1616.8	1615.7	1617.5	0.0081	7.1	319.5	116.1	0.60	9965.0	10081.0
4.177	1990	1609.3	1615.8	1614.8	1616.6	0.0086	7.9	291.7	98.0	0.62	9981.4	10143.3
4.145	1990	1606.3	1612.4	1612.4	1614.4	0.0192	11.5	174.1	44.5	0.99	9972.3	10016.8
4.110	1990	1602.4	1608.1	1607.9	1610.0	0.0163	10.9	185.0	47.0	0.92	9972.8	10019.7
4.013	1990	1594.8	1599.3	1599.2	1600.9	0.0193	10.2	197.7	63.8	0.98	9972.1	10035.9
3.921	1990	1585.1	1591.1	1590.6	1592.9	0.0139	10.8	185.8	40.9	0.86	9982.5	10023.4
3.826	1990	1579.5	1585.3	1584.9	1586.3	0.0117	8.7	261.6	88.6	0.77	9991.6	10080.3
3.731	1990	1573.7	1579.0	1579.0	1580.2	0.0128	9.5	276.6	151.5	0.82	9964.2	10115.8
3.649	1990	1569.5	1574.8	1574.0	1575.5	0.0066	7.1	335.2	115.2	0.60	9955.0	10070.2
3.561	1990	1565.2	1570.5	1570.4	1571.4	0.0119	9.0	293.7	138.3	0.79	9936.0	10074.4
3.520	1990	1562.8	1569.3	1568.1	1569.7	0.0050	5.8	478.3	174.1	0.47	9913.1	10087.2
3.509	1990	1562.0	1569.1	1567.3	1569.4	0.0037	5.1	463.8	198.6	0.41	9895.3	10093.9
3.497	1990	1561.2	1567.6	1567.2	1568.7	0.0115	9.2	288.0	91.7	0.71	9987.8	10079.5
3.487	1990	1560.1	1567.4	1565.2	1568.0	0.0046	6.5	339.4	133.2	0.47	9967.1	10100.3
3.460	1990	1559.1	1565.0	1564.6	1566.5	0.0118	10.0	200.0	49.3	0.86	9986.6	10035.8
3.426	1990	1558.3	1563.9	1562.9	1564.7	0.0068	7.3	274.2	81.5	0.67	9959.0	10040.5

Table 4-11 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 3

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
3.412	1990	1557.8	1562.6	1562.6	1563.9	0.0155	9.6	249.2	101.0	0.89	9929.6	10030.7
3.370	1990	1554.2	1559.4	1559.1	1560.2	0.0104	7.2	332.1	172.8	0.71	9849.5	10022.3
3.351	1990	1553.2	1559.1	1557.2	1559.5	0.0029	5.4	453.6	109.5	0.41	9942.5	10052.0
3.319	1990	1550.8	1558.2	1557.0	1558.8	0.0051	6.9	357.1	103.7	0.52	9990.0	10093.7
3.309	1990	1551.2	1556.5	1556.5	1558.3	0.0138	10.7	193.9	69.5	0.93	9985.0	10054.5
3.257	1990	1547.5	1553.0	1552.9	1554.0	0.0078	8.7	299.3	121.2	0.73	9903.9	10025.1
3.168	2200	1544.1	1548.4	1548.3	1549.2	0.0132	8.3	361.1	166.2	0.81	9973.3	10139.5
3.144	2200	1541.7	1547.4	1547.0	1548.0	0.0073	7.6	456.4	188.4	0.62	9981.8	10170.1
3.114	2200	1540.0	1545.2	1545.2	1546.5	0.0124	9.4	260.6	107.2	0.89	9954.9	10062.1
3.061	2200	1537.6	1543.4	1542.5	1543.8	0.0063	5.9	483.7	177.0	0.52	9861.3	10038.2
3.042	2200	1537.0	1542.9	1541.7	1543.3	0.0052	5.1	518.7	176.4	0.46	9850.7	10027.2
3.015	2200	1535.3	1542.6	1540.3	1542.9	0.0026	4.9	648.9	241.0	0.35	9853.0	10094.0
2.984	2200	1534.3	1539.1	1539.1	1541.0	0.0155	11.2	197.1	51.8	1.00	9975.7	10027.5
2.916	2200	1530.5	1535.1	1535.0	1535.9	0.0101	8.4	393.3	208.6	0.79	9982.2	10190.8
2.850	2200	1527.0	1532.5	1531.7	1533.2	0.0060	7.7	363.0	109.5	0.65	9925.8	10035.3
2.779	2200	1522.7	1529.1	1529.1	1530.4	0.0091	9.7	277.4	117.2	0.79	9928.8	10046.0
2.677	2200	1517.6	1523.7	1523.7	1524.8	0.0082	8.7	314.4	197.0	0.74	9926.8	10123.8
2.581	2200	1513.3	1519.1	1519.1	1520.3	0.0096	9.2	305.4	168.1	0.79	9882.4	10050.6
2.522	2200	1510.9	1516.4	1515.8	1517.3	0.0077	7.6	322.4	147.5	0.71	9974.0	10121.5
2.471	2200	1508.3	1513.6	1513.6	1514.8	0.0111	8.9	301.2	157.0	0.84	9855.6	10012.6
2.421	2200	1505.8	1510.9	1510.3	1511.6	0.0062	7.3	365.4	142.7	0.65	9897.2	10039.9
2.315	2200	1499.8	1506.0	1506.0	1507.3	0.0098	9.8	282.8	185.3	0.81	9981.5	10166.8
2.233	2200	1495.4	1501.2	1501.0	1502.4	0.0102	9.0	276.5	130.1	0.81	9889.7	10019.7
2.118	2200	1488.6	1495.3	1495.3	1496.4	0.0097	8.9	342.3	179.6	0.71	9984.1	10163.7
2.050	2200	1487.1	1491.8	1491.3	1492.5	0.0096	7.8	357.0	175.7	0.71	9915.4	10091.2

Table 4-11 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 3

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
2.011	2200	1482.5	1488.8	1488.5	1490.2	0.0127	9.6	263.8	92.8	0.82	9937.1	10029.9
1.973	2200	1480.3	1487.2	1486.4	1488.1	0.0076	7.8	323.7	97.1	0.64	9980.9	10077.9
1.944	2200	1480.0	1484.7	1484.7	1486.5	0.0150	10.5	210.1	62.0	0.98	9979.0	10041.1
1.872	2200	1475.7	1480.9	1480.2	1482.0	0.0087	8.5	258.8	67.1	0.76	9962.8	10029.9
1.784	2200	1470.7	1475.9	1475.5	1477.3	0.0116	9.6	228.7	60.6	0.87	9960.5	10021.1
1.690	2200	1465.9	1472.4	1470.9	1473.3	0.0055	7.8	284.2	61.2	0.62	9954.7	10015.9
1.641	2570	1464.3	1469.6	1469.6	1471.2	0.0120	10.6	293.1	107.7	0.90	9914.4	10022.1
1.600	2570	1463.0	1467.2	1466.8	1468.2	0.0092	8.0	355.2	148.5	0.76	9868.7	10017.2
1.563	2570	1460.5	1464.3	1464.3	1465.7	0.0222	10.4	283.8	119.7	1.14	9917.4	10037.1
1.537	2570	1452.8	1460.3	1460.3	1462.4	0.0129	12.0	232.0	60.5	0.94	9977.9	10038.4
1.519	2570	1449.9	1457.7	1457.7	1460.1	0.0152	12.5	206.0	44.2	1.00	9984.8	10029.0
1.497	2570	1448.8	1456.4	1455.7	1458.1	0.0093	10.4	250.0	51.8	0.80	9977.3	10029.0
1.481	2570	1447.7	1454.8	1454.8	1457.1	0.0142	12.3	214.7	48.2	0.98	9963.0	10011.2
1.425	2570	1440.7	1449.1	1447.8	1450.5	0.0221	9.7	266.2	48.4	0.71	9977.8	10026.3
1.385	2570	1433.0	1441.7	1441.7	1444.3	0.0400	13.1	203.9	43.6	0.94	9988.9	10032.6
1.356	2570	1429.8	1437.5	1435.6	1438.3	0.0109	7.4	369.2	73.5	0.53	9973.7	10047.2
1.331	2570	1427.7	1436.0	1434.4	1436.8	0.0126	7.5	371.4	77.2	0.55	9942.0	10019.2
1.304	2570	1426.1	1433.1	1432.0	1434.6	0.0173	9.6	267.2	50.8	0.73	9982.1	10032.9
1.259	2570	1417.9	1426.8	1426.8	1429.1	0.0306	12.7	219.4	50.2	0.96	9978.6	10028.7
1.222	2570	1405.2	1416.3	1416.3	1418.8	0.0310	13.2	207.7	41.6	0.93	9975.3	10016.9
1.171	2570	1404.8	1413.3	1410.4	1413.9	0.0058	6.3	411.7	68.1	0.44	9966.7	10034.9
1.152	2570	1402.7	1411.4	1409.9	1412.9	0.0155	9.9	261.3	43.6	0.69	9971.6	10015.2
1.088	2570	1400.2	1407.2	1406.5	1408.8	0.0098	10.2	255.8	54.4	0.80	9985.8	10040.2
1.008	2570	1392.7	1401.4	1400.6	1403.2	0.0185	10.8	238.5	43.9	0.80	9983.8	10027.7
0.986	2570	1392.6	1400.3	1398.7	1401.4	0.0106	8.6	303.3	56.5	0.63	9973.7	10030.2

Table 4-11 (continued)

Summary of results for the natural floodplain profile for Unnamed Wash 3

River Station miles	100-Year Peak Discharge cfs	Minimum Channel Elevation feet	Water Surface Elevation feet	Critical W.S. Elevation feet	Energy Gradeline Elevation feet	Energy Gradeline Slope ft/ft	Channel Velocity fps	Flow Area sq. feet	Top Width feet	Froude # Channel	Water Surface Start and End Stations Left feet	Water Surface Start and End Stations Right feet
0.960	2570	1390.6	1397.2	1397.2	1399.3	0.0232	12.2	242.8	59.3	0.91	9950.5	10009.8
0.928	2570	1387.4	1394.4	1392.9	1395.4	0.0054	7.9	326.1	63.6	0.61	9983.1	10046.7
0.852	2570	1383.9	1389.8	1389.8	1391.9	0.0151	11.7	221.0	53.7	1.00	9972.3	10026.0
0.761	2570	1378.4	1384.8	1384.3	1385.8	0.0095	8.9	357.3	106.8	0.72	9911.3	10018.1
0.734	2570	1376.2	1382.8	1382.3	1384.3	0.0114	10.2	281.7	68.0	0.79	9956.6	10024.6
0.716	2570	1375.6	1382.3	1381.0	1383.3	0.0076	8.2	317.3	72.2	0.65	9957.1	10029.3
0.695	2570	1370.8	1379.2	1379.2	1382.0	0.0182	13.4	195.5	37.7	0.98	9977.5	10015.2
0.658	2570	1368.5	1376.2	1375.5	1377.8	0.0091	10.0	262.6	57.3	0.79	9952.5	10009.9
0.625	2570	1367.1	1373.8	1373.8	1375.6	0.0178	11.4	267.7	76.8	0.88	9941.3	10018.1
0.598	2570	1365.2	1372.1	1370.3	1373.0	0.0076	7.6	338.2	65.1	0.58	9967.9	10033.0
0.583	2570	1364.3	1371.7	1369.6	1372.4	0.0054	6.5	394.8	75.9	0.50	9974.9	10050.8
0.565	2570	1363.3	1369.2	1369.2	1371.5	0.0146	12.0	217.6	53.1	0.99	9980.9	10034.0
0.520	2570	1359.4	1365.5	1365.5	1367.5	0.0157	11.5	223.9	56.2	1.01	9971.5	10027.7
0.481	2570	1357.1	1363.6	1362.6	1364.8	0.0078	8.8	292.5	65.9	0.73	9973.8	10039.7
0.386	2570	1351.9	1358.1	1357.9	1360.0	0.0116	11.2	250.3	68.6	0.90	9978.9	10047.6
0.306	2570	1348.0	1353.4	1353.4	1354.7	0.0124	9.8	314.8	138.4	0.90	9886.2	10024.7
0.240	2570	1343.6	1349.3	1348.7	1349.8	0.0080	6.8	493.5	296.3	0.70	9815.6	10111.9
0.185	2570	1337.3	1344.2	1344.2	1345.8	0.0161	10.4	246.8	76.2	1.01	9968.0	10044.2
0.144	2570	1335.0	1340.7	1340.5	1342.6	0.0134	11.1	236.2	58.6	0.94	9982.9	10041.5

Table 4-12

Summary of results for the floodway profile for Unnamed Wash 1

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
6.311	1797.4	1797.4	1798.7	1798.7	0.0	0.0	9986.5	10021.6
6.216	1789.9	1789.9	1790.5	1790.5	0.0	0.0	9944.2	10042.0
6.100	1780.4	1780.4	1781.3	1781.3	0.0	0.0	9979.2	10045.2
6.015	1771.0	1771.0	1772.1	1772.1	0.0	0.0	9976.8	10018.8
5.969	1768.4	1768.7	1768.6	1769.0	0.3	0.4	9922.0	10019.4
5.917	1765.2	1765.1	1766.2	1766.2	-0.1	0.0	9987.8	10028.2
5.862	1760.1	1760.1	1761.5	1761.5	0.0	0.0	9974.8	10023.4
5.746	1751.9	1752.0	1752.5	1752.6	0.1	0.1	9940.0	10023.5
5.632	1745.9	1746.0	1746.9	1746.9	0.1	0.0	9966.1	10015.5
5.505	1737.6	1737.6	1738.7	1738.7	0.0	0.0	9980.0	10035.7
5.439	1731.4	1731.5	1732.7	1732.7	0.1	0.0	9980.7	10157.7
5.380	1725.7	1725.8	1726.0	1726.3	0.1	0.3	9987.7	10062.4
5.310	1720.7	1721.1	1722.2	1722.3	0.4	0.1	9981.8	10022.3
5.227	1715.8	1715.8	1716.5	1716.7	0.0	0.2	9955.0	10027.2
5.207	1715.3	1715.3	1715.7	1715.7	0.0	0.0	9968.1	10051.8
5.176	1712.9	1713.0	1714.4	1714.4	0.1	0.0	9983.6	10033.7
5.096	1707.1	1707.1	1708.2	1708.2	0.0	0.0	9980.2	10028.7
5.007	1702.8	1702.8	1703.7	1703.7	0.0	0.0	9975.4	10057.7
4.920	1698.2	1698.8	1699.3	1699.9	0.6	0.6	9980.3	10018.3
4.879	1696.8	1697.0	1697.2	1697.8	0.2	0.6	9979.8	10075.0
4.839	1694.8	1695.2	1695.7	1696.1	0.4	0.4	9978.3	10070.0
4.725	1687.7	1687.9	1688.5	1689.2	0.2	0.7	9966.8	10020.0
4.628	1681.9	1681.9	1682.1	1682.1	0.0	0.0	9957.1	10045.5
4.613	1680.8	1680.9	1681.7	1681.8	0.1	0.1	9952.2	10067.1
4.536	1676.2	1676.5	1678.2	1678.4	0.3	0.2	9983.3	10027.1

Table 4-12 (continued)

Summary of results for the floodway profile for Unnamed Wash 1

River	Water Surface Elevation (WSEL)		Energy Grade Line Elevation (EGL)		Surcharge		Floodway Encroachment Station	
Station	Floodplain	Floodway	Floodplain	Floodway	WSEL	EGL	Left	Right
miles	feet	feet	feet	feet	feet	feet	feet	feet
4.170	1654.0	1654.2	1655.5	1655.5	0.2	0.0	9983.6	10083.9
4.077	1649.8	1650.1	1650.5	1651.1	0.3	0.6	9925.0	10021.4
3.987	1645.1	1646.1	1646.3	1647.3	1.0	1.0	9977.4	10050.0
3.895	1642.9	1642.9	1643.2	1643.7	0.0	0.5	9973.5	10062.2
3.803	1642.1	1642.1	1642.3	1642.4	0.0	0.1	9961.9	10053.6
3.706	1642.1	1642.1	1642.2	1642.2	0.0	0.0	9770.8	10040.6
3.671	1642.1	1642.1	1642.2	1642.2	0.0	0.0	9752.1	10120.1
3.643	1642.1	1642.1	1642.2	1642.2	0.0	0.0	9749.8	10157.3
3.631	Inline Weir							
3.617	1626.2	1626.2	1627.1	1627.1	0.0	0.0	9838.8	10013.5
3.577	1623.6	1624.1	1624.4	1624.7	0.5	0.3	9921.0	10050.7
3.515	1619.6	1619.8	1621.1	1621.9	0.2	0.8	9967.6	10016.0
3.453	1616.2	1616.3	1617.1	1617.3	0.1	0.2	9973.4	10034.5
3.366	1611.3	1611.3	1613.0	1613.0	0.0	0.0	9961.7	10028.0
3.274	1604.7	1605.3	1606.4	1606.6	0.6	0.2	9973.7	10028.3
3.186	1601.1	1601.5	1602.1	1602.8	0.4	0.7	9967.4	10048.3
3.121	1597.8	1598.7	1598.5	1599.4	0.9	0.9	9945.0	10024.9
3.073	1594.1	1594.6	1594.6	1595.6	0.5	1.0	9969.5	10047.3
3.015	1588.4	1588.4	1589.8	1589.8	0.0	0.0	9951.5	10033.8
2.923	1581.8	1581.8	1582.9	1582.9	0.0	0.0	9969.1	10035.3
2.880	1577.9	1577.9	1579.5	1579.5	0.0	0.0	9988.0	10058.0
2.848	1574.8	1574.8	1576.1	1576.1	0.0	0.0	9974.1	10082.8
2.813	1571.4	1571.4	1572.8	1572.8	0.0	0.0	9938.2	10009.4
2.770	1568.7	1568.7	1569.7	1569.7	0.0	0.0	9967.0	10051.2
2.674	1561.8	1561.9	1563.2	1563.3	0.1	0.1	9953.2	10012.9

Table 4-12 (continued)

Summary of results for the floodway profile for Unnamed Wash 1

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
2.347	1537.1	1537.5	1537.6	1537.9	0.4	0.3	9994.7	10163.1
2.312	1533.5	1534.2	1534.8	1535.7	0.7	0.9	9911.6	10035.2
2.230	1527.8	1528.5	1528.4	1529.3	0.7	0.9	9931.9	10030.3
2.134	1520.2	1520.1	1521.9	1521.8	-0.1	-0.1	9945.7	10012.6
2.047	1509.8	1509.9	1511.9	1511.9	0.1	0.0	9970.4	10040.4
1.992	1504.1	1504.1	1504.8	1504.8	0.0	0.0	9958.4	10054.5
1.928	1499.3	1499.3	1501.0	1501.0	0.0	0.0	9981.5	10034.1
1.862	1494.4	1494.4	1495.7	1495.7	0.0	0.0	9976.4	10029.5
1.768	1486.7	1486.7	1488.2	1488.2	0.0	0.0	9964.0	10022.7
1.709	1484.0	1484.0	1484.8	1484.8	0.0	0.0	9968.0	10054.4
1.675	1482.4	1482.4	1483.4	1483.4	0.0	0.0	9979.7	10052.8
1.637	1476.8	1476.8	1480.0	1480.0	0.0	0.0	9983.7	10017.0
1.621	1474.6	1474.6	1476.3	1476.3	0.0	0.0	9967.8	10025.4
1.590	1473.3	1473.3	1474.3	1474.3	0.0	0.0	9968.5	10034.5
1.479	1465.7	1465.7	1467.4	1467.4	0.0	0.0	9983.4	10040.8
1.398	1454.0	1454.1	1457.6	1457.6	0.1	0.0	9988.2	10018.4
1.374	1449.4	1449.4	1452.3	1452.3	0.0	0.0	9990.8	10030.6
1.367	1441.2	1441.2	1444.4	1444.4	0.0	0.0	9981.1	10012.6
1.286	1428.4	1428.4	1430.3	1430.3	0.0	0.0	9976.4	10018.4
1.208	1419.9	1419.9	1422.4	1422.4	0.0	0.0	9970.6	10021.4
1.116	1414.8	1414.8	1416.1	1416.1	0.0	0.0	9982.0	10029.1
1.010	1405.9	1405.9	1409.2	1409.2	0.0	0.0	9986.8	10013.1
0.914	1399.5	1399.5	1401.1	1401.1	0.0	0.0	9976.1	10021.4
0.850	1396.0	1396.0	1397.4	1397.4	0.0	0.0	9978.1	10032.3
0.819	1394.7	1394.7	1395.7	1395.7	0.0	0.0	9966.2	10036.7

Table 4-12 (continued)

Summary of results for the floodway profile for Unnamed Wash 1

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
0.523	1379.8	1380.7	1381.6	1381.9	0.9	0.3	9976.6	10069.3
0.484	1379.0	1379.6	1379.8	1380.8	0.6	1.0	9959.1	10017.7
0.453	1378.0	1378.4	1379.0	1379.9	0.4	0.9	9961.2	10019.6
0.414	1377.3	1377.6	1377.9	1378.5	0.3	0.6	9952.8	10023.6
0.356	1376.1	1377.0	1376.6	1377.4	0.9	0.8	9970.0	10107.7
0.323	1373.2	1373.6	1375.1	1376.0	0.4	0.9	9980.5	10037.9
0.238	1370.2	1371.0	1370.5	1371.3	0.8	0.8	9985.3	10140.2
0.190	1369.7	1370.5	1370.0	1370.9	0.8	0.9	9966.4	10090.4
0.141	1368.3	1369.2	1369.2	1370.1	0.9	0.9	9930.0	10011.7
0.046	1367.6	1368.5	1367.8	1368.8	0.9	1.0	9932.0	10044.8

Table 4-13

Summary of results for the floodway profile for Unnamed Wash 2

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
6.789	1845.2	1845.2	1846.1	1846.1	0.0	0.0	9974.7	10037.7
6.765	1843.6	1843.6	1845.0	1845.0	0.0	0.0	9971.1	10015.7
6.714	1839.3	1839.4	1841.9	1841.9	0.1	0.0	9984.3	10014.7
6.669	1833.2	1833.3	1834.9	1834.9	0.1	0.0	9987.5	10042.8
6.643	1830.5	1831.3	1831.7	1831.9	0.8	0.2	9922.9	10028.9
6.595	1826.9	1826.9	1828.0	1829.0	0.0	1.0	9984.4	10023.6
6.570	1824.0	1824.1	1825.9	1825.9	0.1	0.0	9971.1	10014.6
6.501	1817.8	1818.2	1819.0	1820.0	0.4	1.0	9982.9	10024.6
6.451	1813.9	1814.2	1814.9	1815.9	0.3	1.0	9966.3	10018.8
6.418	1810.5	1811.0	1811.6	1812.3	0.5	0.7	9960.1	10029.9
6.392	1808.1	1808.6	1809.0	1809.9	0.5	0.9	9953.4	10026.1
6.318	1803.0	1804.0	1803.5	1804.4	1.0	0.9	9911.3	10014.3
6.271	1800.6	1800.9	1801.2	1802.2	0.3	1.0	9959.7	10020.6
6.218	1796.5	1796.5	1798.0	1798.0	0.0	0.0	9969.9	10031.0
6.161	1792.9	1792.9	1793.5	1793.5	0.0	0.0	9792.5	10012.7
6.058	1786.3	1786.4	1787.7	1787.7	0.1	0.0	9896.2	10022.1
5.974	1781.6	1782.2	1782.5	1783.2	0.6	0.7	9956.4	10032.6
5.927	1778.3	1778.4	1780.2	1780.8	0.1	0.6	9984.1	10041.9
5.865	1773.6	1773.7	1775.2	1775.7	0.1	0.5	9948.8	10036.7
5.845	1768.2	1767.9	1770.2	1770.2	-0.3	0.0	9990.0	10055.0
5.759	1758.8	1758.8	1761.1	1761.1	0.0	0.0	9972.4	10033.0
5.702	1756.0	1756.1	1756.9	1757.5	0.1	0.6	9964.7	10033.0
5.624	1751.3	1751.4	1753.4	1753.4	0.1	0.0	9939.8	10018.5
5.551	1746.3	1746.2	1747.4	1747.4	-0.1	0.0	9892.2	10027.7
5.508	1743.2	1743.3	1744.9	1744.9	0.1	0.0	9967.1	10080.5
5.172	1723.1	1723.4	1724.7	1725.2	0.3	0.5	9967.9	10036.6

Table 4-13 (continued)

Summary of results for the floodway profile for Unnamed Wash 2

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
5.114	1720.3	1721.1	1721.5	1722.5	0.8	1.0	9974.2	10036.0
5.079	1717.7	1718.1	1719.7	1720.7	0.4	1.0	9976.5	10026.3
4.974	1711.3	1712.3	1711.9	1712.7	1.0	0.8	9970.6	10072.8
4.939	1709.0	1709.0	1710.7	1711.6	0.0	0.9	9951.7	10020.1
4.884	1703.9	1704.0	1705.9	1706.6	0.1	0.7	9949.6	10016.1
4.784	1695.7	1696.1	1697.9	1699.0	0.4	1.1	9984.5	10044.5
4.692	1688.8	1688.7	1691.0	1691.1	-0.1	0.1	9970.4	10044.1
4.640	1686.1	1686.2	1687.9	1687.9	0.1	0.0	9880.7	10032.0
4.600	1682.7	1683.0	1685.1	1685.1	0.3	0.0	9983.8	10093.1
4.502	1673.9	1673.8	1675.3	1676.2	-0.1	0.9	9979.1	10039.0
4.430	1668.7	1669.3	1670.4	1670.6	0.6	0.2	9923.4	10020.2
4.391	1665.0	1665.2	1667.0	1667.6	0.2	0.6	9973.4	10039.0
4.365	1663.4	1663.2	1665.0	1665.1	-0.2	0.1	9974.0	10053.7
4.332	1660.4	1660.4	1662.6	1662.6	0.0	0.0	9948.4	10041.6
4.286	1657.0	1657.5	1658.9	1659.6	0.5	0.7	9965.2	10031.9
4.199	1651.9	1652.1	1653.9	1654.4	0.2	0.5	9981.3	10047.4
4.102	1646.7	1646.7	1648.1	1648.3	0.0	0.2	9973.6	10117.9
4.072	1644.9	1645.1	1646.0	1646.2	0.2	0.2	9938.8	10075.0
4.013	1641.4	1641.3	1643.0	1643.1	-0.1	0.1	9888.0	10017.7
3.961	1637.7	1637.7	1639.2	1639.4	0.0	0.2	9928.1	10026.1
3.923	1635.8	1636.2	1637.3	1637.4	0.4	0.1	9968.9	10070.5
3.874	1634.4	1634.3	1635.2	1635.4	-0.1	0.2	9968.9	10099.3
3.825	1630.7	1630.6	1632.6	1632.6	-0.1	0.0	9946.0	10018.0
3.770	1626.0	1626.0	1629.2	1629.2	0.0	0.0	9977.8	10027.9
3.725	1622.2	1622.2	1624.1	1624.1	0.0	0.0	9922.1	10023.8
3.590	1611.3	1611.3	1612.6	1612.6	0.0	0.0	9961.2	10065.8

Table 4-13 (continued)

Summary of results for the floodway profile for Unnamed Wash 2

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
3.523	1606.9	1606.9	1609.5	1609.5	0.0	0.0	9949.6	10031.8
3.426	1600.4	1600.4	1601.6	1601.6	0.0	0.0	9937.0	10043.8
3.311	1592.8	1592.8	1595.7	1595.7	0.0	0.0	9967.7	10022.5
3.211	1584.8	1584.8	1586.4	1586.7	0.0	0.3	9945.1	10026.6
3.122	1582.7	1582.7	1583.8	1583.8	0.0	0.0	9932.3	10026.5
3.053	1582.7	1582.6	1583.0	1583.0	-0.1	0.0	9964.2	10061.0
3.033	1577.1	1577.2	1580.8	1580.8	0.1	0.0	9976.0	10016.3
3.007	1577.2	1577.2	1578.4	1578.4	0.0	0.0	9947.2	10026.3
2.976	1572.9	1572.9	1577.0	1577.0	0.0	0.0	9984.2	10018.8
2.934	1569.3	1569.4	1572.5	1572.5	0.1	0.0	9973.0	10026.8
2.903	1566.7	1566.7	1569.6	1569.6	0.0	0.0	9973.3	10030.8
2.892	1564.1	1564.1	1567.0	1567.0	0.0	0.0	9967.6	10027.3
2.856	1558.0	1558.1	1561.2	1561.2	0.1	0.0	9959.0	10010.4
2.813	1553.8	1554.0	1555.4	1556.3	0.2	0.9	9968.5	10034.9
2.718	1549.0	1548.9	1551.0	1551.2	-0.1	0.2	9963.5	10034.8
2.683	1548.7	1548.6	1549.4	1549.4	-0.1	0.0	9957.2	10070.1
2.656	1545.2	1545.2	1547.9	1547.9	0.0	0.0	9967.2	10084.8
2.625	1540.5	1541.3	1541.3	1542.1	0.8	0.8	9950.0	10080.1
2.603	1538.7	1538.8	1540.3	1541.1	0.1	0.8	9983.2	10071.0
2.521	1533.2	1533.2	1534.9	1534.9	0.0	0.0	9885.4	10024.1
2.424	1527.9	1527.9	1529.4	1529.4	0.0	0.0	9966.9	10064.8
2.401	1526.4	1526.5	1528.2	1528.2	0.1	0.0	9967.5	10059.7
2.319	1522.0	1522.0	1523.9	1523.9	0.0	0.0	9947.7	10025.9
2.225	1516.2	1516.2	1518.5	1518.5	0.0	0.0	9936.3	10027.3
1.818	1491.2	1491.2	1493.5	1493.5	0.0	0.0	9963.5	10043.6
1.781	1488.3	1488.3	1490.5	1490.7	0.0	0.2	9983.0	10054.5

Table 4-13 (continued)

Summary of results for the floodway profile for Unnamed Wash 2

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
1.742	1485.5	1485.5	1487.3	1487.3	0.0	0.0	9920.0	10035.6
1.677	1481.7	1481.8	1483.0	1483.0	0.1	0.0	9942.0	10063.8
1.629	1478.2	1478.3	1480.2	1480.3	0.1	0.1	9979.3	10066.0
1.535	1471.5	1471.7	1473.6	1473.9	0.2	0.3	9926.8	10018.3
1.481	1466.2	1466.3	1469.0	1469.0	0.1	0.0	9989.4	10055.0
1.438	1463.1	1463.1	1465.3	1465.3	0.0	0.0	9968.7	10060.6
1.419	1458.4	1458.5	1461.6	1461.6	0.1	0.0	9958.1	10031.7
1.363	1451.4	1451.4	1454.3	1454.3	0.0	0.0	9955.3	10016.3
1.261	1439.0	1438.8	1441.0	1441.0	-0.2	0.0	9965.2	10054.0
1.168	1433.3	1433.5	1435.6	1435.5	0.2	-0.1	9915.6	10034.7
1.092	1433.2	1433.2	1433.4	1433.5	0.0	0.1	9938.2	10085.8
1.052	1428.2	1428.2	1432.0	1432.0	0.0	0.0	9925.8	10009.3
0.995	1417.7	1417.7	1420.1	1420.1	0.0	0.0	9962.0	10031.9
0.957	1414.3	1414.3	1417.5	1417.5	0.0	0.0	9981.3	10034.2
0.916	1411.2	1411.2	1414.1	1414.1	0.0	0.0	9979.5	10040.8
0.864	1405.7	1405.9	1408.4	1408.4	0.2	0.0	9969.1	10036.2
0.769	1400.6	1400.5	1402.4	1402.6	-0.1	0.2	9980.2	10037.3
0.745	1401.0	1401.1	1401.7	1401.7	0.1	0.0	9946.2	10027.5
0.734	1397.0	1397.0	1401.1	1401.1	0.0	0.0	9982.7	10018.7
0.703	1394.0	1393.8	1394.8	1395.1	-0.2	0.3	9976.7	10033.7
0.650	1389.9	1389.9	1392.9	1392.9	0.0	0.0	9981.5	10018.7
0.625	1389.5	1389.5	1391.6	1391.6	0.0	0.0	9984.7	10026.4
0.610	1386.4	1386.4	1390.6	1390.6	0.0	0.0	9984.6	10019.8
0.589	1379.7	1379.8	1382.4	1382.4	0.1	0.0	9951.7	10022.2
0.252	1363.9	1364.2	1365.4	1366.1	0.3	0.7	9884.4	10069.8
0.205	1360.4	1360.7	1361.3	1361.7	0.3	0.4	9835.2	10117.8

Table 4-14

Summary of results for the floodway profile for Unnamed Wash 3

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
4.540	1641.1	1641.3	1642.2	1642.3	0.2	0.1	9976.8	10025.5
4.464	1636.6	1636.9	1637.4	1637.9	0.3	0.5	9979.4	10019.7
4.428	1635.3	1635.6	1635.7	1636.1	0.3	0.4	9960.0	10024.2
4.417	1634.1	1634.3	1635.1	1635.4	0.2	0.3	9945.0	10014.5
4.399	1631.8	1631.8	1633.0	1633.1	0.0	0.1	9940.0	10014.9
4.379	1629.7	1629.7	1631.0	1631.0	0.0	0.0	9976.1	10022.9
4.338	1626.1	1626.1	1627.3	1627.3	0.0	0.0	9978.6	10031.5
4.289	1622.5	1622.5	1623.7	1623.7	0.0	0.0	9980.1	10023.6
4.229	1618.3	1618.6	1619.3	1619.6	0.3	0.3	9984.4	10025.2
4.197	1616.8	1617.5	1617.5	1618.2	0.7	0.7	9971.9	10032.6
4.177	1615.8	1615.8	1616.6	1617.2	0.0	0.6	9981.4	10027.5
4.145	1612.4	1612.4	1614.4	1614.4	0.0	0.0	9972.3	10016.8
4.110	1608.1	1608.1	1610.0	1610.0	0.0	0.0	9972.8	10019.7
4.013	1599.3	1599.3	1600.9	1600.9	0.0	0.0	9972.1	10035.9
3.921	1591.1	1591.4	1592.9	1593.0	0.3	0.1	9982.5	10023.4
3.826	1585.3	1586.0	1586.3	1587.2	0.7	0.9	9991.6	10040.0
3.731	1579.0	1579.4	1580.2	1581.0	0.4	0.8	9982.2	10028.0
3.649	1574.8	1575.5	1575.5	1576.4	0.7	0.9	9981.1	10032.2
3.561	1570.5	1570.9	1571.5	1572.2	0.4	0.7	9975.0	10045.0
3.520	1569.3	1569.9	1569.7	1570.4	0.6	0.7	9970.0	10065.0
3.509	1569.1	1569.7	1569.4	1570.1	0.6	0.7	9976.5	10060.0
3.497	1567.6	1567.6	1568.7	1569.1	0.0	0.4	9987.8	10058.0
3.487	1567.4	1567.4	1568.0	1568.2	0.0	0.2	9978.5	10025.6
3.460	1565.0	1565.0	1566.5	1566.5	0.0	0.0	9986.6	10035.8
3.426	1563.9	1564.3	1564.7	1565.0	0.4	0.3	9959.0	10040.5

Table 4-14 (continued)

Summary of results for the floodway profile for Unnamed Wash 3

River	Water Surface Elevation (WSEL)		Energy Grade Line Elevation (EGL)		Surcharge		Floodway Encroachment Station	
Station	Floodplain	Floodway	Floodplain	Floodway	WSEL	EGL	Left	Right
miles	feet	feet	feet	feet	feet	feet	feet	feet
3.309	1556.5	1556.6	1558.3	1558.3	0.1	0.0	9985.0	10054.5
3.257	1553.0	1553.7	1554.0	1554.9	0.7	0.9	9970.0	10016.4
3.168	1548.4	1548.7	1549.2	1549.9	0.3	0.7	9973.3	10090.0
3.144	1547.4	1547.4	1548.0	1548.3	-0.1	0.3	9981.8	10125.0
3.114	1545.2	1545.6	1546.5	1546.8	0.4	0.3	9954.9	10022.7
3.061	1543.4	1543.5	1543.8	1544.1	0.1	0.3	9900.0	10015.9
3.042	1542.9	1543.0	1543.3	1543.4	0.1	0.1	9870.0	10027.2
3.015	1542.6	1542.6	1542.9	1542.9	0.0	0.0	9870.0	10011.2
2.984	1539.1	1539.1	1541.1	1541.0	0.0	-0.1	9975.7	10027.5
2.916	1535.1	1535.9	1535.9	1536.8	0.8	0.9	9982.2	10070.0
2.850	1532.5	1532.6	1533.2	1533.8	0.1	0.6	9950.0	10015.3
2.779	1529.1	1529.1	1530.5	1530.8	0.0	-0.1	9928.7	10046.0
2.677	1523.7	1524.4	1524.8	1525.8	0.7	0.6	9975.5	10030.2
2.581	1519.1	1519.1	1520.3	1520.8	0.0	0.5	9970.2	10019.4
2.522	1516.4	1516.4	1517.3	1517.4	0.0	0.1	9974.0	10053.8
2.471	1513.6	1513.6	1514.8	1514.8	0.0	0.0	9880.0	10012.6
2.421	1510.9	1511.7	1511.6	1512.3	0.8	0.7	9955.0	10039.9
2.315	1506.1	1506.0	1507.3	1508.2	-0.1	0.9	9981.5	10022.9
2.233	1501.2	1501.5	1502.4	1502.6	0.3	0.2	9956.5	10019.7
2.118	1495.3	1496.0	1496.4	1497.3	0.7	0.9	9984.1	10029.3
2.050	1491.8	1491.7	1492.5	1493.1	-0.1	0.6	9955.0	10025.0
2.011	1488.8	1488.8	1490.2	1490.2	0.0	0.0	9937.1	10029.9
1.973	1487.2	1487.2	1488.1	1488.1	0.0	0.0	9980.9	10077.9
1.944	1484.7	1484.8	1486.5	1486.5	0.1	0.0	9979.0	10041.1
1.872	1480.9	1480.9	1482.1	1482.0	0.0	-0.1	9962.8	10029.9

Table 4-14 (continued)

Summary of results for the floodway profile for Unnamed Wash 3

River Station miles	Water Surface Elevation (WSEL) Floodplain feet	Water Surface Elevation (WSEL) Floodway feet	Energy Grade Line Elevation (EGL) Floodplain feet	Energy Grade Line Elevation (EGL) Floodway feet	Surcharge WSEL feet	Surcharge EGL feet	Floodway Encroachment Station Left feet	Floodway Encroachment Station Right feet
1.784	1475.9	1475.9	1477.3	1477.3	0.0	0.0	9960.5	10021.1
1.690	1472.4	1472.3	1473.3	1473.3	-0.1	0.0	9954.7	10015.9
1.641	1469.6	1469.7	1471.2	1471.1	0.1	-0.1	9922.0	10022.1
1.600	1467.2	1467.7	1468.2	1468.6	0.5	0.4	9925.8	10017.2
1.563	1464.3	1465.1	1465.7	1466.6	0.8	0.9	9950.0	10037.1
1.537	1460.3	1460.4	1462.4	1462.4	0.1	0.0	9977.9	10038.4
1.519	1457.7	1457.7	1460.1	1460.1	0.0	0.0	9984.8	10029.0
1.497	1456.4	1456.4	1458.1	1458.1	0.0	0.0	9977.3	10029.0
1.481	1454.8	1454.8	1457.1	1457.1	0.0	0.0	9963.0	10011.2
1.425	1449.1	1449.0	1450.5	1450.5	-0.1	0.0	9977.8	10026.3
1.385	1441.7	1441.7	1444.3	1444.3	0.0	0.0	9988.9	10032.6
1.356	1437.5	1437.5	1438.3	1438.3	0.0	0.0	9973.7	10047.2
1.331	1436.0	1436.0	1436.8	1436.8	0.0	0.0	9942.0	10019.2
1.304	1433.1	1433.1	1434.6	1434.6	0.0	0.0	9982.1	10032.9
1.259	1426.8	1426.9	1429.1	1429.1	0.1	0.0	9978.6	10028.7
1.222	1416.3	1416.3	1418.8	1418.8	0.0	0.0	9975.3	10016.9
1.171	1413.3	1413.3	1413.9	1413.9	0.0	0.0	9966.7	10034.9
1.152	1411.4	1411.4	1412.9	1412.9	0.0	0.0	9971.6	10015.2
1.088	1407.2	1407.2	1408.8	1408.8	0.0	0.0	9985.8	10040.2
1.008	1401.4	1401.4	1403.2	1403.2	0.0	0.0	9983.8	10027.7
0.986	1400.3	1400.3	1401.4	1401.4	0.0	0.0	9973.7	10030.2
0.960	1397.2	1397.3	1399.3	1399.3	0.1	0.0	9950.6	10009.8
0.928	1394.4	1394.4	1395.4	1395.4	0.0	0.0	9983.1	10046.7
0.852	1389.8	1389.8	1391.9	1391.9	0.0	0.0	9972.3	10026.0
0.761	1384.8	1384.8	1385.8	1385.9	0.0	0.1	9918.0	10018.1
0.734	1382.8	1382.8	1384.3	1384.4	0.0	0.1	9960.0	10024.6

Table 4-14 (continued)

Summary of results for the floodway profile for Unnamed Wash 3

River Station	Water Surface Elevation (WSEL)		Energy Grade Line Elevation (EGL)		Surcharge		Floodway Encroachment Station	
	Floodplain	Floodway	Floodplain	Floodway	WSEL	EGL	Left	Right
miles	feet	feet	feet	feet	feet	feet	feet	feet
0.716	1382.3	1382.3	1383.3	1383.3	0.0	0.0	9957.1	10029.3
0.695	1379.2	1379.2	1382.0	1382.0	0.0	0.0	9977.5	10015.2
0.658	1376.2	1376.2	1377.8	1377.8	0.0	0.0	9952.5	10009.9
0.625	1373.8	1373.8	1375.6	1375.6	0.0	0.0	9941.3	10018.1
0.481	1363.6	1363.7	1364.8	1364.8	0.1	0.0	9973.8	10039.7
0.386	1358.1	1358.4	1360.0	1360.3	0.3	0.3	9978.9	10025.4
0.306	1353.4	1353.5	1354.7	1355.1	0.1	0.4	9935.0	10025.2
0.240	1349.3	1349.6	1349.8	1350.6	0.3	0.8	9860.0	10060.0
0.185	1344.2	1344.2	1345.9	1345.9	0.0	0.0	9968.0	10044.2
0.144	1340.7	1340.7	1342.6	1342.6	0.0	0.0	9982.9	10041.5

Table 4-15

Summary of normal depth calculations for the approximate method study watercourses

Wash Identification	Cross-section Identifer cfs	Discharge feet	Depth of flow feet	Top Width
Tributary 1 to Unnamed Wash 1	A-A	860	3.09	59.11
Tributary 1 to Unnamed Wash 1	B-B	860	4.08	94.97
Tributary 1 to Unnamed Wash 1	C-C	860	3.90	101.87
Unnamed Wash 2	Structure #7	1670	14.50	----
Unnamed Wash 2	A-A	1670	3.59	55.66
Unnamed Wash 2	B-B	1670	3.78	52.39
Unnamed Wash 2	C-C	1670	4.37	43.87
Unnamed Wash 2	D-D	1670	4.68	39.66
Unnamed Wash 2	E-E	1670	5.80	42.52
Unnamed Wash 2	F-F	1380	4.51	48.58
Unnamed Wash 2	G-G	1380	3.66	44.53
Unnamed Wash 2	H-H	1380	5.02	34.33
Tributary 1 to Unnamed Wash 2	A-A	860	3.82	34.01
Tributary 1 to Unnamed Wash 2	B-B	860	3.52	41.72
Tributary 1 to Unnamed Wash 2	C-C	860	4.62	61.25
Tributary 1 to Unnamed Wash 2	D-D	860	4.10	48.73
Tributary 1 to Unnamed Wash 2	E-E	860	4.60	37.80
Tributary 1 to Unnamed Wash 2	F-F	860	3.44	47.45
Tributary 1 to Unnamed Wash 2	G-G	860	5.23	47.15
Tributary 2 to Unnamed Wash 2	A-A	1130	1.95	173.90
Tributary 2 to Unnamed Wash 2	B-B	1130	3.44	53.28
Tributary 2 to Unnamed Wash 2	Structure #13	1130	11.69	----
Tributary 2 to Unnamed Wash 2	C-C	1130	2.55	61.42
Tributary 2 to Unnamed Wash 2	D-D	1130	3.52	60.27
Tributary 2 to Unnamed Wash 2	E-E	1130	4.17	37.29
Twin Buttes Wash	A-A	1390	4.95	108.87
Twin Buttes Wash	B-B	1390	4.38	59.88
Twin Buttes Wash	C-C	1390	9.68	24.93
Twin Buttes Wash	D-D	1390	4.64	92.63
Twin Buttes Wash	E-E	1390	4.86	34.40
Twin Buttes Wash	F-F	1250	5.07	35.15

Table 4-15 (continued)

Summary of normal depth calculations for the approximate method study watercourses

Wash Identification	Cross-section Identifer cfs	Discharge feet	Depth of flow feet	Top Width
Twin Buttes Wash	G-G	1250	4.65	99.16
Twin Buttes Wash	H-H	1250	3.30	71.32
Twin Buttes Wash	I-I	1250	3.71	53.91
Twin Buttes Wash	J-J	1250	2.29	218.38
Twin Buttes Wash	K-K	1250	3.50	97.73
Twin Buttes Wash	L-L	1250	2.85	122.34
Caterpillar Tank Wash	A-A	1210	5.49	43.79
Caterpillar Tank Wash	B-B	1210	3.43	53.29
Unnamed Wash 4	F-F	772	3.25	487.15
Unnamed Wash 4	G-G	772	1.16	426.38
Unnamed Wash 4	H-H	772	1.97	332.76
Unnamed Wash 4	I-I	689	3.29	238.45
Unnamed Wash 4	J-J	689	3.80	41.79
Tributary 1 to Unnamed Wash 4	A-A	772	5.40	190.28
Tributary 1 to Unnamed Wash 4	B-B	772	4.07	168.45
Unnamed Wash 4	K-K	690	3.91	62.67
Unnamed Wash 4	Structure # 63	1420	13.76	----
Unnamed Wash 4	A-A	1420	1.68	214.53
Unnamed Wash 4	B-B	1420	3.41	80.65
Unnamed Wash 4	C-C	1420	3.88	94.32
Unnamed Wash 4	D-D	1420	3.00	70.25
Unnamed Wash 4	E-E	1420	4.27	53.62
Unnamed Wash 5	A-A	1160	4.37	145.24
Unnamed Wash 5	B-B	1160	2.46	136.09
Unnamed Wash 5	C-C	1160	2.62	247.99
Unnamed Wash 5	D-D	1160	3.71	107.59
Unnamed Wash 5	E-E	1160	3.26	190.57
Unnamed Wash 5	F-F	1160	4.18	112.84
Unnamed Wash 5	G-G	1160	4.40	45.54
Unnamed Wash 5	H-H	1160	4.94	268.76
Unnamed Wash 5	I-I	1160	2.92	95.44

Table 4-15 (continued)

Summary of normal depth calculations for the approximate method study watercourses

Wash Identification	Cross-section Identifer cfs	Depth of Discharge feet	Top flow feet	Width
Unnamed Wash 5	Structure # 62	1160	2.00	33.00
Unnamed Wash 5	J-J	880	3.47	82.00
Unnamed Wash 5	K-K	880	3.27	77.36
Unnamed Wash 5	L-L	880	2.74	106.45
Unnamed Wash 5	M-M	880	4.93	116.69
Unnamed Wash 5	Structure # 74	880	18.37	124.57
Unnamed Wash 5	N-N	1630	4.11	114.53
Unnamed Wash 5	O-O	1630	3.24	166.40
Unnamed Wash 5	Structure # 73	1630	5.88	----
Unnamed Wash 5	P-P	1630	3.17	369.71
Unnamed Wash 5	Q-Q	1630	3.28	272.64
Unnamed Wash 5	R-R	1630	2.35	424.01
Unnamed Wash 6	A-A	1380	4.03	93.50
Unnamed Wash 6	B-B	1380	3.21	119.86
Unnamed Wash 6	C-C	1380	2.85	124.01
Unnamed Wash 6	D-D	1380	3.50	99.26
Unnamed Wash 6	E-E	1380	4.16	55.98
Unnamed Wash 6	F-F	1380	1.83	317.77
Unnamed Wash 6	G-G	1380	3.30	144.87
Unnamed Wash 6	Structure # 106	1380	6.63	----
Unnamed Wash 6	H-H	1380	3.65	165.04
Unnamed Wash 6	I-I	1380	1.79	428.53
Unnamed Wash 6	J-J	1380	3.46	94.54
Unnamed Wash 7	A-A	1790	5.14	133.04
Unnamed Wash 7	B-B	1790	4.40	85.58
Unnamed Wash 7	C-C	1790	4.76	90.86
Unnamed Wash 7	D-D	1790	5.41	53.15
Unnamed Wash 7	E-E	1790	2.07	411.73
Unnamed Wash 7	F-F	1790	2.33	297.28
Unnamed Wash 7	Structure # 76	1790	11.49	----
Unnamed Wash 7	G-G	1790	3.42	181.14

Table 4-15 (continued)

Summary of normal depth calculations for the approximate method study watercourses

Wash Identification	Cross-section Identifer cfs	Depth of Discharge feet	Top flow feet	Width
Unnamed Wash 7	H-H	1790	3.17	195.35
Tributary 1 to Unnamed 7	A-A	1790	5.60	58.62
Tributary 1 to Unnamed 7	B-B	1790	2.08	269.74
Tributary 1 to Unnamed 7	C-C	1790	4.26	143.54
Unnamed Wash 8	A-A	1150	2.62	123.00
Unnamed Wash 8	B-B	1150	3.68	81.20
Unnamed Wash 8	C-C	1150	4.03	73.28
Unnamed Wash 8	D-D	1150	3.97	72.79
Unnamed Wash 8	E-E	1150	3.42	86.93
Unnamed Wash 8	F-F	1150	1.96	311.50
Unnamed Wash 8	Structure # 104	1150	5.57	----
Unnamed Wash 8	G-G	1150	2.55	233.05
Unnamed Wash 8	H-H	1150	1.84	453.68
Unnamed Wash 8	I-I	1150	1.77	527.49
Unnamed Wash 9	A-A	1130	3.34	69.50
Unnamed Wash 9	B-B	1130	2.72	113.40
Unnamed Wash 9	C-C	1130	3.50	108.07
Unnamed Wash 9	D-D	1130	2.36	161.12
Unnamed Wash 9	E-E	1130	3.42	96.69
Unnamed Wash 9	F-F	1130	3.12	84.93
Unnamed Wash 9	G-G	1130	3.48	82.83
Unnamed Wash 9	Structure # 86	1130	8.10	----
Unnamed Wash 9	H-H	860	3.41	96.01

SECTION 5: EROSION/SEDIMENT TRANSPORT ANALYSIS

Erosion/sediment transport analyses are not conducted as part of the floodplain delineation study phase of the North Peoria Area Drainage Master Plan.

SECTION 6: REFERENCE MATERIALS

6.1 Other Published Flood Studies

See discussion in Section 3.6.2 pertaining to previous studies.

6.2 Previous FEMA Studies

Same as Section 6.1

6.3 Other Applicable Studies

No other studies are referenced in this report.

6.4 Published and Unpublished Historical Flood Information

See discussion in Section 3.2.5.1 and Section 3.2.3.2 of this report.

6.5 Bibliography

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SECTION 7: DRAFT FIS REPORT DATA

7.1 General

This section of the report presents completed FEMA Forms, and the results of hydrologic and hydraulic computer modeling results in FEMA format. The following sections also provide additional information in regard to the data included on the FEMA forms for the specific sections that require additional information. The FEMA forms are provided at the end of this section. Detailed information regarding the hydrologic and hydraulic analyses are provided in Sections 3 and 4 of this document.

7.2 Reason for New Hydrologic Analysis

Development with the study area specified for this project is imminent. The goal of this study is to use engineering analyses to establish policies and guidelines for the management of future development from both a watercourse and watershed perspective. As part of this study, floodplain delineations are determined for various watercourses within the watershed limits.

The study watershed includes sub-watersheds that have been previously studied. The reason for the new hydrology for these previously studied areas is to perform Zone A approximate method delineations in their upper reaches and to extend flood hazard delineation beyond the existing detailed delineation. The extents of those studies are shown in relation to the total watershed limits for this study in Figure 3-3. Those studies employ analytical methodologies or computational procedures that are different than what is currently recommended for use in Maricopa County. A brief discussion of the methodologies used for the previous studies are provided in Section 3.6.2. Additionally, detailed soils information was only available for a portion of those study watershed limits. For this study, detailed soils information was used for the entire study area. For the purposes of this study it was desired to have a single homogeneous hydrologic model based on the most current methodologies for the entire study watershed. Watershed models developed for this study are provided on a CD as Appendix O

7.3 Comparison of Base Flood Discharges

Hydrologic analyses were performed for the entire study area of this project, including sub-watersheds previously studied. In general, the results of the hydrologic analysis are used for planning purposes, floodplain delineation and other engineering analyses. Of the floodplain delineations performed as part of this study, only two reaches fell within the limits of the previous studies. The floodplains delineated for these reaches are based on approximate methods and are extension of Twin Buttes Wash and Caterpillar Tank Wash detailed floodplain delineations. The peak discharges used to establish the floodplain limits for these reaches are shown in comparison with the results of the previous study in Section 4 of the MT-2 Form 3. Regulatory peak discharges used for the detailed study watercourses for this study are listed in Tables 7-1 through 7-3. Revisions to existing floodplain delineations were not performed as part of this study and therefore comparisons of peak discharges other than what is listed in Section 4 of the MT-2 Form 3 are unnecessary.

The approximate method delineations located within the watershed limits of the previous studies tie into the Twin Buttes and Caterpillar Tank Washes floodplain delineations upstream of the Central Arizona Project Canal as shown in Figure 7-1. The ponding condition caused by the Canal was mapped as Zone AH. As a result of the storage upstream of the Canal, peak discharges computed for this study immediately downstream of the Canal are nearly identical to those computed in the previous study. Therefore, no transition from the proposed discharges to the effective discharges is required.

Table 7-1

FEMA summary of discharges for Unnamed Wash 1

Flooding Source and Location	Drainage Area	Peak Discharges				Remarks
Unnamed Wash 1		10-Year	50-Year	100-Year	500-Year	
	sq. miles	cfs	cfs	cfs	cfs	
At River Mile 0.046	5.05	N/A	N/A	3,190	N/A	Concentration Point C105L
At River Mile 1.367	4.11	N/A	N/A	2,890	N/A	Concentration Point C104
At River Mile 3.073	2.95	N/A	N/A	2,330	N/A	Concentration Point C103R
At River Mile 4.628	1.20	N/A	N/A	1,190	N/A	Concentration Point C102R
At River Mile 5.969	0.57	N/A	N/A	750	N/A	Subbasin S100

Table 7-2

FEMA summary of discharges for Unnamed Wash 2

Flooding Source and Location	Drainage Area	Peak Discharges				Remarks
Unnamed Wash 2		10-Year	50-Year	100-Year	500-Year	
	sq. miles	cfs	cfs	cfs	cfs	
At River Mile 0.205	12.75	N/A	N/A	7,300	N/A	Concentration Point C105
At River Mile 0.309	7.70	N/A	N/A	4,680	N/A	Concentration Point C105R
At River Mile 1.677	6.74	N/A	N/A	4,570	N/A	Concentration Point C207R
At River Mile 2.656	6.09	N/A	N/A	4,420	N/A	Concentration Point C206
At River Mile 4.974	4.03	N/A	N/A	3,380	N/A	Concentration Point C205L
At River Mile 5.974	3.17	N/A	N/A	2,910	N/A	Concentration Point C204
At River Mile 6.218	1.81	N/A	N/A	1,750	N/A	Concentration Point C203R

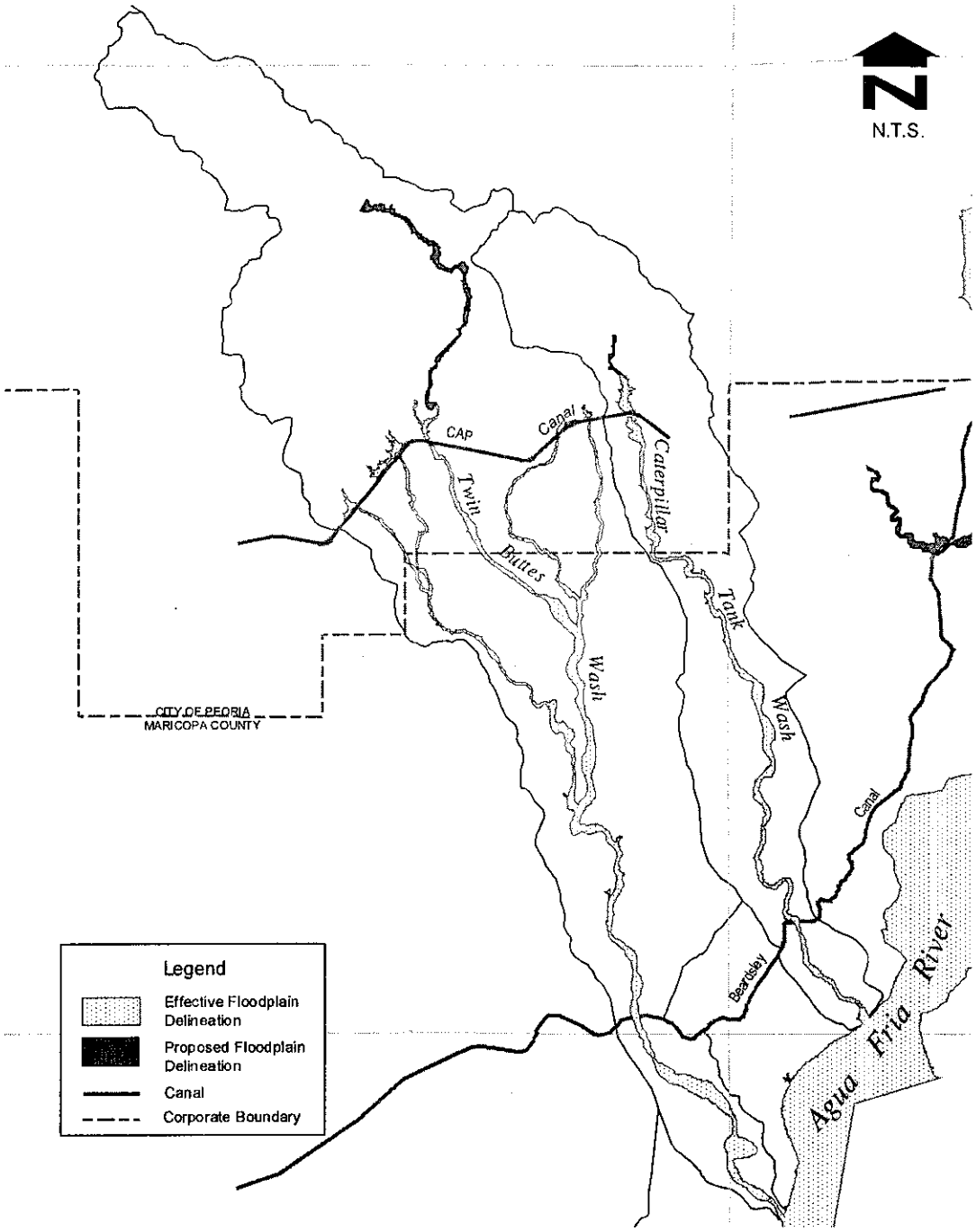
Table 7-3

FEMA summary of discharges for Unnamed Wash 3

Flooding Source and Location	Drainage Area	Peak Discharges				Remarks
Unnamed Wash 3		10-Year	50-Year	100-Year	500-Year	
	sq. miles	cfs	cfs	cfs	cfs	
At River Mile 0.144	3.60	N/A	N/A	2,570	N/A	Concentration Point C303
At River Mile 1.690	2.78	N/A	N/A	2,200	N/A	Concentration Point C302
At River Mile 3.257	2.07	N/A	N/A	1,990	N/A	Concentration Point C301
At River Mile 4.229	0.99	N/A	N/A	1,220	N/A	Subbasin S301

Figure 7-1

Extensions to existing studies



7.4 Models Submitted

Detailed hydraulic analyses for Unnamed Washes 1, 2 and 3 are computed using the Corps of Engineers HEC-RAS computer program version 3.0 dated January 2001. That model is organized by projects, plans, flow data and geometric data. A separate project file is created for each detailed study watercourse. Each project contains a single plan, geometry file and flow file. The flow file contains two profiles, both of which are for the 100-year event. The first profile is for the natural conditions and the second is for the floodway. The floodway for each study watercourse was initially established using the Method 4, equal conveyance option of the HEC-RAS program. Those results were then converted to the Method 1 option and refined as necessary.

7.5 Results

All three detailed study watercourses are run for a subcritical regime. The hydraulic characteristics of these watercourses are such that the model defaults to critical depth at numerous locations and subsequent encroachment often resulted in negative floodway surcharges. Due to these conditions, floodway encroachments are established based on the energy gradeline. Floodway data tables for each detailed study watercourse are provided as Tables 7-4 through 7-6. Despite the use of the energy gradeline for the floodway, there are still locations at which a reduction in water surface elevation occurs. For these locations, the floodway water surface elevations shown in Tables 7-4 through 7-6 and on the work maps are set equal to the floodplain water surface elevation. Flood profiles for each watercourse are provided in Section 7.7.

Table 7-4

Floodway table for Unnamed Wash 1

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 1		feet	sq. feet	fps	feet	feet	feet	feet
A	0.046	112.8	763.4	4.2	1367.6	1367.6	1368.5	0.9
B	0.141	81.7	425.4	7.5	1368.3	1368.3	1369.2	0.9
C	0.190	124.0	728.3	4.4	1369.7	1369.7	1370.5	0.8
D	0.238	154.9	714.4	4.5	1370.2	1370.2	1371.0	0.8
E	0.323	57.4	268.0	11.9	1373.2	1373.2	1373.6	0.4
F	0.356	137.8	706.9	4.5	1376.0	1376.0	1377.0	1.0
G	0.414	70.8	451.9	7.1	1377.3	1377.3	1377.6	0.3
H	0.453	58.4	348.6	9.2	1378.0	1378.0	1378.4	0.4
I	0.484	58.6	386.6	8.3	1378.9	1378.9	1379.6	0.7
J	0.523	92.7	429.8	7.4	1379.8	1379.8	1380.7	0.9
K	0.547	62.8	286.9	11.1	1381.4	1381.4	1381.4	0.0
L	0.575	97.6	456.0	7.0	1383.8	1383.8	1383.8	0.0
M	0.644	88.7	426.7	7.5	1386.5	1386.5	1386.5	0.0
N	0.724	80.3	408.8	7.8	1390.2	1390.2	1390.2	0.0
O	0.819	70.5	396.5	8.1	1394.7	1394.7	1394.7	0.0
P	0.850	54.3	334.5	9.5	1396.0	1396.0	1396.0	0.0
Q	0.914	45.3	318.4	10.0	1399.5	1399.5	1399.5	0.0
R	1.010	26.4	225.1	14.2	1405.9	1405.9	1405.9	0.0
S	1.116	47.1	361.8	8.8	1414.8	1414.8	1414.8	0.0
T	1.208	50.8	253.8	12.6	1419.9	1419.9	1419.9	0.0
U	1.286	42.0	287.2	11.1	1428.4	1428.4	1428.4	0.0
V	1.367	31.5	208.4	13.9	1441.2	1441.2	1441.2	0.0
W	1.374	39.8	215.1	13.4	1449.4	1449.4	1449.4	0.0
X	1.398	30.2	198.7	14.6	1454.0	1454.0	1454.1	0.1
Y	1.479	57.3	278.1	10.4	1465.7	1465.7	1465.7	0.0
Z	1.590	66.0	360.1	8.0	1473.3	1473.3	1473.3	0.0
AA	1.621	57.6	292.5	9.9	1474.6	1474.6	1474.6	0.0
AB	1.637	33.3	202.6	14.3	1476.8	1476.8	1476.8	0.0
AC	1.675	72.9	368.0	7.9	1482.4	1482.4	1482.4	0.0
AD	1.709	86.4	455.7	6.3	1484.0	1484.0	1484.0	0.0
AE	1.768	58.7	287.9	10.0	1486.7	1486.7	1486.7	0.0
AF	1.862	53.1	321.7	9.0	1494.4	1494.4	1494.4	0.0
AG	1.928	52.5	273.1	10.6	1499.2	1499.2	1499.2	0.0
AH	1.992	96.0	464.1	6.2	1504.0	1504.0	1504.0	0.0

Table 7-4 (continued)

Floodway table for Unnamed Wash 1

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 1		feet	sq. feet	fps	feet	feet	feet	feet
AI	2.047	70.0	268.3	10.8	1509.8	1509.8	1509.9	0.1
AJ	2.134	66.4	273.7	10.6	1520.2	1520.2	1520.2	0.0
AK	2.230	98.4	400.2	7.2	1527.8	1527.8	1528.5	0.7
AL	2.312	123.6	317.6	9.1	1533.5	1533.5	1534.2	0.7
AM	2.347	168.4	616.9	4.7	1537.1	1537.1	1537.5	0.4
AN	2.390	113.7	373.3	7.7	1539.9	1539.9	1539.9	0.0
AO	2.467	75.0	375.8	7.7	1545.4	1545.4	1545.5	0.1
AP	2.557	54.1	275.8	10.5	1550.6	1550.6	1550.6	0.0
AQ	2.611	55.1	276.6	10.5	1555.7	1555.7	1555.7	0.0
AR	2.674	59.7	313.7	9.2	1561.8	1561.8	1561.9	0.1
AS	2.770	83.9	368.7	7.8	1568.7	1568.7	1568.7	0.0
AT	2.813	71.2	316.4	9.1	1571.4	1571.4	1571.4	0.0
AU	2.848	75.2	312.6	9.2	1574.8	1574.8	1574.8	0.0
AV	2.880	69.9	297.9	9.7	1577.9	1577.9	1577.9	0.0
AW	2.923	66.2	334.3	8.7	1581.8	1581.8	1581.8	0.0
AX	3.015	82.4	311.0	9.3	1588.4	1588.4	1588.4	0.0
AY	3.073	77.8	293.8	7.9	1594.1	1594.1	1594.6	0.5
AZ	3.121	79.9	360.1	6.5	1597.8	1597.8	1598.7	0.9
BA	3.186	80.9	277.7	8.4	1601.1	1601.1	1601.5	0.4
BB	3.274	54.5	257.6	9.1	1604.7	1604.7	1605.3	0.6
BC	3.366	66.3	222.3	10.5	1611.3	1611.3	1611.3	0.0
BD	3.453	61.1	285.2	8.2	1616.2	1616.2	1616.3	0.1
BE	3.515	48.4	202.0	11.5	1619.6	1619.6	1619.8	0.2
BF	3.577	129.7	428.1	5.4	1623.6	1623.6	1624.1	0.5
BG	3.617	174.7	306.4	7.6	1626.2	1626.2	1626.2	0.0
	3.631	Inline Weir			Inline Weir			
BH	3.643	376.1	4019.3	0.6	1642.1	1642.1	1642.1	0.0
BI	3.671	368.0	3304.3	0.7	1642.1	1642.1	1642.1	0.0
BJ	3.706	269.9	1923.4	1.2	1642.1	1642.1	1642.1	0.0
BK	3.803	91.7	539.3	4.3	1642.1	1642.1	1642.1	0.0
BL	3.895	88.7	350.9	6.6	1642.9	1642.9	1642.9	0.0
BM	3.987	72.6	296.2	7.9	1645.1	1645.1	1646.1	1.0
BN	4.077	96.4	328.7	7.1	1649.7	1649.7	1650.1	0.4
BO	4.170	100.3	314.2	7.4	1654.0	1654.0	1654.2	0.2
BP	4.256	109.6	321.7	7.2	1659.0	1659.0	1659.0	0.0

Table 7-4 (continued)

Floodway table for Unnamed Wash 1

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 1		feet	sq. feet	fps	feet	feet	feet	feet
BQ	4.361	54.5	240.0	9.7	1663.6	1663.6	1664.2	0.6
BR	4.412	59.0	263.3	8.9	1666.7	1666.7	1667.0	0.3
BS	4.436	113.9	293.2	8.0	1669.7	1669.7	1670.0	0.3
BT	4.536	43.8	208.0	11.2	1676.2	1676.2	1676.5	0.3
BU	4.613	114.9	364.9	6.4	1680.8	1680.8	1680.9	0.1
BV	4.628	88.5	321.5	3.7	1681.8	1681.8	1681.9	0.1
BW	4.725	53.2	138.3	8.6	1687.6	1687.6	1687.9	0.3
BX	4.839	91.7	193.0	6.2	1694.8	1694.8	1695.2	0.4
BY	4.879	95.2	206.2	5.8	1696.8	1696.8	1697.0	0.2
BZ	4.920	38.0	144.4	8.2	1698.2	1698.2	1698.8	0.6
CA	5.007	81.8	181.7	6.6	1702.8	1702.8	1702.8	0.0
CB	5.096	48.4	143.1	8.3	1707.1	1707.1	1707.1	0.0
CC	5.176	50.2	135.4	8.8	1712.9	1712.9	1713.0	0.1
CD	5.207	83.7	244.7	4.9	1715.3	1715.3	1715.3	0.0
CE	5.227	71.8	168.0	7.1	1715.8	1715.8	1715.8	0.0
CF	5.310	40.5	135.1	8.8	1720.7	1720.7	1721.1	0.4
CG	5.380	74.6	217.1	5.5	1725.7	1725.7	1725.8	0.1
CH	5.439	60.3	143.6	8.3	1731.4	1731.4	1731.4	0.0
CI	5.505	55.5	137.8	8.6	1737.6	1737.6	1737.6	0.0
CJ	5.632	49.4	152.1	7.8	1745.9	1745.9	1746.0	0.1
CK	5.746	83.5	196.0	6.1	1751.9	1751.9	1752.0	0.1
CL	5.862	48.6	128.2	9.3	1760.1	1760.1	1760.1	0.0
CM	5.917	40.3	94.8	7.9	1765.2	1765.2	1765.2	0.0
CN	5.969	97.4	187.9	4.0	1768.4	1768.4	1768.7	0.3
CO	6.015	42.0	89.5	8.4	1771.0	1771.0	1771.0	0.0
CP	6.100	66.0	124.0	6.1	1780.3	1780.3	1780.4	0.1
CQ	6.216	88.1	114.2	6.6	1789.7	1789.7	1789.7	0.0
CR	6.311	35.2	85.7	8.8	1797.4	1797.4	1797.4	0.0

Table 7-5

Floodway table for Unnamed Wash 2

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 2		feet	sq. feet	fps	feet	feet	feet	feet
A	0.205	276.7	884.0	8.3	1360.4	1360.4	1360.7	0.3
B	0.252	185.4	751.9	9.7	1363.9	1363.9	1364.2	0.3
C	0.309	87.5	527.7	8.9	1367.0	1367.0	1367.9	0.9
D	0.348	90.7	520.4	9.0	1368.6	1368.6	1369.0	0.4
E	0.441	82.4	415.0	11.3	1371.8	1371.8	1372.6	0.8
F	0.537	76.8	475.6	9.8	1377.3	1377.3	1377.6	0.3
G	0.589	70.5	361.9	12.9	1379.7	1379.7	1379.8	0.1
H	0.610	35.2	284.9	16.4	1386.4	1386.4	1386.4	0.0
I	0.625	41.6	402.3	11.6	1389.5	1389.5	1389.5	0.0
J	0.650	37.2	338.3	13.8	1389.9	1389.9	1389.9	0.0
K	0.703	56.9	513.1	9.1	1394.0	1394.0	1394.0	0.0
L	0.734	36.0	289.1	16.2	1397.0	1397.0	1397.0	0.0
M	0.745	81.3	780.5	6.0	1401.0	1401.0	1401.1	0.1
N	0.769	56.9	427.7	10.9	1400.6	1400.6	1400.6	0.0
O	0.864	67.1	363.6	12.9	1405.7	1405.7	1405.9	0.2
P	0.916	61.3	345.9	13.5	1411.1	1411.1	1411.2	0.1
Q	0.957	53.0	327.8	14.3	1414.3	1414.3	1414.3	0.0
R	0.995	69.8	383.1	12.2	1417.7	1417.7	1417.7	0.0
S	1.052	49.1	325.3	14.4	1428.2	1428.2	1428.2	0.0
T	1.092	147.5	1192.2	3.9	1433.2	1433.2	1433.2	0.0
U	1.168	119.1	469.8	10.0	1433.3	1433.3	1433.5	0.2
V	1.261	87.7	395.8	11.8	1439.0	1439.0	1439.0	0.0
W	1.363	60.9	344.7	13.6	1451.4	1451.4	1451.4	0.0
X	1.419	73.7	376.3	12.4	1458.4	1458.4	1458.5	0.1
Y	1.438	91.9	396.2	11.8	1463.1	1463.1	1463.1	0.0
Z	1.481	65.6	353.7	13.2	1466.2	1466.2	1466.2	0.0
AA	1.535	91.5	402.5	11.6	1471.5	1471.5	1471.7	0.2
AB	1.629	86.8	411.5	11.4	1478.2	1478.2	1478.3	0.1
AC	1.677	121.8	508.5	9.0	1481.7	1481.7	1481.8	0.1
AD	1.742	115.6	456.8	10.0	1485.5	1485.5	1485.5	0.0
AE	1.781	71.5	366.8	12.5	1488.3	1488.3	1488.3	0.0
AF	1.818	80.1	371.5	12.3	1491.2	1491.2	1491.2	0.0
AG	1.846	85.9	448.6	10.2	1493.4	1493.4	1493.4	0.0
AH	1.940	86.0	380.1	12.0	1497.9	1497.9	1497.9	0.0
AI	2.034	74.6	405.3	11.3	1503.9	1503.9	1503.9	0.1

Table 7-5 (continued)

Floodway table for Unnamed Wash 2

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 2		feet	sq. feet	fps	feet	feet	feet	feet
AJ	2.131	77.2	393.0	11.6	1509.8	1509.8	1509.8	0.0
AK	2.225	91.0	398.4	11.5	1516.2	1516.2	1516.2	0.0
AL	2.319	78.1	408.9	11.2	1522.0	1522.0	1522.0	0.0
AM	2.401	92.2	430.7	10.6	1526.4	1526.4	1526.4	0.0
AN	2.424	97.9	458.9	10.0	1527.9	1527.9	1527.9	0.0
AO	2.521	138.6	511.3	8.9	1533.2	1533.2	1533.2	0.0
AP	2.603	87.8	408.3	11.2	1538.7	1538.7	1538.8	0.1
AQ	2.625	130.0	686.2	6.7	1540.5	1540.5	1541.3	0.8
AR	2.656	71.7	344.7	12.8	1545.2	1545.2	1545.2	0.0
AS	2.683	112.8	679.2	6.5	1548.7	1548.7	1548.7	0.0
AT	2.718	71.2	384.9	11.5	1549.0	1549.0	1549.0	0.0
AU	2.813	66.5	391.7	11.3	1553.8	1553.8	1554.0	0.2
AV	2.856	51.4	311.4	14.2	1558.0	1558.0	1558.1	0.1
AW	2.892	59.7	326.9	13.5	1564.1	1564.1	1564.1	0.0
AX	2.903	57.5	325.8	13.6	1566.7	1566.7	1566.7	0.0
AY	2.934	53.8	316.8	14.0	1569.3	1569.3	1569.4	0.1
AZ	2.976	34.6	273.6	16.2	1572.9	1572.9	1572.9	0.0
BA	3.007	78.3	522.8	8.5	1577.2	1577.2	1577.2	0.0
BB	3.033	40.3	289.4	15.3	1577.1	1577.1	1577.2	0.1
BC	3.053	96.8	928.1	4.8	1582.7	1582.7	1582.7	0.0
BD	3.122	94.1	568.1	7.8	1582.7	1582.7	1582.7	0.0
BE	3.211	81.5	413.1	10.7	1584.8	1584.8	1584.8	0.0
BF	3.311	54.8	321.1	13.8	1592.8	1592.8	1592.8	0.0
BG	3.426	106.7	508.3	8.7	1600.4	1600.4	1600.4	0.0
BH	3.523	72.5	346.0	12.8	1606.9	1606.9	1606.9	0.0
BI	3.590	99.1	501.6	8.8	1611.3	1611.3	1611.3	0.0
BJ	3.618	85.0	399.7	11.1	1614.6	1614.6	1614.8	0.2
BK	3.643	69.3	358.0	12.4	1616.8	1616.8	1616.8	0.0
BL	3.660	69.2	472.7	9.4	1619.2	1619.2	1619.2	0.0
BM	3.698	145.8	726.2	6.1	1621.7	1621.7	1621.7	0.0
BN	3.725	101.7	420.7	10.5	1622.2	1622.2	1622.2	0.0
BO	3.770	50.0	310.7	14.2	1626.0	1626.0	1626.0	0.0
BP	3.825	71.8	417.5	10.6	1630.7	1630.7	1630.7	0.0
BQ	3.874	130.1	525.4	8.4	1634.4	1634.4	1634.4	0.0
BR	3.923	101.6	490.5	9.0	1635.8	1635.8	1636.2	0.4

Table 7-5 (continued)

Floodway table for Unnamed Wash 2

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 2		feet	sq. feet	fps	feet	feet	feet	feet
BS	3.961	97.9	418.6	10.6	1637.7	1637.7	1637.7	0.0
BT	4.013	129.6	432.7	10.2	1641.4	1641.4	1641.4	0.0
BU	4.072	136.2	538.1	8.2	1644.9	1644.9	1645.1	0.2
BV	4.102	144.2	471.3	9.4	1646.7	1646.7	1646.7	0.0
BW	4.199	66.1	360.9	12.3	1651.9	1651.9	1652.1	0.2
BX	4.286	66.7	386.9	11.4	1657.0	1657.0	1657.5	0.5
BY	4.332	93.2	407.1	10.9	1660.4	1660.4	1660.4	0.0
BZ	4.365	79.5	403.1	11.0	1663.4	1663.4	1663.4	0.0
CA	4.391	65.6	359.5	12.3	1665.0	1665.0	1665.2	0.2
CB	4.430	96.8	482.2	9.2	1668.7	1668.7	1669.3	0.6
CC	4.502	59.9	356.3	12.4	1673.9	1673.9	1673.9	0.0
CD	4.600	109.4	447.1	9.9	1682.7	1682.7	1683.0	0.3
CE	4.640	151.3	508.5	8.7	1686.1	1686.1	1686.2	0.1
CF	4.692	73.5	355.9	12.4	1688.8	1688.8	1688.8	0.0
CG	4.784	60.0	334.8	13.2	1695.6	1695.6	1696.1	0.5
CH	4.884	66.5	342.7	12.9	1703.9	1703.9	1704.0	0.1
CI	4.939	68.4	357.1	12.4	1708.9	1708.9	1709.0	0.1
CJ	4.974	102.2	675.0	5.0	1711.3	1711.3	1712.3	1.0
CK	5.079	49.8	263.9	12.8	1717.7	1717.7	1718.1	0.4
CL	5.114	61.8	368.0	9.2	1720.3	1720.3	1721.1	0.8
CM	5.172	68.7	315.7	10.7	1723.1	1723.1	1723.4	0.3
CN	5.266	51.5	269.8	12.5	1729.1	1729.1	1729.4	0.3
CO	5.304	77.8	446.8	7.6	1731.9	1731.9	1732.5	0.6
CP	5.364	92.3	318.7	10.6	1734.4	1734.4	1734.5	0.1
CQ	5.460	82.8	377.8	9.0	1740.4	1740.4	1740.4	0.0
CR	5.508	113.4	362.5	9.3	1743.2	1743.2	1743.3	0.1
CS	5.551	135.1	432.0	7.8	1746.3	1746.3	1746.3	0.0
CT	5.624	78.7	322.2	10.5	1751.3	1751.3	1751.4	0.1
CU	5.702	68.3	357.7	9.5	1756.0	1756.0	1756.1	0.1
CV	5.759	60.6	278.6	12.1	1758.8	1758.8	1758.8	0.0
CW	5.845	64.2	312.5	10.8	1768.2	1768.2	1768.2	0.0
CX	5.865	87.9	353.1	9.6	1773.6	1773.6	1773.7	0.1
CY	5.927	57.8	273.2	12.4	1778.3	1778.3	1778.4	0.1
CZ	5.974	76.2	368.8	7.9	1781.6	1781.6	1782.2	0.6
DA	6.058	125.8	364.7	8.0	1786.3	1786.3	1786.4	0.1

Table 7-5 (continued)

Floodway table for Unnamed Wash 2

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 2		feet	sq. feet	fps	feet	feet	feet	feet
DB	6.161	220.0	525.3	5.5	1792.9	1792.9	1792.9	0.0
DC	6.218	61.1	183.5	9.5	1796.4	1796.4	1796.5	0.1
DD	6.271	60.9	197.2	8.9	1800.6	1800.6	1800.8	0.2
DE	6.318	103.0	347.5	5.0	1803.0	1803.0	1804.0	1.0
DF	6.392	72.7	194.2	9.0	1808.1	1808.1	1808.6	0.5
DG	6.418	69.8	188.3	9.3	1810.5	1810.5	1811.0	0.5
DH	6.451	52.5	173.6	10.1	1813.9	1813.9	1814.2	0.3
DI	6.501	41.7	161.4	10.8	1817.8	1817.8	1818.2	0.4
DJ	6.570	43.6	162.0	10.8	1824.0	1824.0	1824.1	0.1
DK	6.595	39.2	157.0	11.2	1826.9	1826.9	1826.9	0.0
DL	6.643	106.0	323.1	5.4	1830.5	1830.5	1831.2	0.7
DM	6.669	55.3	188.6	9.3	1833.2	1833.2	1833.3	0.1
DN	6.714	30.4	143.8	12.2	1839.3	1839.3	1839.4	0.1
DO	6.765	44.5	190.5	9.2	1843.6	1843.6	1843.6	0.0
DP	6.789	63.1	248.5	7.0	1845.2	1845.2	1845.2	0.0

Table 7-6

Floodway table for Unnamed Wash 3

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 3		feet	sq. feet	fps	feet	feet	feet	feet
A	0.144	58.6	236.2	10.9	1340.7	1340.7	1340.7	0.0
B	0.185	76.2	248.9	10.3	1344.2	1344.2	1344.2	0.0
C	0.240	200.0	381.7	6.7	1349.3	1349.3	1349.6	0.3
D	0.306	90.2	265.4	9.7	1353.4	1353.4	1353.5	0.1
E	0.386	46.5	235.5	10.9	1358.1	1358.1	1358.4	0.3
F	0.481	65.9	298.5	8.6	1363.6	1363.6	1363.6	0.1
G	0.520	56.2	225.6	11.4	1365.5	1365.5	1365.5	0.0
H	0.565	53.1	219.8	11.7	1369.2	1369.2	1369.3	0.1
I	0.583	75.8	393.9	6.5	1371.7	1371.7	1371.7	0.0
J	0.598	65.1	337.6	7.6	1372.1	1372.1	1372.1	0.0
K	0.625	76.8	270.7	9.5	1373.8	1373.8	1373.8	0.0
L	0.658	57.3	261.0	9.9	1376.2	1376.2	1376.2	0.0
M	0.695	37.7	196.6	13.1	1379.2	1379.2	1379.2	0.0
N	0.716	72.1	316.8	8.1	1382.3	1382.3	1382.3	0.0
O	0.734	64.6	278.5	9.2	1382.8	1382.8	1382.8	0.0
P	0.761	100.1	347.2	7.4	1384.8	1384.8	1384.8	0.0
Q	0.852	53.7	222.3	11.6	1389.8	1389.8	1389.8	0.0
R	0.928	63.5	325.2	7.9	1394.4	1394.4	1394.4	0.0
S	0.960	59.3	245.1	10.5	1397.2	1397.2	1397.3	0.1
T	0.986	56.5	302.1	8.5	1400.3	1400.3	1400.3	0.0
U	1.008	43.9	238.3	10.8	1401.4	1401.4	1401.4	0.0
V	1.088	54.4	255.9	10.0	1407.2	1407.2	1407.2	0.0
W	1.152	43.6	261.3	9.8	1411.4	1411.4	1411.4	0.0
X	1.171	68.1	411.7	6.2	1413.3	1413.3	1413.3	0.0
Y	1.222	41.6	209.0	12.3	1416.3	1416.3	1416.3	0.0
Z	1.259	50.2	223.0	11.5	1426.8	1426.8	1426.9	0.1
AA	1.304	50.6	264.3	9.7	1433.1	1433.1	1433.1	0.0
AB	1.331	77.2	371.9	6.9	1436.0	1436.0	1436.0	0.0
AC	1.356	73.5	369.3	7.0	1437.5	1437.5	1437.5	0.0
AD	1.385	43.6	207.3	12.4	1441.7	1441.7	1441.7	0.0
AE	1.425	48.3	263.7	9.8	1449.1	1449.1	1449.1	0.0
AF	1.481	48.2	216.1	11.9	1454.8	1454.8	1454.8	0.0
AG	1.497	51.7	249.0	10.3	1456.4	1456.4	1456.4	0.0
AH	1.519	44.2	206.9	12.4	1457.7	1457.7	1457.7	0.0
AI	1.537	60.5	238.2	10.8	1460.3	1460.3	1460.4	0.1

Table 7-6 (continued)

Floodway table for Unnamed Wash 3

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 3		feet	sq. feet	fps	feet	feet	feet	feet
AJ	1.563	87.1	270.6	9.5	1464.3	1464.3	1465.1	0.8
AK	1.600	91.4	354.8	7.2	1467.2	1467.2	1467.7	0.5
AL	1.641	100.1	295.5	8.7	1469.6	1469.6	1469.7	0.1
AM	1.690	60.9	280.3	7.8	1472.4	1472.4	1472.4	0.0
AN	1.784	60.6	230.4	9.5	1475.9	1475.9	1475.9	0.0
AO	1.872	67.0	257.5	8.5	1480.9	1480.9	1480.9	0.0
AP	1.944	62.0	211.0	10.4	1484.7	1484.7	1484.8	0.1
AQ	1.973	97.0	322.9	6.8	1487.2	1487.2	1487.2	0.0
AR	2.011	92.8	264.0	8.3	1488.8	1488.8	1488.8	0.0
AS	2.050	70.0	237.0	9.3	1491.8	1491.8	1491.8	0.0
AT	2.118	45.2	249.0	8.8	1495.3	1495.3	1496.0	0.7
AU	2.233	63.2	252.0	8.7	1501.2	1501.2	1501.5	0.3
AV	2.315	41.3	183.7	12.0	1506.0	1506.0	1506.0	0.0
AW	2.421	84.9	359.2	6.1	1510.9	1510.9	1511.7	0.8
AX	2.471	132.6	291.5	7.5	1513.6	1513.6	1513.6	0.0
AY	2.522	79.8	280.4	7.8	1516.4	1516.4	1516.4	0.0
AZ	2.581	49.2	208.3	10.6	1519.1	1519.1	1519.1	0.0
BA	2.677	54.7	270.3	8.1	1523.7	1523.7	1524.4	0.7
BB	2.779	117.2	282.8	7.8	1529.1	1529.1	1529.1	0.0
BC	2.850	65.3	263.6	8.3	1532.5	1532.5	1532.6	0.1
BD	2.916	87.8	311.2	7.1	1535.1	1535.1	1535.9	0.8
BE	2.984	51.8	200.8	11.0	1539.1	1539.1	1539.1	0.0
BF	3.015	141.2	603.1	3.6	1542.6	1542.6	1542.6	0.0
BG	3.042	157.2	473.6	4.6	1542.9	1542.9	1543.0	0.1
BH	3.061	115.9	367.9	6.0	1543.4	1543.4	1543.5	0.1
BI	3.114	67.8	256.0	8.6	1545.2	1545.2	1545.6	0.4
BJ	3.144	143.2	356.6	6.2	1547.4	1547.4	1547.4	0.0
BK	3.168	116.7	295.7	7.4	1548.4	1548.4	1548.7	0.3
BL	3.257	46.4	224.0	8.9	1553.0	1553.0	1553.7	0.7
BM	3.309	69.5	199.2	10.0	1556.5	1556.5	1556.6	0.1
BN	3.319	103.5	354.6	5.6	1558.2	1558.2	1558.2	0.0
BO	3.351	109.5	452.6	4.4	1559.1	1559.1	1559.1	0.0
BP	3.370	162.3	318.2	6.3	1559.4	1559.4	1559.4	0.0
BQ	3.412	62.8	204.3	9.7	1562.6	1562.6	1562.6	0.0
BR	3.426	81.5	310.3	6.4	1563.9	1563.9	1564.3	0.4

Table 7-6 (continued)

Floodway table for Unnamed Wash 3

Floodway Source		Floodway			Base Flood Elevations			
				Mean		Without	With	
Cross Section	Distance	Width	Area	Velocity	Regulatory	Floodway	Floodway	Increase
Unnamed Wash 3		feet	sq. feet	fps	feet	feet	feet	feet
BS	3.460	49.3	200.4	9.9	1565.0	1565.0	1565.0	0.0
BT	3.487	47.1	281.3	7.1	1567.4	1567.4	1567.4	0.0
BU	3.497	70.2	234.1	8.5	1567.6	1567.6	1567.6	0.0
BV	3.509	83.5	407.9	4.9	1569.1	1569.1	1569.7	0.6
BW	3.520	95.0	392.2	5.1	1569.3	1569.3	1569.9	0.6
BX	3.561	70.0	242.0	8.2	1570.5	1570.5	1570.9	0.5
BY	3.649	51.1	258.4	7.7	1574.8	1574.8	1575.5	0.7
BZ	3.731	45.8	197.1	10.1	1579.0	1579.0	1579.4	0.4
CA	3.826	48.4	224.2	8.9	1585.3	1585.3	1586.0	0.7
CB	3.921	40.9	196.1	10.2	1591.1	1591.1	1591.4	0.3
CC	4.013	63.8	198.7	10.0	1599.3	1599.3	1599.3	0.0
CD	4.110	46.9	184.3	10.8	1608.1	1608.1	1608.1	0.0
CE	4.145	44.5	174.9	11.4	1612.4	1612.4	1612.4	0.0
CF	4.177	46.2	215.1	9.3	1615.8	1615.8	1615.8	0.1
CG	4.197	60.7	308.9	6.4	1616.8	1616.8	1617.5	0.7
CH	4.229	40.8	159.0	7.7	1618.2	1618.2	1618.6	0.4
CI	4.289	43.5	141.6	8.6	1622.4	1622.4	1622.5	0.0
CJ	4.338	52.8	145.5	8.4	1626.1	1626.1	1626.1	0.0
CK	4.379	46.8	130.9	9.3	1629.6	1629.6	1629.7	0.0
CL	4.399	61.7	143.3	8.5	1631.8	1631.8	1631.8	0.0
CM	4.417	69.5	153.5	8.0	1634.1	1634.1	1634.2	0.1
CN	4.428	64.2	221.4	5.5	1635.3	1635.3	1635.6	0.3
CO	4.464	40.3	150.0	8.1	1636.6	1636.6	1636.9	0.3
CP	4.540	48.8	158.9	7.7	1641.1	1641.1	1641.3	0.2

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

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

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

1. REQUESTED RESPONSE FROM FEMA

This request is for a:

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

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

☐ Other Describe:

2. OVERVIEW

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

☐ Physical Change ☐ Improved Methodology/Data ☐ Floodway Revision

☒ Other Describe: New Study
Note: A photograph is not required, but is very helpful during review.

2. Flooding Source: Various tributaries of the Agua Fria River

3. Project Name/Identifier: North Peoria Area Drainage Master Plan, Flood Control District of Maricopa County Contract No. 99-45

4. FEMA zone designations affected: AE, A
(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
040050	City of Peoria	AZ	04013C	730F 735F 740F 745F 1160F	03/08/2001 03/08/2001 12/03/1993 08/05/1997 08/05/1997
04037	Maricopa County Unincorporated Areas	AZ	04013C	730F 735F 740F 745F 1160F	03/08/2001 03/08/2001 12/03/1993 08/05/1997 08/05/1997

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

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

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

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

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

5. MAINTENANCE RESPONSIBILITY

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

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

6. REVIEW FEE

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

OR

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

Please see Instructions for Fee Amounts

7. SIGNATURE

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

Signature of Revision Requester

Amir Motamedi, P.E., Hydrology and Hydraulics Branch Manager
Printed Name and Title of Revision Requester

Flood Control District of Maricopa Coutny
Company Name

Telephone No.: 602-506-1501 Date: June 2001

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

Signature of Community Official

Dave Moody, P.E., Public Works/Engineering Director, City Engineer
Printed Name and Title of Community Official

City of Peoria
Community Name

Telephone No.: 623-773-7367 Date: June 2001

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

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

Signature

R. Michael C. Gerlach, P.E., Water Resources Engineer
Printed Name and Title of Revision Requester

Registr No. 35150 Expires (Date) 09/30/2003 State Arizona

Type of License/Expertise: Engineer/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 FORM**	O.M.B No. 3067-0148 Expires April 30, 2001

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

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

Note: Fill out one form for each flooding source studied

Community Name: City of Peoria and unicorporated Maricopa County, Arizona

Flooding Source: Various tributaries of the Agua Fria River

Project Name/Identifier: North Peoria Area Drainage Master Plan, Flood Control District of Maricopa County Contract No 99-45

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)
S400 Caterpillar Tank Wash	1.05	1446	1212
C501 Twin Buttes Wash	1.67	1752	1250
C502 Twin Buttes Wash	3.07	2659	2246

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

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

5. HISTORICAL FLOODING INFORMATION

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

ATTACHMENT D: PRECIPITATION/RUNOFF MODEL

		FIS:		Revised:	
1.	Method or model used:	HEC-1		HEC-1	
	Version:	Unknown		4.1	
	Date:	Varies		June 1998	
2.	Source of rainfall depth:	NOAA Atlas II		NOAA Atlas II	
3.	Source of rainfall distribution:	FCDMC Drainage Manual		See Section 3.2.4.1 of the TDN	
4.	Rainfall duration:	6- and 24-Hour		6- and 24-hour	
5.	Areal adjustment to precipitation (%):	Varies		See Section 3.2.4.3 of the TDN	
6.	Maximum overland flow length	N/A		N/A	
7.	Hydrograph development method:	Varies		Clark Unit Hydrograph	
8.	Loss rate method:	Varies		Green and Ampt	
	Source of soils information:	NRCS Soils Maps		NRCS Soils Maps	
	Source of land use information:	None considered		Maricopa Assoc.of Gov.,1995	
9.	Channel routing method:	Varies		Modified Puls - Normal Depth	
10.	Reservoir routing:	☐ Yes	☐ No	☒ Yes	☐ No
11.	Baseflow considerations: **If Yes, explain below how baseflow was determined:**	☐ Yes	☒ No	☐ Yes	☒ No
12.	Snowmelt considerations:	☐ Yes	☒ No	☐ Yes	☒ No
13.	Model calibration: **If Yes, explain below how calibration was performed**	☐ Yes	☒ No	☐ Yes	☒ No
14.	Future land use condition: **If Yes, explain why below**	☐ Yes	☒ No	☐ Yes	☒ No

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

Information and Maps provided? ☒ Yes ☐ No

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

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

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

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

Note: Fill out one form for each flooding source studied

Community Name: City of Peoria and unicorporated Maricopa County, Arizona

Flooding Source: Unnamed Wash 1

Project Name/Identifier: North Peoria Area Drainage Master Plan, Flood Control District of Maricopa County Contract No. 99-45

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: Unnamed Wash 2 (New study, see draft FIRM panels for limits of new delineations)

Upstream Limit: Arizona State Route 74

2. MODELS SUBMITTED

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

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

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

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

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

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

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. STARTING WATER-SURFACE ELEVATIONS

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

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

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

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

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

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

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

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

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

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

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

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. ***Profile Transition***

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

Downstream End 1367.6 within 0.0 (feet) *Cross-Section #* Upstream End N/A within N/A (feet) *Cross-Section #*

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 1368.5 within 0.0 (feet) *Cross-Section #* Upstream End N/A within N/A (feet) *Cross-Section #*

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

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

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

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

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

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

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

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

Floodway Data Table

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

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

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS FORM**	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.

Note: Fill out one form for each flooding source studied

Community Name: City of Peoria and unicorporated Maricopa County, Arizona

Flooding Source: Unnamed Wash 2

Project Name/Identifier: North Peoria Area Drainage Master Plan, Flood Control District of Maricopa County Contract No. 99-45

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: Agua Fria River

Upstream Limit: Arizona State Route 74

2. MODELS SUBMITTED

Requirements: for areas which 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.

for areas which do not have detailed flooding:
Only the 100-year (Base) flood profile is required. A hydraulic model is not required for areas which do not have detailed flooding; however, BFEs may not be added to the revised FIRM. If a hydraulic model is developed for the area, items 3 and 4 described below must be submitted.

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

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

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

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

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

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. STARTING WATER-SURFACE ELEVATIONS

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

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

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

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

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

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

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

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

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

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

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

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. Profile Transition

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

Downstream End 1360.4 within 0.0 (feet) *Cross-Section #* Upstream End N/A within N/A (feet) *Cross-Section #*

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 1360.7 within 0.0 (feet) *Cross-Section #* Upstream End N/A within N/A (feet) *Cross-Section #*

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

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

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

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

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

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

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

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

Floodway Data Table

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

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

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

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

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

Note: Fill out one form for each flooding source studied

Community Name: City of Peoria and unicorporated Maricopa County, Arizona

Flooding Source: Unnamed Wash 3

Project Name/Identifier: North Peoria Area Drainage Master Plan, Flood Control District of Maricopa County Contract No. 99-45

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: Agua Fria River

Upstream Limit: River Mile 4.540 upstream of the Agua Fria River

2. MODELS SUBMITTED

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

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

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

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

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

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

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

PLEASE REFER TO THE INSTRUCTIONS FOR THE APPROPRIATE MAILING ADDRESS

3. STARTING WATER-SURFACE ELEVATIONS

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

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

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

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

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

☐ Floodway Surcharges Greater Than Maximum Allowed by Community/State

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

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

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

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

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

5. REVISED FIRM/FBFM AND FLOOD PROFILES

1. Profile Transition

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

Downstream End 1340.7 within 0.0 (feet) *Cross-Section #* Upstream End N/A within N/A (feet) *Cross-Section #*

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 1340.7 within 0.0 (feet) *Cross-Section #* Upstream End N/A within N/A (feet) *Cross-Section #*

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

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

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

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

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

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

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

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

Floodway Data Table

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

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

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

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

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

Note: Fill out one form for each flooding source studied

Community Name: City of Peoria and Maricopa County, Arizona unicorporated areas

Flooding Source: Various tributaries of the Agua Fria River (Applies to detail and approximate method studies)

Project Name/Identifier: North Peoria Area Drainage Master Plan, Flood Control District of Maricopa County Contract No. 99-45

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. New study, not applicable.

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.)? Topography prepared by photogrammetric methods to National Map Accuracy Standards, June 1998

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'

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.

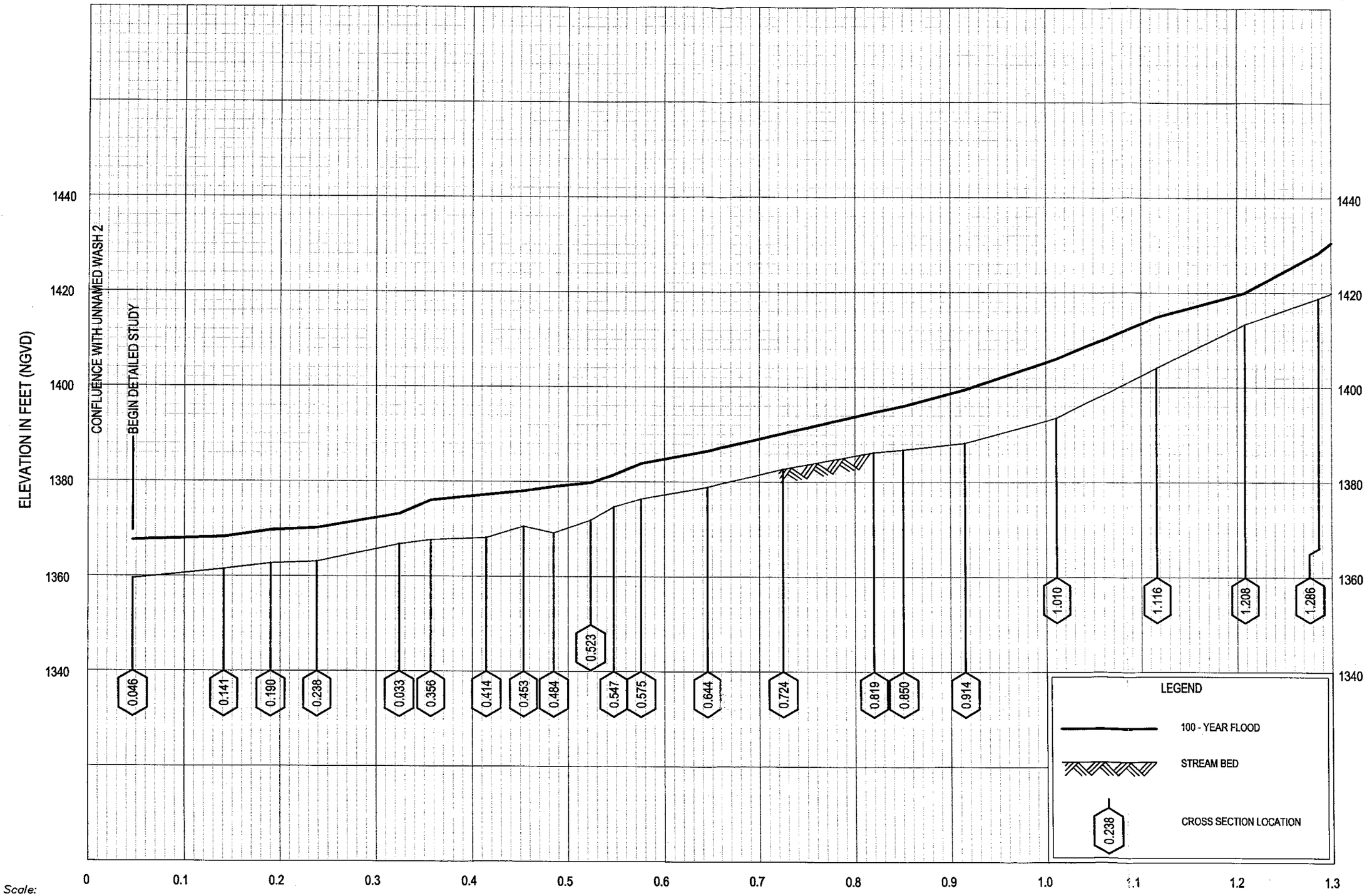
Fill certification attached ☐ **Yes** ☐ **No**

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).



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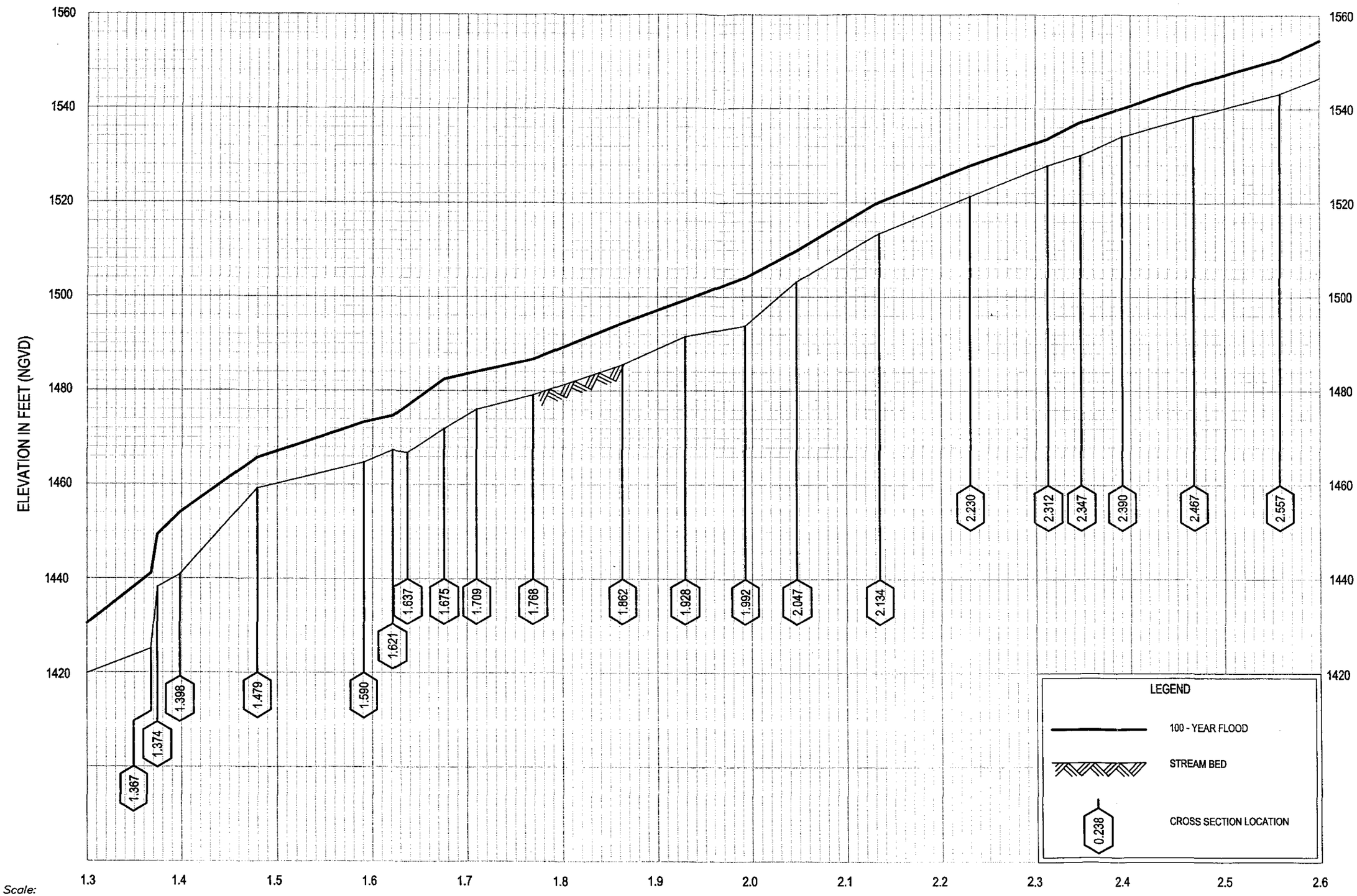
FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS



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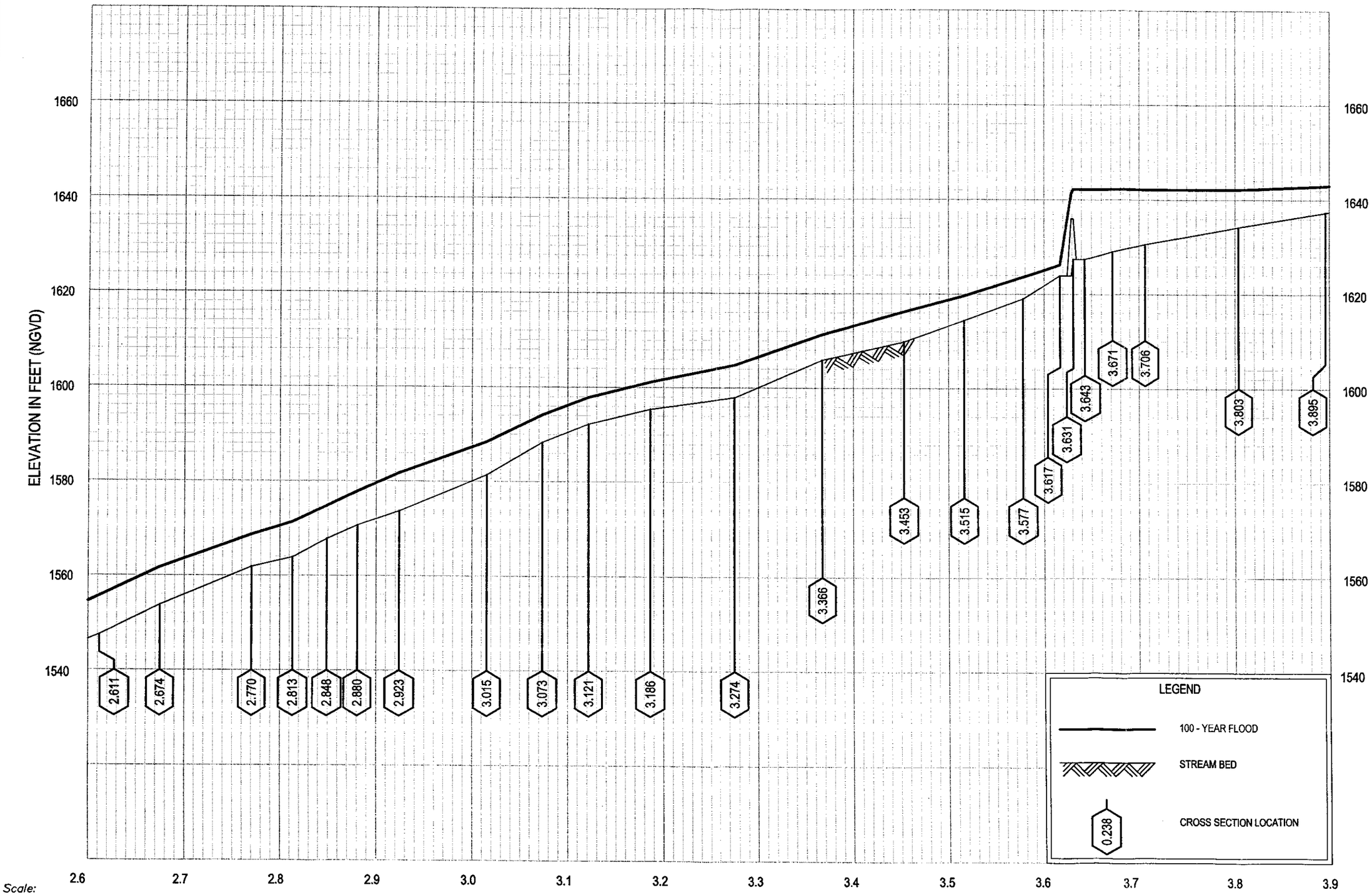
FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS



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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 1

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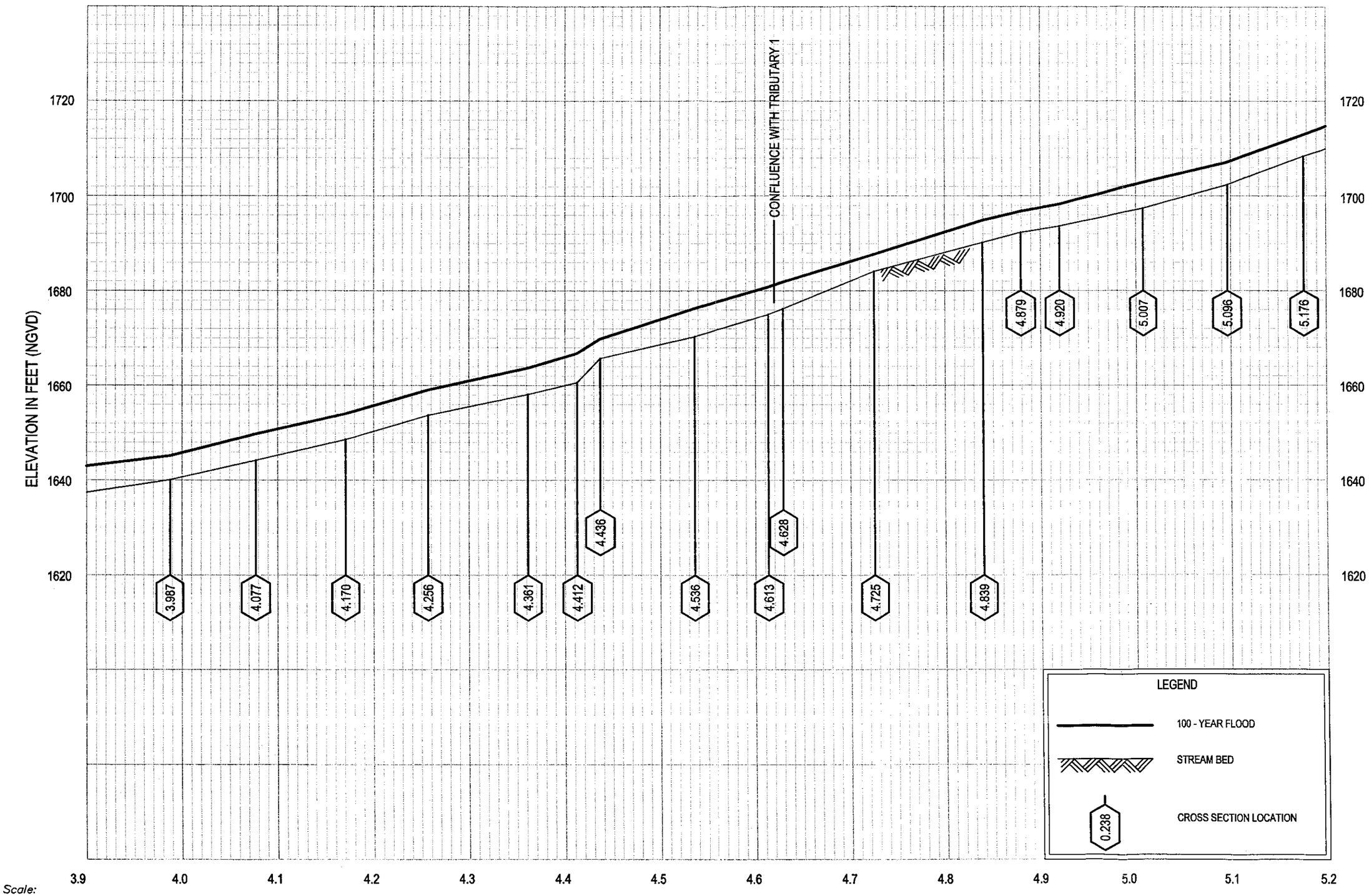

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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 1

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MARICOPA COUNTY, AZ
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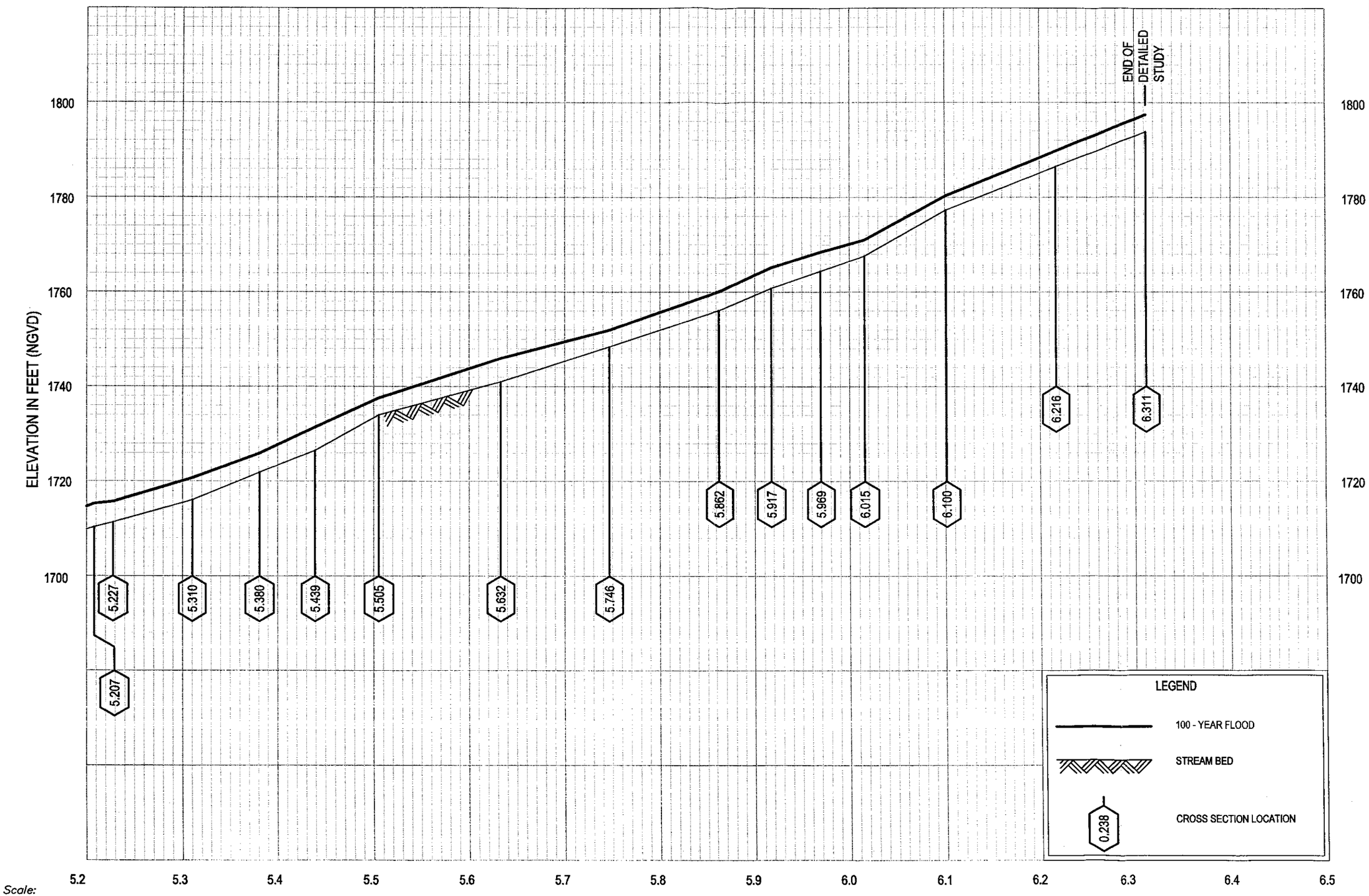

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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 1

FEDERAL EMERGENCY MANAGEMENT AGENCY
MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS

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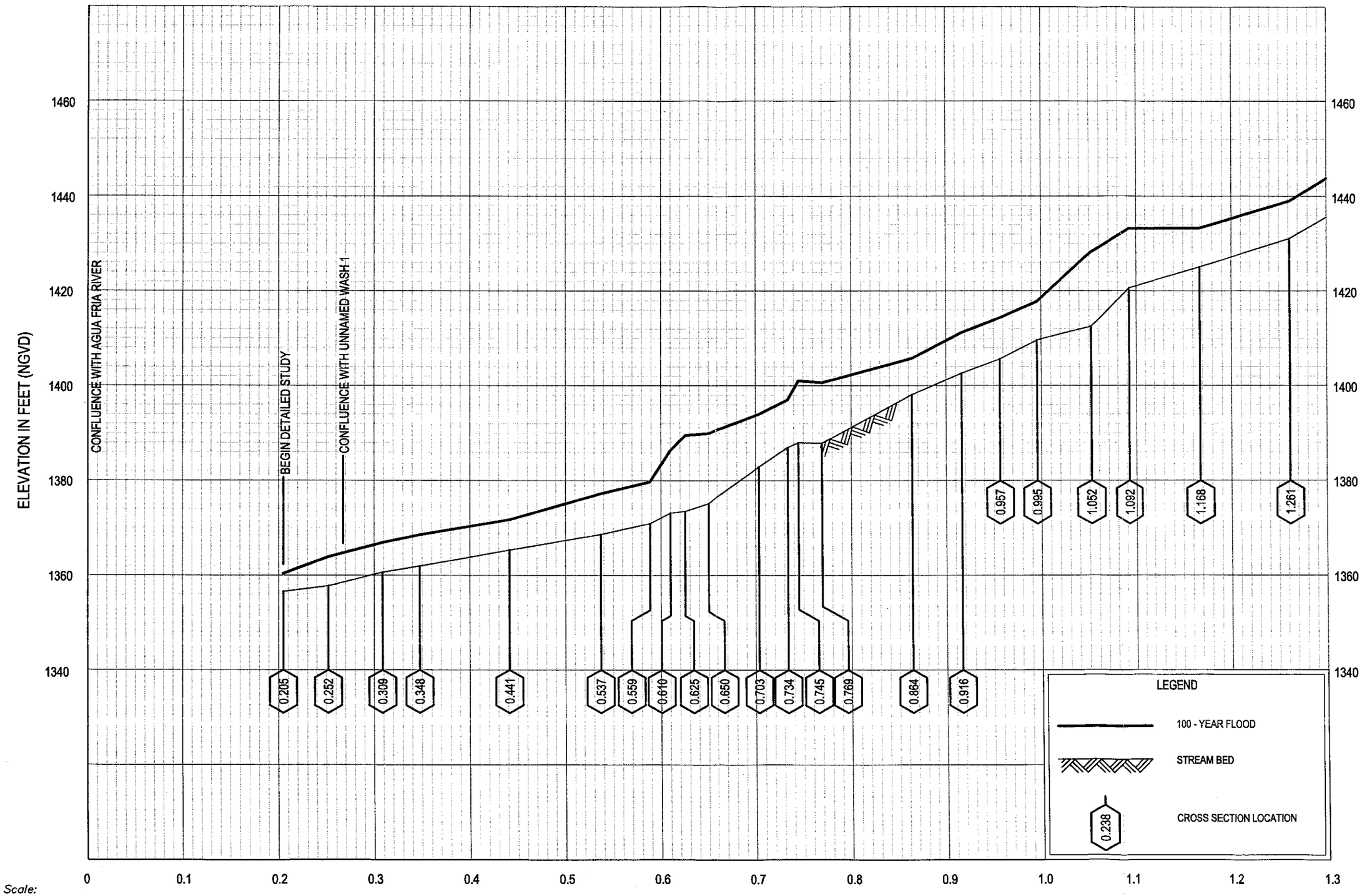

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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 2

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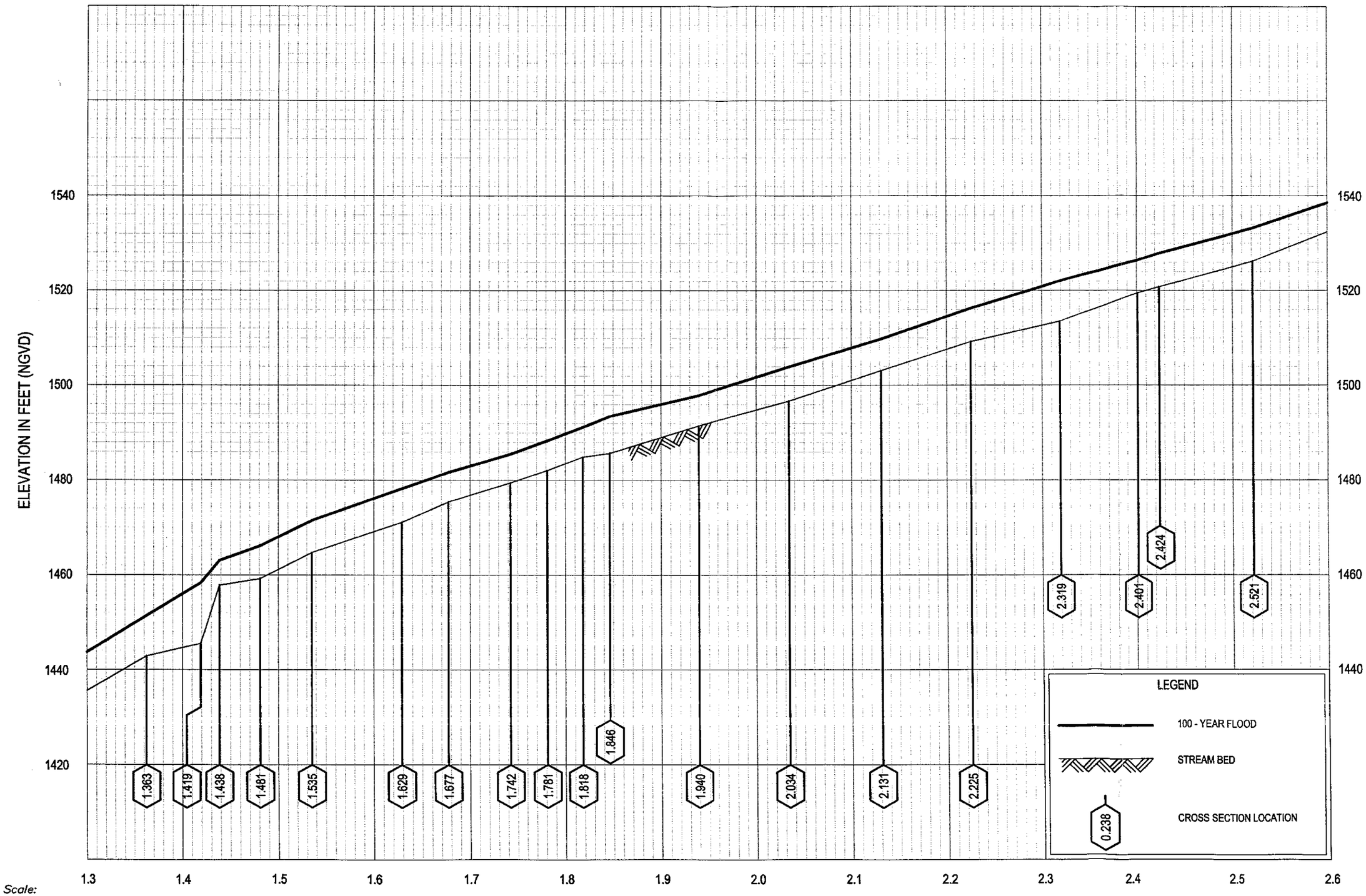
MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS



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STREAM DISTANCE IN MILES ABOVE CONFLUENCE WITH AGUA FRIA RIVER

FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS

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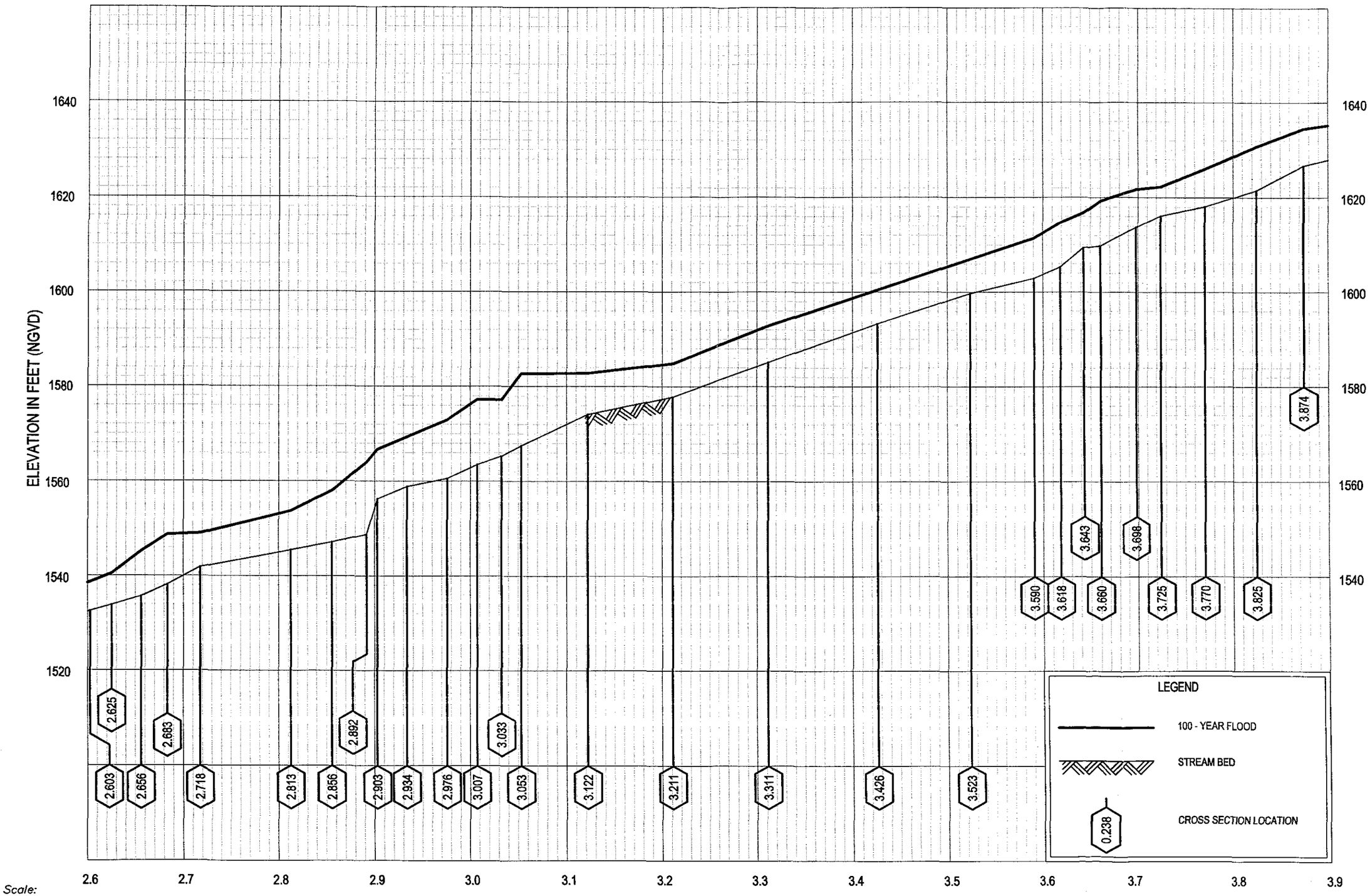

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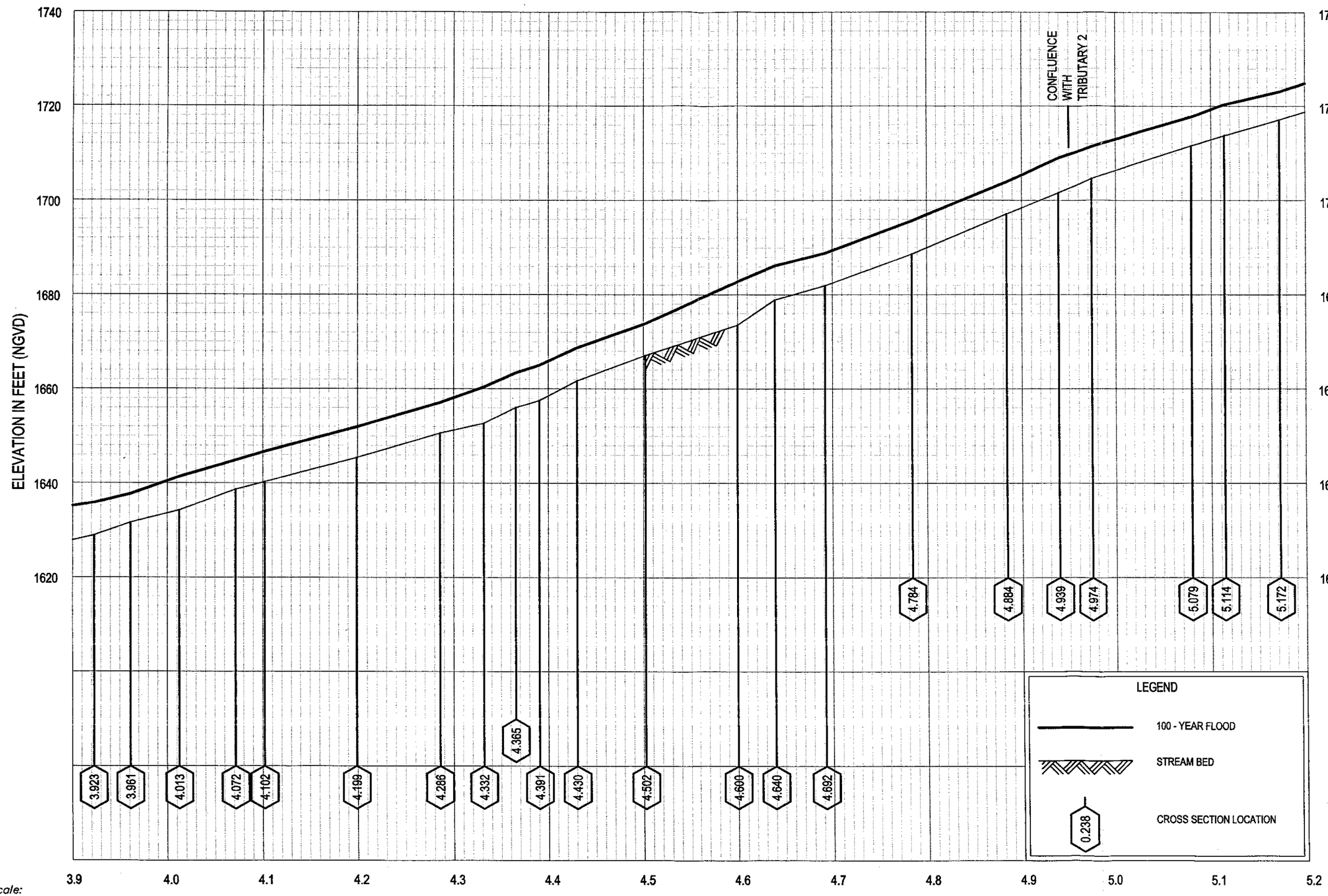
FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS



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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 2

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MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS

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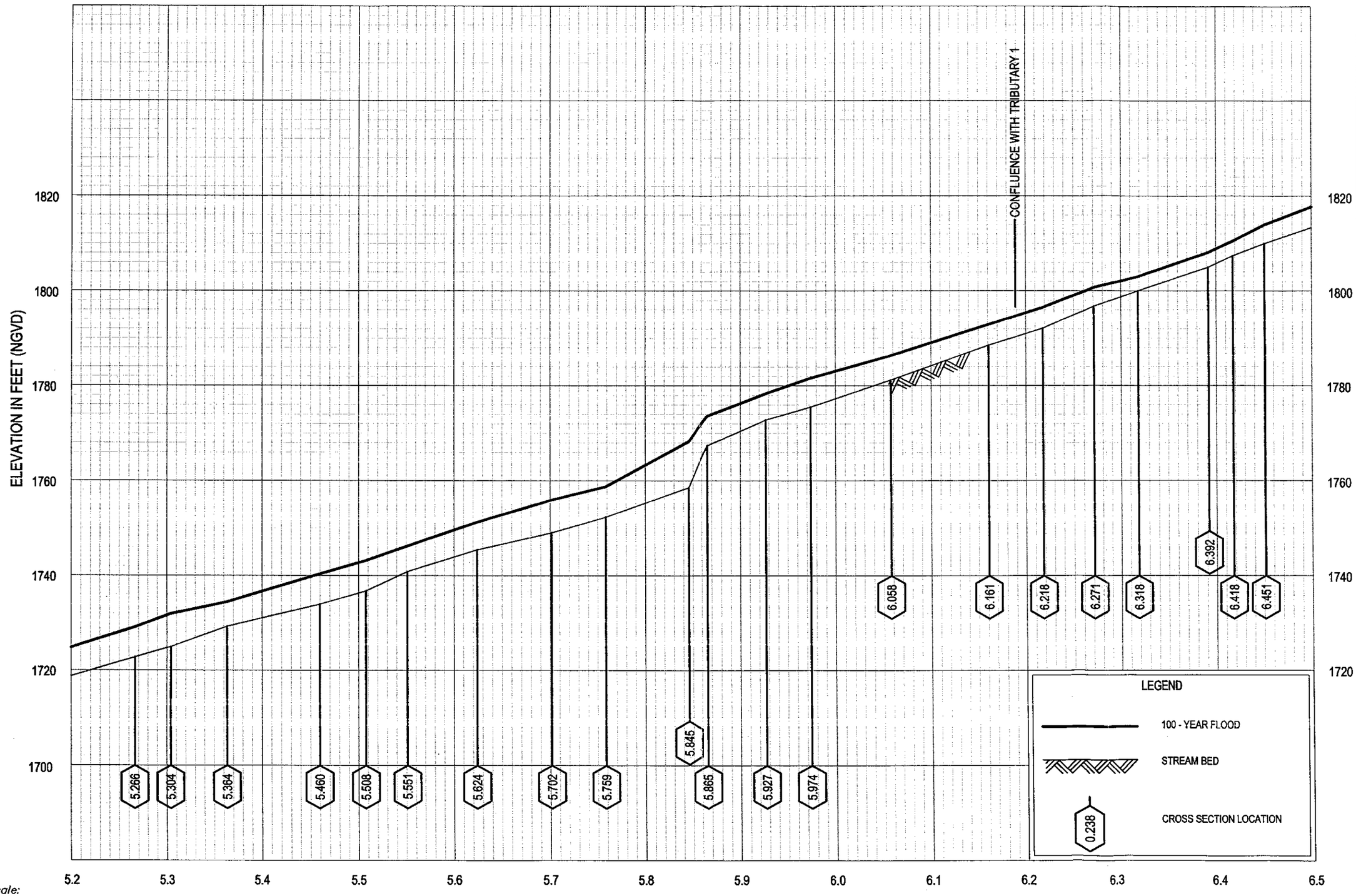

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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 2

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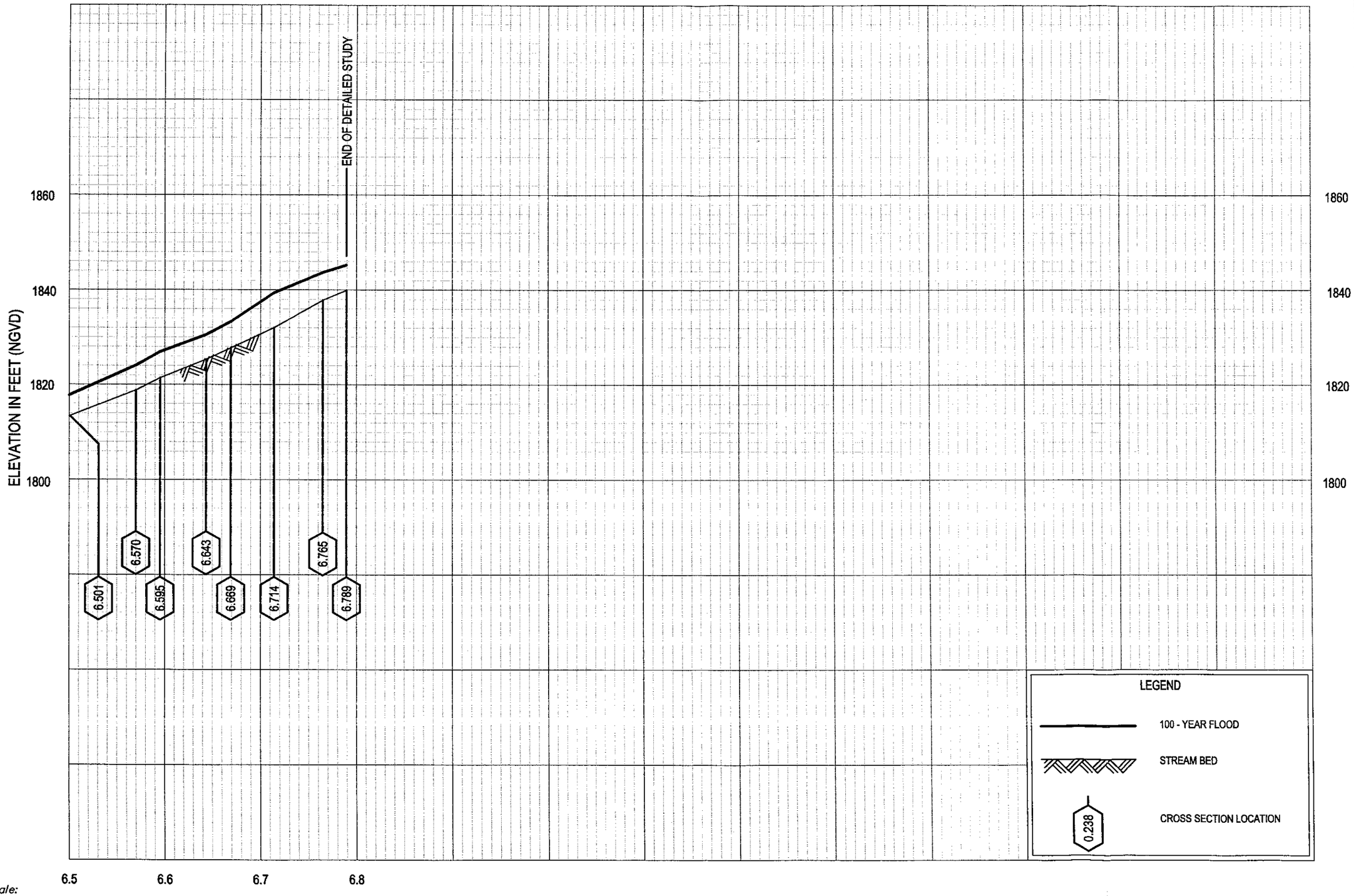

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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 2

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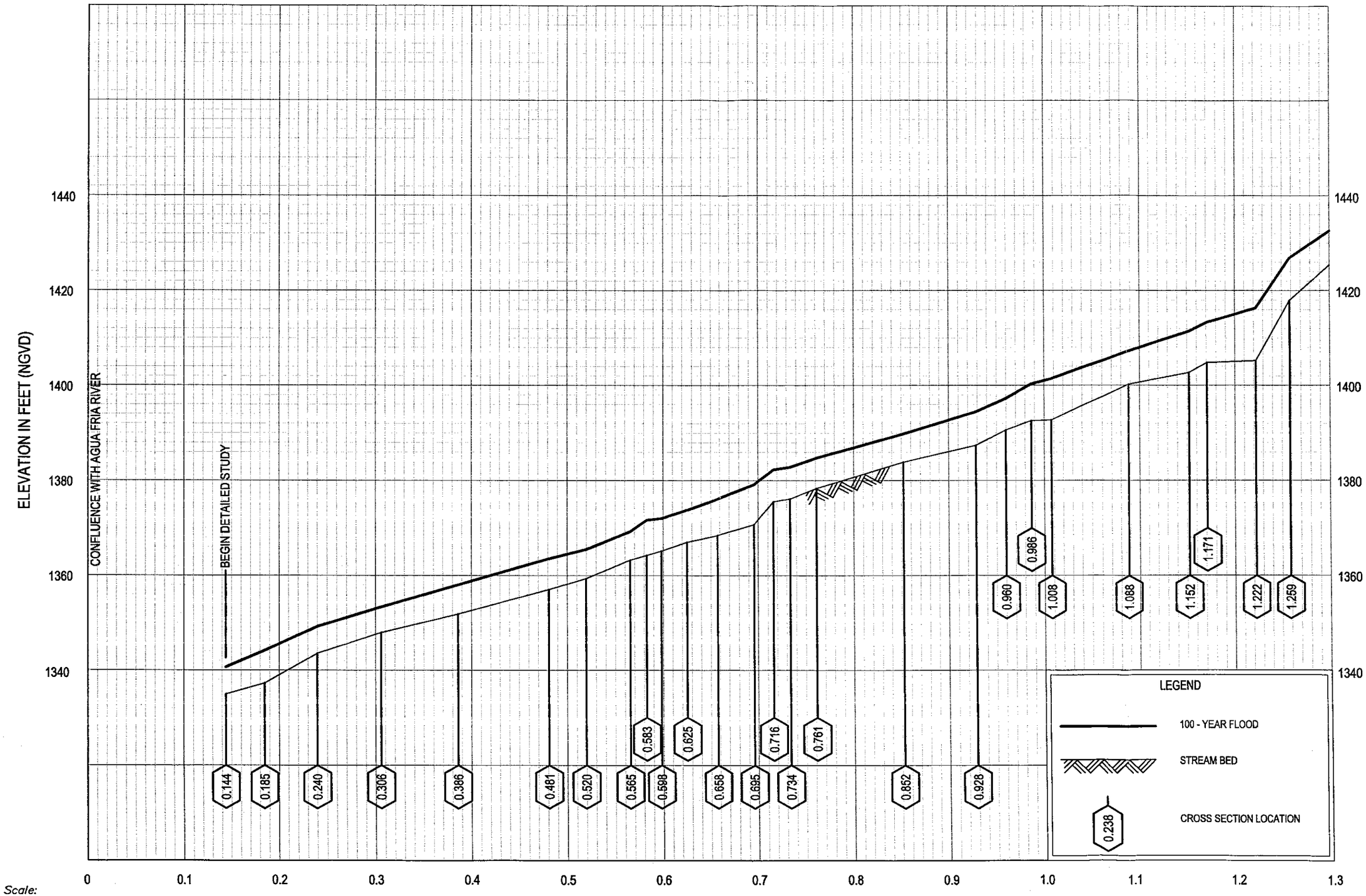
MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS



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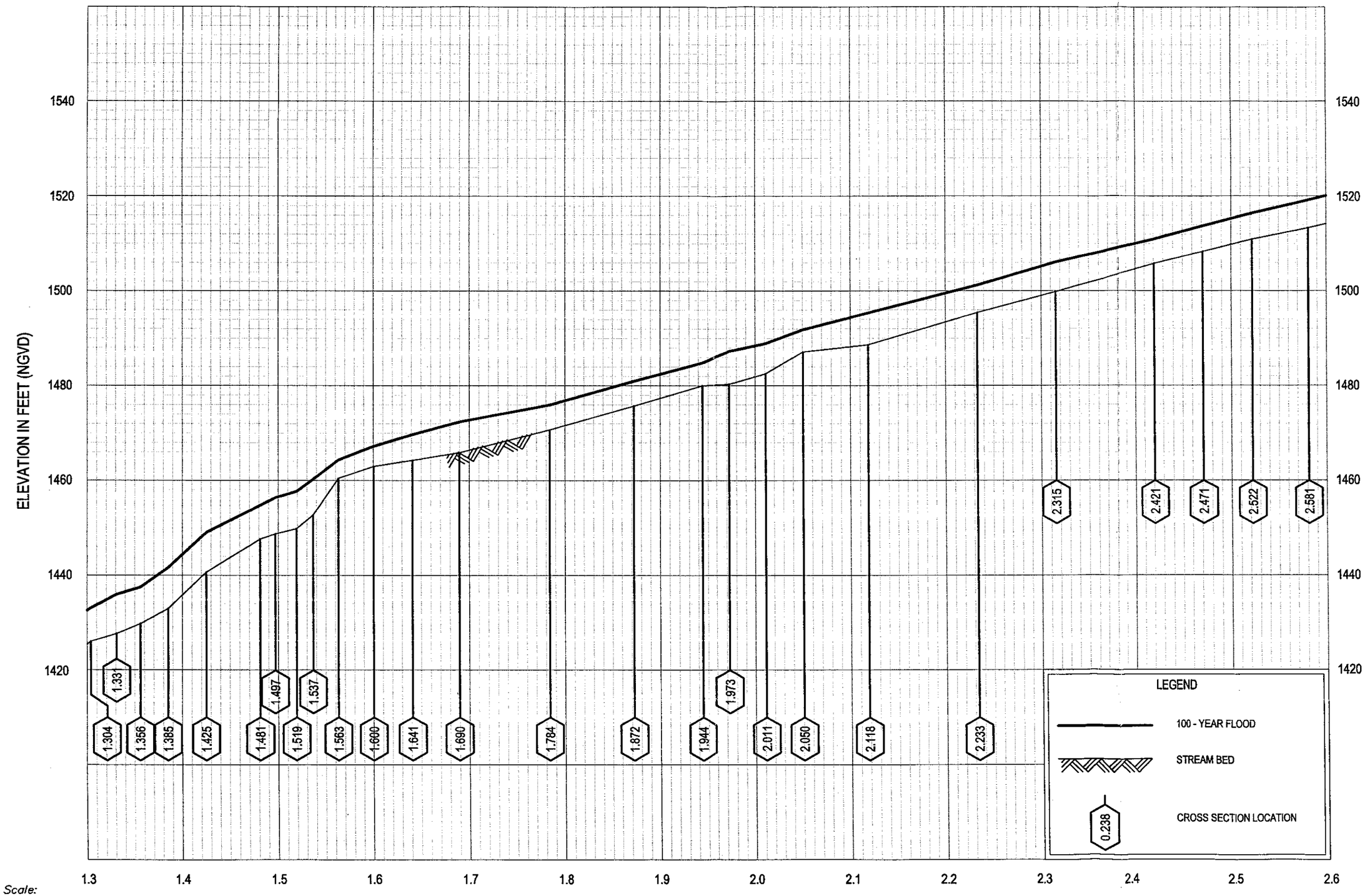
FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS



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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, AZ

AND UNINCORPORATED AREAS

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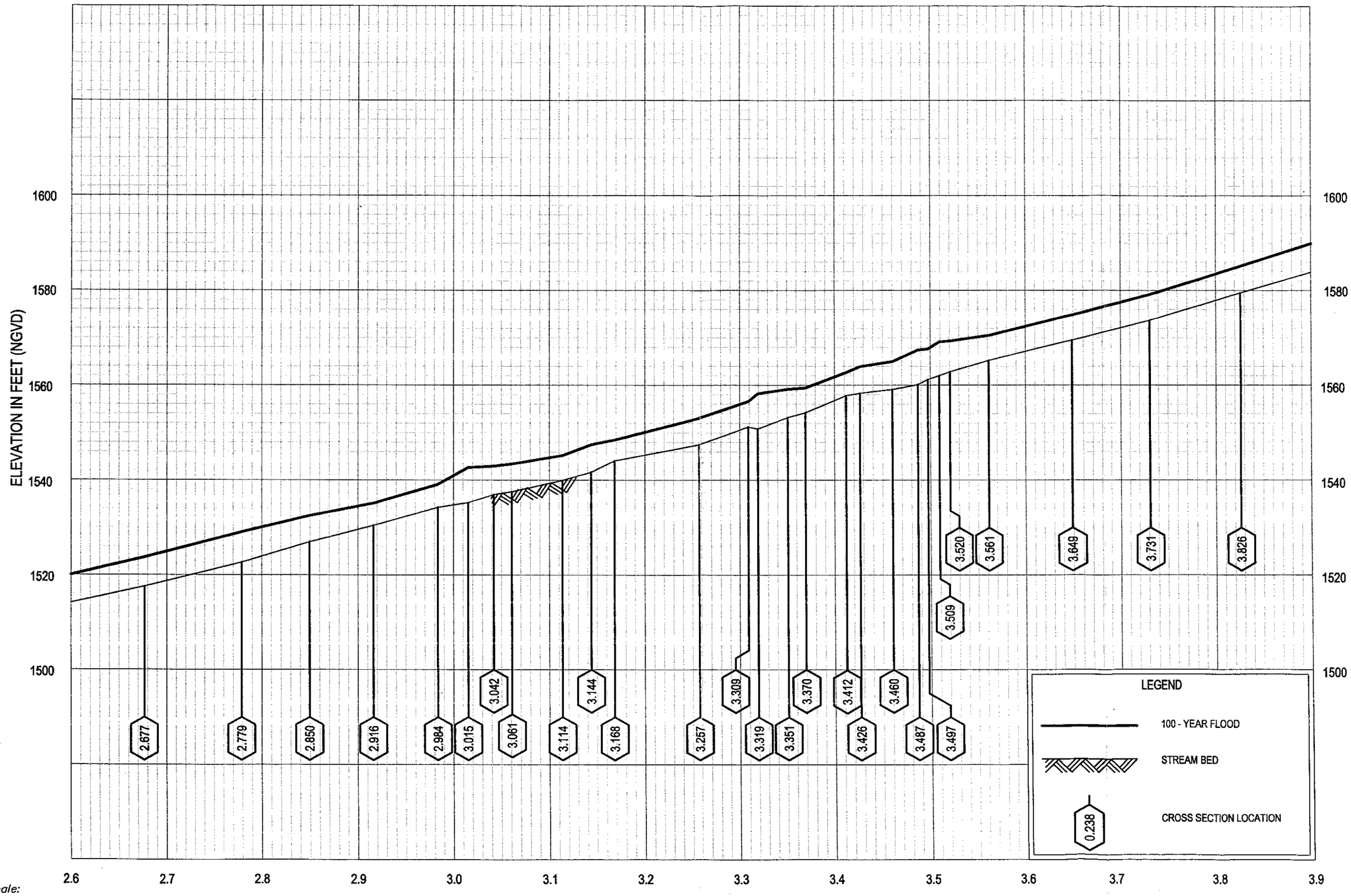

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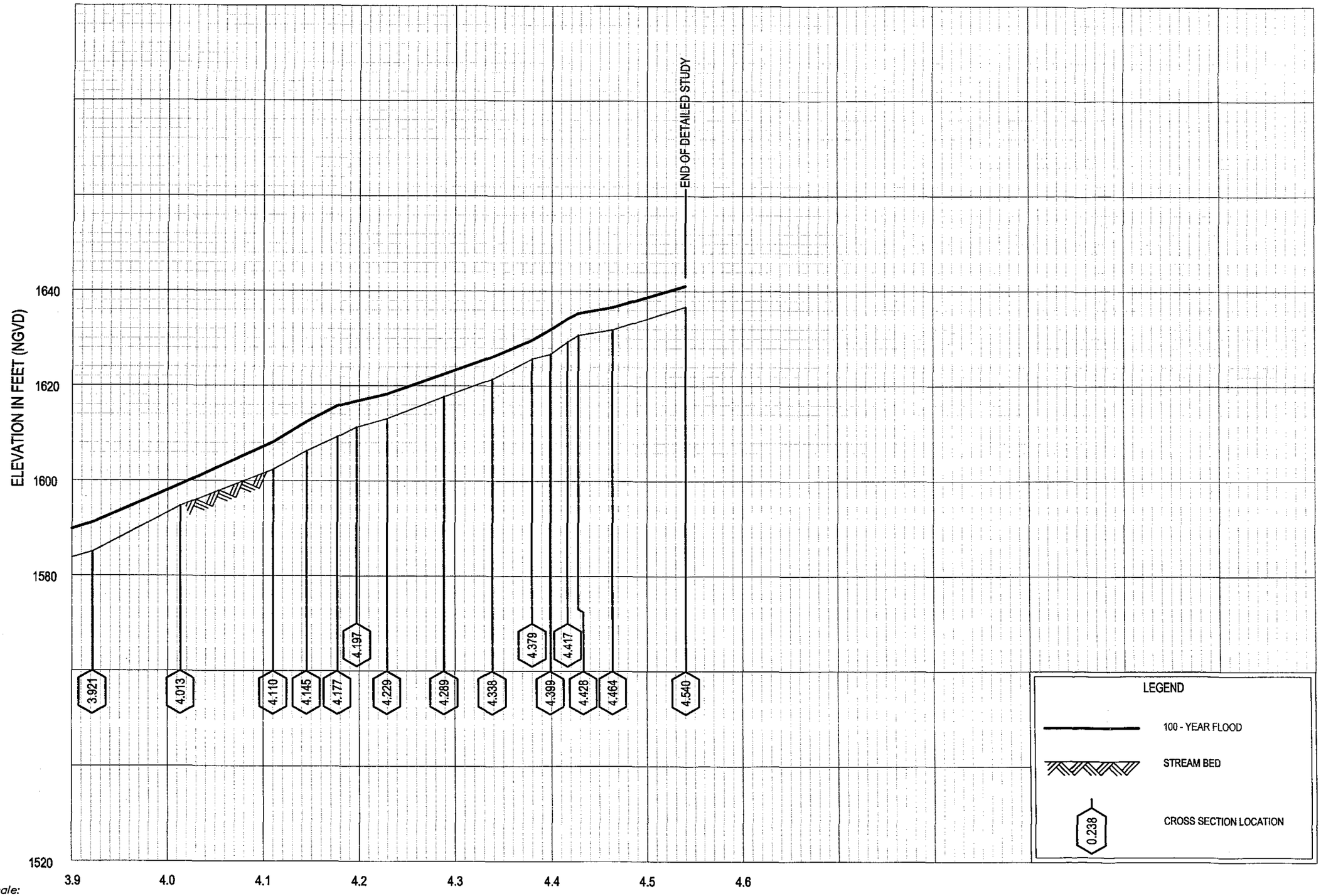
FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 3

FEDERAL EMERGENCY MANAGEMENT AGENCY
MARICOPA COUNTY, AZ
AND UNINCORPORATED AREAS



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FLOOD PROFILES

NORTH PEORIA - UNNAMED WASH 3

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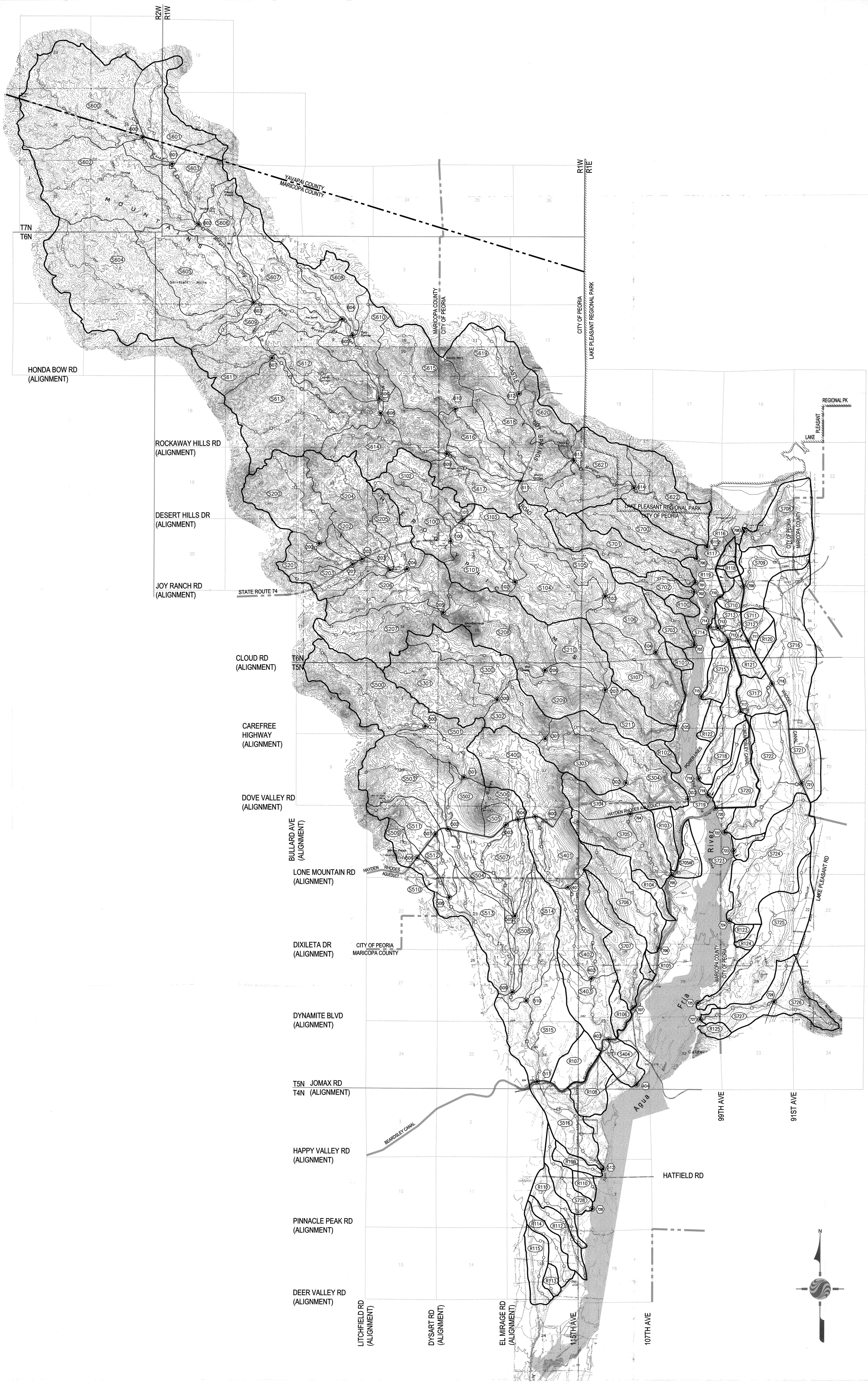
MARICOPA COUNTY, AZ

AND UNINCORPORATED AREAS



Stantec Consulting Inc.
8211 S. 48th Street
Phoenix AZ USA
85044-5355
Tel. 602.438.2200
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File Name: 01wwm146.dwg	HAR	MCG	MCG	04.13.00
	Dwn.	Chkd.	Dsgn.	Date

Legend

- Basin Boundary
- Subbasin Boundary
- Basin Identifier (S504)
- Concentration Point and Identifier (504)
- Time of Concentration Flowpath
- Routing Reach
- Routing Reach and Hydraulic Study Reach
- Canal
- Existing Road
- Corporate Limits
- Park Boundary
- Effective FEMA Floodplain

Prepared for:

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

In conjunction with:

CITY OF PEORIA

Client/Project

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
NORTH PEORIA

AREA DRAINAGE MASTER PLAN
FCD NO. 99-45

Peoria, Arizona

Title

PLATE 1
WATERSHED MAP

Project No.	Scale
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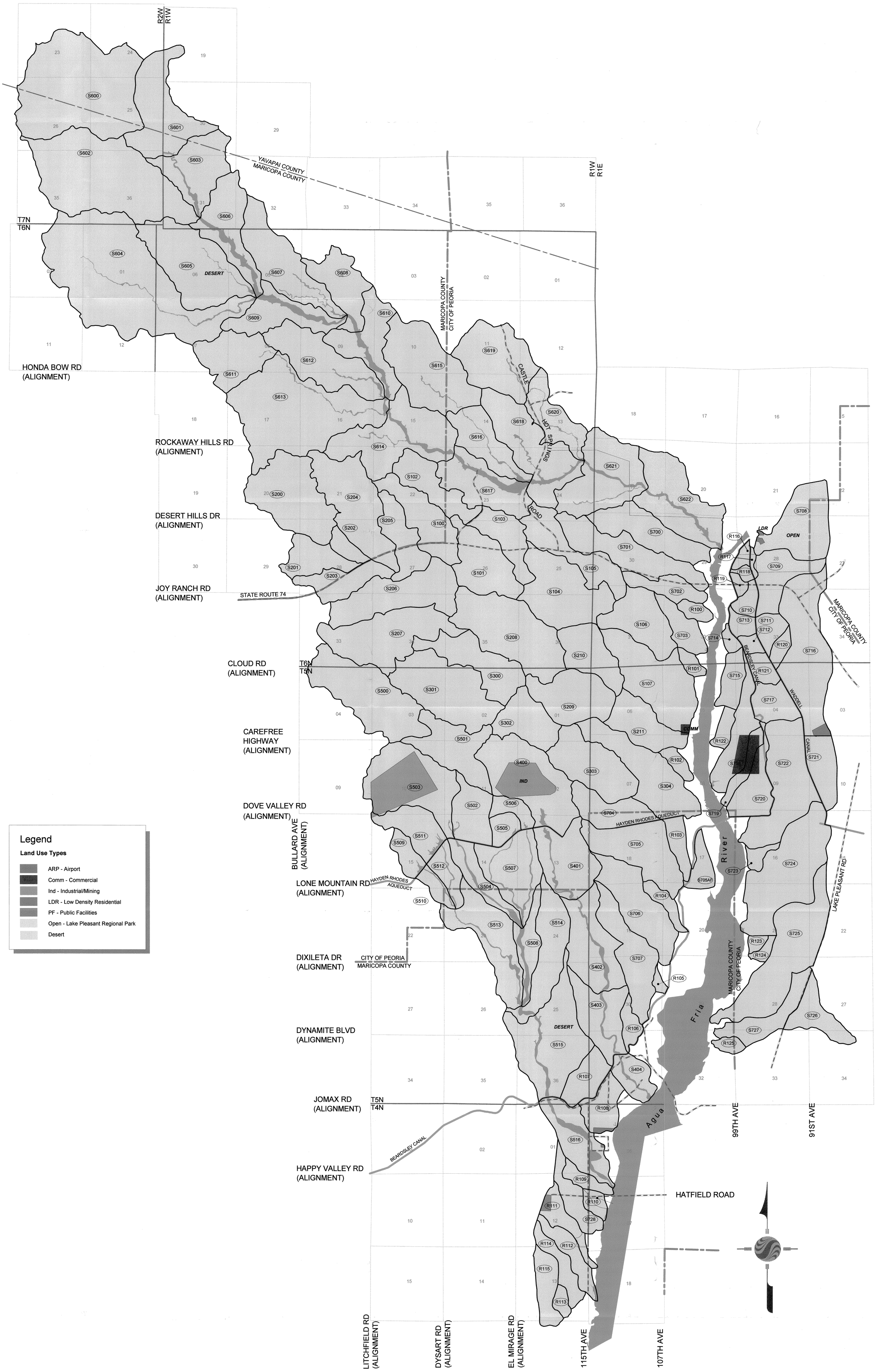
Drawing No.	Sheet

1 of 1



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May 07, 2001

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File Name: fucon146.apr	HAR	PJE	MCG	02.05.01
	Dwn.	Chkd.	Dsgn.	Date

Legend

Subbasin Boundary	
Subbasin Identifier	S101
Section Number	17
Canal	
Existing Road	
Corporate Limits	
Fema Floodplain	

Notes

1. Land use boundaries are approximated based on the City of Peoria General Plan, dated October 2000.
2. Proposed road alignments are approximated based on the City of Peoria General Plan.

Prepared for:

FLOOD CONTROL DISTRICT of MARICOPA COUNTY

In conjunction with:

CITY OF PEORIA

Client/Project

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
NORTH PEORIA
AREA DRAINAGE MASTER PLAN
FCD NO. 99-45
Peoria, Arizona

Title

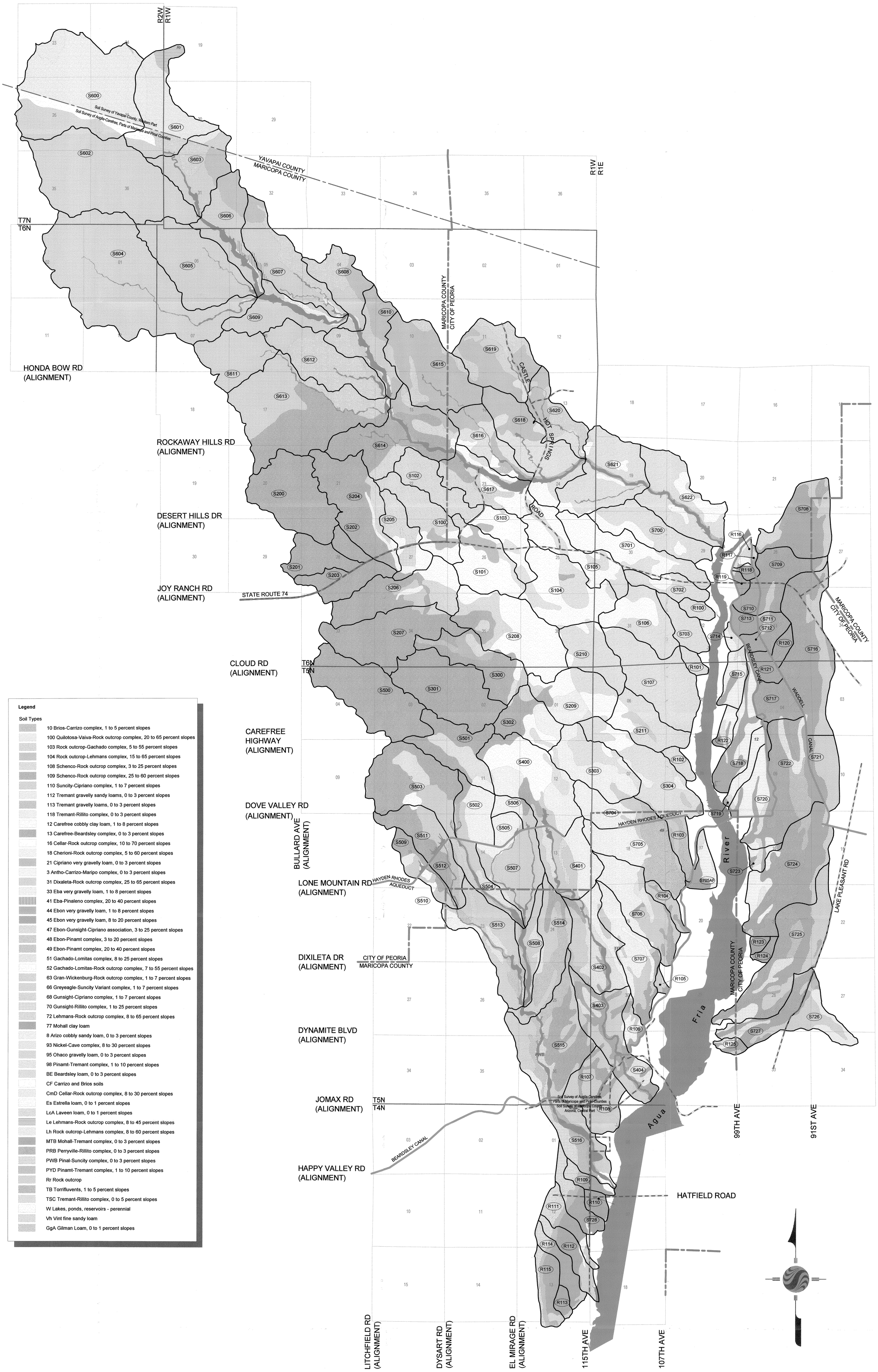
PLATE 3
EXISTING CONDITION LAND USE MAP

Project No. 82000146

Scale 1"=2000' (0, 2000', 3000', 4000')

Drawing No.

Sheet 1 of 1



Legend

Soil Types

- 10 Brios-Carrizo complex, 1 to 5 percent slopes
- 100 Quilotosa-Vaiva-Rock outcrop complex, 20 to 65 percent slopes
- 103 Rock outcrop-Gachado complex, 5 to 55 percent slopes
- 104 Rock outcrop-Lehmans complex, 15 to 65 percent slopes
- 108 Schenco-Rock outcrop complex, 3 to 25 percent slopes
- 109 Schenco-Rock outcrop complex, 25 to 60 percent slopes
- 110 Suncity-Cipriano complex, 1 to 7 percent slopes
- 112 Tremant gravelly sandy loams, 0 to 3 percent slopes
- 113 Tremant gravelly loams, 0 to 3 percent slopes
- 118 Tremant-Rillito complex, 0 to 3 percent slopes
- 12 Carefree cobbly clay loam, 1 to 8 percent slopes
- 13 Carefree-Beardsley complex, 0 to 3 percent slopes
- 16 Cellar-Rock outcrop complex, 10 to 70 percent slopes
- 18 Cherioni-Rock outcrop complex, 5 to 60 percent slopes
- 21 Cipriano very gravelly loam, 0 to 3 percent slopes
- 3 Antho-Carrizo-Maripo complex, 0 to 3 percent slopes
- 31 Dixaleta-Rock outcrop complex, 25 to 65 percent slopes
- 33 Eba very gravelly loam, 1 to 8 percent slopes
- 41 Eba-Pinaleno complex, 20 to 40 percent slopes
- 44 Ebon very gravelly loam, 1 to 8 percent slopes
- 45 Ebon very gravelly loam, 8 to 20 percent slopes
- 47 Ebon-Gunsight-Cipriano association, 3 to 25 percent slopes
- 48 Ebon-Pinamt complex, 3 to 20 percent slopes
- 49 Ebon-Pinamt complex, 20 to 40 percent slopes
- 51 Gachado-Lomitas complex, 8 to 25 percent slopes
- 52 Gachado-Lomitas-Rock outcrop complex, 7 to 55 percent slopes
- 63 Gran-Wickenburg-Rock outcrop complex, 1 to 7 percent slopes
- 66 Greyeagle-Suncity Variant complex, 1 to 7 percent slopes
- 68 Gunsight-Cipriano complex, 1 to 7 percent slopes
- 70 Gunsight-Rillito complex, 1 to 25 percent slopes
- 72 Lehmans-Rock outcrop complex, 8 to 65 percent slopes
- 77 Mohall clay loam
- 8 Arizo cobbly sandy loam, 0 to 3 percent slopes
- 93 Nickel-Cave complex, 8 to 30 percent slopes
- 95 Ohaco gravelly loam, 0 to 3 percent slopes
- 98 Pinamt-Tremant complex, 1 to 10 percent slopes
- BE Beardsley loam, 0 to 3 percent slopes
- CF Carrizo and Brios soils
- CmD Cellar-Rock outcrop complex, 8 to 30 percent slopes
- Es Estrella loam, 0 to 1 percent slopes
- LcA Laveen loam, 0 to 1 percent slopes
- Le Lehmans-Rock outcrop complex, 8 to 45 percent slopes
- Lh Rock outcrop-Lehmans complex, 8 to 60 percent slopes
- MTB Mohall-Tremant complex, 0 to 3 percent slopes
- PRB Perryville-Rillito complex, 0 to 3 percent slopes
- PWB Pinal-Suncity complex, 0 to 3 percent slopes
- PYD Pinamt-Tremant complex, 1 to 10 percent slopes
- Rr Rock outcrop
- TB Torrifluvents, 1 to 5 percent slopes
- TSC Tremant-Rillito complex, 0 to 5 percent slopes
- W Lakes, ponds, reservoirs - perennial
- Vh Vint fine sandy loam
- GggA Gilman Loam, 0 to 1 percent slopes

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File Name:	Dwn.	Chkd.	Dsgn.	Date
excon146.apr	NKD	PJE	MCG	11.06.00

Legend

Subbasin Boundary	
Subbasin Identifier	S101
Section Number	17
Canal	
Existing Road	
Corporate Limits	
Fema Floodplain	

Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

In conjunction with:

CITY OF PEORIA

Client/Project

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
NORTH PEORIA
AREA DRAINAGE MASTER PLAN
FCD NO. 99-45
Peoria, Arizona

Title

PLATE 2
SOILS MAP

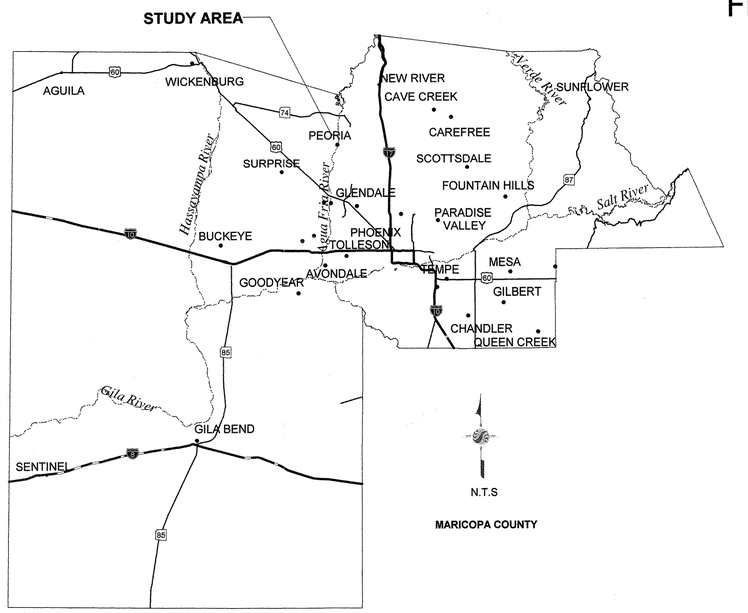
Project No. 82000146

Scale 1"=2000' (0, 2000, 3000, 4000)

Drawing No.

Sheet 1 of 1

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
NORTH PEORIA AREA DRAINAGE MASTER PLAN
DETAIL FLOODPLAIN MAPS
FCD CONTRACT NO. 99-45



LOCATION MAP

DATUM

HORIZONTAL: North American Datum of 1983
VERTICAL: National Geodetic Vertical Datum of 1929

STATEMENTS BY PROFESSIONAL REGISTRANTS

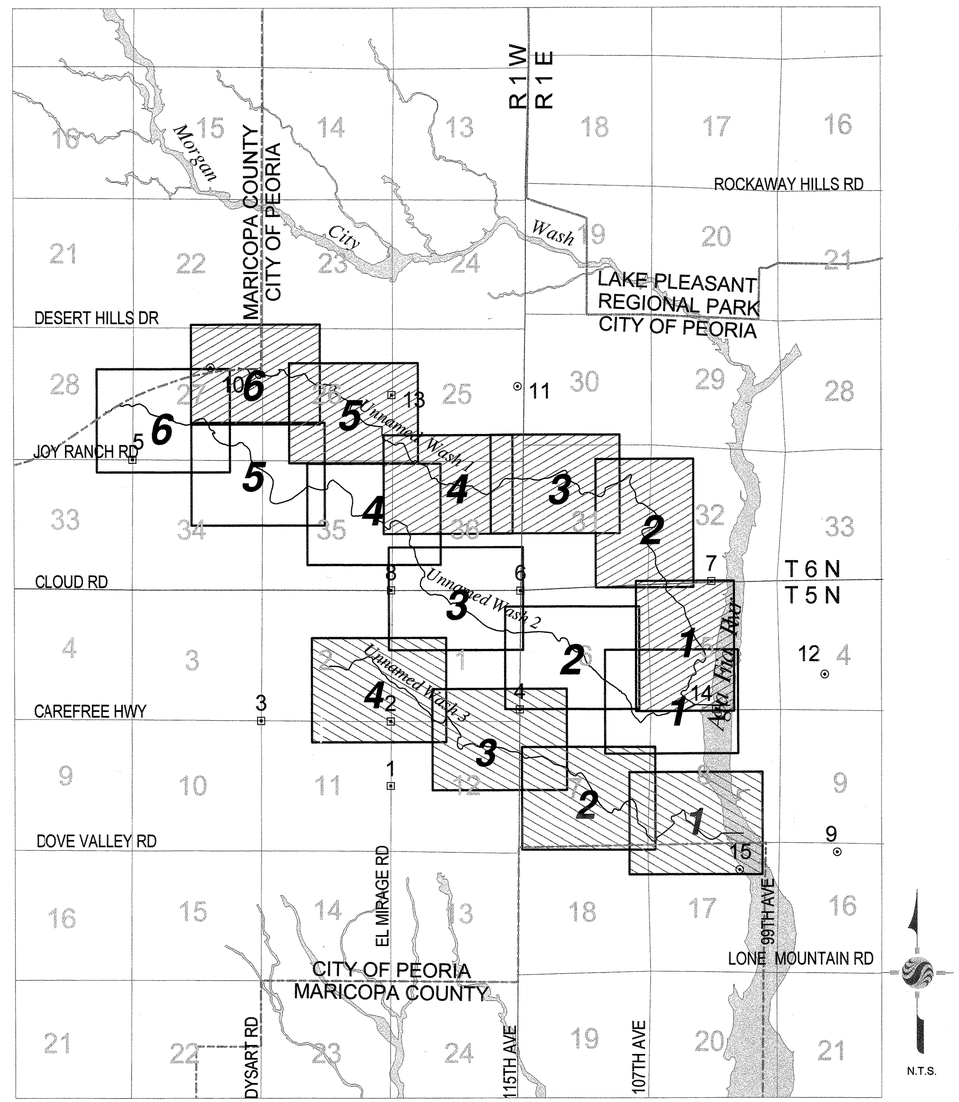
The following statements apply to the individual seals affixed to each of the maps following this cover sheet.

The ground control survey was prepared under my direct supervision:

The photogrammetry and topographic mapping were prepared under my direct supervision:

The hydrologic values used for the floodplain and floodway delineation and the floodplain and floodway delineation were prepared under my direct supervision:

Registered Professional Engineer (Civil) CERTIFICATE NO. MICHAEL C. GERLACH Date Signed 6-11-99 ARIZONA U.S.A.



STUDY AREA MAP
AND INDEX SHEET

AERIAL MAPPING

Cooper Aerial Surveys Co.
11402 N. Cave Creek Road
Phoenix, AZ 85020
(602) 678-5111

GROUND CONTROL

Valco Surveying Corporation
6426 E. Virginia Avenue
Scottsdale, AZ 85257
(480) 990-2412

HYDROLOGY

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(602) 438-2200

HYDRAULICS

Stantec Consulting Inc.
8211 South 48th Street
Phoenix, AZ 85044-5355
(602) 438-2200

LEGEND

- Study Wash
- Plate 4 Sheets
- Plate 5 Sheets
- Plate 6 Sheets
- 1 Sheet Number
- 09 Section Label
- Section Lines
- Corporate Limits
- 12 Control Point with ERM Reference Number
- 1 Section Corner with ERM Reference Number

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PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

COVER SHEET SHEET 1 OF 1

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 400' HORIZONTAL SCALE AND 2 'CONTOUR INTERVALS.

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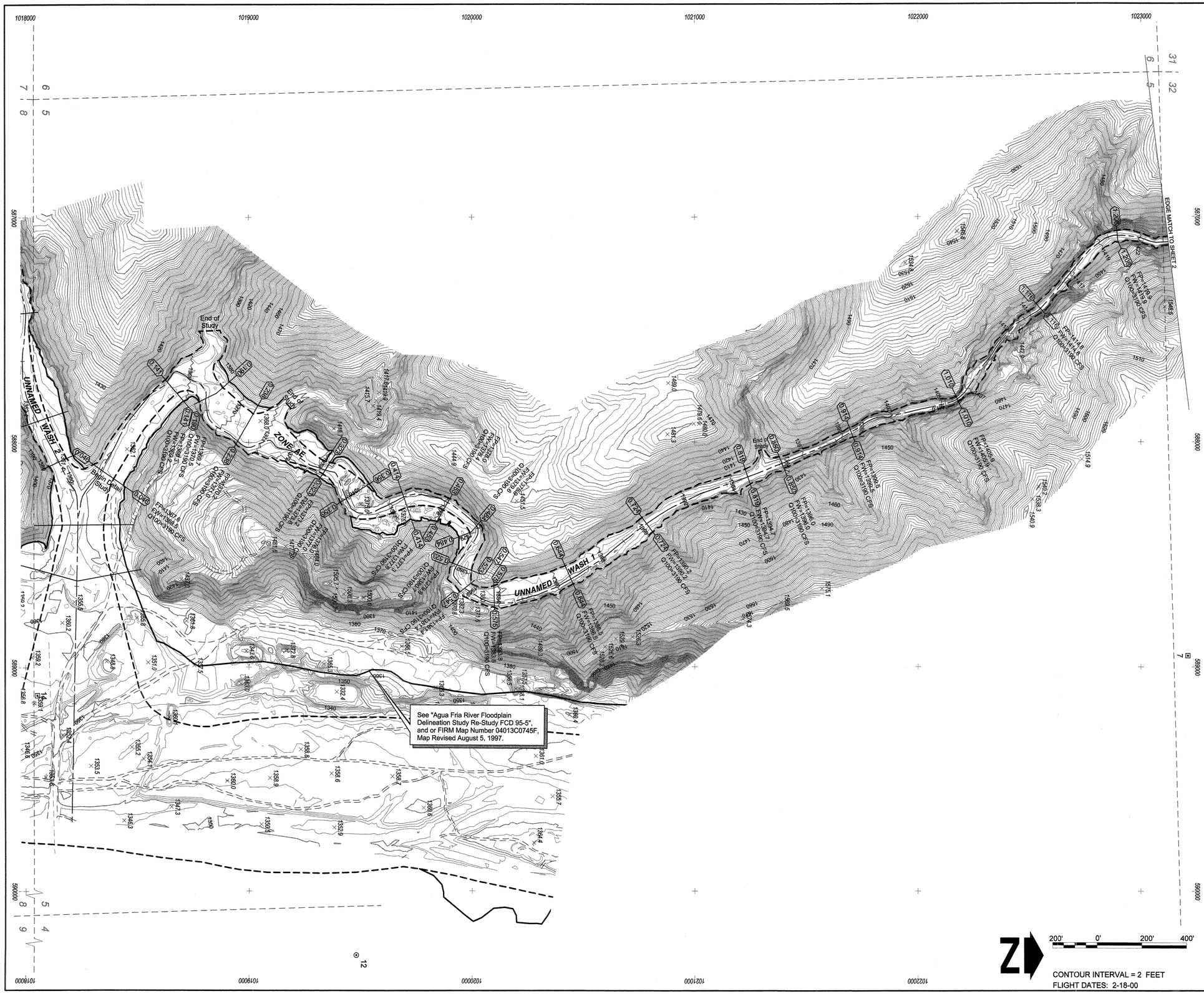
GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.



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GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 (CROSS SECTION RIVER MILE DESIGNATION); FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE)
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

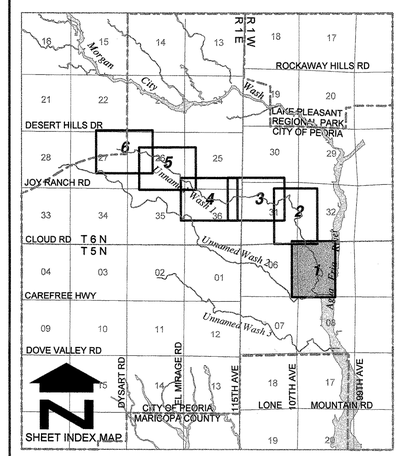
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
7 ⊡	1499.825	GLO BRASS CAP 1/4 CORNER SECTIONS 5 & 32 T 6 N, R 1 E, N: 1023210.001 E: 588949.105
12 ⊙	1440.688	CHISLED "+" ON STRUCTURE, VALCO TBM 65 - NORTHEAST CORNER OF CONCRETE BARRIER ON BRIDGE OVER BEARDSLEY CANAL +-1.6 MILES WEST OF LAKE PLEASANT ROAD AND WEST CAREFREE HIGHWAY. N: 1019462.853 E: 593588.029

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

2- COORDINATES ARE IN NAD 1983 HORIZONTAL AND NGVD 1929 VERTICAL. COORDINATES ARE GRID AND IN INTERNATIONAL FEET. NGVD 1929 ELEVATIONS WERE DERIVED BY SUBTRACTING THE PUBLISHED DIFFERENCE OF 2.07 FEET AT BM S-366 FROM THE ADJUSTED NAVD 1998 VALUES.

3- ALL SECTION LINES ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 1 F.C.D. CONTRACT NO. 99-45

Stantec Consulting Inc.
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www.stantec.com

Registered Professional Engineer (Civil) CERTIFICATE NO. 35184 MICHAEL C. GERLACH Date Signed 6-8-00 ARIZONA U.S.A.

	BY	DATE
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DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 (CROSS SECTION RIVER MILE DESIGNATION) — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE)
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

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

NOTES

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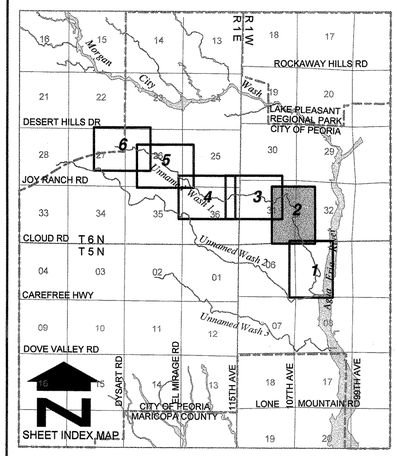
3- ALL SECTION LINES ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 1 F.C.D. CONTRACT NO. 99-45

200' 0' 200' 400'

CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: 2-18-00

Registered Professional Engineer (Civil) 35150 R. MICHAEL C. GERLACH Date Signed 4-11-01 ARIZONA U.S.A.

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	BY	DATE
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DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

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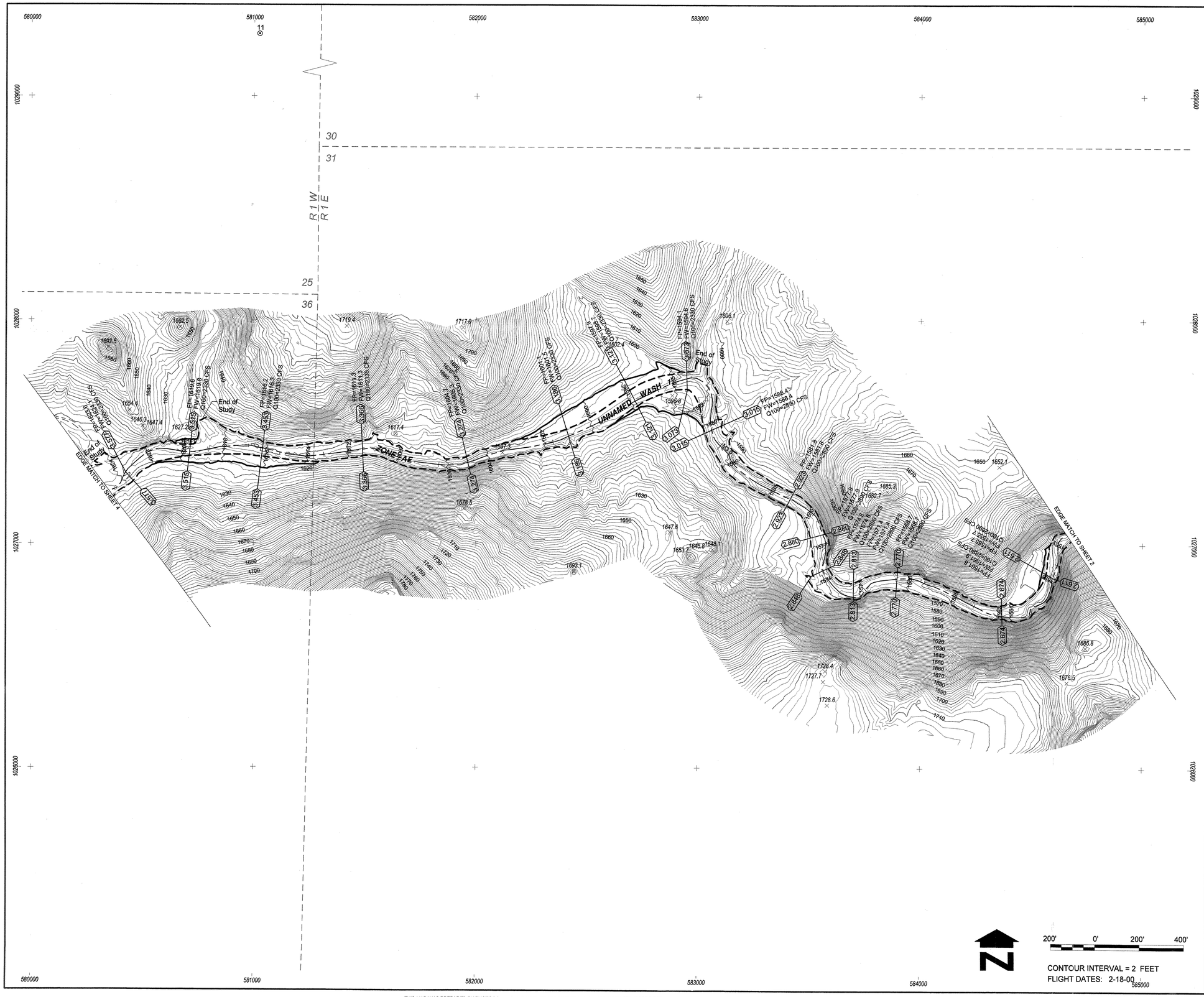

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LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE); CROSS SECTION RIVER MILE DESIGNATION
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

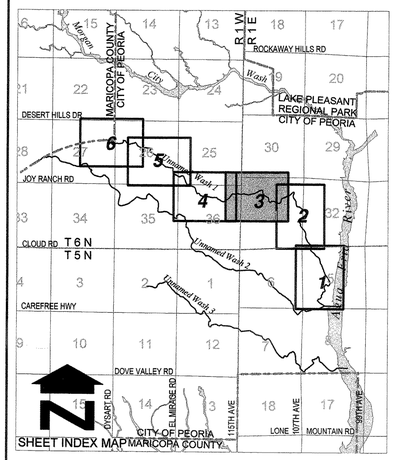
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
11 ⊙	1731.577	ADOT DISK STAMPED "LAKE" IN ROCK OUTCROP, LAKE - IN SOUTH R/W SR 74, 1 MILE SW OF LAKE PLEASANT AT MILEPOST 19.20. THE STATION IS 3 FEET INSIDE THE SOUTH R/W FENCE AND MARKED BY A WITNESS POST & SIGN. N: 1031113.905 E: 581053.811

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

2- COORDINATES ARE IN NAD 1983 HORIZONTAL AND NGVD 1929 VERTICAL. COORDINATES ARE GRID AND IN INTERNATIONAL FEET. NGVD 1929 ELEVATIONS WERE DERIVED BY SUBTRACTING THE PUBLISHED DIFFERENCE OF 2.07 FEET AT BM S-366 FROM THE ADJUSTED NAVD 1998 VALUES.

3- ALL SECTION LINES ARE APPROXIMATE.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 1 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH Date Signed 6-11-01 ARIZONA U.S.A.

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PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 4 SHEET 3 OF 6

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LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE); CROSS SECTION RIVER MILE DESIGNATION
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

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

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

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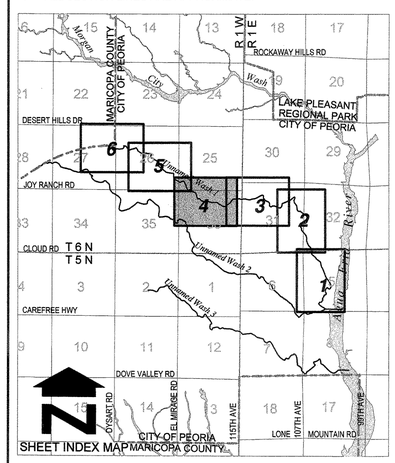
3- ALL SECTION LINES ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 1 F.C.D. CONTRACT NO. 99-45

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	BY	DATE
DESIGN	MCG	04/01
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PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE); CROSS SECTION RIVER MILE DESIGNATION
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SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
13	1747.520	GLO BRASS CAP, 1/4 CORNER SECTION 26 AND 25, T 6 N, R 1 W N: 1030780.041 E: 575913.787

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

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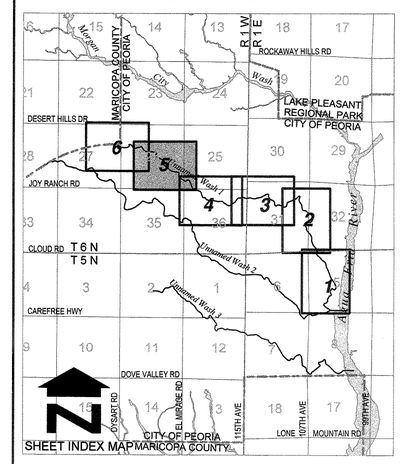

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

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Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH Date Signed 1-11-01 ARIZONA U.S.A.

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	BY	DATE
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DESIGN CHK.	PJE	01/01
PLANS	NKD	01/01
PLANS CHK.	PJE	01/01

PLATE 4 SHEET 5 OF 6

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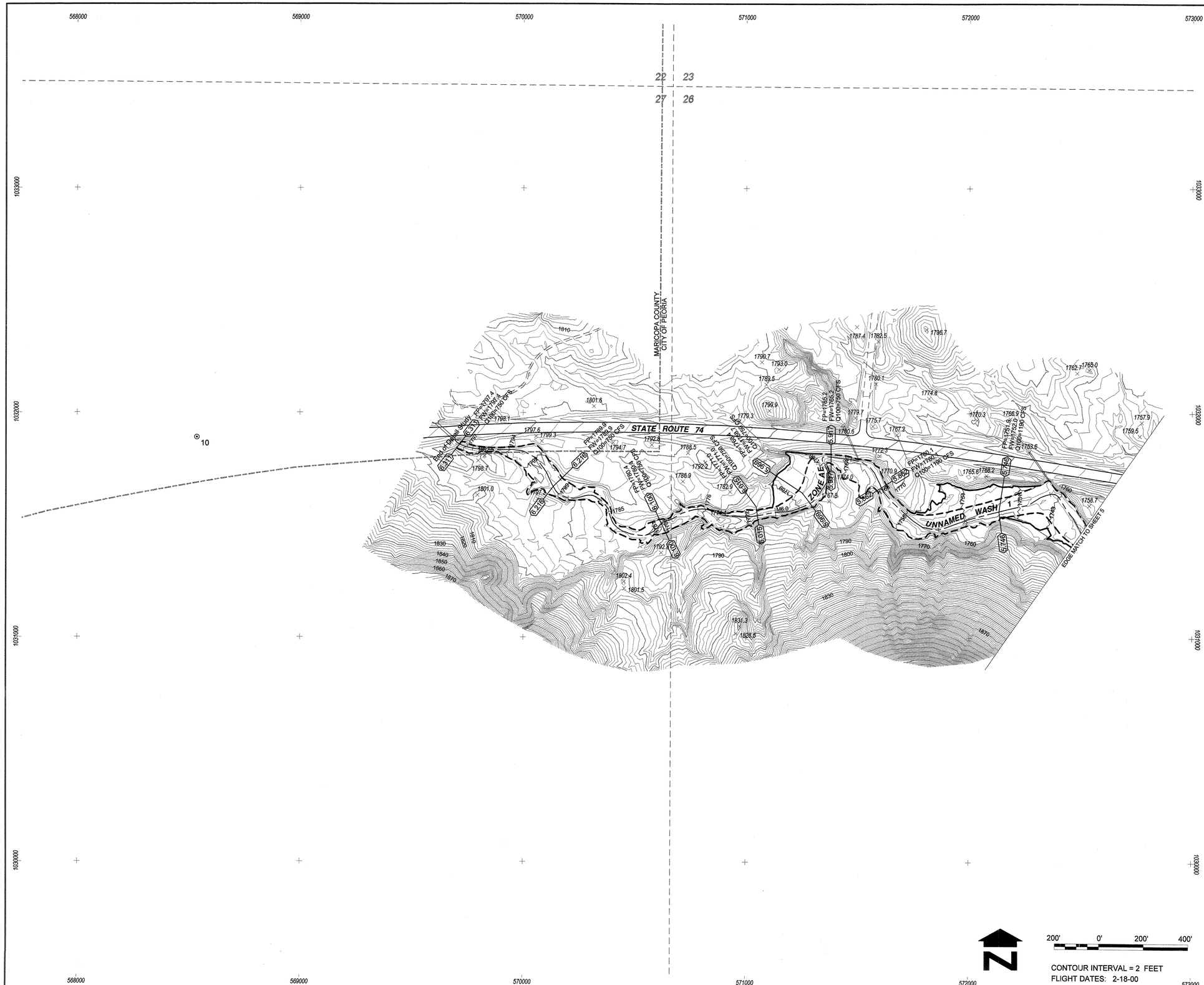

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COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 (CROSS SECTION RIVER MILE DESIGNATION); FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE)
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

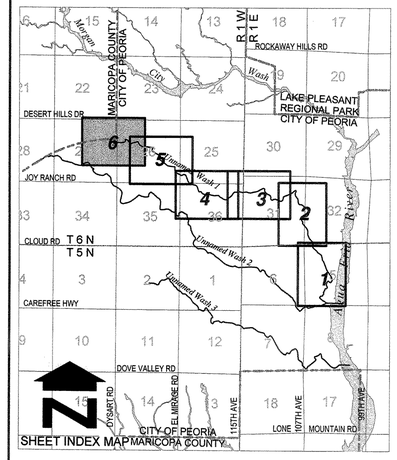
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
10 ⊙	1856.402	ADOT DISK STAMPED "CUT" IN 10" CONC. MONUMENT, CUT- IN NORTH R/W SR74, 5 MI WSW OF LAKE PLEASANT AT MILEPOST 16.99. THE MARK IS 3.5 FEET SOUTH OF THE NORTH R/W FENCE ON TOP OF A 15 FOOT CUTBANK. N: 1031888.332 E: 568536.274

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

2- COORDINATES ARE IN NAD 1983 HORIZONTAL AND NGVD 1929 VERTICAL. COORDINATES ARE GRID AND IN INTERNATIONAL FEET. NGVD 1929 ELEVATIONS WERE DERIVED BY SUBTRACTING THE PUBLISHED DIFFERENCE OF 2.07 FEET AT BM S-366 FROM THE ADJUSTED NAVD 1998 VALUES.

3- ALL SECTION LINES ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 1 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH Date Signed 6-11-04 ARIZONA U.S.A.

Stantec
Stantec Consulting Inc.
8211 South 48th Street
Phoenix, Az 85044-5365 U.S.A.
Tel.: (602) 438-2200
Fax: (602) 431-9562
www.stantec.com

	BY	DATE
DESIGN	MCG	04/01
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 M13.0
CROSS SECTION	0.100 — CROSS SECTION RIVER MILE DESIGNATION; FP= 1888.74 — FLOODPLAIN WATER SURFACE ELEVATION; FW= 1889.54 — ENCROACHED WATER SURFACE ELEVATION; Q100 = CFS — 100 YEAR DISCHARGE
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

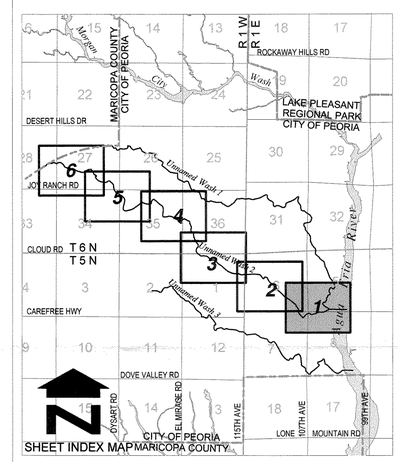
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
14 ⊡	1356.700	DEPT. OF INTERIOR ALUM. CAP, 1/4 CORNER SECTIONS 5 & 8 T5N, R1E N: 1018052.383 E: 589126.608
12 ⊙	1440.688	CHISLED "+" ON STRUCTURE, VALCO TBM 65 - NORTHEAST CORNER OF CONCRETE BARRIER ON BRIDGE OVER BEARDSLEY CANAL +-1.6 MILES WEST OF LAKE PLEASANT ROAD AND WEST CAREFREE HIGHWAY. N: 1019462.853 E: 593588.029

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

2- COORDINATES ARE IN NAD 1983 HORIZONTAL AND NGVD 1929 VERTICAL. COORDINATES ARE GRID AND IN INTERNATIONAL FEET. NGVD 1929 ELEVATIONS WERE DERIVED BY SUBTRACTING THE PUBLISHED DIFFERENCE OF 2.07 FEET AT BM S-366 FROM THE ADJUSTED NAVD 1998 VALUES.

3- ALL SECTION CORNERS ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 2 F.C.D. CONTRACT NO. 99-45

200' 0' 200' 400'

CONTOUR INTERVAL = 2 FEET
FLIGHT DATES: 2-18-00

Registered Professional Engineer (Civil) 35150 R. MICHAEL C. GERLACH Date Signed 6-11-04 ARIZONA U.S.A.

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	BY	DATE
DESIGN	MCG	04/01
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 5 SHEET 1 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE); CROSS SECTION RIVER MILE DESIGNATION
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

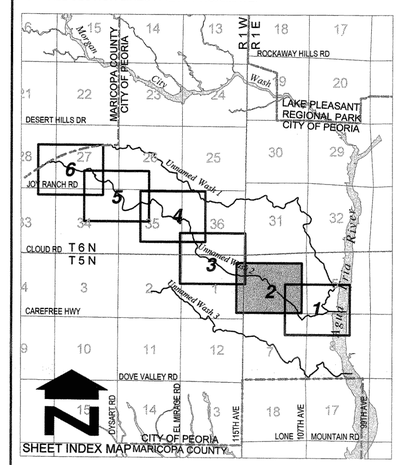
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
4	1744.668	GLO BRASS CAP SECTION CORNER, SECTIONS 1, 6, 7, T5N, R1W & R1E N: 1018061.909 E: 581123.399

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

2- COORDINATES ARE IN NAD 1983 HORIZONTAL AND NGVD 1929 VERTICAL. COORDINATES ARE GRID AND IN INTERNATIONAL FEET. NGVD 1929 ELEVATIONS WERE DERIVED BY SUBTRACTING THE PUBLISHED DIFFERENCE OF 2.07 FEET AT BM S-366 FROM THE ADJUSTED NAVD 1998 VALUES.

3- ALL SECTION LINES ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 2 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH Date Signed 4-11-00 ARIZONA, U.S.A.

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DESIGN	MCG	04/01
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 5 SHEET 2 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2 'CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 M13.0
CROSS SECTION	0.100 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE); CROSS SECTION RIVER MILE DESIGNATION
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
6	1743.227	GLO BRASS CAP SECTION CORNER, SECTIONS 31, 36, 1, 6 T5N, T6N, R1E, R1W N: 1022840.322 E: 581157.608
8	1713.615	GLO BRASS CAP SECTION CORNER, SECTIONS 35, 36, 1, 2 T5N,T6N, R1W N: 1022868.043 E: 575881.369

NOTES

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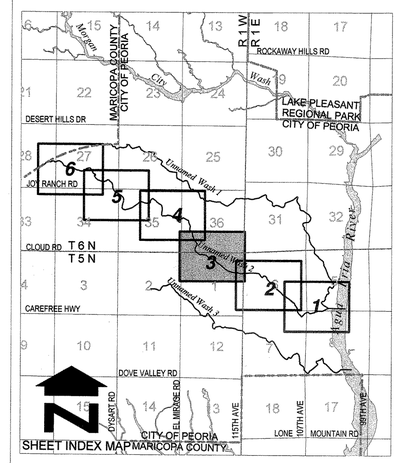
3- ALL SECTION LINES ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 2 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) 05150 R. MICHAEL C. GERLACH Date Signed 4-10-01 ARIZONA U.S.A.

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DESIGN	MCG	04/01
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 5 SHEET 3 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2 'CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2 'CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 M13.0
CROSS SECTION	0.100 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE); CROSS SECTION RIVER MILE DESIGNATION
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

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

NOTES

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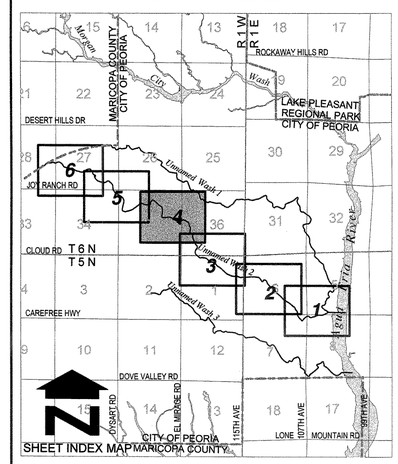
3- ALL SECTION CORNERS ARE APPROXIMATE.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 2 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) 35150 R. MICHAEL C. GERLACH Date Signed 4-11-01 ARIZONA U.S.A.

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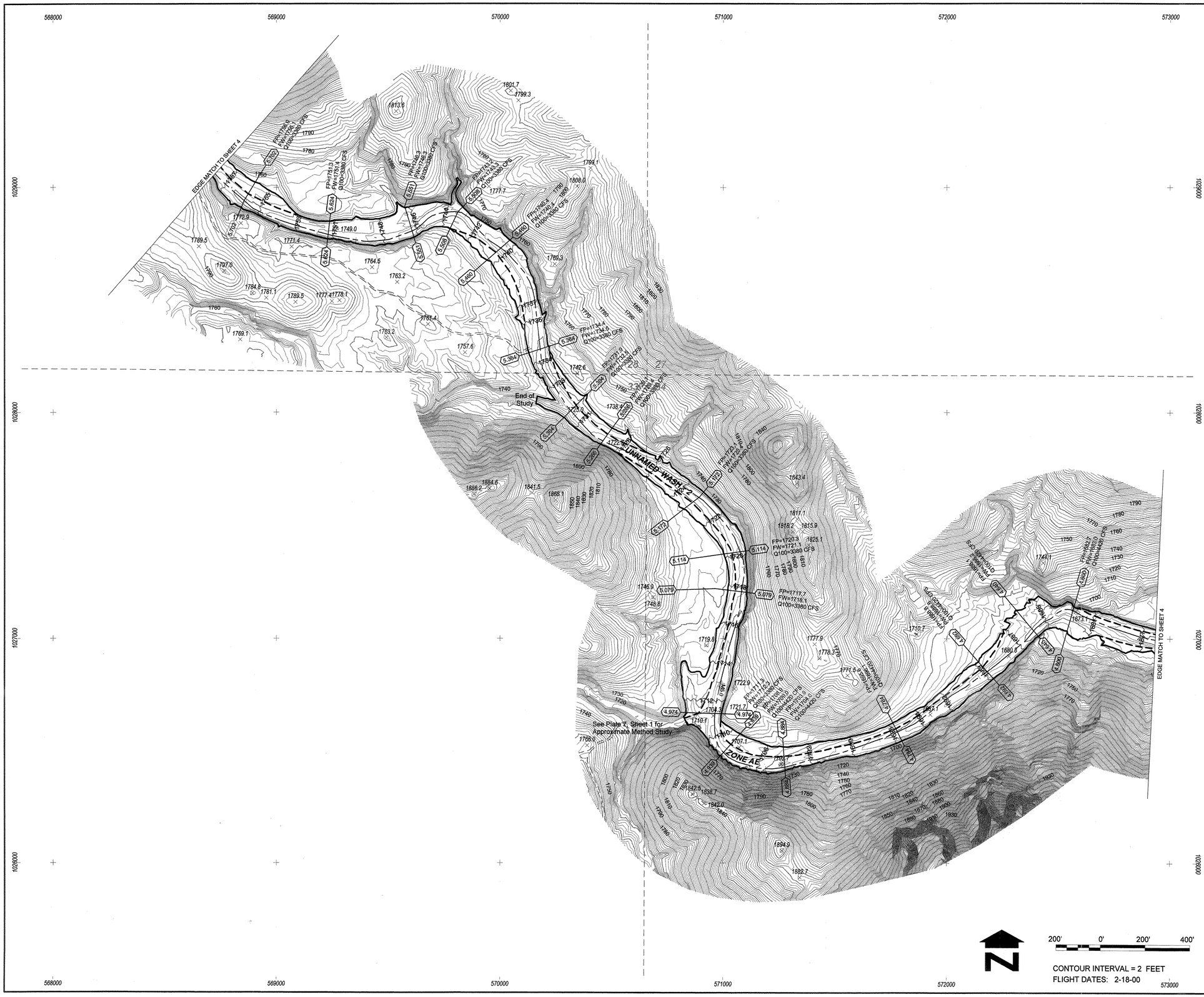
DESIGN	MCG	04/01
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 5 SHEET 4 OF 6



THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2 'CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 (CROSS SECTION RIVER MILE DESIGNATION) — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE)
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

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

NOTES

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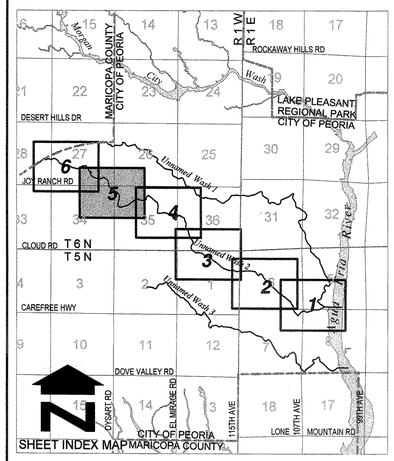
3- ALL SECTION LINES ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 2 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH Date Signed 6-14-01 ARIZONA U.S.A.

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PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 5 SHEET 5 OF 6

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE); CROSS SECTION RIVER MILE DESIGNATION
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COUNTY, PARISH, STATE OR INTERNATIONAL BOUNDARY	County Boundary
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
10 ⊙	1856.402	ADOT DISK STAMPED "CUT" IN 10" CONC. MONUMENT, CUT- IN NORTH R/W SR74, 5 MI WSW OF LAKE PLEASANT AT MILEPOST 16.99. THE MARK IS 3.5 FEET SOUTH OF THE NORTH R/W FENCE ON TOP OF A 15 FOOT CUTBANK. N: 1031888.332 E: 568536.274
5 ⊡	1868.563	GLO BRASS CAP, SECTION CORNER SECTIONS 27, 28, 33, 34, T6N, R1W N: 1028211.900 E: 565351.762

NOTES

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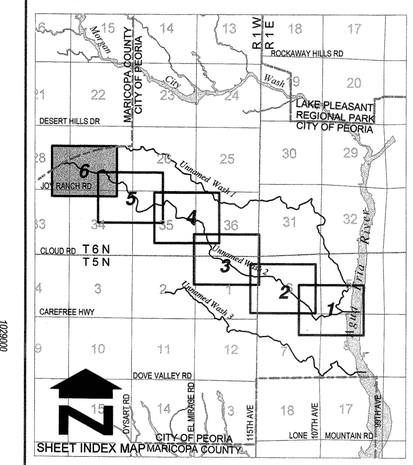

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 2 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH date signed 6-11-01 ARIZONA U.S.A.

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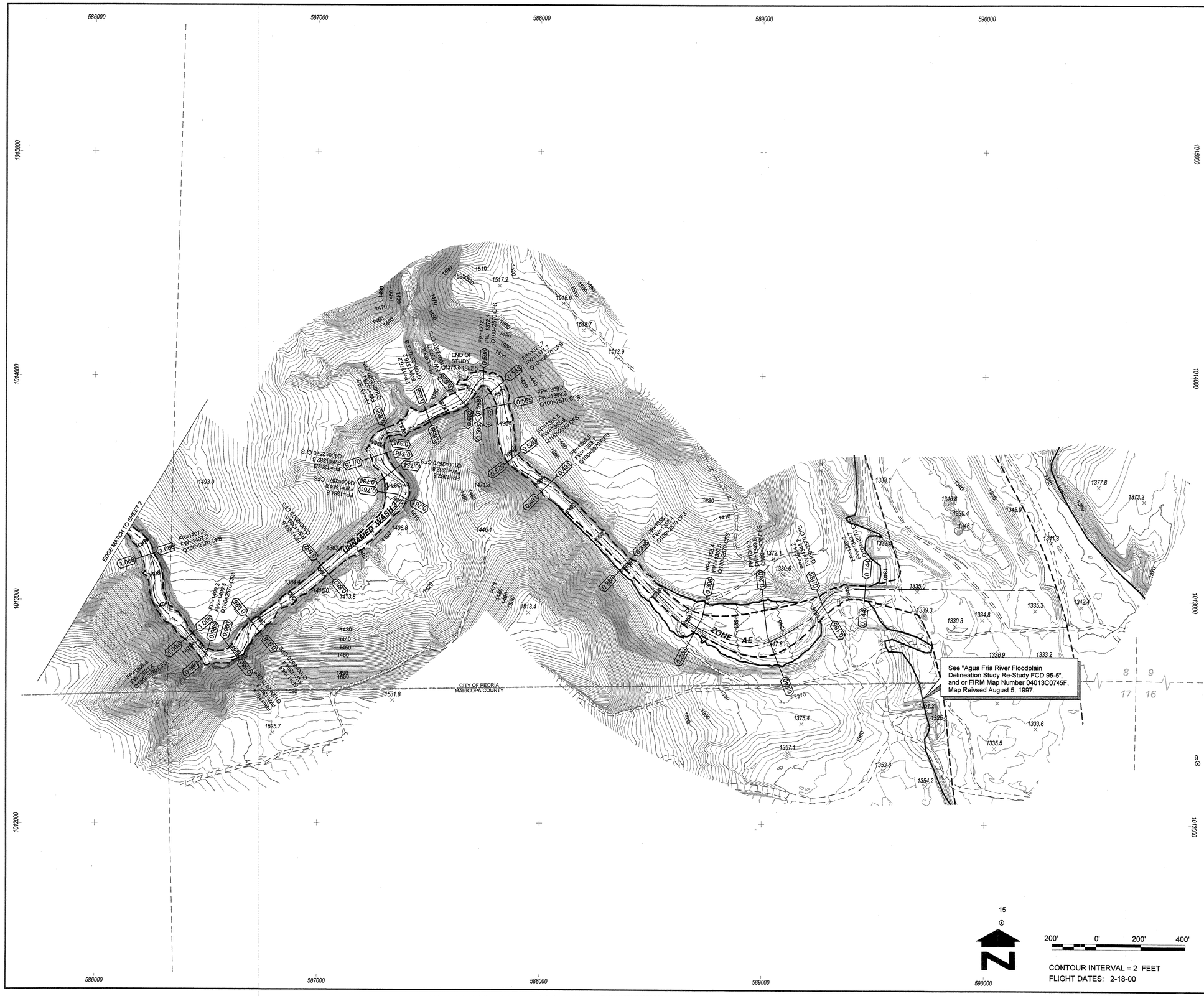
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 5 SHEET 6 OF 6

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2 'CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.



LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE); CROSS SECTION RIVER MILE DESIGNATION
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
15 ⊙	1353.720	+' TOP BOLT IN SW CORNER CONCRETE ABUTTMENT AT WEST END OF FLUME, WEST END BEARDSLEY CANAL FLUME CROSSING AGUA FRIA RIVER N: 1011568.327 E: 590082.699
9 ⊙	1434.830	CHISLED "+" NW COR. CONC. HEADWALL, CHUTE - SOUTH OF BEARDSLEY CANAL AND NORTH OF CAP SERVICE ROAD. +- 1.0 MILES WEST OF LAKE PLEASANT ROAD AND CAP BRIDGE. N: 1012280.199 E: 594087.160

NOTES

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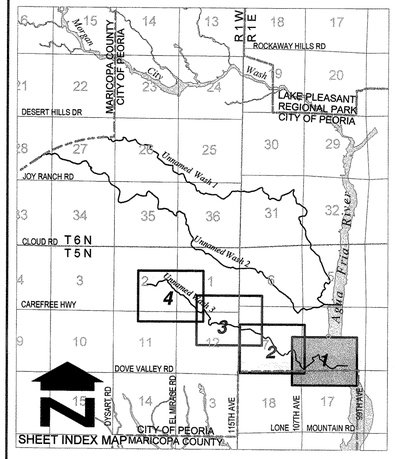

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 3 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH Date Signed 2-18-01 ARIZONA U.S.A.

Stantec
Stantec Consulting Inc.
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PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 6 SHEET 1 OF 4

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2 'CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 (CROSS SECTION RIVER MILE DESIGNATION) — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE)
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

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

NOTES

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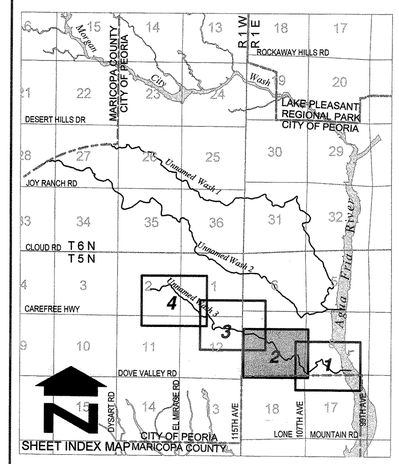
2- COORDINATES ARE IN NAD 1983 HORIZONTAL AND NGVD 1929 VERTICAL. COORDINATES ARE GRID AND IN INTERNATIONAL FEET. NGVD 1929 ELEVATIONS WERE DERIVED BY SUBTRACTING THE PUBLISHED DIFFERENCE OF 2.07 FEET AT BM S-366 FROM THE ADJUSTED NAVD 1998 VALUES.

3- ALL SECTION LINES ARE APPROXIMATE.



SHEET INDEX MAP MARICOPA COUNTY

NO	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

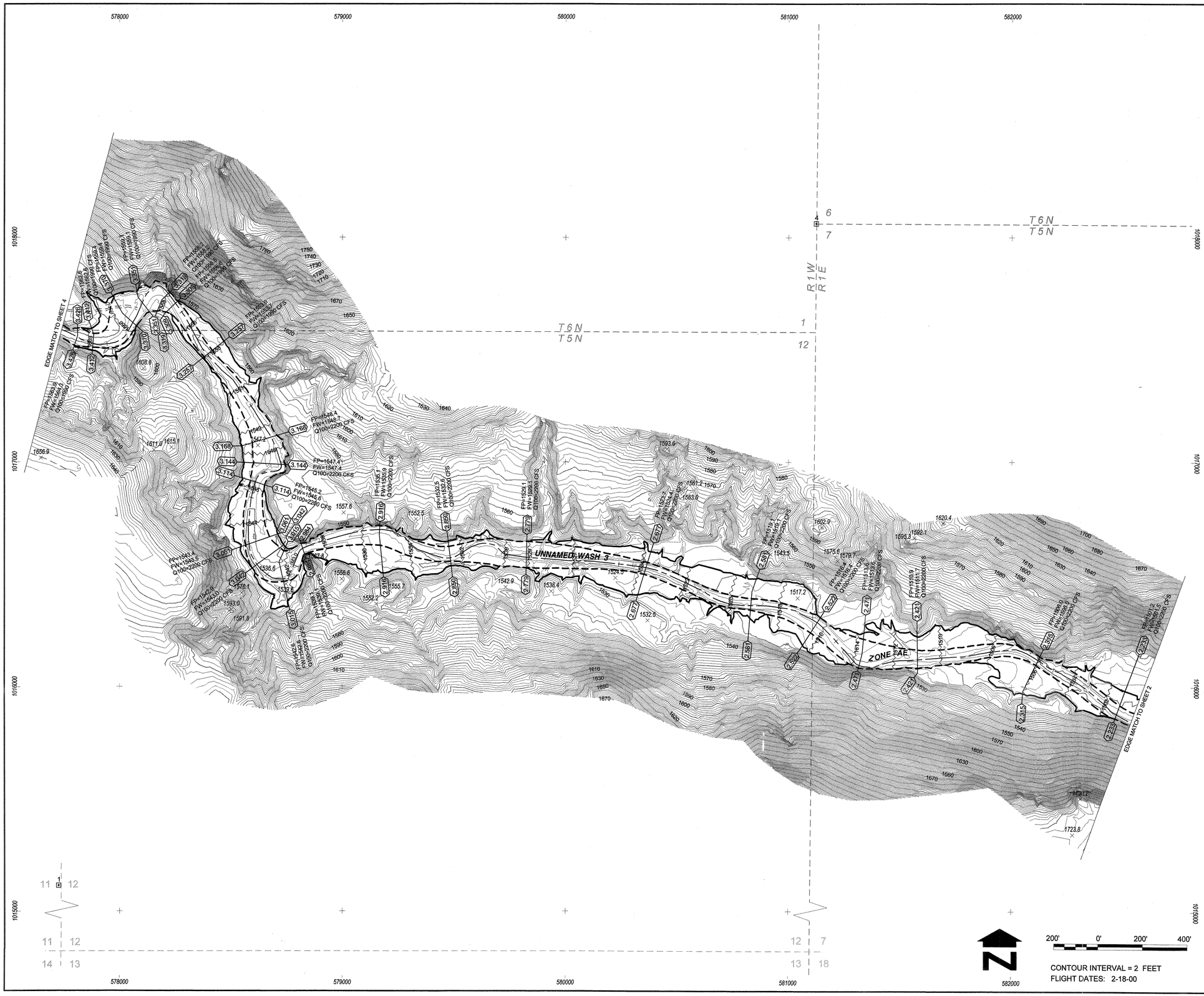
NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 3 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) 35150 R. MICHAEL C. GERLACH Date Signed 1-11-01 ARIZONA U.S.A.

Stantec
Stantec Consulting Inc.
8211 South 48th Street
Phoenix, Az 85044-5355 U.S.A.
Tel.: (602) 438-2200
Fax: (602) 431-9562
www.stantec.com

	BY	DATE
DESIGN	MCG	04/01
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 6 SHEET 2 OF 4



THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2' CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 (CROSS SECTION RIVER MILE DESIGNATION) — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE)
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

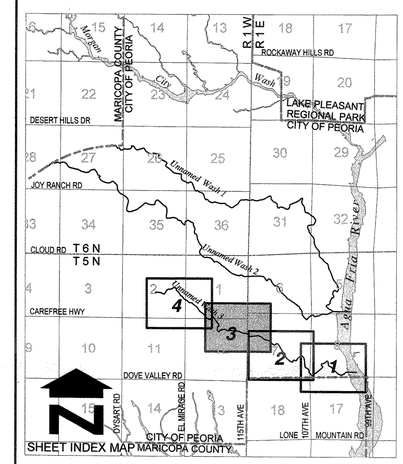
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
4	1744.668	GLO BRASS CAP SECTION CORNER, SECTIONS 1, 6, 7, T5N, R1W & R1E N: 1018061.909 E: 581123.399
1	1611.931	GLO BRASS CAP 1/4 CORNER, SECTIONS 11 & 12 T5N, R1W N: 1014953.756 E: 575853.309

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

2- COORDINATES ARE IN NAD 1983 HORIZONTAL AND NGVD 1929 VERTICAL. COORDINATES ARE GRID AND IN INTERNATIONAL FEET. NGVD 1929 ELEVATIONS WERE DERIVED BY SUBTRACTING THE PUBLISHED DIFFERENCE OF 2.07 FEET AT BM S-366 FROM THE ADJUSTED NAVD 1998 VALUES.

3- ALL SECTION LINES ARE APPROXIMATE.



NO	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 3 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH Date Signed 12-1-00 ARIZONA U.S.A.

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8211 South 48th Street
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	BY	DATE
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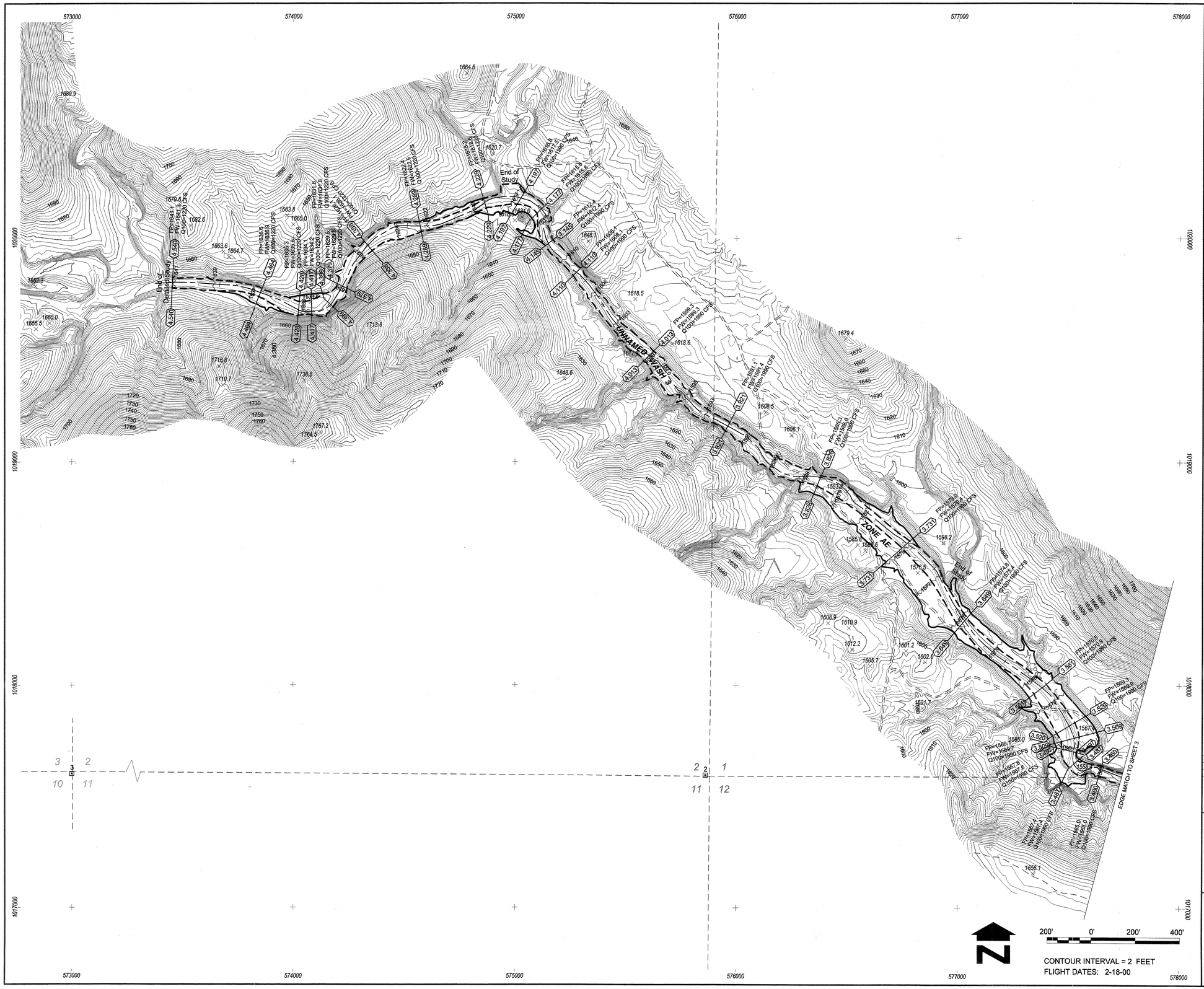
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01

PLATE 6 SHEET 3 OF 4



THIS MAP WAS PREPARED BY PHOTOGRAMMETRIC METHODS TO NATIONAL MAP ACCURACY STANDARDS FOR 1"= 200' HORIZONTAL SCALE AND 2 'CONTOUR INTERVALS.

COOPER AERIAL SURVEYS CO.

GROUND CONTROL SURVEY DATA PROVIDED BY VALCO SURVEYING CORP.

LEGEND

100-YR FLOODPLAIN BOUNDARY	
FLOODWAY BOUNDARY	
HYDRAULIC BASE LINE WITH RIVER MILE	M12.0 — M13.0
CROSS SECTION	0.100 (CROSS SECTION RIVER MILE DESIGNATION) — FP= 1888.74 (FLOODPLAIN WATER SURFACE ELEVATION); FW= 1889.54 (ENCROACHED WATER SURFACE ELEVATION); Q100 = CFS (100 YEAR DISCHARGE)
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
SECTION LINES	

ELEVATION REFERENCE MARKS

NOTE: ALL ELEVATIONS ARE BASED ON NATIONAL GEODETIC VERTICAL DATUM OF 1929.

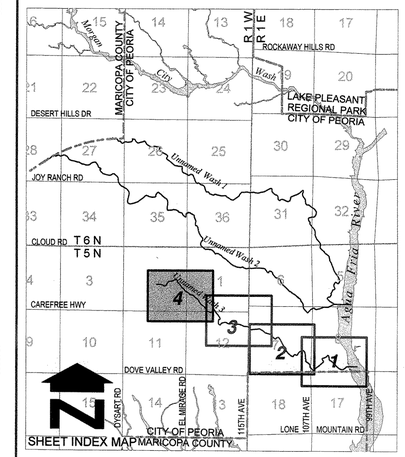
I.D. NUMBER	ELEVATION (FT)	DESCRIPTION/LOCATION
2	1624.244	GLO BRASS CAP SECTION CORNER, SECTIONS 1, 2, 11, 12 T5N, R1W N: 1017591.572 E: 575862.942
3	1646.762	GLO BRASS CAP SECTION CORNER, SECTIONS 2, 3, 10, 11 T5N, R1W N: 1017617.764 E: 570584.939

NOTES

1- THE HYDRAULIC BASE LINE IS CROSS SECTION STATION 10,000 UNLESS NOTED OTHERWISE.

2- COORDINATES ARE IN NAD 1983 HORIZONTAL AND NGVD 1929 VERTICAL. COORDINATES ARE GRID AND IN INTERNATIONAL FEET. NGVD 1929 ELEVATIONS WERE DERIVED BY SUBTRACTING THE PUBLISHED DIFFERENCE OF 2.07 FEET AT BM S-366 FROM THE ADJUSTED NAVD 1998 VALUES.

3- ALL SECTION LINES ARE APPROXIMATE.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODWAY AND FLOODPLAIN MAP UNNAMED WASH 3 F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) 35150 R. MICHAEL C. GERLACH Date Signed 6-1-01 ARIZONA U.S.A.

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8211 South 48th Street
Phoenix, Az 85044-5355 U.S.A.
Tel.: (602) 438-2200
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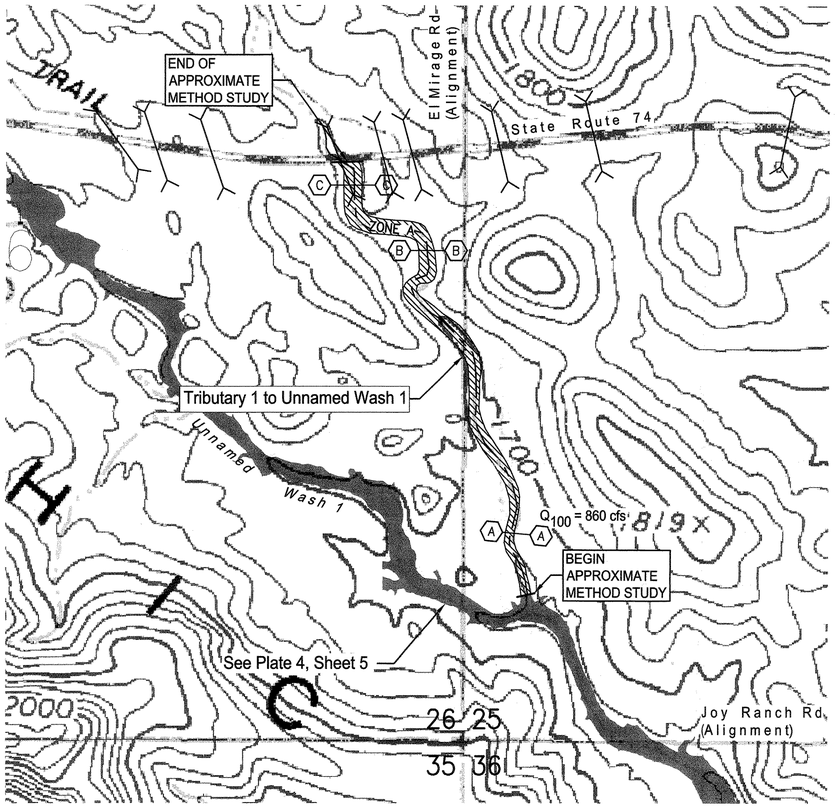
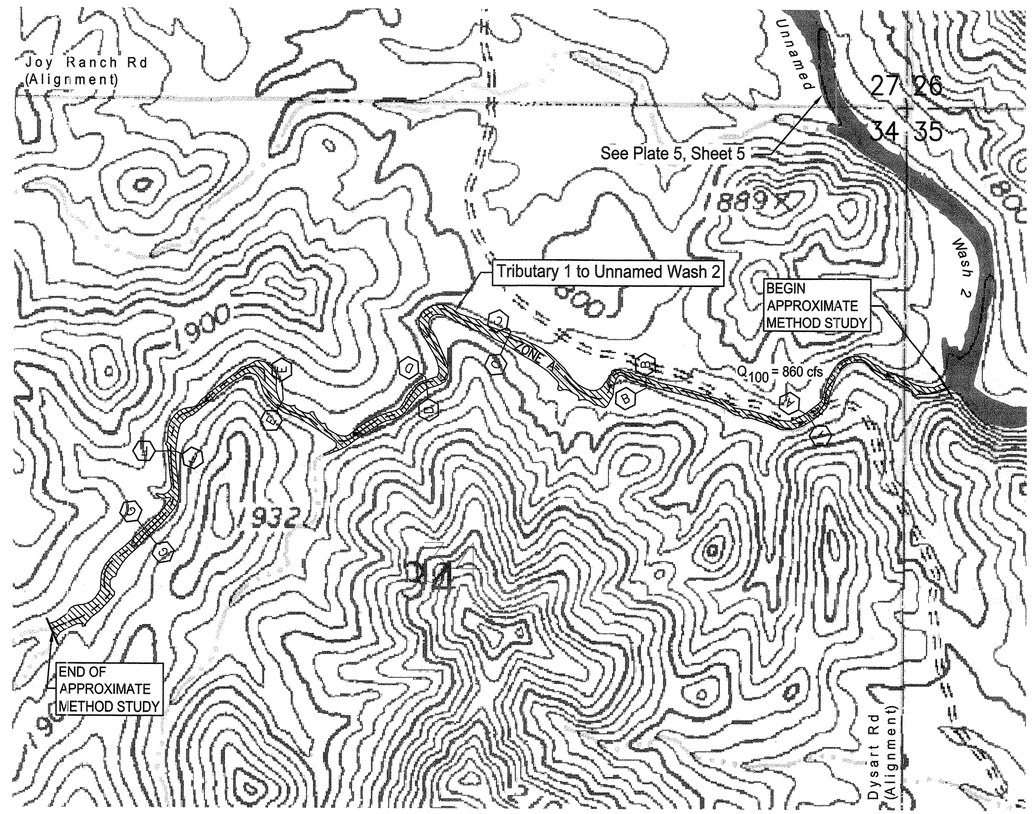
www.stantec.com

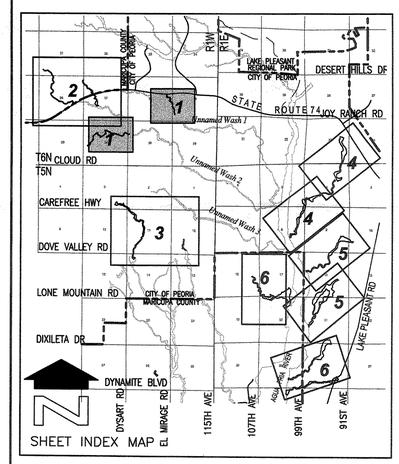
	BY	DATE
DESIGN	MCG	04/01
DESIGN CHK.	PJE	04/01
PLANS	NKD	04/01
PLANS CHK.	PJE	04/01





LEGEND

SPECIAL FLOOD HAZARD AREA, ZONE A	
DETAILED STUDY FLOOD HAZARD AREA, ZONE AE	
END OF STUDY	EOS
CROSS SECTION LOCATION AND IDENTIFIER	A — A
100-YEAR PEAK DISCHARGE	Q_{100} = 860 cfs
HYDRAULIC BASE LINE	
CULVERT	
CORPORATE LIMITS	



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODPLAIN WORK MAP APPROXIMATE METHOD REACHES F.C.D. CONTRACT NO. 99-45

Stantec Consulting Inc.
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Fax. 602.431.9562
www.stantec.com

Registered Professional Engineer (Civil) — R. MICHAEL C. GERLACH — Arizona U.S.A.

	BY	DATE
DESIGN	MMZ	12.15.00
DESIGN CHK.	MCG	01.25.01
PLANS	HAR	12.15.00
PLANS CHK.	MMZ	01.25.01

PLATE 7

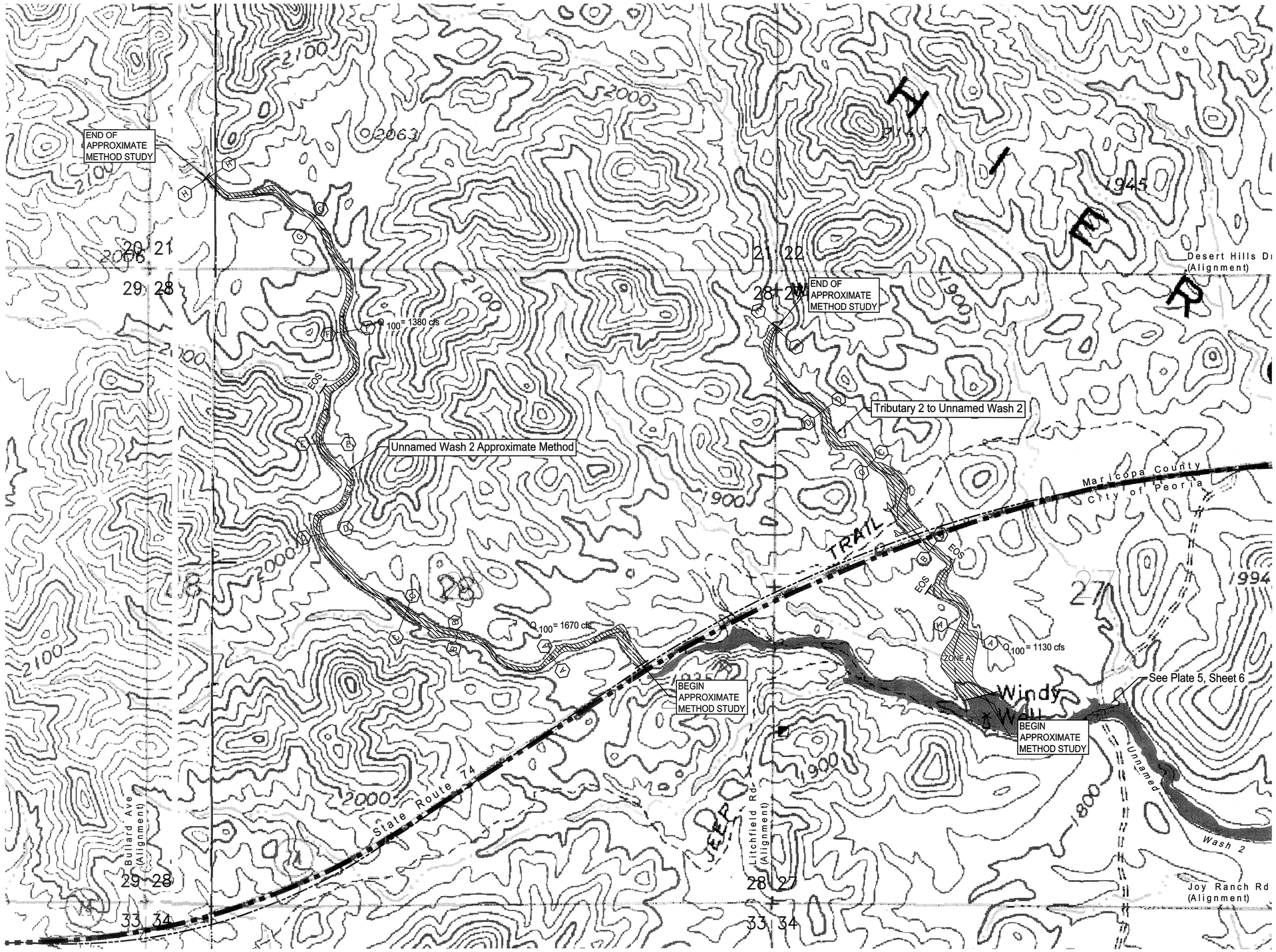
SHEET 1 OF 6

400' 0' 400' 800'

CONTOUR INTERVAL = 20 FEET

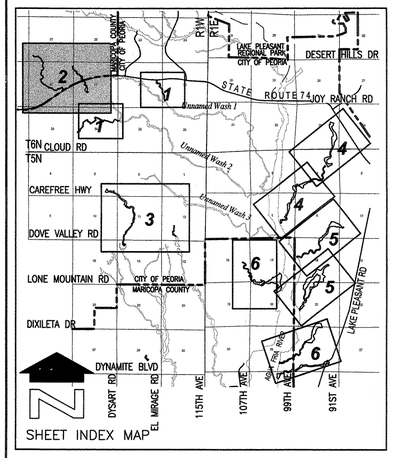
PORTION OF USGS QUADRANGLE BALDY MOUNTAIN

P:\82000146\Dwg\vpodmp\01AMFP01.DWG
2001 November 15, 10:25 a.m.



LEGEND

SPECIAL FLOOD HAZARD AREA, ZONE A	
DETAILED STUDY FLOOD HAZARD AREA, ZONE AE	
END OF STUDY	EOS
CROSS SECTION LOCATION AND IDENTIFIER	A — A
100-YEAR PEAK DISCHARGE	Q_{100} = 860 cfs
HYDRAULIC BASE LINE	
CULVERT	
CORPORATE LIMITS	



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODPLAIN WORK MAP APPROXIMATE METHOD REACHES F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) MICHAEL C. GERLACH 19160 Date Signed 11/9/01 ARIZONA U.S.A.

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8211 South 48th Street
Phoenix AZ 85044-5355 U.S.A.
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	BY	DATE
DESIGN	MMZ	12.15.00
DESIGN CHK.	MCG	01.25.01
PLANS	HAR	12.15.00
PLANS CHK.	MMZ	01.12.01

PLATE 7

PORTION OF USGS QUADRANGLE BALDY MOUNTAIN

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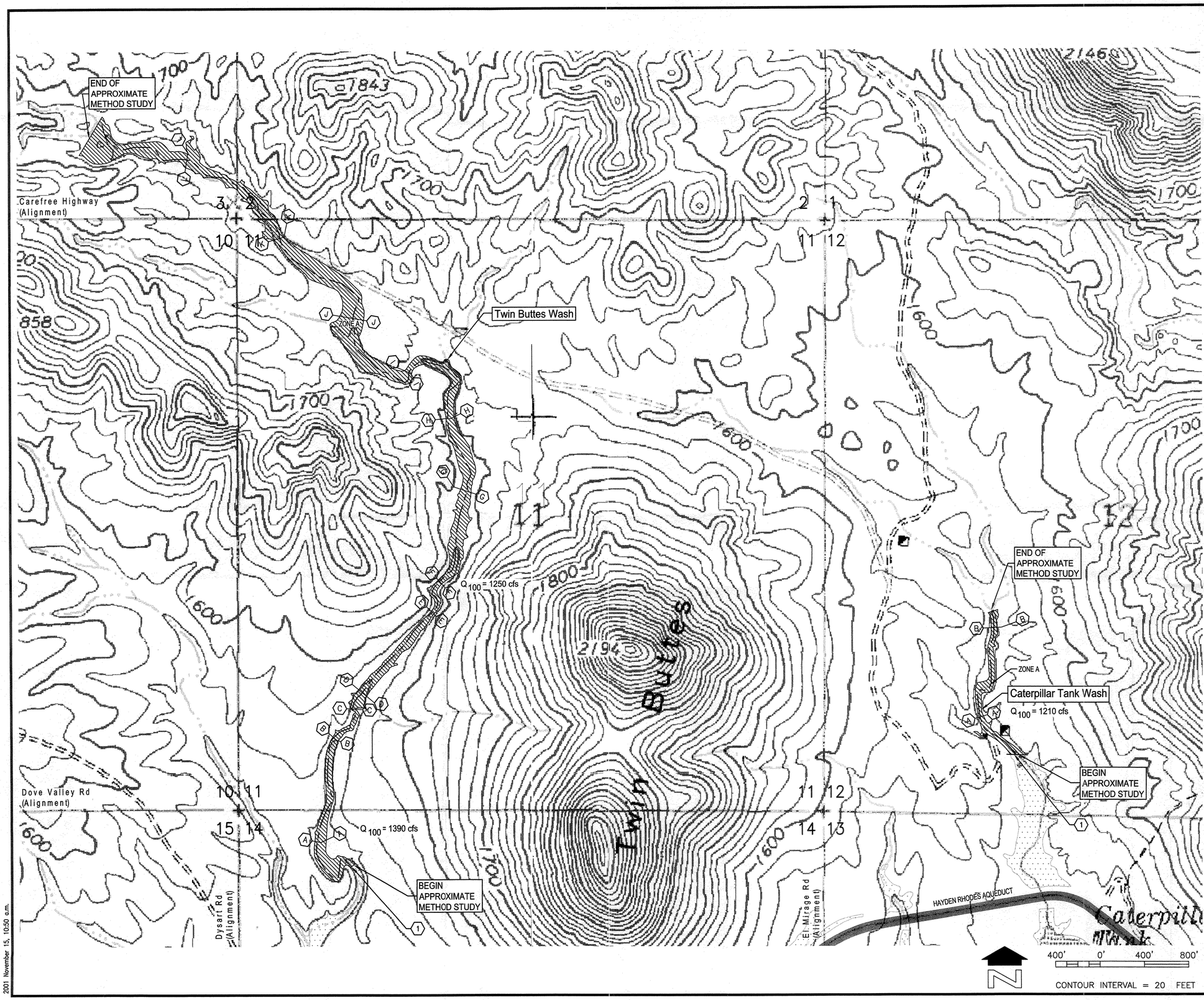
2001 November 15, 10:43 a.m.

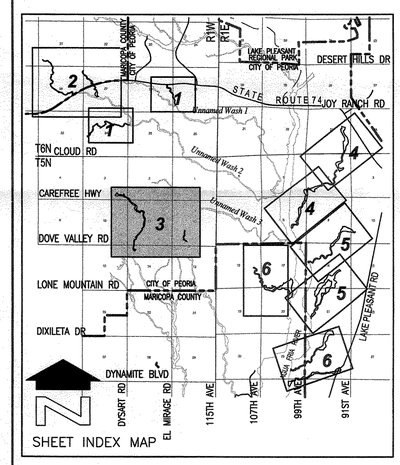


PORTION OF USGS QUADRANGLE BALDY MOUNTAIN

LEGEND

SPECIAL FLOOD HAZARD AREA, ZONE A	
EFFECTIVE SPECIAL FLOOD HAZARD AREA, ZONE AE	
END OF STUDY	EOS
CROSS SECTION LOCATION AND IDENTIFIER	A — A
100-YEAR PEAK DISCHARGE	Q_{100}= 860 cfs
HYDRAULIC BASE LINE	
CULVERT	
CORPORATE LIMITS	

(1) TIE INTO EXISTING SPECIAL FLOOD HAZARD ZONE PER FIRM MAP NUMBER 04013C0740 F, MAP REVISED DECEMBER 3, 1993.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODPLAIN WORK MAP APPROXIMATE METHOD REACHES F.C.D. CONTRACT NO. 99-45

Stantec Consulting Inc.
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Registered Professional Engineer (Civil) CERTIFICATE NO. 35160 R. MICHAEL C. GERLACH Date Signed 11/9/01 ARIZONA U.S.A.

	BY	DATE
DESIGN	MMZ	12.15.00
DESIGN CHK.	MCG	01.25.01
PLANS	HAR	12.15.00
PLANS CHK.	MMZ	01.12.01

PLATE 7

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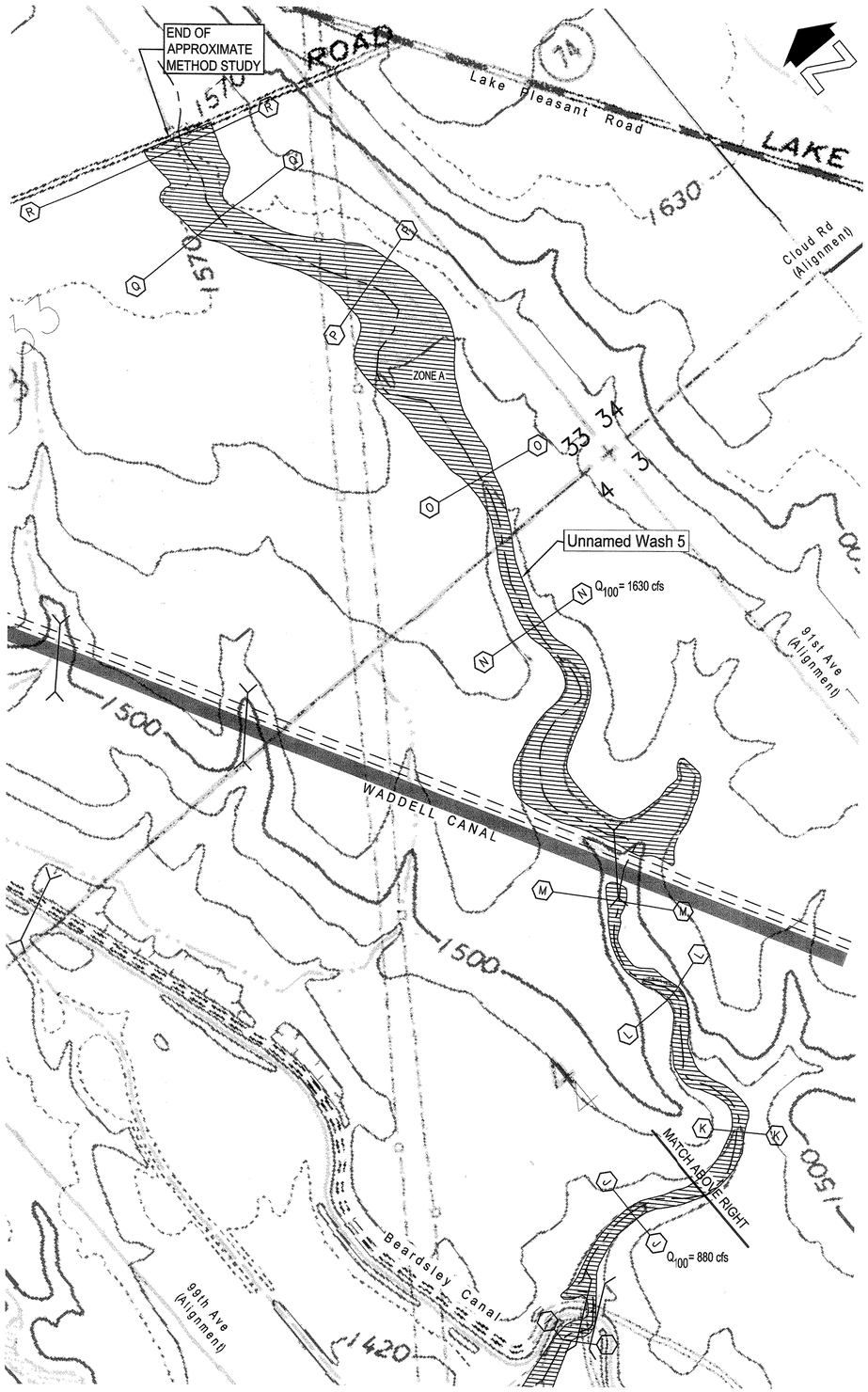
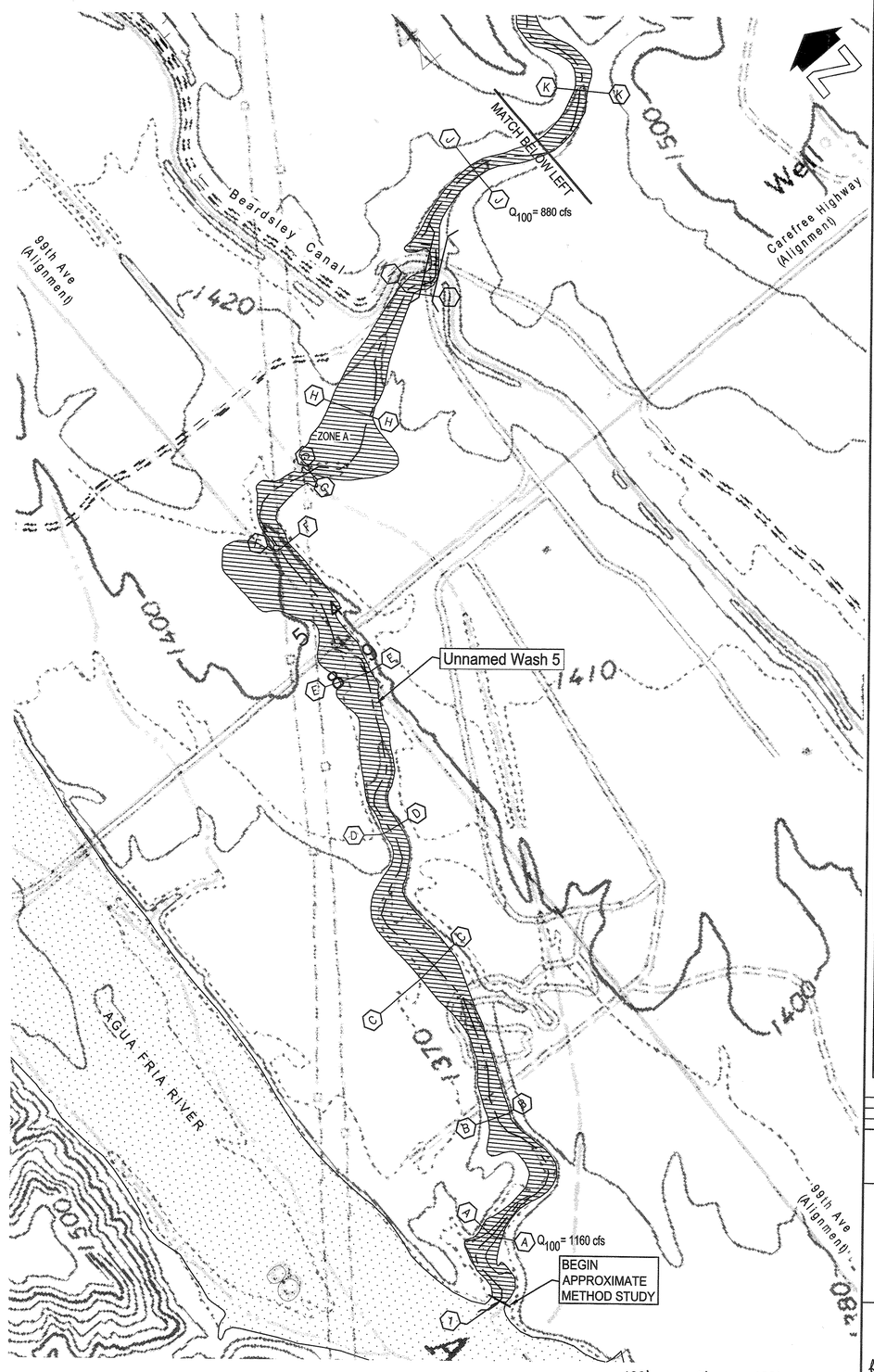




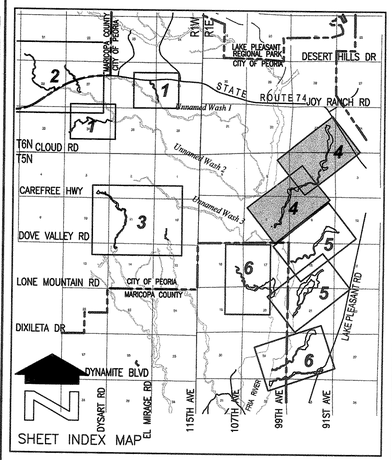
400' 0' 400' 800'

CONTOUR INTERVAL = 20 FEET

LEGEND

SPECIAL FLOOD HAZARD AREA, ZONE A	
EFFECTIVE SPECIAL FLOOD HAZARD AREA, ZONE AE	
END OF STUDY	EOS
CROSS SECTION LOCATION AND IDENTIFIER	A — A
100-YEAR PEAK DISCHARGE	Q_{100}= 860 cfs
HYDRAULIC BASE LINE	
CULVERT	
CORPORATE LIMITS	

(1) TIE INTO EXISTING SPECIAL FLOOD HAZARD ZONE PER FIRM MAP NUMBER 04013C0745 F, MAP REVISED AUGUST 5, 1997.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODPLAIN WORK MAP APPROXIMATE METHOD REACHES F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 33156 R. MICHAEL C. GERLACH Date Signed 11/9/01 ARIZONA U.S.A.

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8211 South 48th Street
Phoenix AZ 85044-5355 U.S.A.
Tel. 602.438.2200
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	BY	DATE
DESIGN	MMZ	12.15.00
DESIGN CHK.	MCG	01.25.01
PLANS	HAR	12.15.00
PLANS CHK.	MMZ	01.12.01

PLATE 7

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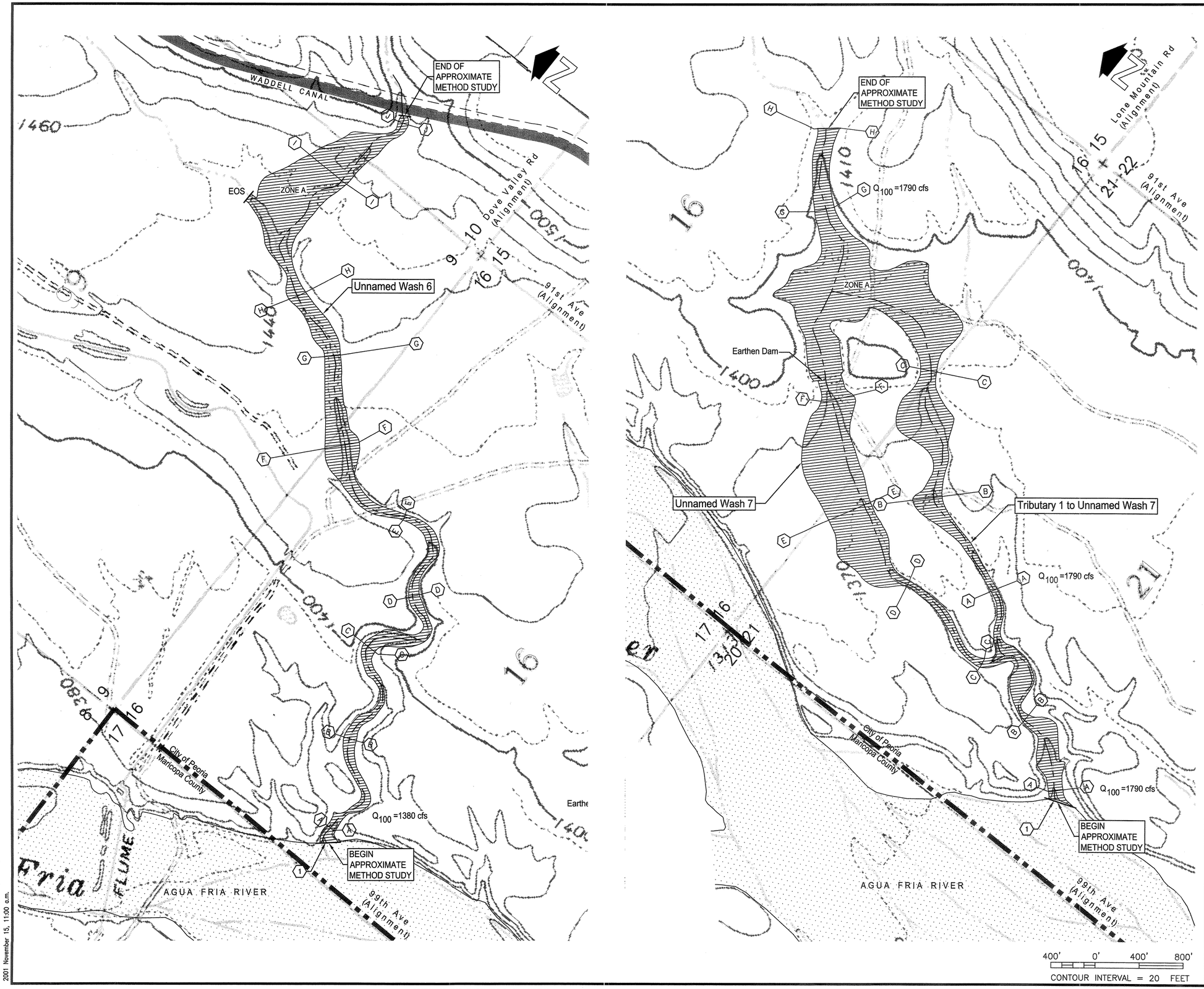
2001 November 15, 10:57 a.m.

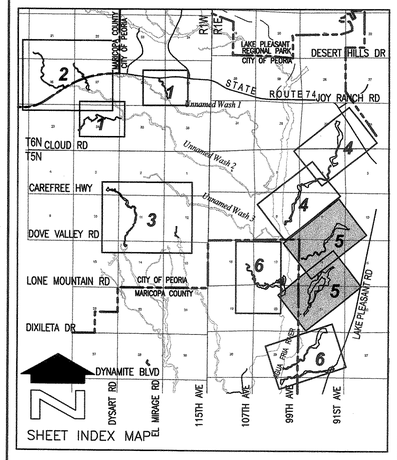
PORTION OF USGS QUADRANGLE BALDY MOUNTAIN



LEGEND

SPECIAL FLOOD HAZARD AREA, ZONE A	
EFFECTIVE SPECIAL FLOOD HAZARD AREA, ZONE AE	
END OF STUDY	EOS
CROSS SECTION LOCATION AND IDENTIFIER	A — A
100-YEAR PEAK DISCHARGE	Q_{100} = 860 cfs
HYDRAULIC BASE LINE	
CULVERT	
CORPORATE LIMITS	

(1) TIE INTO EXISTING SPECIAL FLOOD HAZARD ZONE PER FIRM MAP NUMBER 04013C0745 F, MAP REVISED AUGUST 5, 1997.



NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODPLAIN WORK MAP APPROXIMATE METHOD REACHES F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) 35150 R. MICHAEL C. GERLACH Date Signed 1/9/01 ARIZONA U.S.A.

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Phoenix AZ 85044-5355 U.S.A.
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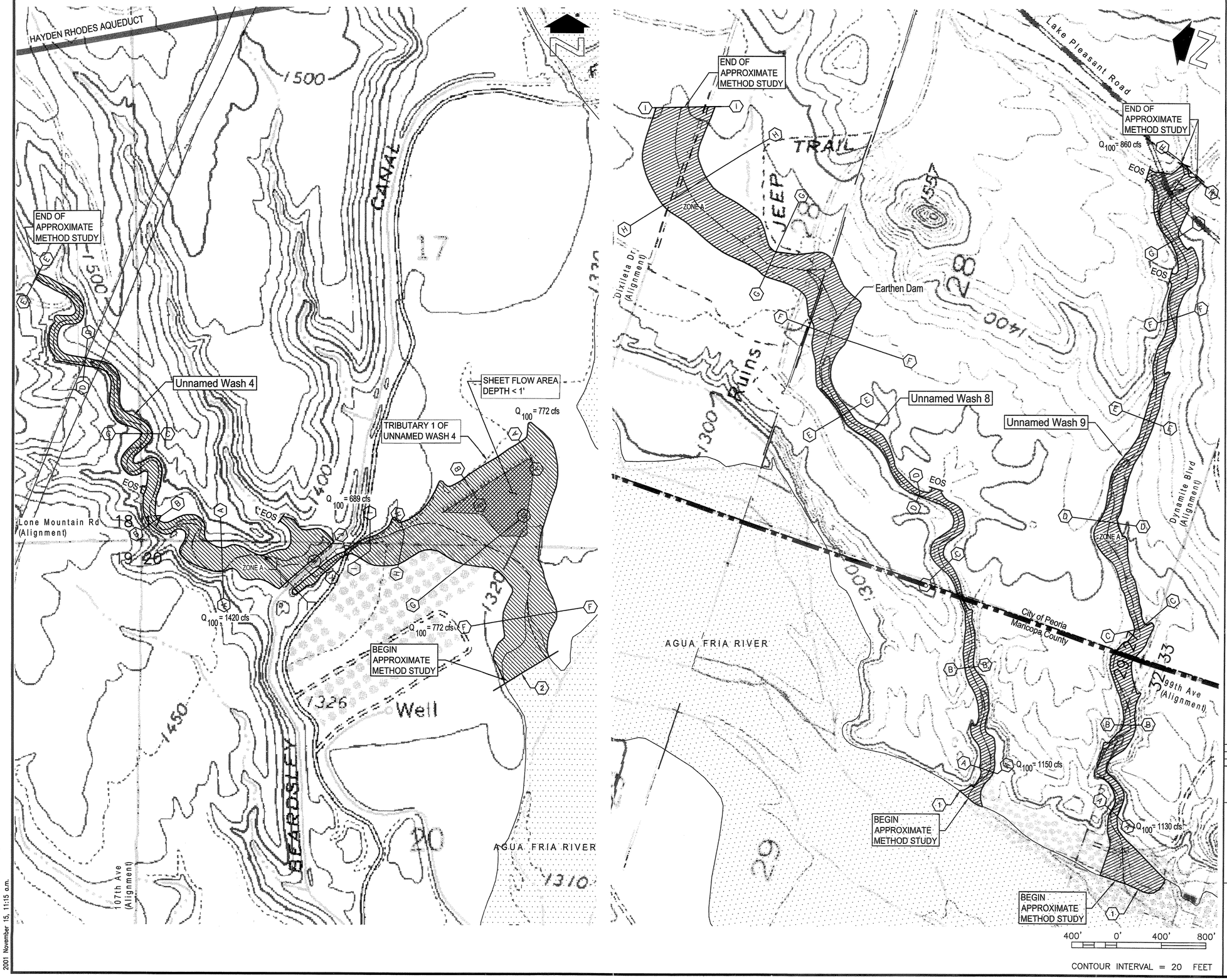
	BY	DATE
DESIGN	MMZ	12.15.00
DESIGN CHK.	MCG	01.25.01
PLANS	HAR	12.15.00
PLANS CHK.	MMZ	01.12.01

PLATE 7

PORTION OF USGS QUADRANGLE BALDY MOUNTAIN

P:\82000146\Dwg\npadmp\05amfp146.dwg
2001 November 15, 11:00 a.m.

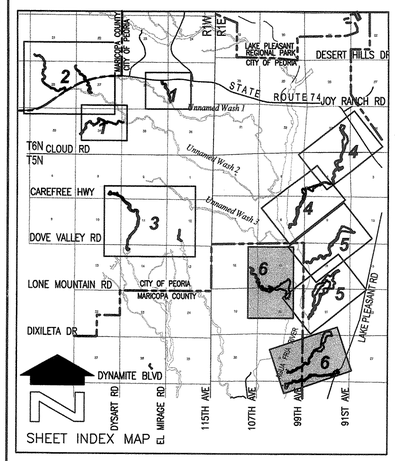


LEGEND

SPECIAL FLOOD HAZARD AREA, ZONE A	
EFFECTIVE SPECIAL FLOOD HAZARD AREA, ZONE AE	
END OF STUDY	EOS
CROSS SECTION LOCATION AND IDENTIFIER	A — A
100-YEAR PEAK DISCHARGE	Q_{100} = 860 cfs
HYDRAULIC BASE LINE	
CULVERT	
CORPORATE LIMITS	

(1) TIE INTO EXISTING SPECIAL FLOOD HAZARD ZONE PER FIRM MAP NUMBER 04013C0760 F, MAP REVISED AUGUST 5, 1997.

(2) TIE INTO EXISTING SPECIAL FLOOD HAZARD ZONE PER FIRM MAP NUMBER 04013C0745 F, MAP REVISED AUGUST 5, 1997.



SHEET INDEX MAP

NO.	REVISION	BY	DATE
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

NORTH PEORIA AREA DRAINAGE MASTER PLAN FLOODPLAIN WORK MAP APPROXIMATE METHOD REACHES F.C.D. CONTRACT NO. 99-45

Registered Professional Engineer (Civil) CERTIFICATE NO. 35150 R. MICHAEL C. GERLACH Date Signed 12/15/01 ARIZONA U.S.A.

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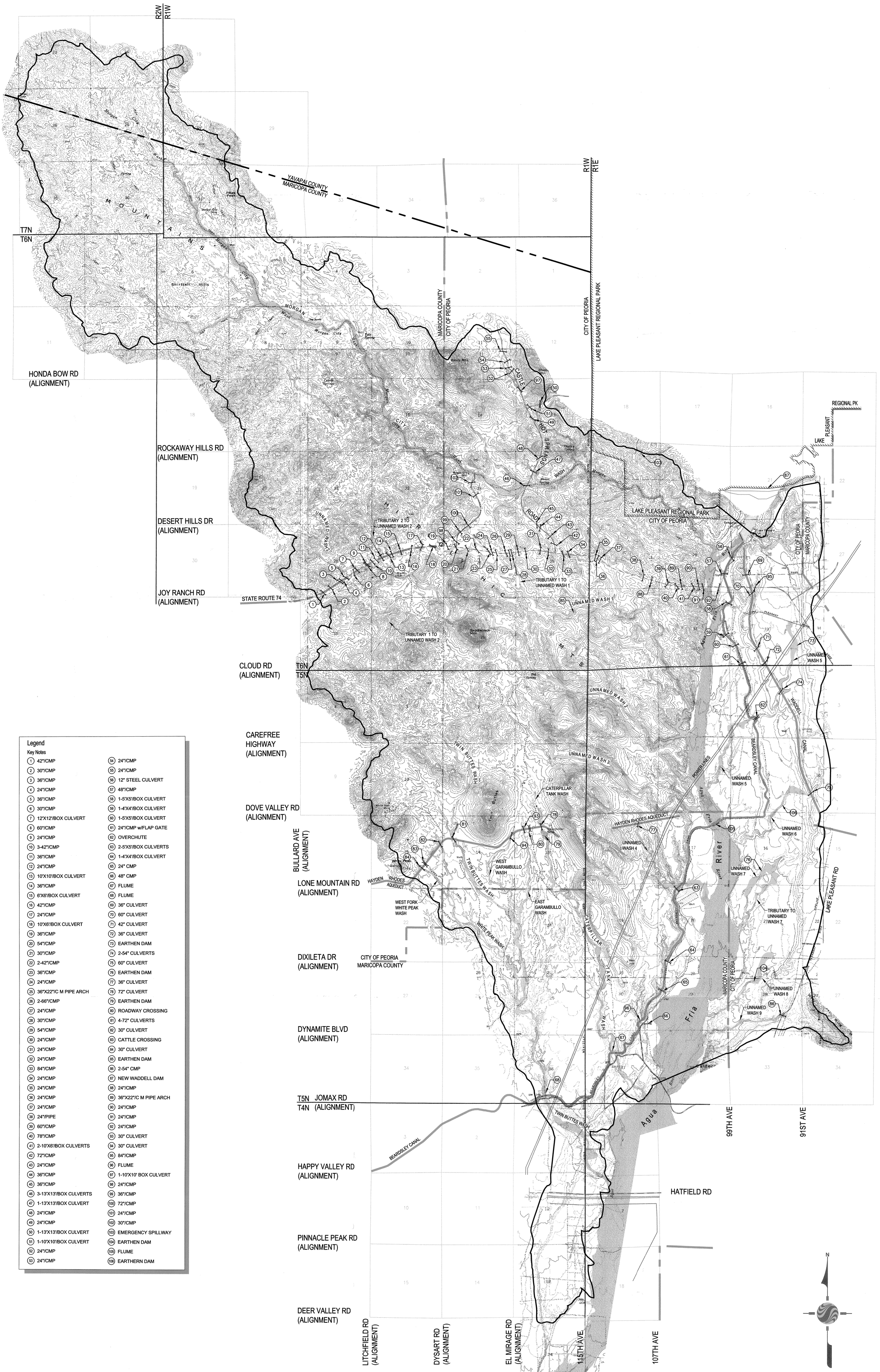
DESIGN	MMZ	12.15.00
DESIGN CHK.	MCG	01.25.01
PLANS	HAR	12.15.00
PLANS CHK.	MMZ	01.12.01

PLATE 7

P:\82000146\Dwg\npadmp\06omfp146.dwg
2001 November 15, 11:15 a.m.

PORTION OF USGS QUADRANGLES BALDY MOUNTAIN AND CALDERWOOD BUTTE



Legend

Key Notes

1	42"/CMP	54	24"/CMP
2	30"/CMP	55	24"/CMP
3	36"/CMP	56	12" STEEL CULVERT
4	24"/CMP	57	48"/CMP
5	36"/CMP	58	1-5'X5'/BOX CULVERT
6	30"/CMP	59	1-4'X4'/BOX CULVERT
7	12'X12'/BOX CULVERT	60	1-5'X5'/BOX CULVERT
8	60"/CMP	61	24"/CMP w/FLAP GATE
9	24"/CMP	62	OVERCHUTE
10	3-42"/CMP	63	2-5'X5'/BOX CULVERTS
11	36"/CMP	64	1-4'X4'/BOX CULVERT
12	24"/CMP	65	24" CMP
13	10'X10'/BOX CULVERT	66	48" CMP
14	36"/CMP	67	FLUME
15	6'X6'/BOX CULVERT	68	FLUME
16	42"/CMP	69	36" CULVERT
17	24"/CMP	70	60" CULVERT
18	10'X6'/BOX CULVERT	71	42" CULVERT
19	36"/CMP	72	36" CULVERT
20	54"/CMP	73	EARTHEN DAM
21	30"/CMP	74	2-54" CULVERTS
22	2-42"/CMP	75	60" CULVERT
23	36"/CMP	76	EARTHEN DAM
24	24"/CMP	77	36" CULVERT
25	36"X22"/C M PIPE ARCH	78	72" CULVERT
26	2-66"/CMP	79	EARTHEN DAM
27	24"/CMP	80	ROADWAY CROSSING
28	30"/CMP	81	4-72" CULVERTS
29	54"/CMP	82	30" CULVERT
30	24"/CMP	83	CATTLE CROSSING
31	24"/CMP	84	30" CULVERT
32	24"/CMP	85	EARTHEN DAM
33	84"/CMP	86	2-54" CMP
34	24"/CMP	87	NEW WADDELL DAM
35	24"/CMP	88	24"/CMP
36	24"/CMP	89	36"X22"/C M PIPE ARCH
37	24"/CMP	90	24"/CMP
38	24"/PIPE	91	24"/CMP
39	60"/CMP	92	24"/CMP
40	78"/CMP	93	30" CULVERT
41	2-10'X6'/BOX CULVERTS	94	30" CULVERT
42	72"/CMP	95	84"/CMP
43	24"/CMP	96	FLUME
44	36"/CMP	97	1-10'X10' BOX CULVERT
45	36"/CMP	98	24"/CMP
46	3-13'X13'/BOX CULVERTS	99	36"/CMP
47	1-13'X13'/BOX CULVERT	100	72"/CMP
48	24"/CMP	101	24"/CMP
49	24"/CMP	102	30"/CMP
50	1-13'X13'/BOX CULVERT	103	EMERGENCY SPILLWAY
51	1-10'X10'/BOX CULVERT	104	EARTHEN DAM
52	24"/CMP	105	FLUME
53	24"/CMP	106	EARTHERN DAM

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June 1 2001, 02:03 PM

Stantec

Stantec Consulting Inc.
8211 South 48th Street
Phoenix AZ USA
85044-5355
Tel. 602.438.2200
Fax. 602.431.9652
www.stantec.com

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File Name: 01efm146.dwg	HAR	MCG	MCG	01.16.01
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Legend

- Overchute
- Culvert
- Canal
- Existing Road
- Corporate Limits
- Park Boundary
- Drainage Ditch with Flow Direction
- Power Lines
- Project Boundary
- Effective FEMA Floodplain
- Zone A Floodplain (New FEMA Submittal)
- Detailed Delineation Floodplain (New FEMA Submittal)

Prepared for:

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

In conjunction with:

CITY OF PEORIA

Client/Project

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
NORTH PEORIA

AREA DRAINAGE MASTER PLAN
FCD NO. 99-45

Peoria, Arizona

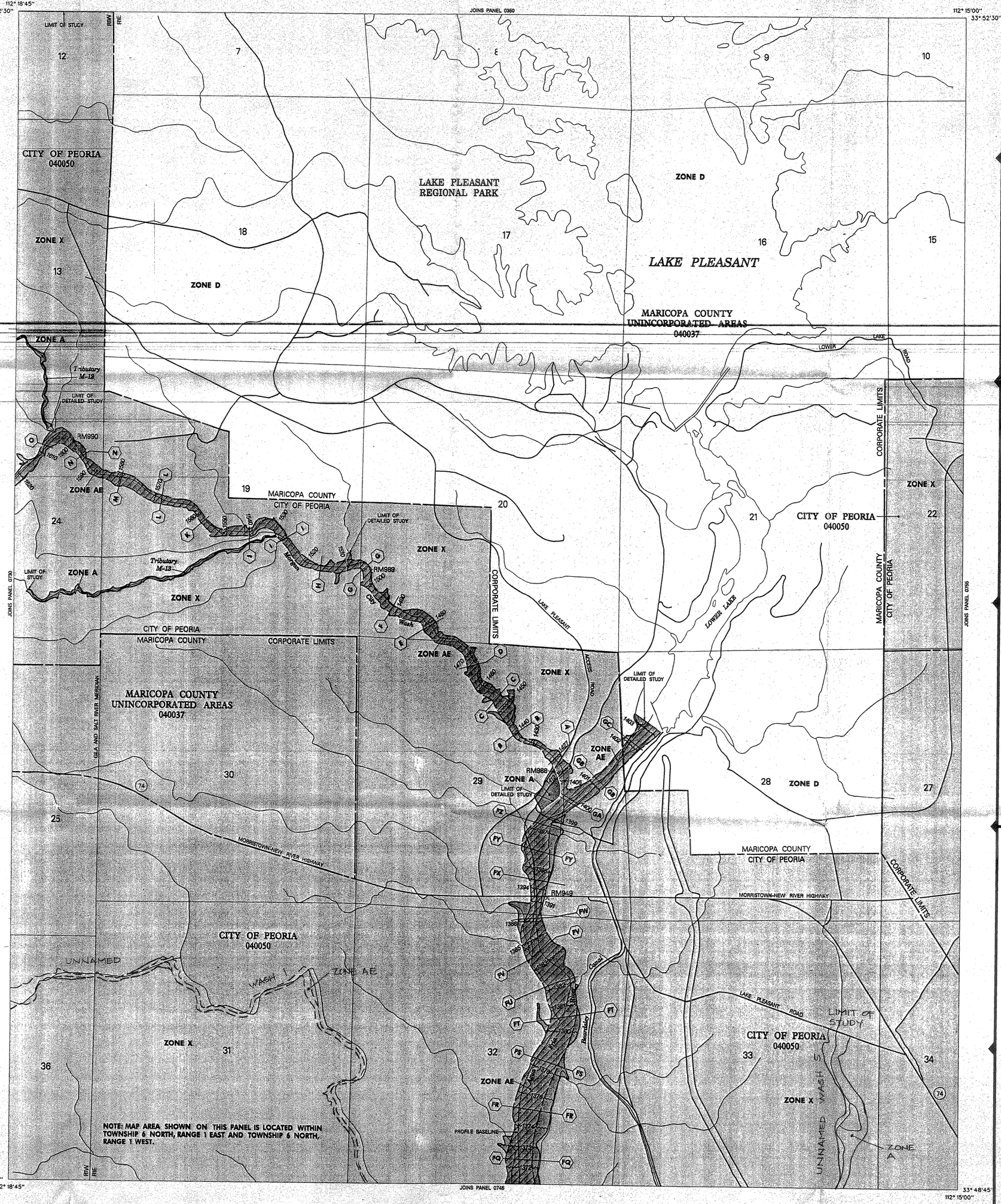
Title

PLATE 8
EXISTING FACILITIES MAP

Project No.	Scale
82000146	1"=2000' (0, 2000', 3000', 4000')
Drawing No.	Sheet
	1 of 1

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM949	1469.31	A.D.O.T. brass cap top headwall at the northeast corner of the east bridge of Lake Pleasant.
RM988	1412.28	A -inch rebar set in concrete approximately 105 feet south of centerline of Morgan City Wash, and approximately 50 feet east of centerline of New Waddell Dam Road, and at the southeast corner of New Waddell Dam Road bridge, marked ERM-22.
RM989	1497.43	Beginning at point Morgan East, thence 0.08 mile southeast in Morgan City Wash to RM 989, a -inch rebar set in concrete approximately 37 feet northeast of centerline of Morgan City Wash at northern edge of bend in wash, and at toe dirt embankment by rock wall, marked ERM-21.
RM990	1590.71	Beginning at point Morgan East, thence 1.44 miles northwest in Morgan City Wash to RM990, a -inch rebar set in concrete approximately 26 feet northeast of centerline of North Fork of Morgan City Wash, and near northeast junction of Chalky Spring at North Fork of Morgan City Wash, marked ERM-20.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 6 NORTH, RANGE 1 EAST AND TOWNSHIP 6 NORTH, RANGE 1 WEST.

LEGEND

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

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

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

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

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

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

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

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

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

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

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

OTHER AREAS

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

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

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

Floodplain Boundary

Floodway Boundary

Zone D Boundary

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

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

D — D Cross Section Line

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

RM7 — Elevation Reference Mark

M2 — River Mile

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

NOTES

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

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

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

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

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

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

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

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

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

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:
DECEMBER 3, 1993

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

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

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 735 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	0735	F
PEORIA, CITY OF	040050	0735	F

REVISED TO REFLECT LOMR DATED MAR 08 2001

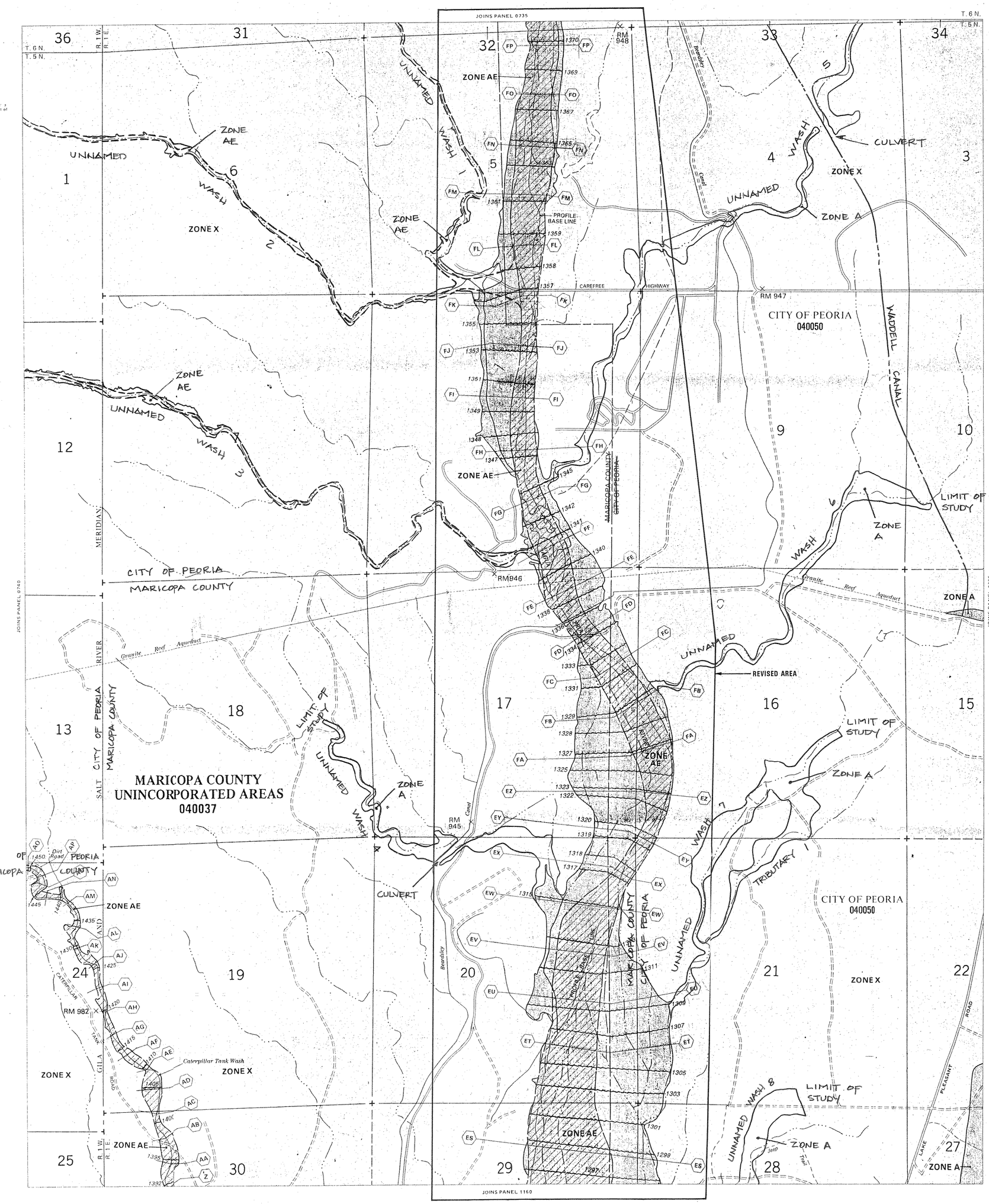
MAP NUMBER 04013C0735 F

MAP REVISED: DECEMBER 3, 1993

Federal Emergency Management Agency

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM945	1,355.76	Cross on northeast corner of cattle guard at the north side of Cardwell on Boundary Canal Road, located approximately 1,950 feet east and 400 feet north of southwest corner Section 17, 3N, R1E
RM946	1,372.18	TD. 1/2" rebar at the south quarter corner, Section 8, 3N, R1E, also approximately 500 feet north and 1,500 feet west of flume
RM947	1,452.47	TD. 5/8" rebar at south quarter corner, Section 4, 3N, R1E approximately 300 feet west of road, top of hill
RM948	1,412.86	TD. spike with marking at the northeast corner, Section 5, 3N, R1E
RM982	1446.35	Set 1/2" RB with aluminum cap stamped "RB-1047", 100' ± west and 2000' ± north of the southeast corner section 24, 1SN R1W, approximately 100' east of Caterpillar Tank Road.



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

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

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year floodplain.
- **ZONE D** — Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS†

Identified 1983 | Identified 1990 | Otherwise Protected Areas

†Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- ~~~513~~~ — Base Flood Elevation Line; Elevation in Feet*
- (D)——(D) — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*
- RM 7x — Elevation Reference Mark
- •M1.5 — River Mile

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

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

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

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

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

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

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

For community map revision history prior to countywide mapping, see section 6.0 of the Flood Insurance Study Report.

For adjoining panels, see separately printed Map Index.

MAP REPOSITORY
Refer to Repository Listing on Index Map

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 15, 1988

EFFECTIVE DATE (S) OF REVISION (S) TO THIS PANEL:

Map revised September 4, 1991 to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names, and to incorporate previously issued letter of map revision.

Map revised December 3, 1993 to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names, to reflect updated topographic information, and to incorporate previously issued letters of map revision.

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

N

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 745 OF 4350

CONTAINS:

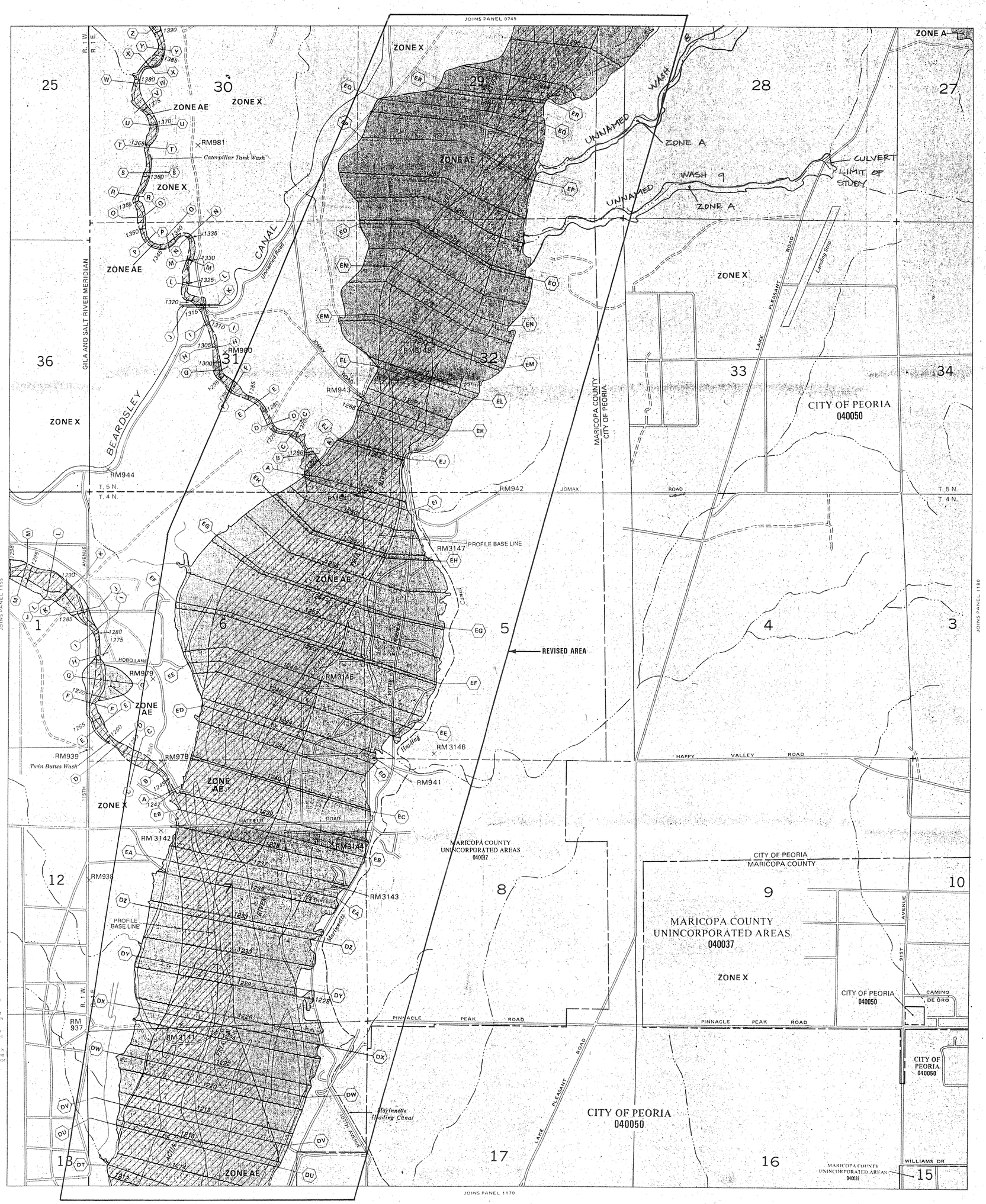
COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	0745	F
PEORIA, CITY OF	040050	0745	F

REVISED TO REFLECT LOMR DATED AUG 5 1997

MAP NUMBER
04013C0745 F

MAP REVISED:
DECEMBER 3, 1993

Federal Emergency Management Agency



ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM927	1292.78	Top of stump at the northwest corner of Section 30, T4N R1E
RM938	1261.05	Arizona Public Service brass cap at the east quarter corner of Section 19 T4N R1W
RM939	1259.32	5/8" rebar at the southwest corner of Section 1, T4N R1W
RM940	1330.61	GLO brass cap at the northwest corner of Section 6, T4N R1E
RM941	1261.21	Arizona Public Service brass cap marked section corner (SECT. T4N R1E) at the intersection of 107th Avenue and Happy Valley Road
RM942	1264.09	Brass cap in 5 x 5 x 12" stone at the south quarter corner of Section 6, T4N R1E
RM943	[illegible]	[illegible]
RM944	1261.16	Brass cap GLO marker in concrete located approximately 40 feet east and 250 feet north of the southwest corner of Section 21, T4N R1E also approximately 25 feet south centerline of the levee Beardsley Canal Road and on top of dike
RM978	1264.61	Brass cap stamped "162" northwest corner section 7, T4N R1E, 1.79' out of ground, set by Arizona Public Service Company
RM979	1275.51	Found 1/2" RB with aluminum cap stamped "520", 300' ± south of Hobo Lane and 113th Avenue, 30' west of Jeep Trail
RM980	1332.85	Found 1/2" RB with aluminum cap stamped "807". Point is 50' ± east and 100' ± north of center section 31, T5N R1E
RM981	1399.95	Set 1/2" RB with aluminum cap stamped "90 501", 2100' ± east and 1500' ± north of the southwest corner section 30, T5N R1E, 9300' ± north of Beardsley Canal and 100' ± east of Caterpillar Tank Road on open area
RM3141	1221.93	¾-inch rebar with aluminum cap at a point, 0.75 mile west of 107th Avenue 60 feet north of wooden pole power line in the bottom of the Agua Fria River.
RM3142	1259.61	¾ inch rebar with aluminum cap at a point, 4500 feet ± west of 107th Avenue on Hatfield Road on west bank of Agua Fria River 100 feet south of centerline of Hatfield Road, approximately 40 feet east of fence.
RM3143	1232.37	¾ inch rebar with aluminum cap approximately 1500 feet southwest of Hatfield Road and 107th Avenue 40 feet north of four strand barbed wire fence.
RM3144	1236.18	¾ inch rebar with aluminum cap at a point 800 feet southwest of Hatfield Road and 107th Avenue 50 feet south of steel electric tower.
RM3145	1245.16	¾ inch rebar with aluminum cap 0.25 mile west and 0.5 mile north of the intersection of 107th Avenue and Hatfield Road 250 feet west of 109th Avenue.
RM3146	1291.06	¾ inch rebar with aluminum cap at the top of ledge east of 107th Avenue approximately 1000 feet ± 50 feet north of south quarter corner of section 5
RM3147	1257.15	¾ inch rebar with aluminum cap 500 feet ± southeast of intersection of Jomax Road and 107th Avenue southwest of old canal by well foundation.
RM3148	1270.37	¾-inch rebar with aluminum cap approximately 1555 feet north of Jomax Road 500 feet east of rock outcrop west bank of river on sand bar approximately 40 feet southwest of 10-foot high juniper tree.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** No base flood elevations determined.
- **ZONE AE** Base flood elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- **ZONE V** Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

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

OTHER AREAS

- **ZONE X** Areas determined to be outside 500-year floodplain.
- **ZONE D** Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS†

Identified 1983 | Identified 1990 | Otherwise Protected Areas

†Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet*
- (D)—(D) Cross Section Line
- (EL 987) Base Flood Elevation in Feet Where Uniform Within Zone*
- RM 7 × Elevation Reference Mark
- •M1.5 River Mile

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

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

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

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

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

Floodway widths in some areas may be too narrow to show to scale. Refer to Floodway Data Table where floodway width is shown at 1/20 inch.

Coastal base flood elevations apply only landward of 0.0 NGVD, and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

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

For community map revision history prior to countywide mapping, see section 6.0 of the Flood Insurance Study Report.

For adjoining panels, see separately printed Map Index.

MAP REPOSITORY
Refer to Repository Listing on Index Map

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 15, 1988

EFFECTIVE DATE (S) OF REVISION (S) TO THIS PANEL:

Map revised September 4, 1991 to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names and to incorporate previously issued letter of map revision.

Map revised December 3, 1993 to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names, to reflect updated topographic information, and to incorporate previously issued letters of map revision.

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

N

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1160 OF 4350

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	1160	F
PEORIA, CITY OF	040050	1160	F

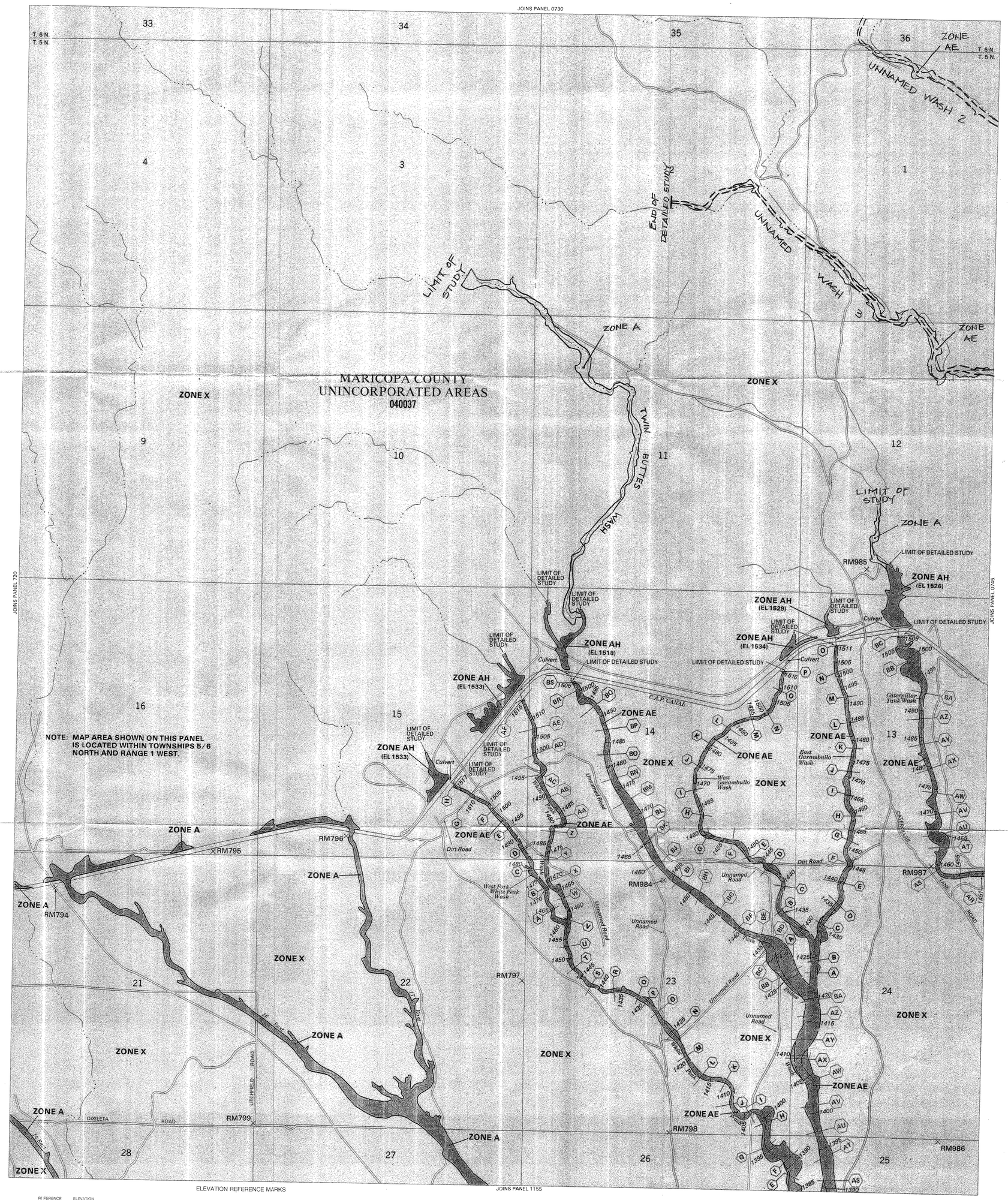
REVISED TO REFLECT LOMR DATED

MAP NUMBER
04013C1160 F

MAP REVISED:
DECEMBER 3, 1993

AUG 5 1997

Federal Emergency Management Agency



ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM794	1,528.60	Brass disk at CAP station 375+50.00, 125 feet south of centerline on right-of-way.
RM795	1,539.49	Brass disk at CAP station 407+67.79, 125 feet south of centerline on right-of-way.
RM796	1,527.62	Brass disk, at CAP station 433+00.00, 125 feet south of centerline on right-of-way.
RM797	1,517.30	Rebar at PP-1013 near quarter corner of Sections 22 and 23.
RM798	1,433.75	Rebar at PP-1503.
RM799	1,454.56	Brass cap on steel post at PP-1505 Sections 21, 22, 27 and 28.
RM984	1476.60	Set 1/2" with aluminum cap stamped "90-504", 300' south of the north 1/4 corner of section 23, T5N R1W. Point lies 100' ± east of Old Dirt Road to White Peak mine.
RM985	1571.89	Set 1/2" RB with aluminum cap stamped "90-828", located 1200' ± east and 500' ± north of the southwest corner of section 12, T5N R1W.
RM986	1421.31	Set 1/2" RB with aluminum cap stamped "90-827", located 100' ± east and 200' ± south of the north quarter corner of section 25, T5N R1W.
RM987	1477.82	FD 1/2" with plastic cap stamped "LS# 18214" assumed north 1/4 corner of section 24, T5N, R1W, approximately 50' east of Caterpillar Tank Road.

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- **ZONE A** — No base flood elevations determined.
- **ZONE AE** — Base flood elevations determined.
- **ZONE AH** — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- **ZONE AO** — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE A99** — To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.
- **ZONE V** — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- **ZONE VE** — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

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

OTHER AREAS

- **ZONE X** — Areas determined to be outside 500-year flood plain.
- **ZONE D** — Areas in which flood hazards are undetermined.

Flood Boundary

Floodway Boundary

Zone D Boundary

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

~~~513~~~ — Base Flood Elevation Line; Elevation in Feet*

(D)——(D) — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone*

RM7X — Elevation Reference Mark

*Referenced to the National Geodetic Vertical Datum of 1929

NOTES

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas.

Areas of special flood hazard (100-year flood) include Zones A, A1-30, AE, AH, AO, A99, V, V1-30 AND VE.

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

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

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Coastal base flood elevations apply only landward of the shoreline.

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

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index

MAP REPOSITORY

Refer to Repository Listing on Index Map

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 15, 1988

EFFECTIVE DATE (S) OF REVISION (S) TO THIS PANEL:

Map revised September 4, 1991 to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names and to incorporate previously issued letter of map revision.

Map revised DECEMBER 3, 1993 to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to change special flood hazard areas, to change zone designations, to update map format, to add roads and road names, to reflect updated topographic information, and to incorporate previously issued letters of map revision.

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

APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 740 OF 4350

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	0740	F

MAP NUMBER
04013C0740 F

MAP REVISED:
DECEMBER 3, 1993

Federal Emergency Management Agency
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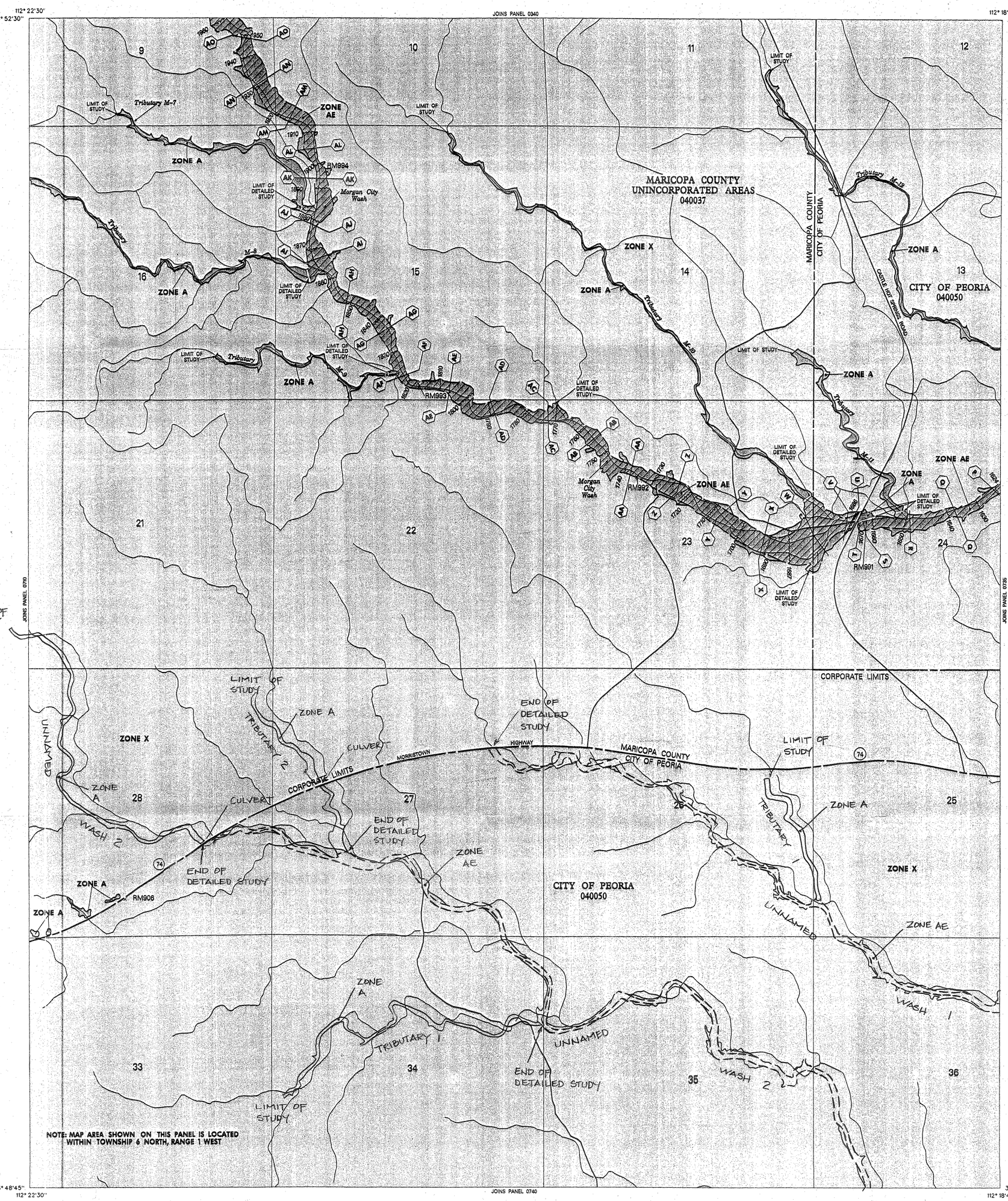
ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FEET NGVD)	DESCRIPTION OF LOCATION
RM906	1917.46	Brass cap 100 feet right in right-of-way station 823 + 88.
RM991	1662.67	From the intersection of Lake Pleasant and Castle Hot Springs Roads, thence 1.23 miles south on Castle Hot Springs Road to RM991, a U.S. G.R. brass cap at centerline station Castle Hot Springs Road 71 + 20.09 at 150 feet right (east) at 4-foot barbed wire fence corner running northerly and southerly, marked ERM-11.
RM992	1732.12	Beginning at point Morgan West, thence 0.05 mile northwest in Morgan City Wash to RM 992, a -inch rebar set in concrete approximately 111 feet southwest of centerline of Morgan City Wash and 88 feet southeast from abandoned (well) and 1.5 feet southeast of southeast face of abandoned concrete water trough, marked ERM-12.
RM993	1806.19	Beginning at point Morgan West, thence 1.05 miles northwest in Morgan City Wash to RM 993, a -inch rebar set in concrete approximately 29 feet northeast of centerline of Morgan City Wash in an alluvial deposit, marked ERM-13.
RM994	1891.94	Beginning at point Morgan West, thence 2.10 miles northwest in Morgan City Wash to RM 994, a -inch rebar set in concrete approximately 73 feet northeast of centerline of Morgan City Wash and approximately 20 feet south of edge of rock wall, marked ERM-14.



LIMIT OF STUDY

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 6 NORTH, RANGE 1 WEST

LEGEND

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

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

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

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

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

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

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

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

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

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

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

OTHER AREAS

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

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

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

Floodplain Boundary

Floodway Boundary

Zone D Boundary

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

~~~513~~~ Base Flood Elevation Line; Elevation In Feet. See Map Index for Elevation Datum.

D——D Cross Section Line

(EL 987) Base Flood Elevation In Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 × Elevation Reference Mark

● M2 River Mile

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

NOTES

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

Areas of Special Flood Hazard (100-year flood) include Zones A, AE, A1-A30, AH, AO, A99, V, VE and V1-V30.

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

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

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

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

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

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

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

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF
COUNTYWIDE FLOOD INSURANCE RATE MAP:
APRIL 15, 1988

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:
SEPTEMBER 4, 1991, DECEMBER 3, 1993

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

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APPROXIMATE SCALE IN FEET
1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

MARICOPA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 730 OF 4350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
MARICOPA COUNTY, UNINCORPORATED AREAS	040037	0730	F
PEORIA, CITY OF	040060	0730	F

REVISED TO REFLECT LOMR DATED MAR 08 2001

MAP NUMBER
04013C0730 F

MAP REVISED:
DECEMBER 3, 1993

Federal Emergency Management Agency
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