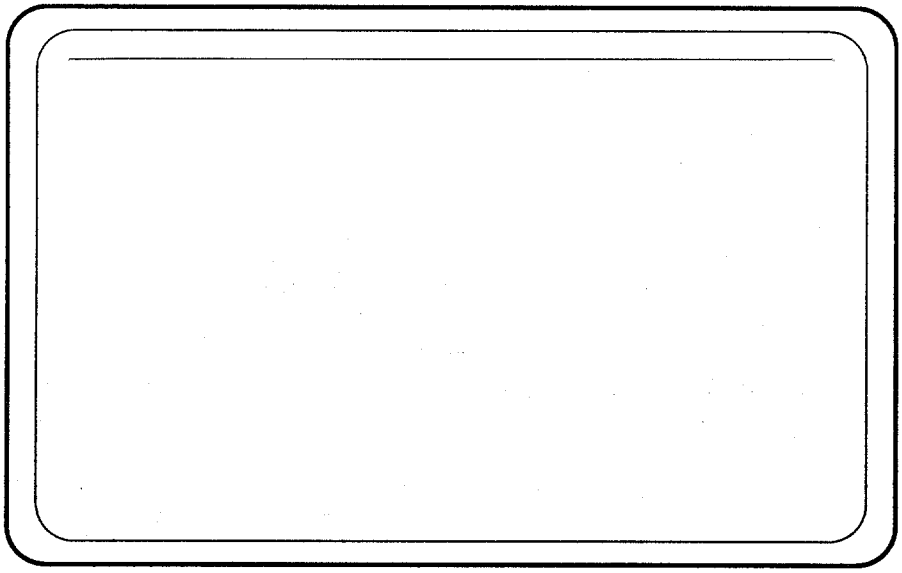
REVIEW COPY



REQUEST FOR
A PHYSICAL MAP REVISION
FOR CAMINO DE OESTE WASH

Prepared for:
Pima County Department of Transportation
and Flood Control District
201 North Stone Avenue, Third Floor
Tucson, Arizona 85701-1207
(520) 740-6410

Submitted to:
Federal Emergency Management Agency, Region IX
Mitigation Division
Building 105
Presidio of San Francisco
San Francisco, California 94129-1250
(415) 923-7175

Prepared by:
Arroyo Engineering, Inc.
290 North Meyer Avenue
Tucson, Arizona 85702
(520) 882-0206

January, 1999

ARROYO ENGINEERING, INC.

2

ARROYO ENGINEERING, INC.
Water Resources & Civil Engineering Consultants

January 28, 1999

Federal Emergency Management Agency
Region IX (Arizona)
Mitigation Division
Building 105
Presidio of San Francisco
San Francisco, California 94129-1250

RE: REQUEST FOR A PHYSICAL MAP REVISION

Dear Sir or Madam:

Enclosed for your review and approval, please find the required material supporting a request for a Physical Map Revision (PMR) for a portion of Camino De Oeste Wash, located within Pima County, Arizona. In addition, a check in the amount of $2,300 is enclosed for review and processing, per the current FEMA Fee Schedule.

We are aware of the new FEMA guidelines, which will require digitized mapping for submittals made after February 8, 1999. Since this submittal is occurring before that date, we have not included a digitized FIRM panel, however, we will be be ready to provide one at any time you request it.

If you have any questions regarding the enclosed information, please call me at (520) 882-0206. Thank you for your consideration of this matter.

Sincerely

ARROYO ENGINEERING, INC.

Robert J. Smolinsky P.E.
Vice President

xc: Elizabeth Hill, Project Manager, Pima County DOT&FCD

290 North Meyer Avenue • P.O. Box 2668 Tucson, AZ 85702 • (520) 882-0206 • Fax (520) 882-2929

Enclosures: Summary of Technical Information
FEMA MT-2 Forms
Work Map
Proposed Revisions to Flood Insurance Rate Map
Computer Disk w/ HEC-2 Files
Check ($2,300)

INTRODUCTION

This request for a Physical Map Revision (PMR) is for a reach of Camino De Oeste Wash from Goret Road to Camino De Oeste Road. The reach of the revision is approximately 18,000 feet in length, located within Section 32, Township 13 South, Range 13 East, and Sections 6 and 7, Township 14 South, Range 13 East, Gila and Salt River Base and Meridian, Pima County, Arizona. A location map is provided on Figure 1 of this report. A portion of this watercourse is identified as Zone A of Flood Insurance Rate Map (FIRM) Community Panel Number 040073 1620 D, September 30, 1992 (i.e. between the downstream study limit and Ironwood Hill Drive). Upstream from Ironwood Hill Drive the watercourse is unmapped on FIRM Community Panel Number 040073 2225 C, September 6, 1989. This requested PMR is to reflect improved topographical data available subsequent to the Flood Insurance Study of this area, and to establish base flood elevations for the floodplain.

Peak discharges for this study were obtained from Pima County Department of Transportation and Flood Control District as part of the Tucson Mountain Basin Study, March, 1986. Peak discharges were determined to be 6,418 cfs and 4,117 cfs at cross-sections 14300 and 16230, respectively.

CROSS-SECTION	DRAINAGE AREA	100-YEAR PEAK DISCHARGE
14300	3.98 mi^2	6418
16230	2.86 mi^2	4117

Hydraulic modeling for the 100-year peak discharge was performed using the U.S. Army Corps of Engineers HEC-2 Water Surface Profiles computer program (Version 4.6.2, May 1991). A Manning's "n-value" of 0.035 was used for the main channel of the watercourse. This value is representative of the existing channel which is composed of a natural sand bottom and banks with

trees and shrubs. An overbank "n-value" of 0.060 was chosen to be representative of the normal-density desert brush floodplain, existing along the subject reach.

Topographic mapping utilized for the hydraulic modeling has a scale of 1" = 200' and a contour interval of 2- feet. The mapping datum is based on NGVD 29 and was performed by McLain Aerial Mapping and Surveying, dated May, 1986 for sections 6 and 7. For section 32, mapping was provided by Cooper Aerial and is dated September 20, 1982.

The downstream limit of the study begins at Goret Road, the corporate boundary of Tucson City Limits, and continues upstream through sections 32, 7, and 6. The study ends at Camino De Oeste Road approximately 18,000 feet upstream. A 7 cell, 12W x 8H x 46L reinforced concrete box culvert crossing is located at West Speedway Blvd., as shown on the work map. The HEC-2 Special Culvert Routine was utilized to model the hydraulic performance of this crossing.

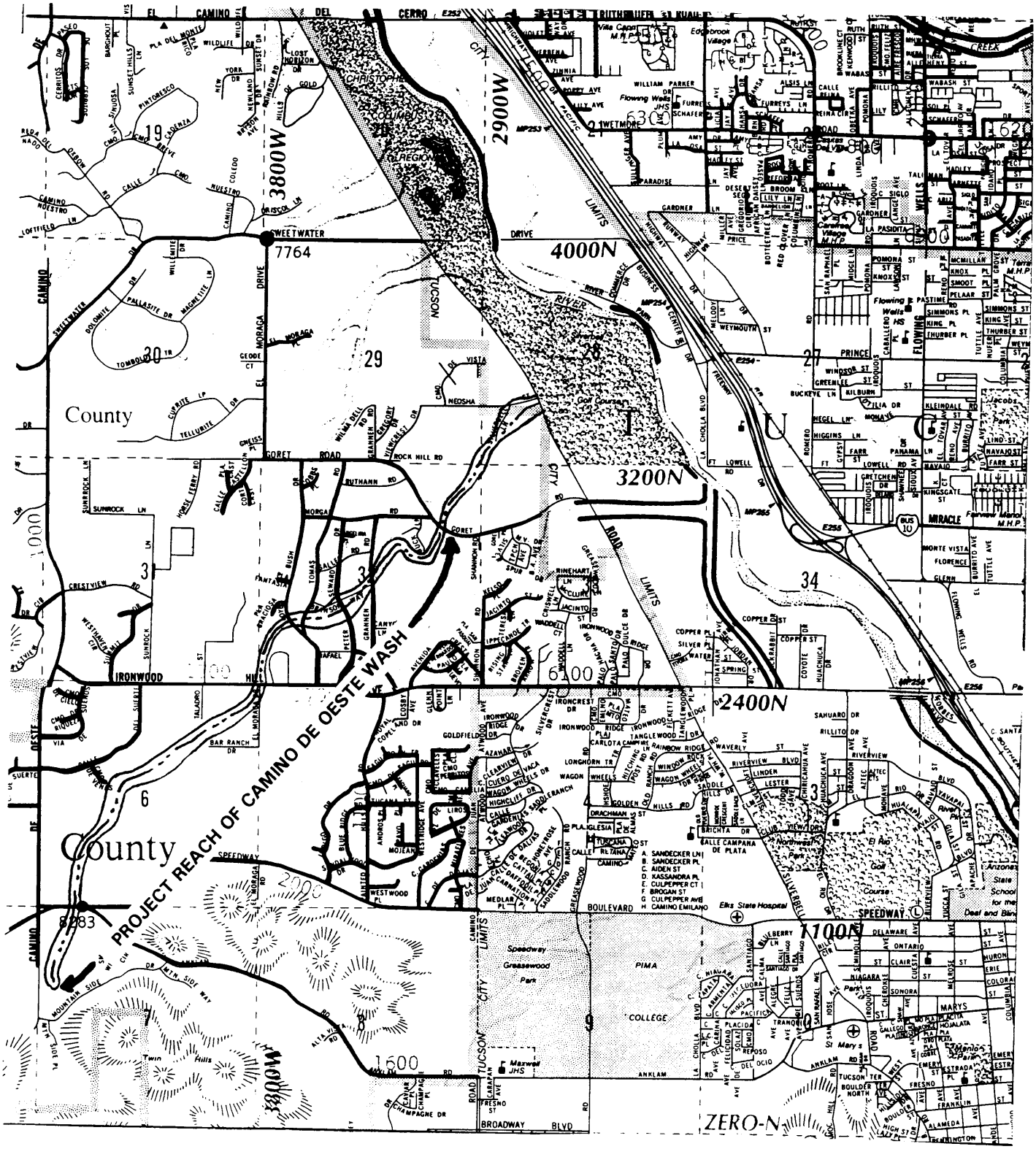


FIGURE 1
LOCATION MAP
(not to scale)

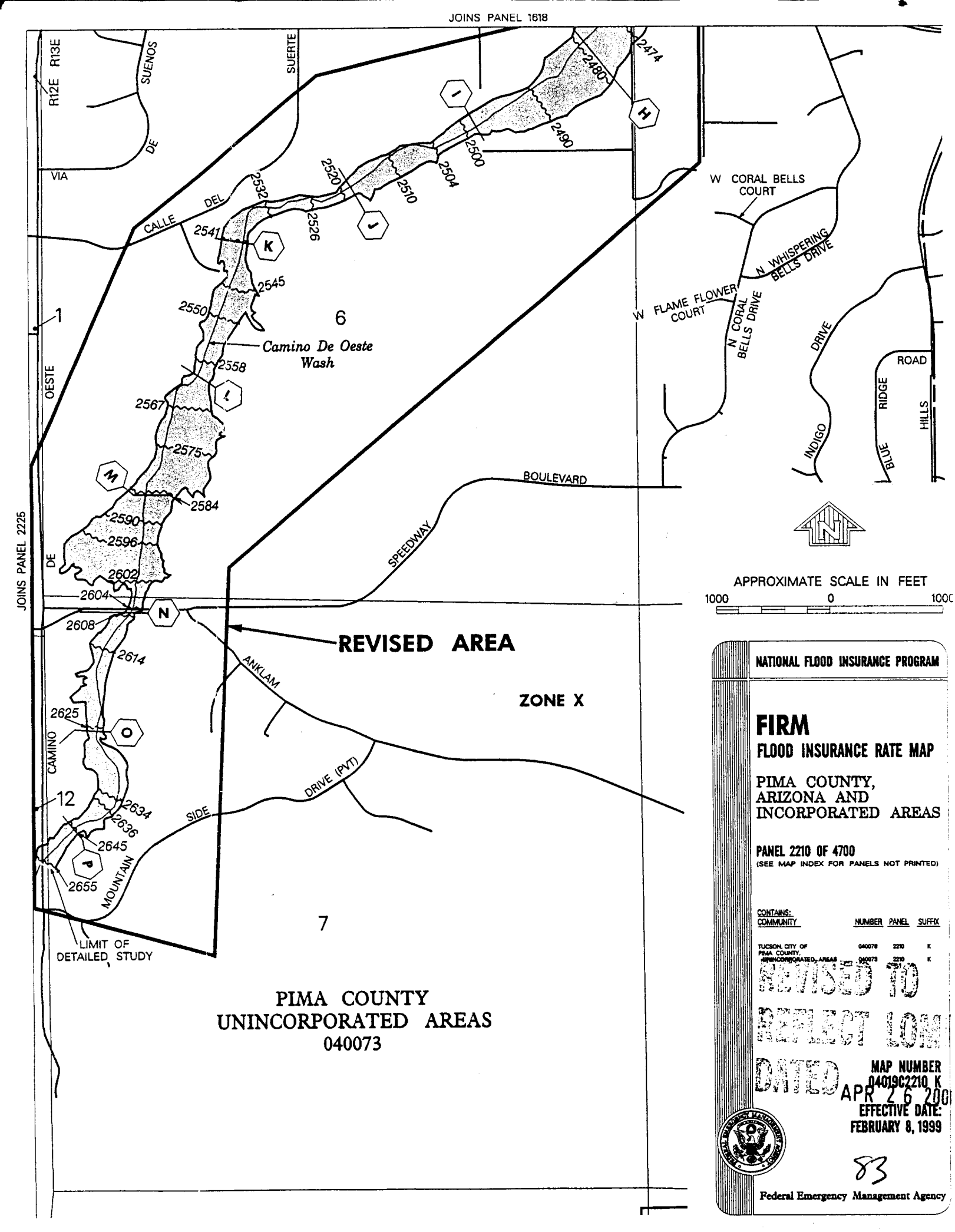
ARROYO ENGINEERING, INC.

FEMA MT-2 FORMS

FOR

PHYSICAL MAP REVISION

ARROYO ENGINEERING, INC.



PIMA COUNTY
UNINCORPORATED AREAS
040073

FEDERAL EMERGENCY MANAGEMENT AGENCY **REVISION REQUESTOR AND COMMUNITY OFFICIAL FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

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.

1. OVERVIEW

1. The basis for this revision request is (are): *(check all that apply)*
   - ☐ Physical change
     - ☐ Existing
     - ☐ Proposed
   - ☐ Improved methodology
   - ☑ Improved data
   - ☐ Floodway revision
   - ☐ Other

   Explain
2. Flooding Source: **Camino De Oeste Wash**
3. Project Name/Identifier: **Camino De Oeste Wash between Goret road and Camino De Oeste road.**
4. FEMA zone designations affected: **A**

   (example: A, AH, AO. A1-30, A99, AE, V, V1-30, VE, B, C, D, X)
5. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	County	State	Map No.	Panel No.	Effective Date
EX: 480301	Katy, City	Harris, Fort Bend	TX	480301	0005D	02/08/83
480287	Harris County	Harris	TX	48201C	0220G	09/28/90
40073	**Pima County**	**Pima**	**AZ**		**1620D**	**9/30/92**
40073	**Pima County**	**Pima**	**AZ**		**2225C**	**9/6/89**

6. The area of revision encompasses the following types of flooding, structures, and associated disciplines: *(check all that apply)*

Types of Flooding	Structures	Disciplines*
☑ Riverine	☐ Channelization	☐ Water Resources
☐ Coastal	☐ Levee/Floodwall	☑ Hydrology
☐ Alluvial Fan	☑ Bridge/Culvert	☑ Hydraulics
☐ Shallow Flooding *(e.g. Zones AO and AH)*	☐ Dam	☐ Sediment Transport
☐ Lakes	☐ Coastal	☐ Interior Drainage
	☐ Fill	☐ Structural
Affected by wind/wave action	☐ Pump Station	☐ Geotechnical
☐ Yes	☐ None	☐ Land Surveying
☑ No	☐ Channel Relocation	☐ Other *(describe)*
	☐ Excavation	
	☐ Other *(describe)*	

☐ Other (describe)

*** Attach completed "Certification by Registered Professional Engineer and/or Land Surveyor" Form for each discipline checked. (Form 2)**

2. FLOODWAY INFORMATION

7. Does the affected flooding source have a floodway designated on the effective FIRM or FBFM? ☐ Yes ☑ No
8. Does the revised floodway delineation differ from that shown on the effective FIRM or FBFM ☐ Yes ☑ No

   If yes, give reason:

9

Attach copy of either a public notice distributed by the community stating the community's intent to revise the floodway or a statement by the community that it has notified all affected property owners and affected adjacent jurisdictions

9. Does the state have jurisdiction over the floodway or its adoption by communities participating in the NFIP? ☐ Yes ☑ No

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

3. PROPOSED ENCROACHMENTS

10. With floodways:

1A. Does the revision request involve fill, new construction, substantial improvements, or other development in the floodway? ☐ Yes ☐ No

1B If yes, does the development cause the 100-year water surface elevation to increase at any location by more that 0.000 feet? ☐ Yes ☐ No

11. Without floodways:

2A. Does the revision request involve fill, new construction, substantial improvements, or other development in the 100-year floodplain? ☐ Yes ☑ No

2B If yes, does the cumulative effect of all development that has occurred since the effective SFHA was originally identified cause the 100-year water surface elevation to increase at any location by more than one foot *(or other surcharge limit if community or state has adopted more stringent criteria)*? ☐ Yes ☐ No

If the answer to either Items 1B or 2B is yes, please provide 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.

4. REVISION REQUESTOR ACKNOWLEDGMENT

12. Having read NFIP Regulations, 44 CFR Ch.1, parts 59, 60, 61, and 72, I believe that the proposed revision ☑ is ☐ is not in compliance with the requirements of the aforementioned NFIP Regulations.

5. COMMUNITY OFFICIAL ACKNOWLEDGMENT

13. Was this revision request reviewed by the community for compliance with the community's adopted floodplain management ordinances? ☑ Yes ☐ No

14. Does this revision request have the endorsement of the community? ☑ Yes ☐ No

If no to either of the above questions, please explain: _____

Please note that community acknowledgment and/or notification is required for all requests as outlined in Section 65.4 (b) of the NFIP Regulations.

6. OPERATION AND MAINTENANCE

15. Does the physical change involve a flood control structure (e.g., levees, floodwalls, channelization, basins, dams)? ☐ Yes ☑ No

If yes, please provide the following information for each of the new flood control structures:

A. Inspection of the flood control project will be conducted periodically by _____ (entity) _____ with a maximum interval of _____ months between inspections.

B. Based on the results of scheduled periodic inspections, appropriate maintenance of the flood control facilities will be conducted by (entity) _____

to ensure the integrity and degree of flood protection of the structure

C. A formal plan of operation, including documentation of the flood warning system, specifications and assignments of responsibility by individual name or title, and provisions for testing the plan at intervals not less than one year, ☐ has ☐ has not been prepared for the flood control structure.

D. The community is willing to assume responsibility for ☐ performing ☐ overseeing compliance with the maintenance and operation plan of the N/A (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.

Attach operation and maintenance plans

7. REQUESTED RESPONSE FROM FEMA

16. After examining the pertinent NFIP regulations and reviewing the document entitled " Appeals, Revisions, and Amendments to Flood Insurance Maps: A guide for Community Officials," dated January 1990, this request is for a:

____	a.	CLOMR	A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision *(LOMR or PMR)*, or proposed hydrology changes *(see 44 CFR Ch.I, Parts 60, 65, and 72).*
____	b.	LOMR	A letter from FEMA officially revising the current NFIP map to show changes in floodplain, floodways, or flood elevations. LOMRs typically depict decreased flood hazards. *(see 44 CFR Ch.I Parts 60 and 65.)*
X	c.	PMR	A reprinted NFIP map incorporating changes to flood plains, floodways, or flood elevations Because of the time and cost involved to change, reprint, and redistribute an NFIP map, a PMR is usually processed when a revision reflects increased flood hazards or large-scope changes. *(See 44 CFR Ch.I, Parts 60 and 65.)*
____	d.	Other	Describe _____

8. FORMS INCLUDED

17. Form 2 entitled, "Certification By Registered Professional Engineer and/or Land Surveyor" must be submitted.

The following forms should be included with this request if (check the included forms):

• Hydrologic analysis for flooding source differs from that used to develop FIRM	☑ Hydrologic Analysis Form (Form 3)
• Hydraulic analysis for riverine flooding differs from that used to develop FIRM	☑ Riverine Hydraulic Analysis Form (Form 4)
• The request is based on updated topographic information or a revised floodplain or floodway delineation is requested	☑ Riverine/Coastal Mapping Form (Form 5)
• The request involves any type of channel modification	☐ Channelization Form (Form 6)
• The request involves new bridge or culvert or revised analysis of an existing bridge or culvert	☑ Bridge/Culvert Form (Form 7)
• The request involves a new levee/floodwall system	☐ Levee/Floodwall System Analysis Form (Form 8)
• The request involves analysis of coastal flooding	☐ Coastal Analysis Form (Form 9)
• The request involves coastal structures credited as providing protection from the 100-year flood	☐ Coastal Structures (Form 10)
• The request involves an existing, proposed, or modified dam	☐ Dam Form (Form 11)
• The request involves structures credited as providing protection from the 100-year flood on an alluvial fan	☐ Alluvial Fan Flooding Form (Form 12)

9. INITIAL REVIEW FEE

18. The Minimum initial review fee for the appropriate request category has been included. ☑ Yes ☐ No
Initial fee amount: $ **2,300**

Check or money order only. Make check or money order payable to: **National Flood Insurance Program**. If paying by Visa or Mastercard please refer to the credit card information form which follows this form.

or

19. This request is for a project that is for public benefit and is primarily intended for flood loss reduction to insurable structures in identified flood hazard areas which were in existence prior to the commencement of construction of the flood control project. ☐ Yes ☑ No

or

20. This request is to correct map errors, to include the effects of natural changes within the areas of special flood hazard, or solely to provide more detailed data. ☑ Yes ☐ No

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

Signature of Revision Requester

Robert J. Smolinsky, P.E.
Printed Name and Title of Revision Requester

Arroyo Engineering, Inc.
Company Name

(520) 882-0206 Telephone No.

January 22, 1999 Date

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

Tim Morrison, P.E.
Floodplain Management Section Manager
Printed Name and Title of Community Official

Pima County, Arizona
Community Name

January 22, 1999
Date

Does this request impact any other communities? ☐ Yes ☑ No

If yes, attach letters from all affected jurisdictions acknowledging revision request and approving changes to floodway, If applicable.

Note: Although a photograph of physical changes is not required, it may be helpful for FEMA's review.

FEDERAL EMERGENCY MANAGEMENT AGENCY **CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average .23 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.

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

2. I am licensed with an expertise in **Water Resources (hydrology, hydraulics, sediment transport)**
   [example: water resources *(hydrology, hydraulics, sediment transport, interior drainage)** structural, geotechnical, land surveying.]

3. I have **18** years experience in the expertise listed above.

4. I have ☑ prepared ☐ reviewed the attached supporting data and analyses related to my expertise.

5. I ☑ have ☐ have not visited and physically viewed the project.

6. In my opinion, the following analyses and/or designs, is/are being certified:
   Hydraulic analysis of Camino De Oeste Wash.

7. Based upon the following review, the modifications in place have been constructed in general concordance with plans and specifications.

   Basis for above statement: (check all that apply)
   a. ☐ Viewed all phases of actual construction.
   b. ☐ Compared plans and specifications with as-built survey information.
   c. ☐ Examined plans and specifications and compared with competed projects.
   d. ☐ Other _____

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

Name: **Robert J Smolinsky, P.E.**
(please print or type)

Title: **Senior Civil Engineer**
(please print or type)

Registration No. **18683** Expiration Date: **6/30/2001**

State **Arizona**

Type of License **Registered Professional Engineer (Civil)**

Signature

January 22, 1999
Date

Seal
(Optional)

* Specify Subdiscipline
Note: Insert not applicable (N/A) when statement does not apply.

FEDERAL EMERGENCY MANAGEMENT AGENCY **HYDROLOGIC ANALYSIS FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

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.

Community Name: **Pima County, Arizona**

Flooding Source: **Camino De Oeste Wash**
(One form for each flooding source)

Project Name / Identifier: **Camino De Oeste Wash between Goret road and Camino De Oeste road.**

1. HYDRAULIC ANALYSIS IN FIS

- ☑ Approximate study stream (Zone A)
- ☐ Detailed study stream (briefly explain methodology) _____

2. REASON FOR NEW HYDROLOGIC ANALYSIS

- ☑ No existing analysis
- ☑ Improved Data *(see data revision on page 3)*
- ☐ Changed physical conditions of watershed *(explain)* _____
- ☐ Alternative methodology *(justify why the revised model is better than model used in the effective **FIS**)*
- ☐ Evaluation of proposed conditions (CLOMRs only) (explain) _____
- ☐ Other _____

If a computer program/model was used in revising the hydrologic analysis, please provide a diskette with the input files for the 10-, 50-, 100- and 500-year recurrence intervals.

Only the 100-year recurrence interval need be included for SFHA designated as Zone A.

3. APPROVAL OF ANALYSIS

- ☑ Approval of hydrologic analysis, including the resulting peak discharge value (s) has been provided by the appropriate local, state, or Federal Agency. (i.e., **Pima County Dept. of Transportation and Flood Control District (letter attached)**)
  Attach evidence of approval.
- ☐ Approval of the hydrologic analysis is not required by any local, state, or Federal Agency.

PIMA COUNTY
DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT
201 NORTH STONE AVENUE, THIRD FLOOR
TUCSON, ARIZONA 85701-1207

BROOKS A. KEENAN, P.E.
DIRECTOR

(520) 740-6410
FAX (520) 620-1933

January 22, 1999

Federal Emergency Management Agency
Region IX (Arizona)
Mitigation Division
Building 105
Presidio of San Francisco
San Francisco, California 94129-1250

RE: Supporting Documentation for Physical Map Revision (PMR)
MT-2, Form 3, Page 1: Approval of Analysis

Dear Sir or Madam:

This letter is being submitted to acknowledge approval for the hydrologic analysis used in the Physical Map Revision for a portion of the Camino de Oeste Wash, located in Pima County. The Pima County Department of Transportation and Flood Control District approved the report entitled "Tucson Mountain Basin Study", dated March 15, 1986. This report was the hydrologic source for the discharge values used in the referenced PMR submittal.

Sincerely,

Thomas J. Helfrich, Manager
Flood Control Planning

THJ:eh

4. REVIEW OF RESULTS

Stream: **Camino De Oeste Wash**

Comparison of 100-year Discharges

Location:	Drainage area (Sq. mi.)	FIS (cfs):	Revised (cfs):
Cross-section 16230	2.86	N/A	4117
Cross-section 14300	3.98	N/A	6418

Note: When revised discharges are not significantly different than FIS discharges, FEMA may require a confidence limits analysis on attachment D at a later date to complete the review

As is often the case with revision requests, only a portion of a stream may actually be revised or be affected by a revision. Therefore, transition to the unrevised portion is important to maintain the continuity of the study. NFIP regulations stipulate that such a transition must be assured. What is the transition from the proposed discharges to the effective discharges? Please explain how the transition was made *(attach separate sheet if necessary)*

Not applicable (N/A).

ATTACH A COMPLETED REVIEW OF RESULTS PAGE FOR EACH FLOODING SOURCE.

Is the new hydrologic analysis being developed solely to revise the flow values presented in the FIS *(i.e. no changed hydraulic conditions)?* ☐ Yes ☑ No

If yes, does the 100-year water surface elevation change by 1.0 foot or more? ☐ Yes ☐ No

FEMA does not normally revise NFIP maps solely due to insignificant flow changes where changes in the 100-year water surface elevation are less than 1.0 foot.

5. HISTORICAL FLOODING INFORMATION

Is historical data available for the flooding source? ☐ Yes ☑ No

If yes, provide the following:

Location along flooding source: _____

Maximum peak discharge: _____ cfs

Second highest peak discharge: _____ cfs

Source of information: _____

6. GAGE RECORD INFORMATION

Location of the nearest gage to project site *(along flooding source or similar watershed: specify)*

Not applicable

Gaging Station: _____

Drainage area at gage: _____ mi^2

Number of years of data: _____

7. DATA REVISION

Please use the following table to list all the data and/or parameters affected by this request and identify them as new data *(New)* or as revising existing data *(Revised)*. *(If necessary, attach a separate sheet.)*

Data Parameter	New	Revised	Data Source
Hydrologic Model	☑	☐	**Pima County**
Topographic Mapping	☑	☐	**Cooper Aerial Co. &**
	☐	☐	**McLain Harbers Co., Inc**
	☐	☐	
	☐	☐	

- Data source can be from Federal, State, or local government agency, or from a private source. Some State and local governments may have less strict data requirements than Federal Agencies, in which case the hydrologic data may not be accepted by FEMA unless it is demonstrated that the data give a better estimate of the flood discharge.

- Attach documentation corroborating each data source *(i.e. certified statement, report, bibliographical reference to a published document)*. In each case of a published document or a government report, providing copies of the cover and pertinent pages may be helpful.

8. METHODOLOGY FOR NEW ANALYSIS

☐ Statistical Analysis of Gage Records *(use Attachment A)*

☐ Regional Regression Equations *(use Attachment B)*

☑ Precipitation/Runoff Model *(use Attachment C)*

☑ Other *(specify; attach backup computations and supporting data)* _____

"Pima County Hydrology Method" was used to predict 100-year flood peaks, and the U.S.C.E. HEC-2 Model was used to predict water surface profiles.

ATTACHMENT A: STATISTICAL ANALYSIS OF GAGE RECORDS

Gaging Station: **Not Applicable**

Gage Location (latitude and longitude): _____

	FIS:	Revised:
1. Number of years of data	**Not applicable**	
Systematic		
Historical		
2. Homogeneous data	☐ Yes ☐ No	☐ Yes ☐ No
3. Data adjustments	☐ Yes ☐ No	☐ Yes ☐ No
4. Number of high outliers		
Low outliers		
Zero events		
5. Generalized skew		
6. Station skew		
7. Adopted skew		
8. Probability distribution used (justify if log-Pearson III was not used)		
9. Transfer equations to ungaged sites		☐ Yes ☐ No
If yes, specify method		
10. Expected probability*	☐ Yes ☐ No	☐ Yes ☐ No
11. Comparison of results with other analyses	☐ Yes ☐ No	☐ Yes ☐ No
If yes, describe comparison		

***FEMA** does not accept expected probability analyses for the purpose of reflecting flood hazard information in a FIS.

If any data is not available, indicate by N/A

Attach analysis including plot of flood frequency curve.

ATTACHMENT B: REGIONAL REGRESSION EQUATIONS

1. Bibliographic Reference: **Not Applicable**

_____

_____

_____

(attach a copy of title page, table of contents, and pertinent pages including equations)

2. Gaged or ungaged stream: _____

3. Hydrologic region(s): _____
Attach backup map.

4. Provide parameters, values, and source of data used to define parameters.

_____

_____

_____

		FIS:	Revised:
5.	Urbanized conditions calculations	☐ Yes ☐ No	☐ Yes ☐ No
6.	Percent of watershed urbanization	_____	_____
7.	Is the watershed controlled?	☐ Yes ☐ No	☐ Yes ☐ No
8.	Comparison with other analyses	☐ Yes ☐ No	☐ Yes ☐ No

If the answer to 5, 7, or 8, is yes, explain methodology in comments.
If data is not available, indicate by N/A.

Comments

_____

_____

_____

_____

Attach computation and supporting maps, delineating the watershed boundary and drainage area divides.

19

ATTACHMENT C: PRECIPITATION / RUNOFF MODEL

		FIS:	Revised:
1.	Method or model used:	None	Pima County Hydrology Method
	Version:		
	Date:		
2.	Source of Rainfall Depth:		
3.	Source of rainfall distribution		
4.	Rainfall duration:		
5.	Areal adjustment to precipitation (%):		
6.	Maximum overland flow length		
7.	Hydrograph development method:		
8.	Loss rate method:		
	Source of soils information		
	Source of land use information		
9.	Channel routing method:		
10.	Reservoir routing	☐ Yes ☐ No	☐ Yes ☑ No
11.	Baseflow considerations:	☐ Yes ☐ No	☐ Yes ☑ No
	If yes, explain how baseflow was determined:		
12.	Snowmelt considerations:	☐ Yes ☐ No	☐ Yes ☑ No
13.	Model calibration:	☐ Yes ☐ No	☐ Yes ☑ No
	If yes, explain how calibration was performed		
14.	Future land use condition:		☐ Yes ☑ No
	If yes, explain why		

100 - year peak discharge were taken from "Tucson Mountain Basin Study". This report has been approved and adopted by Pima County Department of Transportation and Flood Control District.

NOTE: FEMA policy is to base flooding on existing conditions.
If data is not available, indicate by N/A.

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.

ATTACHMENT D: CONFIDENCE LIMITS EVALUATION

Stream: **Not Applicable**

Select one location for Confidence Limits Evaluation *(describe location)* : _____

_____

Discharge for selected location.

Exceedance Probability		FIS		Revised	
10%	(10-year)	_____	cfs	_____	cfs
2%	(50-year)	_____	cfs	_____	cfs
1%	(100-year)	_____	cfs	_____	cfs
0.2%	(500-year)	_____	cfs	_____	cfs

1% (100-year) Flood Confidence Intervals

90% Confidence Interval: 5% limit _____ cfs

95% limit _____

50% Confidence Interval: 25% limit _____

75% limit _____

If the value of the 100-year frequency flood in the FIS is beyond the 50% confidence interval but within the 90% confidence interval, does the 100-year water surface elevation change by 1.0 foot or more? ☐ Yes ☐ No

An example of confidence limits analysis can be found in Appendix 9 of Bulletin 17B.

Attach Confidence Limits Analysis.

FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE HYDRAULIC ANALYSIS FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

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.

Community Name: **Pima County, Arizona**

Flooding Source: **Camino De Oeste Wash**
(One form for each flooding source)

Project Name / Identifier: **Camino De Oeste Wash from Goret road to Camino De Oeste Road**

1. REACH TO BE REVISED

Downstream limit: **Goret Road**
Upstream limit: **Camino De Oeste road**

2. EFFECTIVE FIS

☐ Not studied

☑ Studied by approximate methods
Downstream limit of study: Goret road
Upstream limit of study: Ironwood Hill drive

☐ Studied by detailed methods
Downstream limit of study: _____
Upstream limit of study: _____

☐ Floodway delineated
Downstream limit of study: _____
Upstream limit of study: _____

3. HYDRAULIC ANALYSIS

Why is the hydraulic analysis different from that used to develop the FIRM. *(Check all that apply)*

☑ Not studied in FIS

☐ Improved hydrologic data / analysis. Explain: _____

☑ Improved hydraulic data/ analysis. Explain: **Recent, more detailed topographic mapping is available at a contour interval of two (2) feet.**

☐ Flood control structure. Explain: _____

☐ Other. Explain: _____

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3. RIVERINE HYDRAULIC ANALYSIS FORM
Models Submitted

For areas which have detailed flooding:

Full input and output listings along with files on diskette (if available) for each of the models listed below (items 1, 2, 3, 4, and 5) and summary of the source of input parameters used in the models must be provided. The summary must include a complete 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 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 for existing or pre-project conditions and revised or post-project conditions must be submitted. All calculations must be submitted for these analyses. (see item 6 below)

	Natural	Floodway
1. Duplicate Effective Model 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 requestor's equipment to produce the duplicate effective model. This is required to assure that the effective model input data has been transferred correctly to the requestor'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 The corrected effective model is the model that corrects any errors that occur in the duplicate effective model, adds any additional cross sections to the duplicate effective model, or incorporates more detailed topographic information than that used in the currently effective model. The corrected effective model must not reflect any man-made physical changes since the date of the effective model. An error could be a technical error in the modeling procedures, or any construction in the floodplain that occurred prior to the date of the effective model but was not incorporated into the effective model.	☐	☐
3. Existing or Pre-Project Conditions Model The duplicate effective or corrected 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 or duplicate effective model.	☑	☐
4. Revised or Post-Project Conditions Model The existing or pre-project conditions model *(or duplicate effective 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 proposed project this model should reflect proposed conditions.	☐	☐
5. Other: Please attach a sheet describing all other models submitted 6. Hydraulic Analyses (Only if Hydraulic Models are not developed)	☐	☐

Please Attach all calculations for the existing or pre-project conditions and the revised or post-project conditions. Proceed to form 5, "Riverine/Coastal Mapping Form".

See comments on following page

4. MODEL PARAMETERS (from model used to revise 100-year water surface elevation)

1. Discharges:

	Upstream limit	Downstream limit
10-year	N/A	N/A
50-year	N/A	N/A
100-year	4117 cfs	6418cfs
500-year	N/A	N/A

Attach diagram showing changes in 100-year discharge

2. Explain how the starting water surface elevations were determined **Critical depth was used as the starting water surface elevations.**

3. Give range of friction loss coefficients *(Manning's "N")* Channel **0.035**

Overbanks **0.06**

If friction loss coefficients are different anywhere along the revised reach from those used to develop the FIRM, give location, value used in the effective FIS, and the revised values and an explanation as to how the revised values were determined.

Location	FIS	Revised
N/A	N/A	N/A

Explain:

4. Describe how the cross section geometry data were determined *(e.g., field survey, topographic map, taken from previous study)* and list cross sections that were added.

Cross section data were developed using topographic mapping (2 ft contours) prepared from aerial photographs taken May 1986 for sections 6&7 and September 1982 for section 32.

5. Were natural channel banks selected as the location of the left and right channel banks in the model?

☑ Yes ☐ No If no, explain why not:

4. MODEL PARAMETERS (Cont'd)

6. Explain how reach lengths for channel and overbanks were determined:

Cross sections were set at representative locations along the main channel, as well as at locations where changes occur in roughness and shape. Channel reach lengths were measured along the thalweg. Left and right overbank lengths were measure along the channel banks.

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

1. Do the results indicate:

a. Water surface elevations higher than end points of cross sections? . . . . . ☐ Yes ☑ No

b. Supercritical depth? . . . . . ☑ Yes ☐ No

c. Critical depth? . . . . . ☑ Yes ☐ No

d. Other unique situations . . . . . ☐ Yes ☑ No

If yes to any of the above, attach an explanation that discusses the situation and how it is presented on the profiles, tables, and maps. **Comments are listed below.**

2. What is the maximum change in energy gradient between cross-sections? . . . . . **13.03 feet**
   Specify location . . . . . **18230 and 18630**

3. What is the distance between the cross-sections in 2 above? . . . . . **400 feet**

4. What is the maximum distance between cross-sections? . . . . . **550 feet**
   Specify location . . . . . **800 and 1350**

5. Floodway determination
   a. What is the maximum surcharge allowed by the community or State? . . . . . N/A foot
   b. What is the maximum surcharge for the revised conditions? . . . . . foot
      Specify location . . . . .
   c. What is the maximum velocity? . . . . . fps
   Specify location . . . . .

   d. Are there any negative surcharge values at any cross-section ☐ Yes ☐ No
   If yes, the floodway may need to widen. If it is not widened, please explain and indicate the maximum negative surcharge.

Explain: **No floodway analyses conducted.**

Expanation for Item1 above: **Critical depth messages occured within the modeling output indicating critical or supercritical flow in these areas. Critical depth was used for the water surface profile at these locations.**

5. RESULTS (Cont'd)

6. Is the discharge value used to determine the floodway anywhere different from that used to determine the natural 100-year flood elevations? . . . . . ☐ Yes ☐ No

If yes, explain: **Not applicable.**

7. Do 100-year water surface elevations increase at any location? . . . . . ☐ Yes ☐ No

If yes, please attach a list of the locations where the increases occur, state whether or not the increases are located on the requestor's property, and provide an explanation of the reason for the increases. *(For example: State if the increase is due to fill placed within the floodway fringe or placed within the currently adopted floodway limits)*

Please attach a completed comparison table entitled: Water Surface Elevation Check (See page 6)

6. REVISED FIRM/FBFM AND FLOOD PROFILES

A. The revised water surface elevations tie into those computed by the effective FIS Model *(10-, 50-, 100-, and 500-year)* downstream of the project at cross-section _____ within _____ feet *(vertical)* and upstream of the project at cross section _____ within _____ feet *(vertical)*.

Note: The effective SFHA was determined by approximate methods, and therefore the new existing conditions model does not necessarily tie into the effective flood plain boundary.

B. The revised floodway elevations tie into those computed by the effective FIS model, downstream of the project at cross section _____ within _____ feet *(vertical)* and upstream of the project at cross section _____ within _____ feet *(vertical)*.

C. Attach profiles, at the same vertical and horizontal scale as the profiles in the effective FIS report, showing stream bed and profiles of all floods studied (without encroachment). Also, label all cross sections, road crossings (including low chord an top-of-road data), culverts, tributaries, corporate limits, and study limits. If channel distance has changed, the stationing should be revised for all profile sheets.

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

Not applicable

Proceed to Riverine / Coastal Mapping Form

FEDERAL EMERGENCY MANAGEMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME	FLOODING SOURCE	PROJECT NAME/IDENTIFER
Pima County, Arizona	**Camino De Oeste Wash**	**Goret Rd. to Camino De Oeste Road**

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
0										2356.1					
400										2362.8					
800										2369.4					
1350										2374.7					
1750										2381.5					
2150										2385.4					
2650										2392.8					
3050										2397.6					
3450										2404.5					
3850										2411.6					
4250										2417.4					
4650										2423.5					
5050										2429.0					
5450										2436.0					
5850										2443.0					
6250										2449.2					

COMMENTS:

1- 100-year (natural) Water Surface Elevation 2- Encroachment (floodway) Water Surface Elevation 3 - Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses. MT-2 Form 4

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FEDERAL EMERGENCY MANAGEMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME	FLOODING SOURCE	PROJECT NAME/IDENTIFER
Pima County, Arizona	**Camino De Oeste Wash**	**Goret Rd. to Camino De Oeste Road**

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
6650										2454.4					
7050										2460.9					
7460										2466.6					
7860										2473.2					
8260										2479.9					
8660										2486.5					
9060										2493.0					
9460										2499.1					
9860										2504.3					
10260										2511.0					
10660										2518.5					
11060										2526.4					
11460										2532.7					
11860										2541.1					
12260										2545.1					
12700										2552.6					

COMMENTS:

1- 100-year (natural) Water Surface Elevation 2- Encroachment (floodway) Water Surface Elevation 3 - Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses. MT-2 Form 4 Page 6 of 6

Sheet 2 of 3

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FEDERAL EMERGENCY MANAGEMENT AGENCY

WATER SURFACE ELEVATION CHECK

COMMUNITY NAME	FLOODING SOURCE	PROJECT NAME/IDENTIFER
Pima County, Arizona	**Camino De Oeste Wash**	**Goret Rd. to Camino De Oeste Road**

	EFFECTIVE			DUPLICATE EFFECTIVE			CORRECTED EFFECTIVE			EXISTING/PRE-PROJECT			REVISED/PROJECT		
SECNO	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]	NCWSEL[1]	FCWSEL[2]	SURC.[3]
13100										2560.3					
13500										2567.1					
13900										2576.6					
14300										2584.5					
14700										2595.1					
15100										2602.6					
15330										2606.6					
15380										2607.9					
15780										2613.7					
16230										2621.4					
16630										2626.0					
17030										2630.5					
17430										2634.8					
17830										2645.3					
18230										2655.4					

COMMENTS:

1- 100-year (natural) Water Surface Elevation 2- Encroachment (floodway) Water Surface Elevation 3 - Surcharge Value

Include all cross sections in the models between tie-in points. Any interpolated values should be indicated in parentheses. MT-2 Form 4

Sheet 3 of 3

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FEDERAL EMERGENCY MANAGEMENT AGENCY **RIVERINE/COASTAL MAPPING FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

Community Name: **Pima County, Arizona**

Flooding Source: **Camino De Oeste Wash**

Project Name / Identifier: **Camino De Oeste Wash between Goret Road and Camino De Oeste Road.**

1. MAPPING CHANGES

1. A topographic work map of suitable scale, contour interval, and planimetric definition must be submitted showing *(indicate N/A when not applicable):*

		Included		
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 100-year floodway boundaries	☐ Yes	☐ No	☑ N/A
D.	Location and alignment of all cross sections used in the revised hydraulic model with stationing control indicated	☑ Yes	☐ No	☐ N/A
E.	Stream alignments, road and dam alignments	☑ Yes	☐ No	☐ N/A
F.	Current community boundaries	☑ Yes	☐ No	☐ N/A
G.	Effective 100- and 500-year floodplain and 100-year floodway boundaries from the FIRM/FBFM reduced or enlarged to the scale of the topographic work map	☑ Yes	☐ No	☐ N/A
H.	Tie-ins between the effective and revised 100- and 500-year floodplains and 100-year floodway boundaries	☐ Yes	☐ No	☑ N/A
I.	The requestor'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 etc.)	☑ 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 analyses	☐ Yes	☐ No	☑ N/A

If any of the items above are marked no or N/A, please Explain:

The items marked N/A are not applicable to this submttal

2. What is the source and data of the updated topographic information *(example: orthophoto maps, July 1985: field survey, May 1979, beach profiles, June 1987, etc.)?* **Aerial Topographic Mapping, 1986 (1929 NGVD)**

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

   a. Effective FIS **N/A** scale **N/A** Contour interval

   b. Revision Request **1" = 200'** scale **2 foot** Contour interval

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

4. Attach an annotated FIRM and FBFM at the scale of the effective FIRM and FBFM showing the revised 100-year and 500-year floodplains and the 100-year floodway boundaries and how they tie into those shown on the effective FIRM and FBFM downstream and upstream of the revision or adjacent to the area of revision for coastal studies.

Attach additional pages if needed.

1. MAPPING CHANGES (Cont'd)

5. Flood boundaries and 100-year water surface elevations:

Has the 100-year floodplain been shifted or increased or the 100-year water surface elevation increased at any location on the property other than the requestor's or community's? ☑ Yes ☐ No

If yes, please give the location of shift or increase and an explanation of the increase.

Floodplain limits have been shifted along the reach from Goret Road to Ironwood Hill Drive.

New floodplain limits have been added along the reach from Ironwood Hill Drive to Camino De Oeste Dr.

(see work maps)

a. Have the affected property owners been notified of this shift or increase and the effect it will have on their property? . . . . . ☐ Yes ☑ No

If yes, please attach letters from these property owners stating they have no objections to the revised flood boundaries if a LOMR is being requested.

b. What is the number of insurable structures that will be impacted by this shift or increase?

Approximately 15 structure will be removed from floodplain between Goret Rd. & Ironwood Hill Dr.

6. Have the floodway boundaries shifted or increased at any location compared to those shown on the effective FBFM or FIRM? . . . . . ☐ Yes ☐ No

If yes, explain: **No floodway analysis conducted.**

7. If a V-zone has been designated, has it been delineated to extend landward to the heel of the primary frontal dune? ☐ Yes ☐ No

If no, explain:

N/A

8. Manual or digital map submission:

☑ Manual
☐ Digital

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 of submission as possible.

2. EARTH FILL PLACEMENT

1. The fill is: ☐ Existing ☐ Proposed **Not applicable**

2. Has fill been / will be placed in the regulatory floodway? . . . . . ☐ Yes ☑ No
If yes, please attach complete Riverine Hydraulic Analysis Form.

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

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

If yes, justify steeper slopes **N/A**

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 **N/A**

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, provide certification of fill compaction (item C. above) by the community's NFIP permit official, a registered professional engineer, or an accredited soils engineer.

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.

FEDERAL EMERGENCY MANAGEMENT AGENCY **BRIDGE / CULVERT FORM**	*O.M.B. Burden No. 3067-0148* *Expires July 31, 1997*	FEMA USE ONLY

PUBLIC BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 2.0 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.

Community Name: **Pima County, Arizona**

Flooding Source: **Camino De Oeste Wash**

Project Name / Identifier: **Camino De Oeste between Goret road and Camino De Oeste road.**

1. IDENTIFIER

1. Name of roadway, railroad, etc.: **Speedway Blvd**
2. Location of bridge/culvert along flooding source (in terms of stream distance or cross-section identifier): **Between HEC-2 cross sections #15330 and #15380**
3. This revision reflects *(check one of the following):*
   - ☑ New bridge/culvert not modeled in the FIS
   - ☐ Modified bridge/culvert previously modeled in the FIS
   - ☐ New analysis of bridge/culvert previously modeled in the FIS

   (Explain why new analysis was performed) _____

2. BACKGROUND

Provide the following information about the structure:

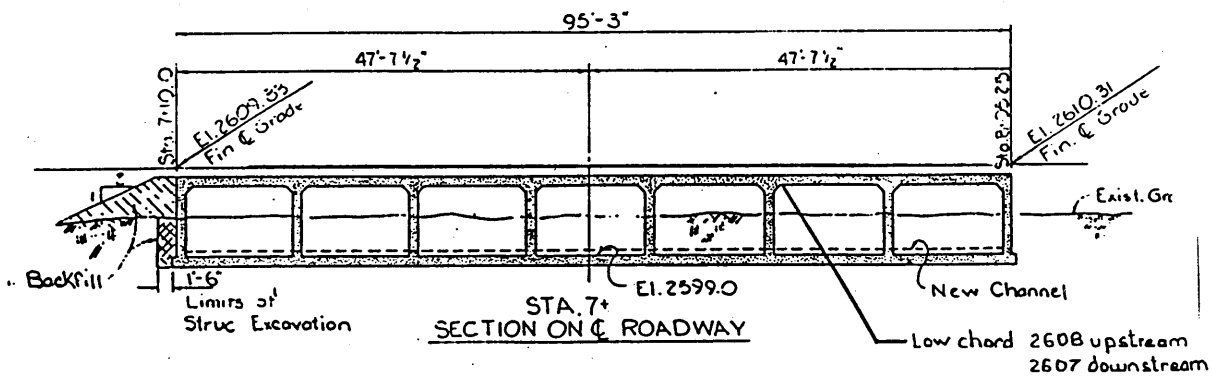
1. Dimension, material, and shape (e.g. two 10 x 5 feet reinforced concrete box culvert; three 30-foot span bridge with 2 rows of 3-foot diameter circular piers; 40-foot wide ogee shape spillway) **This structure is a 7-cell 8'X 12'X 46' Reinforced Concrete Box Culvert (RCBC)**
2. Entrance geometry of culvert/type of bridge opening (e.g. 30o - 75o wing walls with square top edge, sloping embankments and vertical abutments) **30 degree to 75 degree wing walls with square edges**
3. Hydraulic model used to analyze the structure *(e.g., HEC-2 with special bridge routine, WSPRO, HY8)* **HEC-2, Special Culvert Routine**

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

Note: If any items do not apply to submitted hydraulic analysis, indicate by N/A
*** One form per new/revised bridge/culvert**

3. ANALYSIS

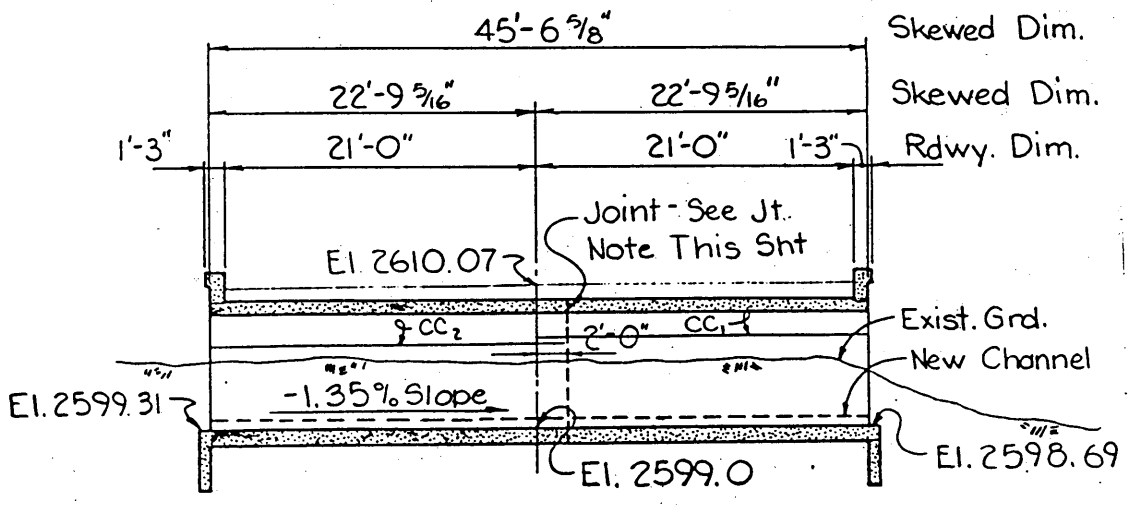
Sketch the downstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, minimum top of road elevation, and ineffective flow widths.



UPSTREAM and DOWNSTREAM FACE

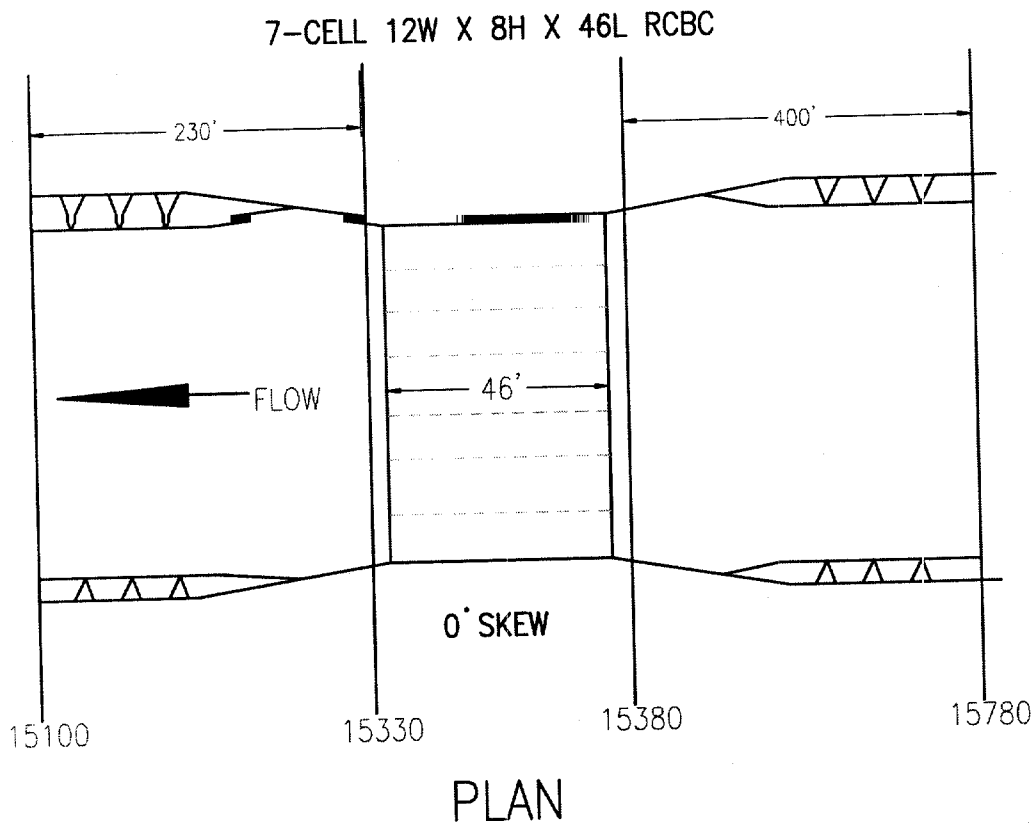
Sketch the upstream face of the structure together with the road profile. Show, at a minimum, the maximum low chord elevation, invert elevation, and minimum top of road elevation.

PROFILE



SECTION ON ℄ BOX CULVERT

Sketch the plan view of the structure(s). Show, at a minimum, the skew angle, cross-section locations, distances between cross sections, and length of structure(s).



Attach plans of the structure(s) certified by a registered Professional Engineer.

Culvert length or bridge width (ft)	**45 feet**
Calculated culvert/bridge area (ft^2) by the hydraulic model, if applicable	**N/A**
Total culvert/bridge area (ft^2)	**672 sf**

Elevations Above Which Flow is Effective for Overbanks

	Left Overbank	Right Overbank
Upstream face	2610	2610
Downstream face	2610	2610

Minimum Top of Road Elevation

	Left Overbank	Right Overbank
Upstream face	2609.33	2610.31
Downstream face	2609.33	2610.31

100-year Elevations	Water Surface Elevations	Energy Gradient Elevations
Upstream face	2607.62	2610.33
Downstream face	2606.6	2609

Discharge	Low Flow	Pressure Flow	Weir Flow	Total Flow
Amount of flow through/over the structure(s) (cfs)	6195	0	199	6394

The maximum depth of flow over the roadway/railroad (ft.)	.83
Weir length (ft.)	368

Top Widths	Total Floodplain Width	Total Effective Flow Width	Floodway Width
Upstream face	110	93	N/A
Downstream face	115	93	N/A

3. ANALYSIS (Cont'd)

Loss Coefficients

Entrance loss coefficient	.5
Manning's "n" value assigned to the structure(s)	0.012
Friction loss coefficient through structure(s)	.012
Other loss coefficients (e.g. bend manhole, etc.)	N/A
Total loss coefficient	2.6
Weir coefficient	2.60
Pier coefficient	N/A
Contraction loss coefficient	0.1
Expansion loss coefficient	0.3

4. SEDIMENT TRANSPORT CONSIDERATIONS

1. A. Is there any indication from historical records that sediment transport *(including scour and deposition)* can affect the 100-year water surface elevations? . . . . . ☐ Yes ☑ No

   B. Based on the conditions *(such as geomorphology, vegetative cover and development of watershed and stream bed, and bank conditions)*, is there a potential for debris and sediment transport *(including scour and deposition)* to affect the 100-year water surface elevations and/or conveyance capacity through the bridge/culvert? . . . . . ☐ Yes ☑ No

2. If the answer to either 1A or 1B is yes:

   A. What is the estimated sediment *(bed material)* load?

   _____ cfs *(attach gradation curve)*

   Explain method used to estimate the sediment transport and depth of scour and /or deposition **N/A**

   B. Will sediment accumulate anywhere through the bridge/culvert? ☐ Yes ☑ No

   If yes, explain the impact on the conveyance capacity through the bridge/culvert? **Small accumulations of sediment were observed in the culvert but should not significantly affect conveyance.**

5. FLOODWAY ANALYSIS

Explain method of bridge encroachment (Floodway run) **N/A**

5. FLOODWAY ANALYSIS (Cont'd)

Comments *(explain any unusual situations):* N/A

Attach analysis.

Summary of Additional Data Required to Support a
Letter of Map Revision (LOMR)

Case No.: 99-09-434P

Requester: Mr. Robert J. Smolinsky, P.E.

Community: Pima County, Arizona

Community No.: 040073

With your January 28 LOMR request, you submitted a HEC-2 hydraulic computer model of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) along Camino De Oeste Wash. On May 11, 1999, we received a revised hydrologic analysis of the base flood prepared by your firm dated May 5, 1999. The May 5 analysis was performed using the PC-HYDRO computer program, which is based on the Pima County Hydrology Method. With the May 5 analysis, you also submitted base flood discharge calculations that were determined using the U.S. Geological Survey (USGS) regression equations from *Methods for Estimating Magnitude and Frequency of Floods in the Southwestern United States*, USGS Open-File Report (OFR) 93-419. Please address the following concerns regarding the hydrologic and hydraulic analyses.

1. We compared the base flood discharge values computed in the May 5 analysis to gage data for the Tucson area; to values for nearby watercourses from the effective Flood Insurance Study (FIS) for Pima County, Arizona and Incorporated Areas; and to values determined using the regression equations in OFR 93-419 and in *Estimation of Magnitude of Floods, Pima County, Arizona, With Comparisons of Alternate Methods*, USGS Water-Resources Investigations Report (WRIR) 84-4142. Based on these comparisons, we are concerned that the values computed in the May 5 hydrologic analysis may be too high.

   The base flood discharge values computed in the May 5 hydrologic analysis are higher than those in the effective FIS report for watersheds of similar size in the vicinity of Camino De Oeste. The values computed in the May 5 analysis are also higher than those determined using both OFR 93-419 and WRIR 84-4142. Our review revealed that the regression equations in WRIR 84-4142, which include drainage area, channel slope, and basin shape as independent variables, are preferable to those in OFR 93-419, where drainage area is the only independent variable. We also found that the values determined using WRIR 84-412 are consistent with gage records for nine gage stations in the Tucson area (using gage data from WRIR 84-412).

   Please revise the base flood discharge values in the submitted hydraulic analysis using the regression equations in WRIR 84-412. Alternatively, please revise the discharge values based on the May 5 hydrologic analysis, and submit documentation to demonstrate why it is more appropriate to use those values.

2. In the submitted hydraulic analysis, Speedway Boulevard is modeled using the HEC-2 Special Culvert Option, in which the stations and ground elevations of each point in a cross section are input using GR records and culvert data is input using X2 and SC records. However, the upstream and downstream invert elevations input in the SC record for the Speedway Boulevard culvert do not agree with the thalweg elevations input in the GR records for the cross sections along the upstream and downstream faces of Speedway Boulevard. Specifically, the upstream and downstream culvert invert elevations in the SC record are 2,599.3 feet and 2,598.69 feet, respectively, while the thalweg elevations in the GR records for the upstream and downstream face sections of Speedway Boulevard are 2,602 feet and 2,600 feet, respectively. The sketch of the

Speedway Boulevard culvert provided on FEMA Form 7, entitled "Bridge/Culvert Form," shows the invert elevation at the culvert centerline to be 2,599 feet. Please either revise the GR data for Sections 15380 and 15330 of the submitted HEC-2 model to agree with the culvert invert elevations in the SC record, or revise the data in the SC record and the culvert information on Form 7.

3. The submitted subcritical HEC-2 model computed velocities as high as 16.4 feet per second (fps), which is high enough to cause erosion of unprotected channel surfaces. We note that the subcritical model defaulted to critical depth at several cross sections, and a supercritical model of Camino De Oeste would likely compute higher velocities. Please submit documentation addressing the effects of erosion and sediment transport and deposition on the flood hazard along Camino De Oeste Wash during the base flood.

4. If revisions to the hydrologic and/or hydraulic analyses result in changes in the proposed base floodplain boundary delineations for Camino De Oeste Wash, please submit a revised topographic work map that shows the effective and revised base floodplain boundary delineations. The map must show how the revised boundary delineations tie into the effective boundary delineations at the upstream and downstream ends of the revised reach. The map must include the locations and alignments of all cross sections used in the hydraulic analyses and stream and road alignments. The scale and topographic definition of the map must be sufficient to provide reasonable accuracy, and the map must be certified by a registered professional engineer. Please also submit revised annotated copies of Flood Insurance Rate Map Panels 04019C1618 K and 04019C2210 K, both dated February 8, 1999, showing the proposed revisions.

5. Please submit a computer diskette containing input and output files for all submitted computer models.

Please send the required data directly to our Technical Evaluation Contractor at the following address:

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

Attention: Ms. Pernille Buch-Pedersen
(703) 317-6224

For identification purposes, you must include the case number referenced above on all correspondence.

ARROYO ENGINEERING, INC.
Water Resources & Civil Engineering Consultants

June 28, 1999

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304
ATTN: Ms. Pernille Buch-Pedersen

RE: REQUEST FOR A PHYSICAL MAP REVISION OF THE CAMINO DE OESTE WASH
Case No. 99-09-434P
Community: Pima County, Arizona
Community No.: 040073

Dear Ms. Buch-Pedersen:

Enclosed with this letter is a report containing revised hydrologic data, prepared in response to the review letter dated May 20, 1999, regarding the above referenced submittal. The reviewer expressed a concern about our use of the Pima County Hydrology Method (PC-HYDRO) for base flood determination, instead recommending the USGS regression equation WRIR 84-4142. We were offered the option of choosing PC-HYDRO under the stipulation that we document its appropriateness in this situation. The Procedures section of the report supports our decision to use the PC-HYDRO Method.

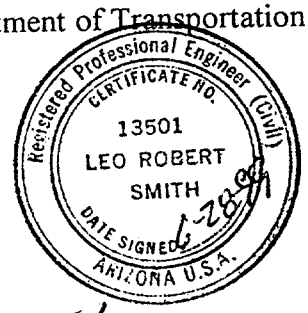
In order to meet the 90-day deadline from the May 20 review letter for submittal of revised data, we respectfully request that a determination of hydrological method be made as quickly as possible so that we may proceed with the revised HEC-II floodplain analysis.

290 North Meyer Avenue • P.O. Box 2668 Tucson, AZ 85702 • (520) 882-0206 • Fax: (520) 882-2929

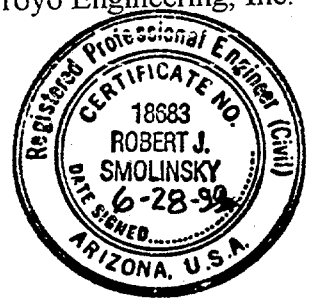
If you have any further questions, please contact Mr. Robert Smolinsky at (520) 882-0206.

Sincerely,

Leo R. Smith, P.E., Manager, Floodplain Management
Department of Transportation and Flood Control District



Robert J. Smolinsky, P.E., Vice-President
Arroyo Engineering, Inc.



LRS/RJS/eh
attachment

HYDROLOGIC REPORT
TO SUPPORT A REQUEST FOR A PHYSICAL MAP REVISION
OF THE CAMINO DE OESTE WASH
Case No. 99-09-434P
Community: Pima County, Arizona
Community No.: 040073

PURPOSE

This report contains revised base flood peak discharge values, which are intended to replace those used in the Camino de Oeste Wash Physical Map Revision, submitted January 28, 1999. Further, this report addresses a concern with the method used to generate the peak flood discharges, as stated in Paragraph 1 of the review letter dated May 20, 1999.

PROCEDURE

Initial review comments from staff at Michael Baker Jr., Inc. (FEMA Technical Evaluation Contractor) stated concern over use of the Pima County Hydrology Method (PC-HYDRO) to generate flood peak discharge values for the Camino de Oeste Wash (letter dated May 20, 1999). The reviewer was concerned that the peak discharge values were high relative to those that would be obtained using the USGS regression equation WRIR 84-4142. However, it is our opinion that the PC-HYDRO method is more appropriate for this situation and our reasoning is as follows:

PC-HYDRO is designed to model arid lands hydrology, and has been used consistently in Pima County for the past 20 years for the purpose of structural design and floodplain management. In addition, hundreds of FEMA-approved studies, including FIS, LOMR, LOMA and PMR, have used this hydrologic model. PC-HYDRO has been designated as the preferred hydrologic model for use in estimating peak discharge values on watersheds less than 10 square miles in size by the Board of Directors of the Pima County Flood Control District. This has established a consistency in floodplain management efforts within Pima County that we wish to continue. We believe that the peak discharge values obtained using PC-HYDRO are conservatively high compared to the lower values obtained using the USGS regression method. Use of the higher values allows the Flood Control District to regulate to a higher standard of safety with respect to flood hazard and associated risk. Additionally, we believe it is reasonable to expect higher peak discharges from this particular watershed, compared to the "average" watershed located within Pima County, because of the high percentage of type "D" soils present within the watershed (a parameter that is not explicitly taken into account in the USGS regression method).

LOCATION

Figure 1 shows the Camino de Oeste Wash basin boundaries delineated on USGS 7.5 minute quadrangles, (Cat Mountain (1992) and Jaynes (1992)), at 1:24000 scale. Also shown are five concentration points where new 100-year discharge values have been calculated.

DISCUSSION OF PARAMETERS

Existing conditions hydrologic parameters have been used to generate peak discharge values, per FEMA guidelines. A roughness coefficient (n_b) varying from 0.045 (flatter slope) to 0.048 (steeper slope) was used to model the rugged watershed with rocky outcrops and medium to heavy coverings of brush and grasses. Soils types ranged from type "D" soils in the steep, mountainous elevations to type "B" soils in the lower, flatter region. The desert brush and herbaceous cover types are in good condition at 40% cover density. Mean slopes ranged from 2% to 3%. The area is very sparsely developed, yielding a weighted imperviousness of 1%. Rainfall values were determined from National Weather Service isopluvial precipitation maps (Hydrology Manual for Engineering Design and Floodplain Management Within Pima County, Arizona (1979)) which indicated that the 100-yr 1-hr storm would produce a rainfall depth of 2.77 inches.

Table 1 summarizes the peak discharges for the 5 concentration points by both the PC-HYDRO and regression equation method.

Table 1 - Summary of 100-yr Peak Discharges (cfs)

Concentration Point	PC-HYDRO Q-100 (cfs)	WRIR 84-4142 Q-100 (cfs)
C.P. 1	4410	2504
C.P. 2	5984	3268
C.P. 3	6488	3559
C.P. 4	5477	3374
C.P. 5	4172	3229

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

(PC-HYDRO Version 3.0)
Arroyo Engineering, Inc.

Client: Pima County | Prepared by: ES/EH
Project Name: Camino de Oeste PMR | Date: 6/14/99
Concentration Point: 1 | Job #:

Watershed Area: 2.8 sm | Watershed Type: Undeveloped-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	120.0	5,818	0.0206	.048
2	50.0	2,965	0.0169	.048
3	510.0	9,904	0.0515	.048

Length of Watercourse (Lc): 18,687 feet | Mean Slope: 0.0305
Length to Cen. of Gravity (Lca): 5,818 feet | Weighted Basin Fac.: 0.048
Veg. Cover Type(s): Desert Brush | Veg. Cover Density: 40 %

RETURN PERIOD: 100-years

Rainfall Values

	1-hour	2-hour	3-hour	6-hour	24-hour
Point Values (in)	2.77	3.12	3.35	3.80	4.80
Areal Values (in)	2.77	3.12	3.35	3.80	4.80

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	0	.	.	0.000
C	0	.	.	0.000
D	100	89.	91.7	0.692
Imp.	1	99.	99.	0.957

Weighted Runoff Coef. (Cw): 0.695
Time of Concentration: 42.0 min
Rainfall Intensity (i) @ Tc: 3.51 in/hr
Runoff Supply Rate (q) @ Tc: 2.44 in/hr

PEAK DISCHARGE: 4,409.7 cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

(PC-HYDRO Version 3.0)
Arroyo Engineering, Inc.

Client: Pima County | Prepared by: ES/EH
Project Name: Camino de Oeste PMR | Date: 6/14/99
Concentration Point: 2 | Job #:

Watershed Area: 3.8 sm | Watershed Type: Undeveloped-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	120.0	5,818	0.0206	.048
2	50.0	2,965	0.0169	.048
3	510.0	9,904	0.0515	.048

Length of Watercourse (Lc): 18,687 feet | Mean Slope: 0.0305
Length to Cen. of Gravity (Lca): 5,818 feet | Weighted Basin Fac.: 0.048
Veg. Cover Type(s): Desert Brush | Veg. Cover Density: 40 %

RETURN PERIOD: 100-years

Rainfall Values

	1-hour	2-hour	3-hour	6-hour	24-hour
Point Values (in)	2.77	3.12	3.35	3.80	4.80
Areal Values (in)	2.77	3.12	3.35	3.80	4.80

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	0	.	.	0.000
C	0	.	.	0.000
D	100	89.	91.7	0.692
Imp.	1	99.	99.	0.957

Weighted Runoff Coef. (Cw): 0.695
Time of Concentration: 42.0 min
Rainfall Intensity (i) @ Tc: 3.51 in/hr
Runoff Supply Rate (q) @ Tc: 2.44 in/hr

PEAK DISCHARGE: 5,984.6 cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

(PC-HYDRO Version 3.0)
Arroyo Engineering, Inc.

Client: Pima County
Project Name: Camino de Oeste PMR
Concentration Point: 3

Prepared by: ES/EH
Date: 6/14/99
Job #:

Watershed Area: 4.8 sm Watershed Type: Undeveloped-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	80.0	4,123	0.0194	.045
2	90.0	5,018	0.0179	.045
3	80.0	3,765	0.0212	.045
4	510.0	9,904	0.0515	.045

Length of Watercourse (Lc): 22,810 feet Mean Slope: 0.0279
Length to Cen. of Gravity (Lca): 9,141 feet Weighted Basin Fac.: 0.045
Veg. Cover Type(s): Desert Brush Veg. Cover Density: 40 %

RETURN PERIOD: 100-years

Rainfall Values

	1-hour	2-hour	3-hour	6-hour	24-hour
Point Values (in)	2.77	3.12	3.35	3.80	4.80
Areal Values (in)	2.77	3.12	3.35	3.80	4.80

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	0	.	.	0.000
C	0	.	.	0.000
D	100	89.	91.7	0.692
Imp.	1	99.	99.	0.957

Weighted Runoff Coef. (Cw): 0.695
Time of Concentration: 53.0 min
Rainfall Intensity (i) @ Tc: 3.01 in/hr
Runoff Supply Rate (q) @ Tc: 2.09 in/hr

PEAK DISCHARGE: 6,488.0 cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

(PC-HYDRO Version 3.0)
Arroyo Engineering, Inc.

Client: Pima County | Prepared by: ES/EH
Project Name: Camino de Oeste PMR | Date: 6/14/99
Concentration Point: 4 | Job #:

Watershed Area: 5.0 sm | Watershed Type: Undeveloped-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	70.0	4,582	0.0153	.045
2	150.0	7,928	0.0189	.045
3	110.0	4,978	0.0221	.045
4	510.0	9,904	0.0515	.045

Length of Watercourse (Lc): 27,392 feet | Mean Slope: 0.0254
Length to Cen. of Gravity (Lca): 12,510 feet | Weighted Basin Fac.: 0.045
Veg. Cover Type(s): Desert Brush | Veg. Cover Density: 40 %

RETURN PERIOD: 100-years

Rainfall Values

	1-hour	2-hour	3-hour	6-hour	24-hour
Point Values (in)	2.77	3.12	3.35	3.80	4.80
Areal Values (in)	2.77	3.12	3.35	3.80	4.80

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	3	82.	86.61	0.545
C	0	.	.	0.000
D	97	89.	91.7	0.692
Imp.	1	99.	99.	0.957

Weighted Runoff Coef. (Cw): 0.691
Time of Concentration: 1.1 hrs
Rainfall Intensity (i) @ Tc: 2.46 in/hr
Runoff Supply Rate (q) @ Tc: 1.70 in/hr

PEAK DISCHARGE: 5,477.0 cfs

HYDROLOGIC DATA SHEET FOR PIMA COUNTY FLOOD PEAK PROCEDURE

(PC-HYDRO Version 3.0)
Arroyo Engineering, Inc.

Client: Pima County | Prepared by: ES/EH
Project Name: Camino de Oeste PMR | Date: 6/14/99
Concentration Point: 5 (Goret Road) | Job #:

Watershed Area: 5.3 sm | Watershed Type: Undeveloped-Foothills

Watercourse Data By Reach

Reach No.	Height (Hi)	Length (Li)	Slope (Si)	Basin Factor (Nb)
1	110.0	6,870	0.0160	.045
2	190.0	12,068	0.0157	.045
3	110.0	5,420	0.0203	.045
4	510.0	9,904	0.0515	.045

Length of Watercourse (Lc): 34,262 feet | Mean Slope: 0.0218
Length to Cen. of Gravity (Lca): 18,938 feet | Weighted Basin Fac.: 0.045
Veg. Cover Type(s): Desert Brush | Veg. Cover Density: 40 %

RETURN PERIOD: 100-years

Rainfall Values

	1-hour	2-hour	3-hour	6-hour	24-hour
Point Values (in)	2.77	3.12	3.35	3.80	4.80
Areal Values (in)	2.77	3.12	3.35	3.80	4.80

Soils Data

Soil Type	Percent	Curve # (CN)	Adj. Curve # (CN*)	Runoff Coef. (C)
B	8	82.	86.61	0.545
C	0	.	.	0.000
D	92	89.	91.7	0.692
Imp.	1	99.	99.	0.957

Weighted Runoff Coef. (Cw): 0.683
Time of Concentration: 1.7 hrs
Rainfall Intensity (i) @ Tc: 1.79 in/hr
Runoff Supply Rate (q) @ Tc: 1.22 in/hr

PEAK DISCHARGE: 4,171.9 cfs

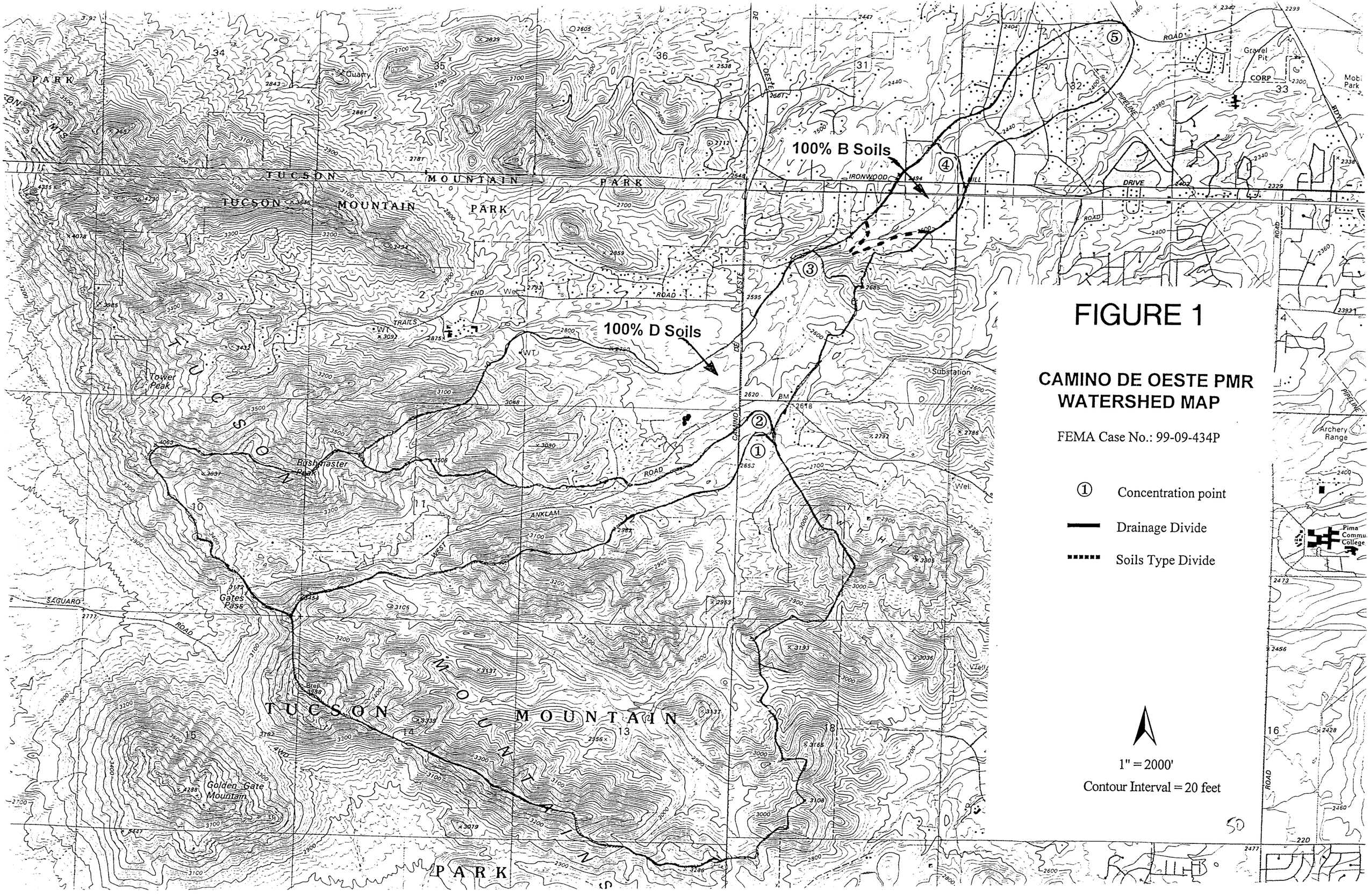


FIGURE 1

CAMINO DE OESTE PMR WATERSHED MAP

FEMA Case No.: 99-09-434P

① Concentration point

Drainage Divide

Soils Type Divide

1" = 2000'

Contour Interval = 20 feet

50

Summary of Additional Data Required to Support a
Letter of Map Revision (LOMR)

Case No.: 99-09-943R

Requester: Mr. Robert J. Smolinksky, P.E.

Community: Pima County, Arizona

Community No.: 040073

Please submit the following items that were requested in our letter to you dated May 20, 1999 (copy enclosed).

1. A revised HEC-2 hydraulic computer model in which the discrepancy between the data in the GR and SC records at Speedway Boulevard has been resolved. The data used in the GR and SC records must agree with the data on Application/Certification Form 7, entitled "Bridge/Culvert Form."

2. Documentation that addresses the effects of erosion and sediment transport and deposition on the flood hazard along Camino De Oeste Wash during the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood)

3. A revised topographic work map that shows the effective and revised base floodplain boundary delineations for Camino De Oeste Wash. The map must show how the revised floodplain boundary delineations tie into the effective floodplain boundary delineations at the upstream and downstream ends of the revised reach. The map must include the locations and alignments of all cross sections used in your hydraulic analyses and stream and road alignments. The scale and topographic definition of the map must be sufficient to provide reasonable accuracy, and the map must be certified by a registered professional engineer. Please also submit revised annotated copies of Flood Insurance Rate Map Panels 04019C1618 K and 04019C2210 K, both dated February 8, 1999, showing the proposed revisions.

4. A computer diskette containing input and output files for all submitted computer models

Please send the required data directly to our Technical Evaluation Contractor at the following address:

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304

Attention: Ms. Sheila M. Norlin
(703) 317-3054

For identification purposes, you must include the case number referenced above on all correspondence.

ARROYO ENGINEERING, INC.
Water Resources & Civil Engineering Consultants

September 23, 1999

Michael Baker Jr., Inc.
3601 Eisenhower Avenue, Suite 600
Alexandria, Virginia 22304
ATTEN: Ms. Sheila M. Norlin

RE: REQUEST FOR A PHYSICAL MAP REVISION
Case No. 99-09-434R
Community: Pima County, Arizona
Community No.: 040073

Dear Ms. Norlin

Enclosed, please find hydrologic information related to the above referenced Request for a Physical Map Revision, that was requested within your August 16, 1999 letter regarding this matter (attached). The following numbered responses coincide with the numbered items contained within the above referenced letter:

1. A revised HEC-2 hydraulic computer model is attached which resolves the discrepancy between the data in the "GR" and "SC" records for the existing culvert structure, located at Speedway Boulevard.

2. An erosion analysis was not performed along study reach of the Camino de Oeste Wash. However, the 100-year flow velocities along this reach are of a magnitude that would likely cause some degree of erosion of the earthen channel banks. Pima County drainage regulations require that conservative erosion-hazard setbacks be utilized along such channel reaches, unless a detailed erosion study is performed, or unless approved bank protection measures are constructed along the watercourse.

3. Revised topographic work maps and annotated copies of Flood Insurance Rate Maps are attached.

4. A computer disk containing input and output files for the submitted computer model is attached.

290 North Meyer Avenue • P.O. Box 2668 Tucson, AZ 85702 • (520) 882-0206 • Fax (520) 882-2929

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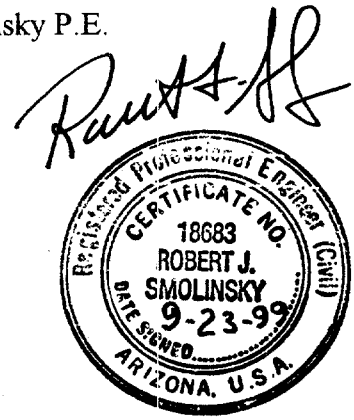
If you have any questions regarding the enclosed information, please call me at (520) 882-0206. Thank you for your consideration of this matter.

Sincerely

ARROYO ENGINEERING, INC.

Robert J. Smolinsky P.E.
Vice President



xc: Elizabeth Hill, Project Manager, Pima County DOT&FCD

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Federal Emergency Management Agency

Washington, D.C. 20472

DEC 2 8 1999

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

IN REPLY REFER TO:
Case No.: 99-09-434P

The Honorable Sharon Bronson
Chairperson, Pima County Board
of Supervisors
130 West Congress, 11th Floor
Tucson, AZ 85701

Community: Pima County, Arizona
Community No.: 040073
Panels Affected: 04019C1618 K and 2210 K
Effective Date of
This Revision: **APR 2 6 2000**

102-I-A-C

Dear Ms. Bronson:

This responds to a request that the Federal Emergency Management Agency (FEMA) revise the effective Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) report for Pima County, Arizona and Incorporated Areas (the effective FIRM and FIS report for your community), in accordance with Part 65 of the National Flood Insurance Program (NFIP) regulations. In a letter dated January 28, 1999, Mr. Robert J. Smolinsky, P.E., Vice President, Arroyo Engineering, Inc., requested that FEMA revise the FIRM and FIS report to show the effects of more detailed hydrologic and hydraulic analyses along Camino De Oeste Wash from just downstream of Goret Road to just upstream of Camino De Oeste.

All data required to complete our review of this request were submitted with letters from Mr. Smolinsky and Mr. Leo R. Smith, Floodplain Management Division, Pima County Department of Transportation and Flood Control District.

We have completed our review of the submitted data and the flood data shown on the effective FIRM and FIS report. We have revised the FIRM to modify the elevations, floodplain boundary delineations, and zone designations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) along Camino De Oeste Wash. As a result of the modifications, the width of the Special Flood Hazard Area (SFHA), the area that would be inundated by the base flood, increased in some areas and decreased in other areas from just downstream of Goret Road to just upstream of Ironwood Hill Drive. In addition, an SFHA was added along Camino De Oeste Wash from just upstream of Ironwood Hill Drive to just upstream of Camino De Oeste, base flood elevations (BFEs) were established for Camino De Oeste Wash from just downstream of Goret Road to just upstream of Camino De Oeste, and Profile Panels 227P through 232P were added to the FIS report. The modifications are shown on the enclosed annotated copies of FIRM Panel(s) 04019C1618 K and 04019C2210 K and Profile Panel(s) 227P through 232P. This Letter of Map Revision (LOMR) hereby revises the above-referenced panel(s) of the effective FIRM and the affected portions of the FIS report, both dated February 8, 1999.

The following table is a partial listing of existing and modified BFEs:

Location	Existing BFE (feet)*	Modified BFE (feet)*
Just downstream of Goret Road	None	2,358
Just upstream of Camino De Oeste	None	2,655

*Referenced to the National Geodetic Vertical Datum, rounded to the nearest whole foot

Public notification of the proposed modified BFEs will be given in *The Arizona Daily Star* on or about January 20 and January 27, 2000. A copy of this notification is enclosed. In addition, a notice of changes will be published in the *Federal Register*. Within 90 days of the second publication in *The Arizona Daily Star*, a citizen may request that FEMA reconsider the determination made by this LOMR. Any request for reconsideration must be based on scientific or technical data. All interested parties are on notice that, until the 90-day period elapses, the determination to modify the BFEs presented in this LOMR may itself be modified.

The modifications will be effective after the 90-day appeal period has elapsed. The map panel(s) as listed above and as modified by this letter will be used for all flood insurance policies and renewals issued for your community.

Because this LOMR will not be printed and distributed to primary users, such as local insurance agents and mortgage lenders, your community will serve as a repository for these new data. We encourage you to disseminate the information reflected by this LOMR throughout the community, so that interested persons, such as property owners, local insurance agents, and mortgage lenders, may benefit from the information. We also encourage you to prepare a related article for publication in your community's local newspaper. This article should describe the assistance that officials of your community will give to interested persons by providing these data and interpreting the NFIP maps.

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel(s) and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This LOMR is based on minimum floodplain management criteria established under the NFIP. Your community is responsible for approving all floodplain development, and for ensuring all necessary permits required by Federal or State law have been received. State, county, and community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction in the SFHA. If the State, county, or community has adopted more restrictive or comprehensive floodplain management criteria, these criteria take precedence over the minimum NFIP criteria.

This determination has been made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and is in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed minimum NFIP criteria. These criteria are the minimum and do not supersede any State or local requirements of a more stringent nature. This includes adoption of the effective FIRM to which the regulations apply and the modifications described in this LOMR. Our records show that your community has met this requirement.

A Consultation Coordination Officer (CCO) has been designated to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Sally Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
The Presidio of San Francisco, Building 105
San Francisco, California 94129-1250
(415) 923-7177

FEMA makes flood insurance available in participating communities; in addition, we encourage communities to develop their own loss reduction and prevention programs. Our Project Impact initiative, developed by FEMA Director James Lee Witt, seeks to focus the energy of businesses, citizens, and communities in the United States on the importance of reducing their susceptibility to the impact of all natural disasters, including floods, hurricanes, severe storms, earthquakes, and wildfires. Natural hazard mitigation is most effective when it is planned for and implemented at the local level, by the entities who are most knowledgeable of local conditions and whose economic stability and safety are at stake. For your information, we are enclosing a Project Impact Fact Sheet. For additional information on Project Impact, please visit our Web site at **www.fema.gov**.

If you have any questions regarding floodplain management regulations for your community or the NFIP in general, please contact the CCO for your community at the telephone number cited above. If you have any technical questions regarding this LOMR, please contact Mr. Max Yuan of our staff in Washington, DC, either by telephone at (202) 646-3843 or by facsimile at (202) 646-4596.

Sincerely,

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

For: Matthew B. Miller, P.E., Chief
Hazards Study Branch
Mitigation Directorate

Enclosure(s)

cc: Mr. R "Terry" Hendricks
Principal Hydrologist
Floodplain Management Division
Pima County Department of Transportation
and Flood Control District

Mr. Robert J. Smolinsky, P.E.
Vice President
Arroyo Engineering, Inc.

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE UNINCORPORATED AREAS OF PIMA COUNTY, ARIZONA, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On February 8, 1999, the Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the unincorporated areas of Pima County, Arizona, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Directorate has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate. The modified base flood elevations (BFEs) revise the FIRM for the community.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

More detailed hydrologic and hydraulic analyses were performed for Camino De Oeste Wash and have resulted in increases and decreases in SFHA width and establishment of additional BFEs for Camino De Oeste Wash. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Just downstream of Goret Road	None	2,358
Just upstream of Camino De Oeste	None	2,655

*National Geodetic Vertical Datum, rounded to nearest whole foot

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Directorate must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Directorate reconsider the determination. Any request for reconsideration must be based on knowledge of changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Directorate's determination to modify the BFEs may itself be changed.

Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Sharon Bronson
Chairperson, Pima County Board of Supervisors
130 West Congress, 11th Floor
Tucson, Arizona 85701

Federal Emergency Management Agency

Office of Emergency Information and Media Affairs, Washington, D.C. 20472 (202) 646-4600

FACT SHEET

PROJECT IMPACT
Building a Disaster Resistant Community

BACKGROUND

PROJECT IMPACT is an initiative developed by FEMA Director James Lee Witt to challenge the country to undertake actions that protect families, businesses and communities by reducing the effects of natural disasters. This initiative includes a national awareness campaign, the selection of pilot communities that demonstrate the benefits of hazard mitigation through a partnership approach, and an outreach effort to businesses and communities using a new guidebook that offers a formula for a community or business to follow to become disaster resistant.

RATIONALE

The increasing number and severity of natural disasters the past decade demands that action be taken to reduce the threat that hurricanes, severe storms, earthquakes, floods and wildfires impose upon the economic stability, economic future and safety of the citizens of the U.S. As the federal agency responsible for emergency management, FEMA is committed to reducing disaster losses by focusing the energy of businesses, citizens, and communities in the U.S. on the importance of reducing their susceptibility to the impact of natural disasters.

There are three primary tenets of the PROJECT IMPACT initiative:

- *Mitigation is a local issue.* It is best addressed by a local partnership that involves government, businesses and private citizens.

- *Private sector participation is essential.* Disasters threaten the economic and commercial growth of our cities, towns, villages and counties. Without the participation of the private sector, comprehensive solutions will not be developed.

- *Mitigation is a long-term effort that requires long-term investment.* Disaster losses will not be eliminated overnight.

PILOT COMMUNITIES

Director Witt and FEMA have worked closely with seven communities throughout the U.S. to develop a PROJECT IMPACT plan that localities, businesses and citizens can follow to build disaster resistant communities where they live and work. Director Witt will participate in events in each of these communities to congratulate them on their foresight, commitment, and contribution to a disaster resistant nation.

PROJECT IMPACT GUIDEBOOK

The guidebook presents that steps a community can take to become disaster resistant. It also provides examples of the actions and resources available to accomplish this goal.

Need Information on FEMA FLOOD HAZARD MAPS?

CONTACT 1-877-FEMA MAP

(Toll Free 1-877-336-2627)

NFIP
National Flood Insurance Program
Administered by FEMA

This release is intended to acquaint the public with the Federal Emergency Management Agency's new toll-free number established to respond to questions regarding National Flood Insurance Program (NFIP) Flood Hazard maps, including:

- How do I go about getting a Letter of Map Amendment (LOMA)? A Letter of Map Revision Based on Fill (LOMR-F)? A Letter of Map Revision (LOMR)?
- What is the status of my request for a LOMA? LOMR-F? Study?
- How long does it take to get the map revised?
- Did FEMA receive my request for a Letter of Map Amendment?
- I was just told by my lender that my house is in a floodplain and I need flood insurance, what are my options?
- Was a LOMA ever issued for my property?
- Has the National Flood Insurance Program Flood Hazard map for my community been revised?

The following procedures have been established by FEMA for changing and correcting the NFIP Flood Hazard maps. They are: Letters of Map Amendment (LOMAs), Letters of Map Revision(LOMRs), Letters of Map Revision Based on Fill (LOMR-Fs), and Physical Map Revisions.

As a result of numerous requests for revisions or corrections to the NFIP Flood Hazard maps, FEMA has assigned a dedicated staff of trained professionals to respond to the public's requests for information on the procedures to revise or correct the NFIP Flood Hazard maps.

If you have any questions regarding the NFIP Flood Hazard maps or need current information and facts on FEMA Mapping Procedures, call 1-877-FEMA-MAP.

Below are additional Toll-Free numbers that can be used to obtain other information regarding the NFIP and its products.

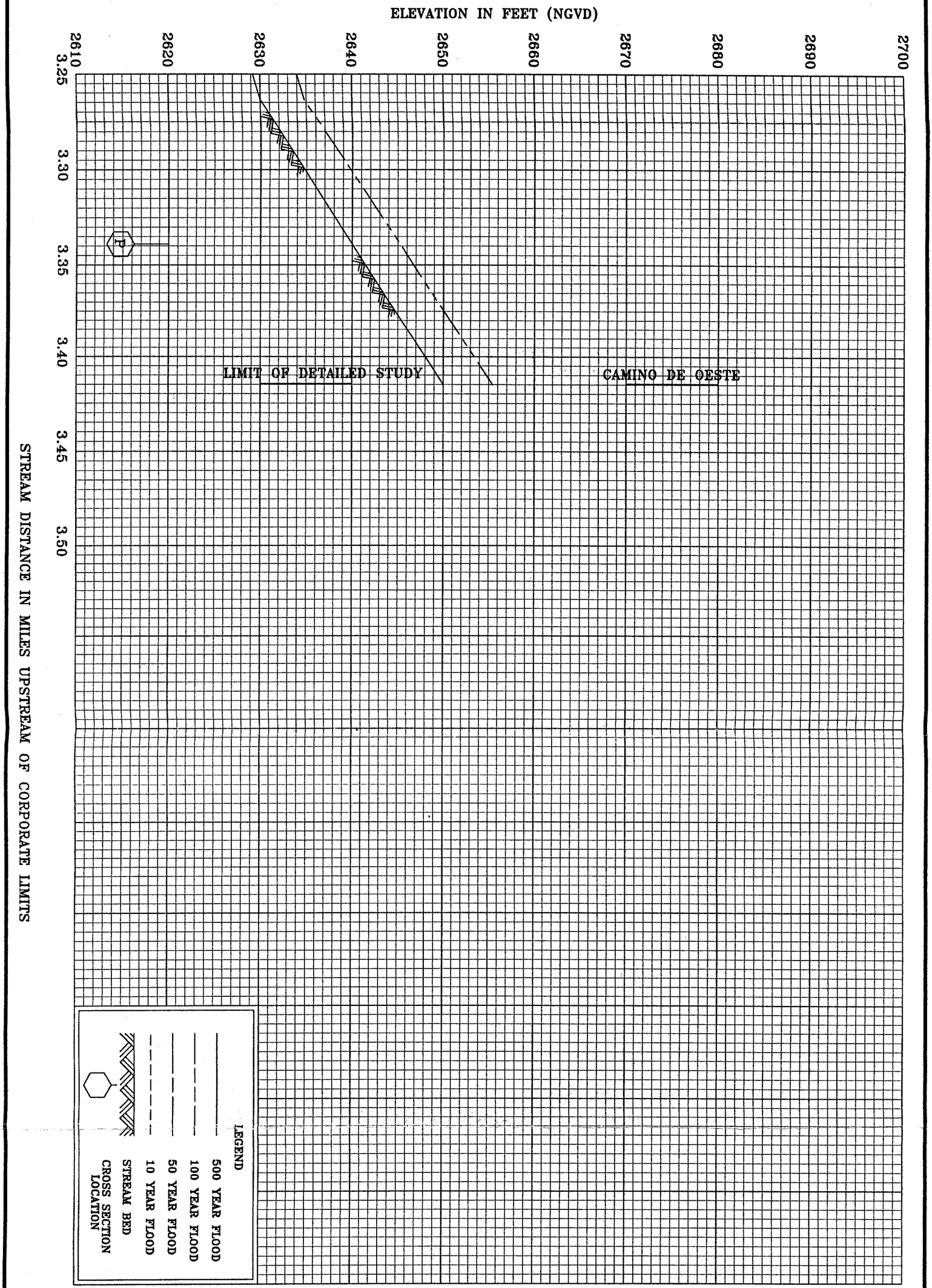
- For information about the NFIP's Preferred Risk Policy, ask your insurance agent or company, or call the NFIP's toll-free number at 1-800-427-9662.

- For any current FEMA publications, call FEMA's Publication Center at 1-800-480-2520.

- For answers to flood insurance related questions, call the National Flood Insurance Telephone Response Center at 1-800-427-4661.

- For ordering printed copies of effective NFIP Flood Hazard maps and related documents, call the FEMA Map Service Center at 1-800-358-9616.

Additional information on flood insurance and other FEMA programs and activities is available on the FEMA World Wide Web Site (http://www.FEMA.gov) and from FEMA's 24-hour-FAX-on-Demand system at (202) 646-FEMA. TDD# 1-800-427-5593.



232P

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIMA COUNTY, AZ

AND INCORPORATED AREAS

FLOOD PROFILES

CAMINO DE OESTE WASH

APR 26 2000

07

ELEVATION IN FEET (NGVD)

2640
2630
2620
2610
2600
2590
2580
2570
2560
2550

SPEEDWAY BOULEVARD

M
N
O

LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION

2.60 2.65 2.70 2.75 2.80 2.85 2.90 2.95 3.00 3.05 3.10 3.15 3.20 3.25

STREAM DISTANCE IN MILES UPSTREAM OF CORPORATE LIMITS

FLOOD PROFILES

CAMINO DE OESTE WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY
PIMA COUNTY, AZ
AND INCORPORATED AREAS

231P

ELEVATION IN FEET (NGVD)

2580
2570
2560
2550
2540
2530
2520
2510
2500
2490

1.95 2.00 2.05 2.10 2.15 2.20 2.25 2.30 2.35 2.40 2.45 2.50 2.55 2.60

STREAM DISTANCE IN MILES UPSTREAM OF CORPORATE LIMITS

J K L

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

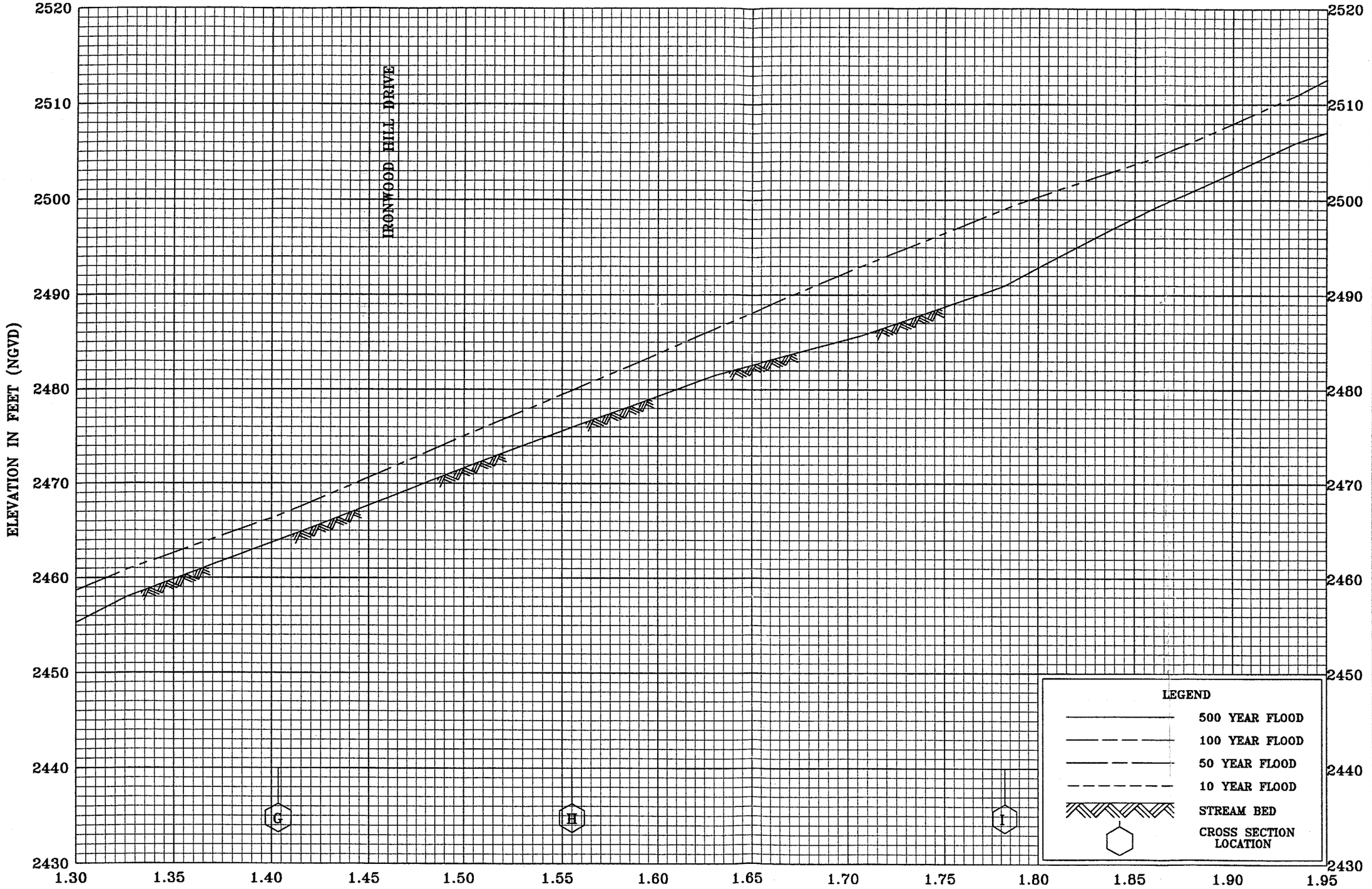
CAMINO DE OESTE WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIMA COUNTY, AZ

AND INCORPORATED AREAS

230P



REVISED TO REFLECT FLOOD DATED

APR 26 2000

FLOOD PROFILES

CAMINO DE OESTE WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIMA COUNTY, AZ

AND INCORPORATED AREAS

229P

ELEVATION IN FEET (NGVD)

2420
2410
2400
2390
2380
2370
2360
2350
2340
2330

LIMIT OF DETAILED STUDY

GORET ROAD

BUCK LANE

GRANNEN ROAD

A
B
C

LEGEND

500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION

0 0.05 0.1 0.15 0.2 0.25 0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65

STREAM DISTANCE IN MILES UPSTREAM OF CORPORATE LIMITS

FLOOD PROFILES

CAMINO DE OESTE WASH

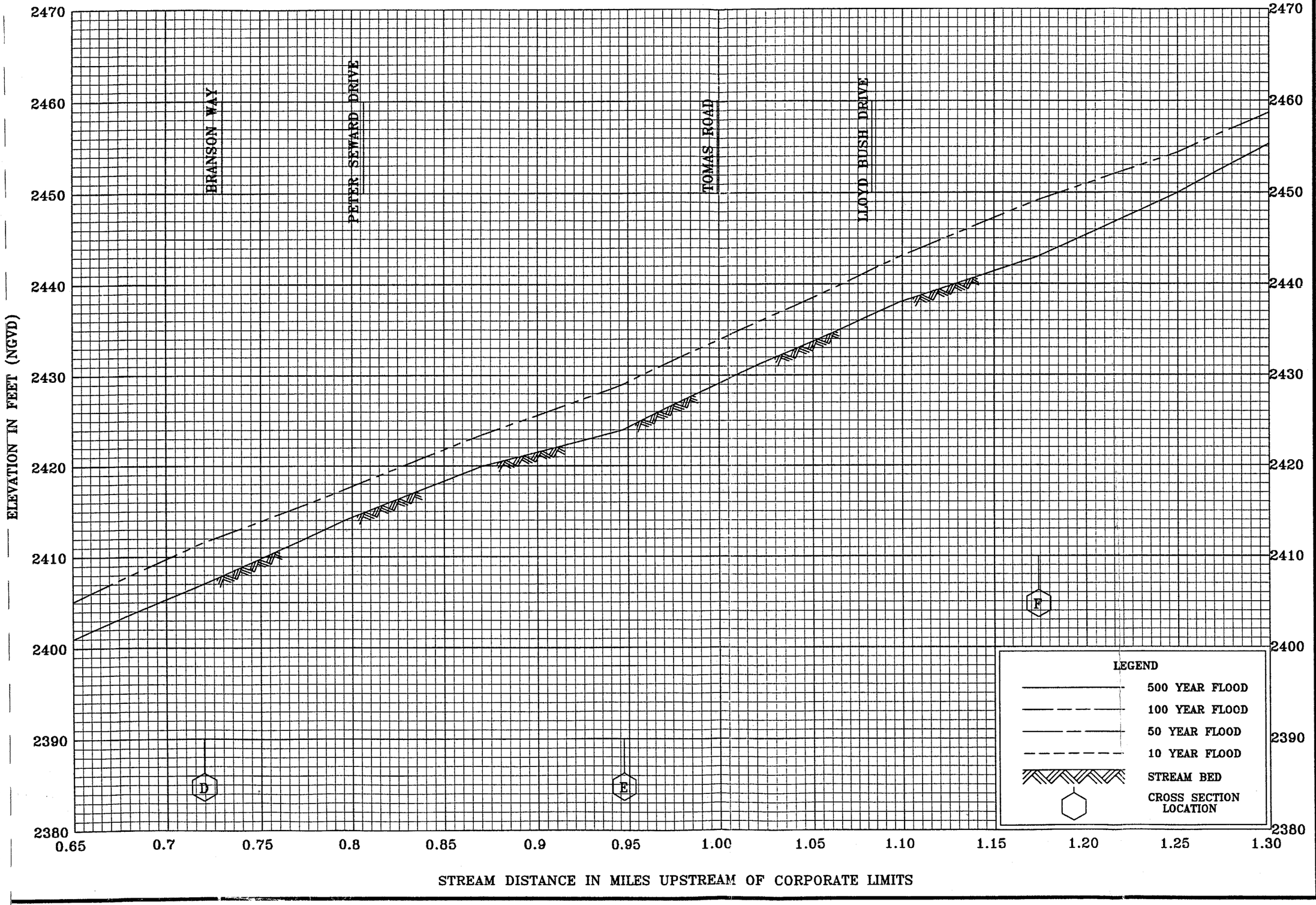
FEDERAL EMERGENCY MANAGEMENT AGENCY

PIMA COUNTY, AZ

AND INCORPORATED AREAS

227P

64



FLOOD PROFILES

CAMINO DE OESTE WASH

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIMA COUNTY, AZ

AND INCORPORATED AREAS

228P

65

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*  HEC-2 WATER SURFACE PROFILES             *
*                                           *
*  Version   4.6.2;  May 1991               *
*                                           *
*  RUN DATE    23SEP99    TIME   09:29:38   *
*********************************************
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**********************************************
*  U.S. ARMY CORPS OF ENGINEERS              *
*  HYDROLOGIC ENGINEERING CENTER             *
*  609 SECOND STREET, SUITE D                *
*  DAVIS, CALIFORNIA 95616-4687              *
*          (916) 756-1104                    *
**********************************************
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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
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XXXXXXX  XXXX     X          XXXXX    XXXXX
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X     X  X        X     X             X
X     X  XXXXXXX   XXXXX              XXXXXXX
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1*****************************************
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*  Version  4.6.2;  May 1991              *
*                                         *
*  RUN DATE    07FEB00    TIME   15:34:57 *
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*****************************************
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*  HYDROLOGIC ENGINEERING CENTER          *
*  609 SECOND STREET, SUITE D             *
*  DAVIS, CALIFORNIA 95616-4687           *
*        (916) 756-1104                   *
*****************************************
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X    X  X       X              X
XXXXXXX  XXXX   X        XXXXX  XXXXX
X    X  X       X              X
X    X  X       X     X        X
X    X  XXXXXXX  XXXXX         XXXXXXX
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1

07FEB00 15:34:57 PAGE 1

THIS RUN EXECUTED 07FEB00 15:34:57

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*************************************
 HEC-2 WATER SURFACE PROFILES

 Version  4.6.2;  May 1991
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T1
T2 ARROYO ENGINEERING
T3      CAMINO DE OESTE WASH
T4 100-YEAR DISCHARGE
T5 ARROYO JOB #PDOT02.1
T5

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
        0        2        0        0       -1        0        0        0     2351        0
J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
       -1        0       -1        0        0        0        0

J3  VARIABLE CODES FOR SUMMARY PRINTOUT
       38        1        8       26       13       14       15       53       54

NC      .06      .06     .035      .1       .3
QT        1     6488

  First cross section downstream of Goret Road
X1        0       13      280      350        0        0        0
GR     2370        0     2358       60     2356       90     2354      120     2354      250
GR     2352      280     2350      300     2350      325     2352      350     2354      395
GR     2366      445     2368      465     2370      485

X1      400       17      430      490      410      400      400
GR     2370        0     2364       40     2360      120     2361      160     2361      290
GR     2360      330     2361      340     2360      350     2360      430     2358      440
GR     2356      450     2356      480     2358      485     2360      490     2370      510
GR     2372      515     2374      540

X1      800       17      600      660      400      440      400
GR     2380        0     2370       30     2368       70     2368      258     2368      430
GR     2366      450     2367      460     2368      470     2367      520     2366      600
GR     2364      605     2362      610     2361      620     2362      630     2364      660
GR     2374      690     2377      740
```

1

07FEB00 15:34:57 PAGE 2

X1	1350	15	410	450	500	630	550				
GR	2380	0	2371	80	2374	160	2374	270	2372	290	
GR	2373	330	2372	360	2371	365	2372	370	2372	390	
GR	2370	410	2370	430	2370	450	2374	570	2380	600	
X1	1750	11	40	110	400	400	400				
GR	2384	0	2380	40	2374	60	2374	90	2378	110	
GR	2379	130	2378	150	2380	190	2380	470	2382	520	
GR	2390	560									

Downstream of pipeline crossing

X1	2150	21	195	320	420	400	400				
GR	2392	0	2390	70	2389	120	2388	170	2388	190	
GR	2390	195	2380	200	2380	205	2382	235	2384	255	
GR	2384	275	2382	280	2381	285	2382	290	2384	320	
GR	2384	490	2382	510	2382	530	2384	550	2384	780	
GR	2390	810									

Salle road termination point in left overbank (downstream of 2650)

X1	2650	14	490	600	550	490	500				
GR	2400	0	2392	30	2392	170	2394	200	2394	230	
GR	2392	360	2390	460	2390	490	2389.5	520	2390	550	
GR	2390	600	2390	640	2390	690	2400	750			

Downstream of Grannen Road crossing

X1	3050	14	300	530	400	400	400				
GR	2410	0	2400	40	2398	50	2396	60	2396	70	
GR	2394	150	2394	210	2396	240	2396	280	2394	300	
GR	2394	340	2396	460	2398	530	2404	560			
X1	3450	12	300	375	400	400	400				
GR	2416	0	2402	60	2402	80	2402	200	2402	300	
GR	2401	325	2400.5	350	2402	375	2404	395	2406	515	
GR	2408	525	2410	565							
X1	3850	14	210	410	400	400	400				
GR	2422	0	2410	50	2410	210	2408	230	2407	240	
GR	2408	250	2410	260	2412	270	2412	280	2410	290	
GR	2408	300	2408	380	2410	410	2420	520			

Peter Steward drive

X1	4250	10	500	600	410	470	400				
GR	2430	0	2416	200	2414	250	2416	300	2416	500	
GR	2414	550	2415	600	2414	680	2414	700	2426	745	
X1	4650	15	530	590	370	480	400				
GR	2434	0	2430	50	2420	120	2420	220	2422	250	
GR	2422	530	2421	560	2422	590	2430	610	2424	640	
GR	2424	650	2430	670	2436	710	2438	740	2440	890	
X1	5050	13	320	480	410	400	400				
GR	2436	0	2426	70	2426	190	2428	320	2424	370	
GR	2426	380	2426	390	2428	480	2430	505	2430	585	
GR	2428	585	2428	635	2446	705					

Tomas road (downstream of cross-section 5450)

X1	5450	10	50	100	400	400	400				
GR	2444	0	2440	40	2436	50	2432	60	2431.3	80	
GR	2432	100	2434	320	2436	350	2438	430	2440	460	

LLoyd Bush drive (downstream side of 5850)

X1	5850	12	30	100	420	400	400				
GR	2450	0	2440	30	2438	40	2439.5	65	2438	90	
GR	2440	100	2441	300	2442	440	2442	500	2441	510	
GR	2442	520	2458	635							
X1	6250	15	90	270	420	400	400				

GR	2456	0	2456	70	2450	90	2444	100	2443	110
GR	2444	120	2446	140	2446	210	2446	240	2448	270
GR	2448	430	2450	455	2450	595	2452	665	2460	745
X1	6650	13	150	270	440	380	400			
GR	2462	0	2452	40	2452	150	2452	210	2450	240
GR	2450	260	2452	270	2452	345	2454	365	2454	375
GR	2456	475	2458	505	2466	565				
X1	7050	10	240	530	400	400	400			
GR	2470	0	2460	90	2460	240	2458	320	2458	350
GR	2458	490	2460	530	2462	540	2462	640	2466	695
X1	7460	11	30	395	420	430	410			
GR	2470	0	2464	30	2466	40	2466	70	2464	170
GR	2464	185	2464	215	2464	335	2464	355	2464	395
GR	2474	465								

Upstream of Ironwood Hill Drive crossing

X1	7860	8	280	360	400	400	400			
GR	2480	0	2470	40	2470	90	2471	280	2472	350
GR	2472	540	2474	620	2480	640				
X1	8260	19	170	250	400	410	400			
GR	2486	0	2480	80	2478	90	2476	100	2478	110
GR	2479	140	2478	170	2477	210	2478	250	2478	350
GR	2478	590	2476	605	2476	615	2480	625	2482	635
GR	2484	660	2486	680	2488	710	2490	760		
X1	8660	9	120	280	400	400	400			
GR	2492	0	2484	120	2482	200	2481.5	230	2482	260
GR	2484	280	2486	330	2486	490	2498	560		
X1	9060	9	70	150	400	400	400			
GR	2500	0	2490	70	2486	90	2485.7	110	2486	130
GR	2490	150	2492	310	2492	380	2502	430		
X1	9460	14	160	220	400	400	400			
GR	2510	0	2500	60	2498	80	2496	100	2496	110
GR	2498	130	2496	160	2492	180	2491	200	2492	220
GR	2496	240	2498	270	2500	330	2520	390		
X1	9860	11	160	270	400	400	400			
GR	2516	0	2506	40	2504	60	2504	70	2504	140
GR	2500	160	2499	185	2499	210	2500	240	2500	270
GR	2510	320								
X1	10260	8	80	220	410	400	400			
GR	2520	0	2510	80	2506	120	2508	180	2507	220
GR	2508	250	2510	300	2520	320				
X1	10660	8	110	160	410	400	400			
GR	2530	0	2520	60	2512	110	2511	130	2511	145
GR	2512	160	2520	210	2530	250				
X1	11060	9	60	90	380	420	400			
GR	2550	0	2540	10	2530	30	2520	60	2518	70
GR	2517	80	2518	90	2520	110	2530	180		

X1	11460	10	50	120	400	400	400			
GR	2550	0	2540	20	2530	50	2526	70	2525.5	90
GR	2526	110	2528	120	2530	150	2540	190	2550	230

X1	11860	11	210	270	480	380	400			
GR	2550	0	2540	50	2538	70	2538	200	2537	210
GR	2536	220	2534	240	2536	260	2538	270	2540	280
GR	2550	320								
X1	12260	11	110	170	400	400	400			
GR	2552	0	2550	20	2544	50	2544	90	2542	110
GR	2540	120	2540	160	2542	170	2542	330	2550	360
GR	2552	400								
X1	12700	14	150	240	440	440	440			
GR	2560	0	2554	30	2554	40	2556	50	2556	80
GR	2554	100	2552	120	2550	150	2546	170	2545.5	195
GR	2546	210	2550	240	2552	340	2560	370		
X1	13100	12	120	230	400	430	400			
GR	2570	0	2566	30	2566	100	2560	120	2554	140
GR	2554	160	2556	190	2555	210	2556	220	2558	230
GR	2560	260	2570	310						
X1	13500	15	215	265	400	395	400			
GR	2580	0	2578	70	2576	150	2574	175	2564	215
GR	2563	235	2563	245	2564	265	2564	405	2566	445
GR	2566	535	2564	545	2564	565	2570	585	2580	625
X1	13900	16	130	180	400	400	400			
GR	2584	0	2570	130	2569	155	2570	180	2574	230
GR	2576	220	2580	290	2580	340	2578	440	2577	450
GR	2576	470	2576	490	2578	520	2578	540	2580	550
GR	2584	610								
X1	14300	16	120	190	420	410	400			
GR	2590	0	2582	40	2580	50	2580	80	2582	90
GR	2582	120	2580	130	2580	190	2588	230	2588	280
GR	2586	300	2584	360	2582	370	2580	380	2588	430
GR	2590	470								

X1	14700	14	490	550	400	400	400			
GR	2610	0	2600	50	2592	80	2592	100	2594	150
GR	2594	230	2594	460	2592	480	2590	490	2589.5	520
GR	2590	550	2592	590	2592	630	2600	660		
X1	15100	24	560	650	400	400	400			
GR	2606	0	2604	110	2602	190	2600	200	2602	230
GR	2604	250	2604	320	2602	420	2602	500	2600	560
GR	2598	570	2596	580	2595	600	2595	620	2596	630
GR	2598	640	2600	650	2602	670	2602	710	2604	720
GR	2604	760	2606	780	2608	820	2610	840		

Downstream face of W. Speedway 7 cell box culvert

X1	15330	10	450	560	230	230	230			
X3	10									
GR	2610	0	2608	200	2608	320	2610	390	2610	450
GR	2598.7	450	2598.7	550	2602	560	2610	560	2612	670
SC	7.012	.5	2.6	0	8	12	45.6	9.2	2599.3	2598.69

Upstream face of W. Speedway 7 cell box culvert

X1	15380	10	120	210	50	50	50			
X2	0	0	2	2608	2608.38	0	0	1.33	0	
X3	10									
BT	9	0	2609.5		180	2608		410	2609	
BT	430	2609.8		440	2610		520	2610.2		530
BT	2610.3		540	2610.3		600	2611			
GR	2608	0	2610	70	2610	120	2599.3	120	2599.3	130
GR	2599.3	200	2599.3	210	2610	210	2611	290	2612	320

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X1    15780       16       350       460       420       390       400
GR     2620        0      2618        40      2618       120      2616       210      2614       270
GR     2612      310      2612       350      2610       400      2608       410      2607       430
GR     2608      460      2610       470      2612       490      2612       530      2620       560
GR     2622      580

QT        1     4410
X1    16230       10       170       240       450       450       450
GR     2628        0      2626        70      2624        90      2622       140      2620       170
GR     2616      190      2614       200      2614       210      2620       240      2636       280

X1    16630       13       350       440       420       380       400
GR     2640        0      2638        30      2636        80      2634       130      2632       190
GR     2630      240      2628       320      2626       350      2624       370      2620       390
GR     2620      420      2624       440      2636       510
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X1    17030       18       230       350       400       440       400
GR     2640        0      2632        40      2632        60      2634        70      2634       120
GR     2632      130      2630       140      2630       220      2628       230      2626       240
GR     2626      250      2628       280      2628       290      2626       300      2626       330
GR     2628      350      2630       360      2638       400

X1    17430       11       130       285       405       430       400
GR     2642        0      2640        10      2636        60      2634       130      2632       180
GR     2632      220      2630       240      2630       265      2640       285      2650       305
GR     2660      385

X1    17830       10        30       110       440       420       400
GR     2650        0      2648        30      2640        70      2642        90      2642       100
GR     2640      110      2640       120      2642       140      2648       180      2650       220

  Upstream of Camino de Oeste Road crossing

X1    18230       10        20       130       440       410       400
GR     2660        0      2650        20      2650        50      2652        80      2654       110
GR     2655      130      2656       230      2658       310      2658       340      2660       360
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


*PROF 1
0

CCHV=     .100 CEHV=     .300
*SECNO  .000
3720 CRITICAL DEPTH ASSUMED
      .000      6.09   2356.09   2356.09   2351.00   2357.54      1.45       .00       .00   2352.00
    6488.0    1462.0    4368.1     657.9     397.8     381.5     148.3        .0        .0   2352.00
       .00      3.67     11.45      4.44       .060      .035      .060       .000   2350.00     88.60
   .007605        0.        0.        0.         0        28         0       .00    315.13    403.72


*SECNO 400.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
   400.000      6.82   2362.82   2362.82       .00   2364.00      1.18      2.85       .03   2360.00
    6488.0    2630.0    3839.3      18.7     774.2     349.3       8.0       9.6       3.5   2360.00
       .01      3.40     10.99      2.34       .060      .035      .060       .000   2356.00     63.57
   .006567      410.      400.      400.        20         8         0       .00    432.07    495.64


*SECNO 800.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
   800.000      8.38   2369.38   2369.38       .00   2370.38       .99      2.14       .02   2366.00
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6488.0	2335.7	4018.2	134.0	936.9	403.0	43.5	21.2	8.4	2364.00
.03	2.49	9.97	3.08	.060	.035	.060	.000	2361.00	42.35
.004444	400.	400.	440.	20	17	0	.00	633.80	676.15

*SECNO 1350.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

1350.000	4.66	2374.66	2374.66	.00	2375.64	.97	3.50	.00	2370.00
6488.0	2703.5	2241.7	1542.8	648.4	186.5	320.6	36.6	15.3	2370.00
.05	4.17	12.02	4.81	.060	.035	.060	.000	2370.00	47.44
.010286	500.	550.	630.	20	11	0	.00	525.87	573.31

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 1750.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

1750.000	7.53	2381.53	2381.53	.00	2382.79	1.25	3.00	.08	2380.00
6488.0	18.4	4525.6	1944.0	11.8	427.4	681.9	47.1	20.0	2378.00
.06	1.56	10.59	2.85	.060	.035	.060	.000	2374.00	24.65
.005708	400.	400.	400.	20	14	0	.00	483.71	508.37

*SECNO 2150.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

2150.000	5.42	2385.42	2385.42	.00	2386.33	.91	3.26	.03	2390.00
6488.0	.0	3563.1	2924.9	.0	368.1	739.6	57.3	24.9	2384.00
.08	.00	9.68	3.95	.000	.035	.060	.000	2380.00	197.29
.012562	420.	400.	400.	8	13	0	.00	589.83	787.11

*SECNO 2650.000

3265 DIVIDED FLOW

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

2650.000	3.35	2392.85	2392.85	.00	2393.83	.98	6.46	.02	2390.00
6488.0	1627.1	3312.0	1548.9	418.9	328.2	280.6	69.7	31.6	2390.00
.10	3.88	10.09	5.52	.060	.035	.060	.000	2389.50	26.82
.013151	550.	500.	490.	4	14	0	.00	558.06	707.08

*SECNO 3050.000

3050.000	3.60	2397.60	.00	.00	2398.17	.57	4.30	.04	2394.00
6488.0	2958.8	3529.2	.0	641.0	501.3	.0	79.6	36.3	2398.00
.12	4.62	7.04	.00	.060	.035	.000	.000	2394.00	51.99
.008952	400.	400.	400.	3	0	0	.00	464.10	516.09

*SECNO 3450.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3450.000	4.04	2404.54	2404.54	.00	2405.72	1.18	4.51	.18	2402.00
6488.0	3439.2	2916.0	132.8	622.3	252.7	39.3	89.1	40.2	2402.00
.13	5.53	11.54	3.38	.060	.035	.060	.000	2400.50	49.13

.014650	400.	400.	400.	20	8	0	.00	377.99	427.12

*SECNO 3850.000

3265 DIVIDED FLOW

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3850.000	4.61	2411.61	2411.61	.00	2412.87	1.26	5.26	.02	2410.00
6488.0	967.5	5487.3	33.2	263.1	566.8	14.3	97.2	43.6	2410.00
.14	3.68	9.68	2.33	.060	.035	.060	.000	2407.00	43.29
.011862	400.	400.	400.	3	11	0	.00	370.53	427.72

*SECNO 4250.000

3301 HV CHANGED MORE THAN HVINS

4250.000	3.37	2417.37	.00	.00	2418.12	.75	5.19	.05	2416.00
6488.0	2200.9	2442.0	1845.0	523.9	261.8	318.1	106.5	47.9	2415.00
.16	4.20	9.33	5.80	.060	.035	.060	.000	2414.00	180.45
.013378	410.	400.	470.	4	0	0	.00	532.18	712.63

*SECNO 4650.000

4650.000	3.54	2423.54	.00	.00	2424.22	.67	6.09	.01	2422.00
6488.0	5352.8	1127.3	7.9	907.0	122.6	3.0	116.1	52.5	2422.00
.18	5.90	9.19	2.67	.060	.035	.060	.000	2420.00	95.19
.018082	370.	400.	480.	4	0	0	.00	498.67	593.86

*SECNO 5050.000

3265 DIVIDED FLOW

5050.000	5.03	2429.03	.00	.00	2429.69	.67	5.48	.00	2428.00
6488.0	3096.2	3247.4	144.4	659.0	404.4	60.0	126.1	57.1	2428.00
.20	4.70	8.03	2.41	.060	.035	.060	.000	2424.00	48.81
.010421	410.	400.	400.	5	0	0	.00	498.03	639.00

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 5450.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

5450.000	4.68	2435.98	2435.98	.00	2437.20	1.23	4.85	.17	2436.00
6488.0	.0	2386.0	4102.0	.0	192.9	684.3	135.3	60.8	2432.00
.21	.00	12.37	5.99	.000	.035	.060	.000	2431.30	50.06
.014312	400.	400.	400.	3	10	0	.00	299.60	349.66

*SECNO 5850.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

5850.000	5.03	2443.03	2443.03	.00	2444.06	1.02	4.66	.02	2440.00
6488.0	42.9	3196.7	3248.4	13.8	294.8	817.8	144.5	64.5	2440.00
.22	3.11	10.84	3.97	.060	.035	.060	.000	2438.00	20.90
.009677	420.	400.	400.	3	8	0	.00	506.53	527.43

*SECNO 6250.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

6250.000	6.24	2449.24	2449.24	.00	2450.56	1.31	3.93	.09	2450.00
6488.0	.0	5900.3	587.7	.0	614.6	208.9	153.5	68.5	2448.00
.24	.00	9.60	2.81	.000	.035	.060	.000	2443.00	91.26
.009980	420.	400.	400.	6	11	0	.00	354.30	445.56

*SECNO 6650.000

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

6650.000	4.43	2454.43	2454.43	.00	2455.66	1.23	4.71	.01	2452.00
6488.0	1452.2	3954.1	1081.7	279.1	371.6	219.8	161.3	71.8	2452.00
.25	5.20	10.64	4.92	.060	.035	.060	.000	2450.00	30.28
.013953	440.	400.	380.	4	19	0	.00	366.23	396.51

*SECNO 7050.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

7050.000	2.93	2460.93	2460.93	.00	2461.97	1.04	5.03	.02	2460.00
6488.0	358.8	6125.8	3.4	143.7	730.2	2.2	169.3	75.5	2460.00
.26	2.50	8.39	1.57	.060	.035	.060	.000	2458.00	81.61
.011398	400.	400.	400.	4	14	0	.00	453.05	534.66

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 7460.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

7460.000	2.57	2466.57	2466.57	.00	2467.61	1.04	5.19	.00	2464.00
6488.0	56.6	6351.6	79.8	16.5	768.1	23.1	177.3	79.5	2464.00
.28	3.43	8.27	3.45	.060	.035	.060	.000	2464.00	17.15
.014079	420.	410.	430.	3	11	0	.00	395.84	412.99

*SECNO 7860.000

7860.000	3.22	2473.22	.00	.00	2473.86	.64	6.21	.04	2471.00
6488.0	4503.6	1100.2	884.2	698.5	137.6	249.4	186.0	83.9	2472.00
.30	6.45	8.00	3.55	.060	.035	.060	.000	2470.00	27.12
.017212	400.	400.	400.	3	0	0	.00	561.68	588.80

*SECNO 8260.000

8260.000	3.92	2479.92	.00	.00	2480.63	.71	6.75	.02	2478.00
6488.0	739.1	1887.6	3861.2	152.8	193.6	755.0	196.1	89.1	2478.00
.31	4.84	9.75	5.11	.060	.035	.060	.000	2476.00	80.40
.016239	400.	400.	410.	5	0	0	.00	544.40	624.80

*SECNO 8660.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

8660.000	4.97	2486.47	2486.47	.00	2487.81	1.34	4.49	.19	2484.00
6488.0	118.3	6053.3	316.4	45.8	630.3	149.4	205.0	93.5	2484.00
.33	2.58	9.60	2.12	.060	.035	.060	.000	2481.50	82.94
.008234	400.	400.	400.	3	11	0	.00	409.80	492.74

*SECNO 9060.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

9060.000	7.32	2493.02	2493.02	.00	2494.53	1.50	2.77	.05	2490.00
6488.0	79.7	5279.9	1128.3	32.0	488.0	398.2	213.0	96.9	2490.00
.34	2.49	10.82	2.83	.060	.035	.060	.000	2485.70	48.83
.005905	400.	400.	400.	20	11	0	.00	336.29	385.12

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 9460.000

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

9460.000	8.09	2499.09	2499.09	.00	2501.00	1.90	2.52	.12	2496.00
6488.0	627.2	5023.6	837.2	183.5	405.6	182.6	220.7	99.5	2492.00
.35	3.42	12.39	4.58	.060	.035	.060	.000	2491.00	69.06
.006722	400.	400.	400.	20	8	0	.00	233.74	302.81

*SECNO 9860.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

9860.000	5.37	2504.37	2504.37	.00	2506.27	1.90	3.06	.00	2500.00
6488.0	229.6	6074.1	184.3	78.0	533.5	47.8	227.3	101.7	2500.00
.36	2.94	11.38	3.85	.060	.035	.060	.000	2499.00	56.27
.008761	400.	400.	400.	20	14	0	.00	235.60	291.87

*SECNO 10260.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

10260.000	4.97	2510.97	2510.97	.00	2512.58	1.61	4.12	.03	2510.00
6488.0	6.3	5403.3	1078.4	3.8	495.6	203.4	233.6	103.8	2507.00
.37	1.68	10.90	5.30	.060	.035	.060	.000	2506.00	72.25
.012250	410.	400.	400.	14	11	0	.00	229.69	301.94

*SECNO 10660.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

10660.000	7.51	2518.51	2518.51	.00	2521.18	2.67	4.03	.32	2512.00
6488.0	655.5	5177.0	655.5	132.5	358.0	132.5	239.7	105.5	2512.00
.38	4.95	14.46	4.95	.060	.035	.060	.000	2511.00	69.31
.008416	410.	400.	400.	20	14	0	.00	131.38	200.69

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 11060.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

11060.000	9.43	2526.43	2526.43	.00	2529.35	2.92	3.47	.08	2520.00
6488.0	303.0	4146.8	2038.2	62.0	252.8	293.2	245.4	106.6	2518.00
.39	4.89	16.40	6.95	.060	.035	.060	.000	2517.00	40.72
.008815	380.	400.	420.	20	11	0	.00	114.28	154.99

*SECNO 11460.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

11460.000	7.20	2532.70	2532.70	.00	2535.27	2.57	3.58	.04	2530.00
6488.0	30.6	5788.8	668.6	11.0	429.3	125.7	250.8	107.7	2528.00
.40	2.79	13.49	5.32	.060	.035	.060	.000	2525.50	41.89
.009091	400.	400.	400.	20	15	0	.00	118.93	160.82

*SECNO 11860.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

11860.000	7.08	2541.08	2541.08	.00	2542.71	1.62	3.70	.09	2537.00
6488.0	2329.4	4077.2	81.5	481.1	329.9	23.2	257.6	109.5	2538.00
.41	4.84	12.36	3.52	.060	.035	.060	.000	2534.00	44.59
.008815	480.	400.	380.	20	8	0	.00	239.74	284.33

*SECNO 12260.000

12260.000	5.11	2545.11	2545.09	.00	2546.53	1.42	3.80	.02	2542.00
6488.0	296.9	3476.9	2714.2	89.4	286.3	515.0	265.5	111.9	2542.00
.42	3.32	12.14	5.27	.060	.035	.060	.000	2540.00	44.47
.010268	400.	400.	400.	4	19	0	.00	297.17	341.65

*SECNO 12700.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3720 CRITICAL DEPTH ASSUMED

12700.000	7.18	2552.68	2552.68	.00	2554.51	1.83	3.75	.12	2550.00
6488.0	152.2	5834.9	500.9	52.8	511.5	169.2	273.7	114.6	2550.00
.43	2.88	11.41	2.96	.060	.035	.060	.000	2545.50	113.17
.007189	440.	440.	440.	20	11	0	.00	229.39	342.56

*SECNO 13100.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

13100.000	6.33	2560.33	2560.33	.00	2562.52	2.20	3.37	.11	2560.00
6488.0	.1	6369.1	118.8	.2	531.1	40.1	279.8	116.4	2558.00
.44	.72	11.99	2.96	.060	.035	.060	.000	2554.00	118.91
.009923	400.	400.	430.	20	11	0	.00	142.73	261.64

*SECNO 13500.000

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

13500.000	4.09	2567.09	2567.09	.00	2568.28	1.19	4.83	.10	2564.00
6488.0	76.5	2304.8	4106.7	19.1	184.7	714.2	286.6	118.7	2564.00
.45	4.00	12.48	5.75	.060	.035	.060	.000	2563.00	202.62
.015143	400.	400.	395.	14	14	0	.00	372.69	575.31

*SECNO 13900.000

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

13900.000	7.66	2576.66	2576.66	.00	2578.86	2.20	4.09	.31	2570.00
6488.0	972.0	4841.4	674.6	206.0	358.0	148.9	294.1	121.3	2570.00
.46	4.72	13.52	4.53	.060	.035	.060	.000	2569.00	68.15
.007357	400.	400.	400.	20	14	0	.00	199.91	499.91

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 14300.000

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

14300.000	4.51	2584.51	2584.51	.00	2586.15	1.64	3.77	.06	2582.00
6488.0	1871.5	3809.9	806.6	296.5	305.7	168.5	301.0	123.4	2580.00
.48	6.31	12.46	4.79	.060	.035	.060	.000	2580.00	27.45
.012120	420.	400.	410.	20	11	0	.00	248.57	408.18

*SECNO 14700.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

14700.000	5.55	2595.05	2595.05	.00	2596.08	1.03	3.57	.06	2590.00
6488.0	1680.8	3393.0	1414.1	588.6	318.1	301.6	310.1	127.2	2590.00
.49	2.86	10.67	4.69	.060	.035	.060	.000	2589.50	68.56
.006829	400.	400.	400.	20	8	0	.00	572.89	641.44

*SECNO 15100.000

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

15100.000	7.65	2602.65	2602.65	.00	2604.22	1.58	2.47	.16	2600.00
6488.0	513.3	5853.5	121.2	237.0	553.1	59.8	319.6	131.7	2600.00
.50	2.17	10.58	2.03	.060	.035	.060	.000	2595.00	164.19
.005591	400.	400.	400.	20	15	0	.00	397.75	713.23

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 15330.000

3301 HV CHANGED MORE THAN HVINS

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 2610.00 ELREA= 2610.00

15330.000	5.22	2603.92	.00	.00	2606.02	2.10	1.64	.16	2610.00
6488.0	.0	6488.0	.0	.0	558.3	.0	323.3	133.0	2610.00
.51	.00	11.62	.00	.000	.035	.000	.000	2598.70	450.00
.009395	230.	230.	230.	1	0	0	.00	110.00	560.00

SPECIAL CULVERT

SC	CUNO	CUNV	ENTLC	COFQ	RDLEN	RISE	SPAN	CULVLN	CHRT	SCL	ELCHU	ELCHD
	7	.012	.50	2.60	.00	8.00	12.00	45.60	9	2	2599.30	2598.69

CHART 9 - BOX CULVERT WITH FLARED WINGWALL AND INLET TOP EDGE BEVEL
SCALE 2 - WINGWALL FLARED 18 TO 33.7 DEGREES; INLET TOP EDGE BEVEL = 0.083D

*SECNO 15380.000

SPECIAL CULVERT OUTLET CONTROL + WEIR FLOW EG = 2608.93

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.81

SPECIAL CULVERT

EGIC	EGOC	H4	QWEIR	QCULV	VCH	ACULV	ELTRD	WEIRLN
2608.12	2609.28	2.91	269.	6154.	8.460	672.0	2608.38	326.

3495 OVERBANK AREA ASSUMED NON-EFFECTIVE, ELLEA= 2610.00 ELREA= 2610.00

15380.000	8.52	2607.82	.00	.00	2608.93	1.11	2.91	.00	2610.00
6488.0	.0	6488.0	.0	.0	766.9	.0	324.1	133.1	2610.00
.51	.00	8.46	.00	.000	.035	.000	.000	2599.30	120.00
.002875	50.	50.	50.	3	0	0	.00	90.00	210.00

*SECNO 15780.000

3301 HV CHANGED MORE THAN HVINS

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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

15780.000	6.66	2613.66	2613.66	.00	2615.31	1.65	1.91	.16	2612.00
6488.0	282.6	5417.0	788.4	94.0	487.7	171.4	331.0	134.7	2608.00
.52	3.01	11.11	4.60	.060	.035	.060	.000	2607.00	276.78
.009427	420.	400.	390.	20	15	0	.00	259.45	536.23

*SECNO 16230.000

3301 HV CHANGED MORE THAN HVINS

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

16230.000	7.66	2621.66	2621.66	.00	2623.96	2.30	4.29	.20	2620.00
4410.0	44.5	4358.4	7.1	20.7	356.2	3.4	336.9	136.6	2620.00
.53	2.15	12.23	2.05	.060	.035	.060	.000	2614.00	145.09
.009700	450.	450.	450.	20	8	0	.00	99.06	244.15

*SECNO 16630.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

16630.000	6.20	2626.20	2626.20	.00	2628.26	2.05	4.14	.02	2626.00
4410.0	.2	4370.8	39.0	.3	378.4	14.2	340.4	137.5	2624.00
.54	.57	11.55	2.75	.060	.035	.060	.000	2620.00	346.93
.011047	420.	400.	380.	3	15	0	.00	105.93	452.86

*SECNO 17030.000

3301 HV CHANGED MORE THAN HVINS

17030.000	4.68	2630.68	2630.40	.00	2631.87	1.19	3.53	.09	2628.00
4410.0	139.5	4220.0	50.5	72.6	471.9	18.0	344.8	139.1	2628.00
.55	1.92	8.94	2.81	.060	.035	.060	.000	2626.00	136.59
.007189	400.	400.	440.	2	19	0	.00	226.83	363.41

*SECNO 17430.000
7185 MINIMUM SPECIFIC ENERGY
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

3720 CRITICAL DEPTH ASSUMED

17430.000	4.98	2634.98	2634.98	.00	2636.46	1.49	3.66	.09	2634.00
4410.0	28.2	4381.8	.0	16.7	446.7	.0	349.6	141.0	2640.00
.57	1.69	9.81	.00	.060	.035	.000	.000	2630.00	95.80
.012049	405.	400.	430.	1	8	0	.00	179.15	274.95

*SECNO 17830.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

17830.000	5.49	2645.49	2645.49	.00	2647.34	1.85	5.39	.11	2648.00
4410.0	.0	2978.6	1431.4	.0	245.2	185.5	353.7	142.4	2640.00
.58	.00	12.15	7.72	.000	.035	.060	.000	2640.00	42.53
.014891	440.	400.	420.	20	8	0	.00	120.76	163.29

*SECNO 18230.000
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

18230.000	5.57	2655.57	2655.57	.00	2657.24	1.67	5.10	.02	2650.00
4410.0	147.7	4243.8	18.5	31.1	403.1	16.4	357.8	143.8	2655.00
.59	4.76	10.53	1.12	.060	.035	.060	.000	2650.00	8.85
.010907	440.	400.	410.	12	5	0	.00	178.47	187.32

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

CAMINO DE OESTE WASH

SUMMARY PRINTOUT

	SECNO	CWSEL	DEPTH	VCH	QLOB	QCH	QROB	SSTA	ENDST
*	.000	2356.09	6.09	11.45	1462.00	4368.11	657.89	88.60	403.72
*	400.000	2362.82	6.82	10.99	2630.01	3839.34	18.65	63.57	495.64
*	800.000	2369.38	8.38	9.97	2335.74	4018.22	134.04	42.35	676.15
*	1350.000	2374.66	4.66	12.02	2703.54	2241.69	1542.78	47.44	573.31
*	1750.000	2381.53	7.53	10.59	18.41	4525.61	1943.98	24.65	508.37
*	2150.000	2385.42	5.42	9.68	.00	3563.08	2924.92	197.29	787.11
*	2650.000	2392.85	3.35	10.09	1627.15	3311.99	1548.87	26.82	707.08
	3050.000	2397.60	3.60	7.04	2958.84	3529.16	.00	51.99	516.09
*	3450.000	2404.54	4.04	11.54	3439.21	2915.97	132.81	49.13	427.12
*	3850.000	2411.61	4.61	9.68	967.48	5487.30	33.22	43.29	427.72
	4250.000	2417.37	3.37	9.33	2200.93	2442.03	1845.04	180.45	712.63
	4650.000	2423.54	3.54	9.19	5352.79	1127.26	7.95	95.19	593.86
	5050.000	2429.03	5.03	8.03	3096.18	3247.38	144.44	48.81	639.00
*	5450.000	2435.98	4.68	12.37	.00	2385.98	4102.01	50.06	349.66
*	5850.000	2443.03	5.03	10.84	42.85	3196.70	3248.44	20.90	527.43
*	6250.000	2449.24	6.24	9.60	.00	5900.28	587.72	91.26	445.56
*	6650.000	2454.43	4.43	10.64	1452.19	3954.06	1081.74	30.28	396.51

	SECNO	CWSEL	DEPTH	VCH	QLOB	QCH	QROB	SSTA	ENDST
*	7050.000	2460.93	2.93	8.39	358.81	6125.78	3.41	81.61	534.66
*	7460.000	2466.57	2.57	8.27	56.61	6351.62	79.76	17.15	412.99
	7860.000	2473.22	3.22	8.00	4503.56	1100.22	884.22	27.12	588.80
	8260.000	2479.92	3.92	9.75	739.15	1887.61	3861.24	80.40	624.80
*	8660.000	2486.47	4.97	9.60	118.25	6053.33	316.42	82.94	492.74
*	9060.000	2493.02	7.32	10.82	79.74	5279.94	1128.33	48.83	385.12
*	9460.000	2499.09	8.09	12.39	627.23	5023.56	837.21	69.06	302.81
*	9860.000	2504.37	5.37	11.38	229.57	6074.15	184.28	56.27	291.87
*	10260.000	2510.97	4.97	10.90	6.31	5403.28	1078.41	72.25	301.94
*	10660.000	2518.51	7.51	14.46	655.52	5176.96	655.52	69.31	200.69
*	11060.000	2526.43	9.43	16.40	303.02	4146.78	2038.19	40.72	154.99
*	11460.000	2532.70	7.20	13.49	30.57	5788.84	668.59	41.89	160.82
*	11860.000	2541.08	7.08	12.36	2329.38	4077.16	81.46	44.59	284.33
	12260.000	2545.11	5.11	12.14	296.86	3476.91	2714.23	44.47	341.65
*	12700.000	2552.68	7.18	11.41	152.20	5834.89	500.92	113.17	342.56
*	13100.000	2560.33	6.33	11.99	.13	6369.12	118.75	118.91	261.64
*	13500.000	2567.09	4.09	12.48	76.51	2304.80	4106.69	202.62	575.31
*	13900.000	2576.66	7.66	13.52	972.02	4841.42	674.56	68.15	499.91
*	14300.000	2584.51	4.51	12.46	1871.50	3809.94	806.56	27.45	408.18
*	14700.000	2595.05	5.55	10.67	1680.84	3393.03	1414.13	68.56	641.44
*	15100.000	2602.65	7.65	10.58	513.30	5853.48	121.23	164.19	713.23
	15330.000	2603.92	5.22	11.62	.00	6488.00	.00	450.00	560.00
*	15380.000	2607.82	8.52	8.46	.00	6488.00	.00	120.00	210.00
*	15780.000	2613.66	6.66	11.11	282.62	5416.96	788.42	276.78	536.23
*	16230.000	2621.66	7.66	12.23	44.50	4358.43	7.07	145.09	244.15
*	16630.000	2626.20	6.20	11.55	.18	4370.81	39.01	346.93	452.86

	SECNO	CWSEL	DEPTH	VCH	QLOB	QCH	QROB	SSTA	ENDST
	17030.000	2630.68	4.68	8.94	139.48	4219.99	50.53	136.59	363.41
*	17430.000	2634.98	4.98	9.81	28.16	4381.84	.00	95.80	274.95
*	17830.000	2645.49	5.49	12.15	.00	2978.62	1431.38	42.53	163.29
*	18230.000	2655.57	5.57	10.53	147.70	4243.83	18.47	8.85	187.32

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO= .000 PROFILE= 1 CRITICAL DEPTH ASSUMED

CAUTION SECNO= 400.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 400.000 PROFILE= 1 PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO= 400.000 PROFILE= 1 20 TRIALS ATTEMPTED TO BALANCE WSEL

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CAUTION SECNO=    800.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=    800.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=    800.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   1350.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   1350.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   1350.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   1750.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   1750.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   1750.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   2150.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   2150.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   2650.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   2650.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   3450.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   3450.000  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=   3450.000  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=   3850.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   3850.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   5450.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   5450.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   5850.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   5850.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   6250.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   6250.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   6650.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   6650.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   7050.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=   7050.000  PROFILE=  1  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=   7460.000  PROFILE=  1  CRITICAL DEPTH ASSUMED
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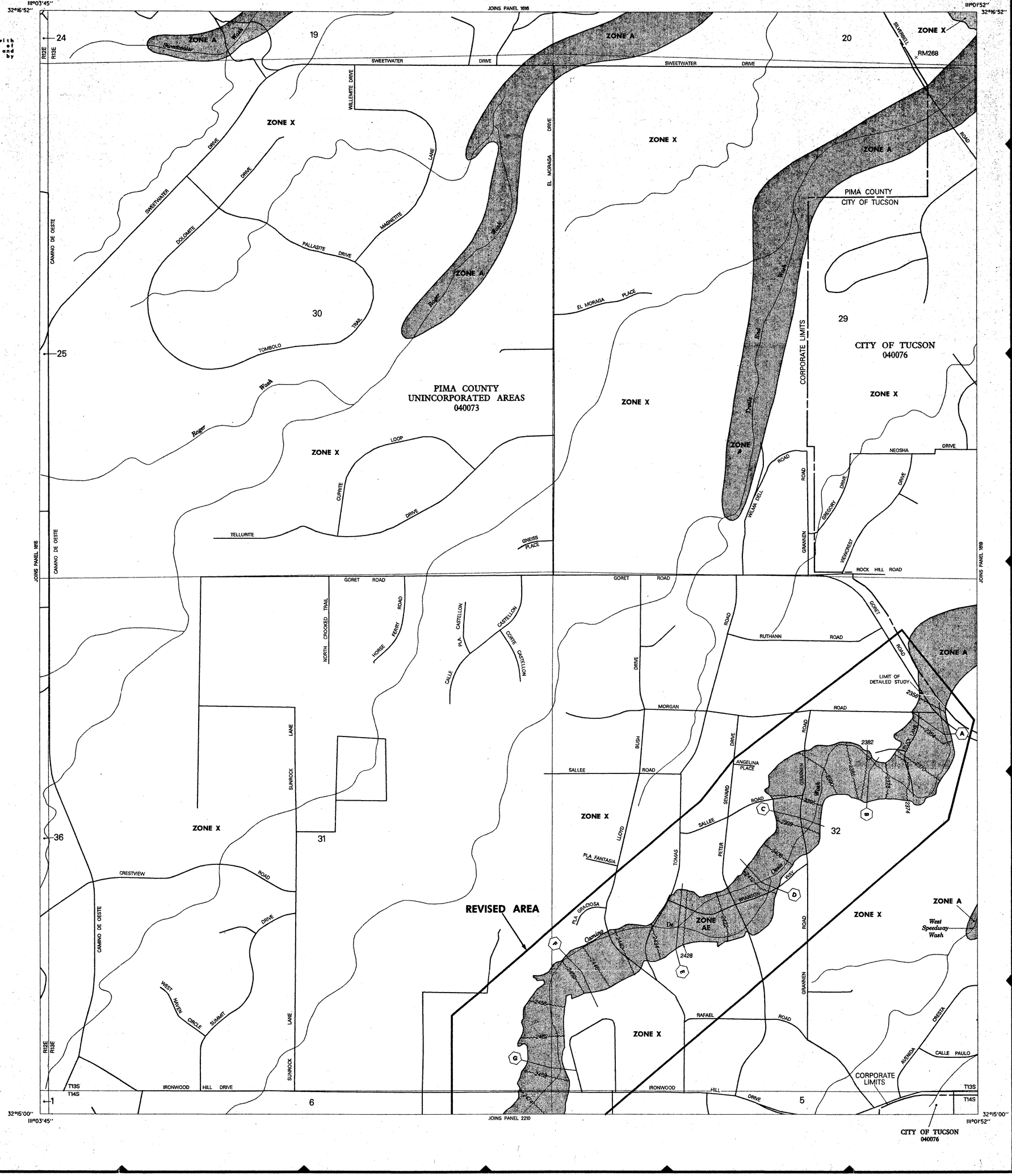


LEGEND

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.

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.

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:
FEBRUARY 8, 1999

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

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when actuarial rates apply to structures in zones where elevations or depths have been established.

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
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

PIMA COUNTY, ARIZONA AND INCORPORATED AREAS

PANEL 1618 OF 4700
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
TUCSON, CITY OF	040076	1618	K
PIMA COUNTY, UNINCORPORATED AREAS	040073	1618	K

REVISED TO REFLECT LOMR DATED APR 26 2000

MAP NUMBER 04019C1618 K

EFFECTIVE DATE: FEBRUARY 8, 1999

Federal Emergency Management Agency

MCLAIN AERIAL MAPPING & SURVEYING, INC
1665 E 18 th STREET TUCSON, ARIZONA
622-7272

1" 200'

CONTOURS AT
2' INTERVALS

CITY OF TUCSON

DEPARTMENT OF TRANSPORTATION, ENGINEERING DIVISION

MAY, 1986

WORK MAP

SHEET 3/3

CAMINO DE OESTE WASH
SECTION 7
FROM WEST SPEEDWAY BLVD
TO CAMINO DE OESTE ROAD

ARROYO ENGINEERING, INC.
Water Resources & Civil Engineering Consultants
290 N. MEYER AVE., TUCSON, ARIZ. 85701, P.O. BOX 2668
PH. (520) 882-0206, FAX (520) 882-2929

LEGEND

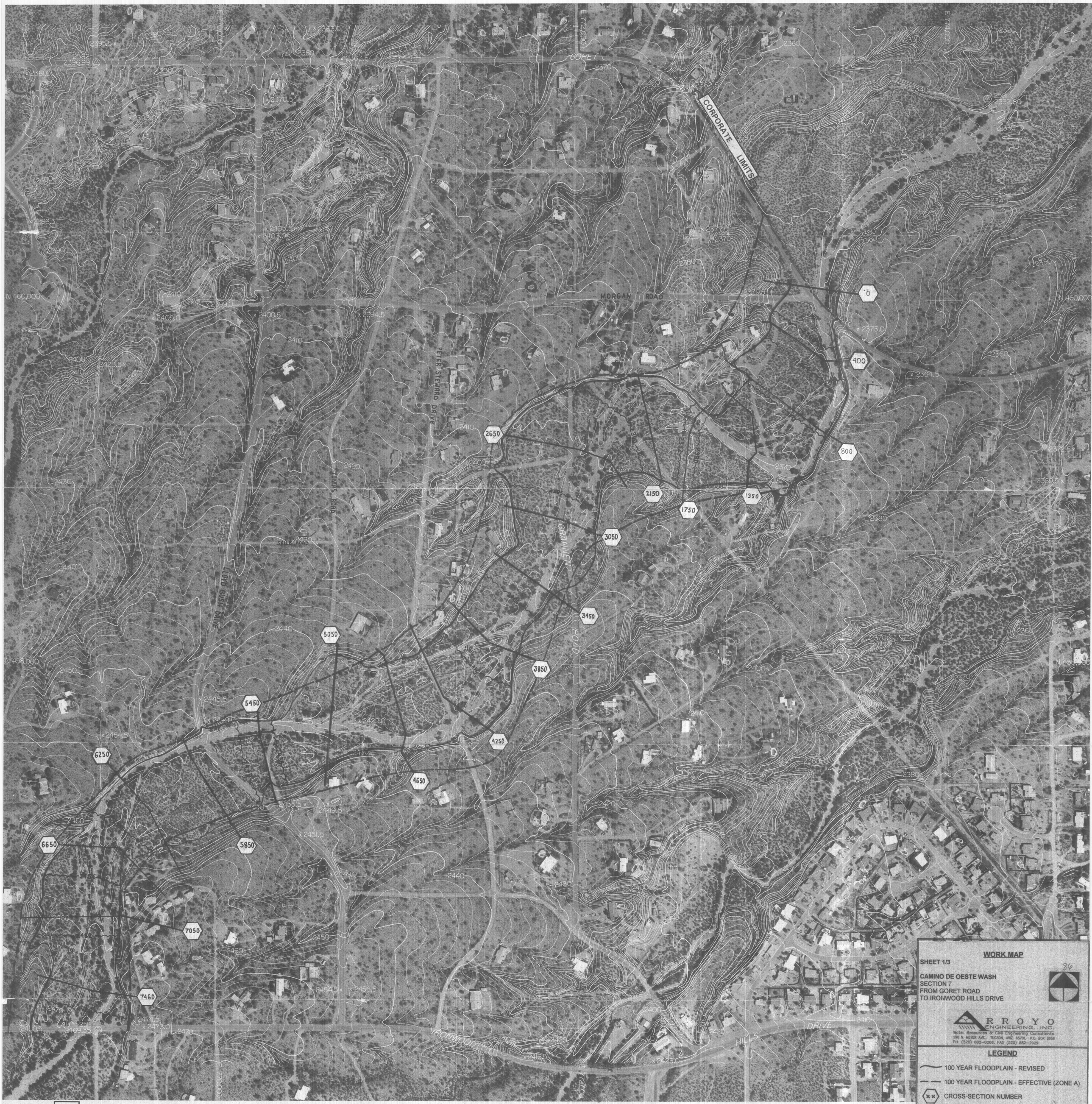
- 100 YEAR FLOODPLAIN - REVISED
- 100 YEAR FLOODPLAIN - EFFECTIVE (ZONE A)
- CROSS-SECTION NUMBER

SECTION MAPS ARE FOR PLANNING AND PRELIMINARY ENGINEERING USE ONLY.

RESALE ONLY BY: MCLAIN AERIAL MAPPING

T.14 S.,R.13 E.

SEC. 7



Cooper Aerial Survey Co.
TUCSON, ARIZONA

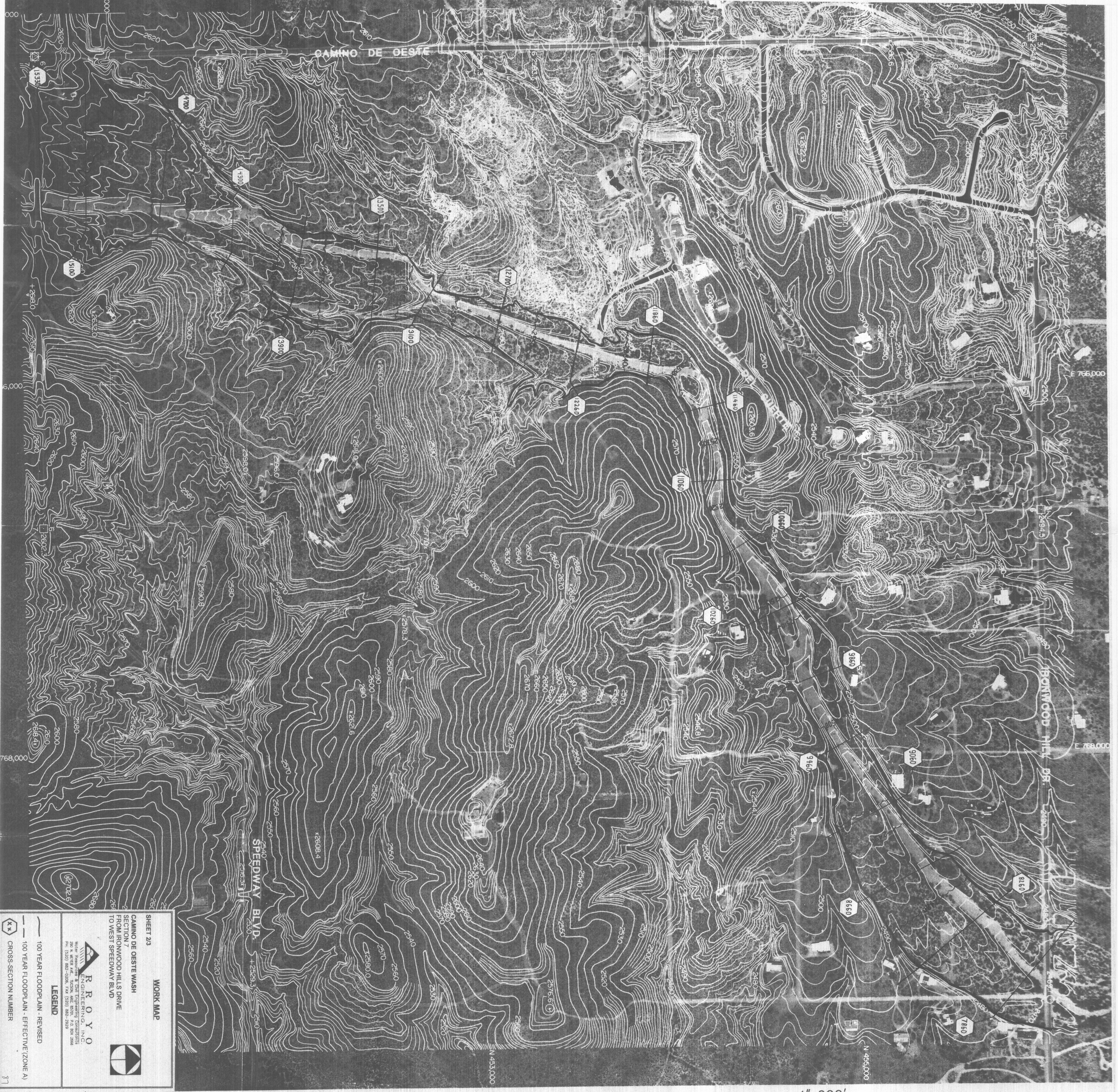
1" = 200' C.I. 2'

PIMA COUNTY

Sept. 20, 1982

SECTION 32
T13S R13E

20-37



WORK MAP

SHEET 2/3

CAMINO DE OESTE WASH
SECTION 7
FROM IRONWOOD HILLS DRIVE
TO WEST SPEEDWAY BLVD

ARROYO ENGINEERING, INC.
Water Resources & Civil Engineering Consultants
280 N. MEYER AVE., TUCSON, ARIZ. 85701, P.O. BOX 2668
PH. (520) 882-0206, FAX (520) 882-2929

LEGEND

100 YEAR FLOODPLAIN - REVISED

100 YEAR FLOODPLAIN - EFFECTIVE (ZONE A)

CROSS-SECTION NUMBER

SECTION MAPS ARE FOR PLANNING AND PRELIMINARY ENGINEERING USE ONLY.

RESALE ONLY BY: McLAIN AERIAL MAPPING

T.14 S.,R.13 E.
SEC. 6

MAY, 1986

CITY OF TUCSON

DEPARTMENT OF TRANSPORTATION, ENGINEERING DIVISION

1" 200'

CONTOURS AT
2' INTERVALS

McLAIN AERIAL MAPPING & SURVEYING INC.
1665 E. 18th STREET, TUCSON, ARIZONA
622-7473