File
M21/D15A

RECEIVED
JUN 02 2005

AYRES ASSOCIATES

June 1, 2005

Mr. Loren Meinz
Albuquerque Metropolitan Arroyo
Flood Control Authority
2600 Prospect Avenue NE
Albuquerque, New Mexico 87101

Re: Review of Proposed Juan Tabo Boulevard Crossing of Tijeras Arroyo

Dear Loren,

This letter summarized our review of the proposed 3-span Juan Tabo Boulevard bridge crossing of Tijeras Arroyo. The review was carried out to address concerns about potential flooding impacts to the Hidden Valley subdivision caused by deposition due to the extreme backwater from the proposed bridge. There were also concerns about long-term maintenance of the channel if the deposition persists. The following steps were carried out as part of our review:

1. Initial review of the proposed bridge design and identification of potential problems
2. Brief review of the HEC-RAS model
3. Sediment continuity analysis to evaluate potential sedimentation problems associated with bridge backwater
4. Review of bridge plans with respect to scour mitigation measures

Initial Review

Bridge plans and hydraulic modeling results were reviewed to become familiar with the bridge design and to identify potential problems. The following general observations resulted from the review:

- Proposed bridge is a 3-span structure with pile-supported abutments and two pile-supported piers
- Bridge width is 280 feet (measured along the alignment of the bridge) and the bridge is skewed 26°16'16" with the alignment of the arroyo (piers are aligned with the flow)
- Bridge and approach embankment create a significant encroachment of the arroyo
- Encroachment causes significant backwater that begins at flows greater than about a 2-year event; flow depths are approximately doubled just upstream of the bridge for the 100-year event
- Model is predicting Class B low flow through the bridge opening (flow passes through critical depth at the bridge) with very severe hydraulic conditions and, therefore, very high scour potential
- Guide banks consisting of shot-crete lined levees direct flow into and through the bridge opening; the levees appear to be aligned well and tied back adequately upstream of the bridge
- Channel bottom is lined with shot-crete beneath the bridge opening

Owen Ayres & Associates, Inc
Engineers/Scientists/Surveyors
3665 JFK Parkway Building 2 Suite 200 P O Box 270460 Fort Collins CO 80527
(970) 223 5556 Denver Metro (303) 572-1806 FAX (970) 223-5578

Printed on recycled paper

Review of HEC-RAS Model

A brief review of the HEC-RAS hydraulic model developed to support the bridge design was carried out to identify any significant modeling deficiencies. The following are general comments and observations regarding the modeling:

- Cross-section spacing in the model is too high; there are many warnings related to this in the output. To determine the potential effects of the cross section spacing on the results, we re-ran the model with interpolated cross sections and compared the results with the original model. In general the results with the interpolated cross sections did not change significantly, although there were three or four cross sections with significant differences (computed water-surface elevations of the 100-year event up to 1.6 feet different).
- The model was run in "mixed" flow-regime mode; there were some very high Froude Numbers downstream of the bridge (up to 2.2 for the 100-year event). This is unlikely for a sand-bed channel bed such as Tijeras Arroyo, and water-surface elevations should be based on the sequent depth as described in the AMAFCA Sediment and Erosion Design Guide (Design Guide, Mussetter et al. 1994, Chapter 3).
- Selection of bank stations seemed inconsistent.
- Selected main-channel Manning's n = 0.035 and overbank n = 0.045 are reasonable. The main-channel n was lowered to 0.02 through the bridge opening, presumably to reflect the shot-crete lined channel. This may not be a good assumption (at least for evaluating water-surface rise) as sediment will likely cover the shot-crete from transport upstream.
- Bridge deck is significantly above the computed water-surface elevations so there is no pressure or weir flow. The low-flow hydraulics through the bridge were modeled by selecting the highest energy solution between the energy, momentum, and Yarnell methods. The momentum equation governed which is reasonable for the flow conditions. The Yarnell method is not appropriate for the flow conditions at this location.

Sediment Continuity Analysis

We performed a simple sediment continuity analysis to evaluate sediment transport rates and potential aggradation volumes in the backwater area upstream of the bridge. Flow hydrographs for the 2- through 100-year events were taken from a previous Ayres study of Tijeras Arroyo just upstream (Ayres Associates 1999). Hydraulics were based on the HEC-RAS model provided to us, but run in subcritical mode with additional flows to capture the entire range of flows up through the 100-year peak. By running the model in subcritical mode the solution at many of the cross sections defaults to critical depth, which we believe to be more representative of actual hydraulic conditions than the supercritical solution that results at many of these cross sections when the model is run in "mixed" flow-regime mode.

Three subreaches were identified for carrying out the sediment continuity analysis: Sub-reach 1: "supply" reach upstream of bridge backwater; Sub-reach 2: backwater area upstream of bridge; and Sub-reach 3: representative reach downstream of bridge encroachment. The hydraulic results in each sub-reach were averaged for use in the sediment transport calculations. We used the MPM-Woo regression equation from the Design Guide to compute sediment transport rates. A median diameter sediment size of 2.45mm was used in the calculations based on the Ayres study just upstream (Ayres Associates 1999).

Sub-reach 1 was used to estimate the sediment supply to the backwater area upstream of the bridge (Sub-reach 2). This reach represents current conditions upstream of the backwater area, and provides a reasonable means to estimate the short-term sediment supply to the bridge. Due to upstream watershed conditions this reach is currently degrading, which means that long-term sediment supply will decrease. There is a significant volume of sediment stored in the reach between the proposed bridge and a grade-control structure located upstream, however, and the short-term sediment supply based on current conditions provides a reasonable, if somewhat conservative, estimate of what could occur in a single storm event in the short- to medium-term future.

Table 1 summarizes the sediment continuity results. The following general observations can be drawn from the data:

- Due to the short duration of the storm hydrographs (6 hours), the sediment volumes are not that significant when compared to typical representative reaches along the arroyo.
- Due to the short reach length of the backwater area upstream of the bridge (Sub-reach 2), there is a potential for significant local aggradation in this area for the larger flood events (greater than about the 10-year event). Computed average aggradation depths are greater than 4 feet for the 50- and 100-year events. This amount of aggradation would result in significant changes in computed water-surface elevations.
- Due to the relatively small sediment volumes, downstream impacts of the stored sediment upstream of the bridge are not likely to be significant (Sub-reach 3). This is especially true as accumulated sediment would likely flush through during low flows (there is a net degradational potential in Sub-reach 2 for the 2-year flood).

Table 1. Summary of Sediment Continuity Calculations.

Sub-reach	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	Average Annual*
Sediment Transport Capacity (ft^3, bulked)							
1 (Supply)	35,400	107,300	246,500	599,000	1,101,500	1,158,100	113,200
2 (Backwater Area)	50,800	86,300	155,400	294,600	334,900	329,500	71,700
3 (Downstream)	64,400	140,900	232,700	461,300	777,600	810,800	114,800
Aggradation/Degradation Volume (ft^3, bulked)							
2 (Backwater Area)	-15,400	21,000	91,100	304,400	766,500	828,600	41,400
3 (Downstream)	-13,700	-54,600	-77,300	-166,700	-442,700	-481,400	-43,100
Approximate Aggradation/Degradation Depth (feet)**							
2 (Backwater Area)	-0.1	0.1	0.5	1.6	4.1	4.4	0.2
3 (Downstream)	0.0	-0.1	-0.1	-0.3	-0.8	-0.9	-0.1

*From Equation 1.1 in the Design Guide.

**Aggradation/Degradation volume divided by average effective width and approximate reach length.

Review of Scour Mitigation Measures

We reviewed the design of the scour mitigation measures as shown on the bridge plans. The following are our observations and comments:

- Scour mitigation consists of tinted shot-crete. It is our understanding that the shot-crete application being considered will consist of a rebar cage and a concrete thickness that would be durable and sufficient to resist the very high velocities expected in the vicinity of the bridge.
- The channel bed is lined underneath the bridge, which will mitigate for potential contraction scour and scour at the bridge piers. The bed lining is toed-down at the upstream and downstream ends of the bridge to match toe-downs for bank lining upstream and downstream of the bridge. These toe-downs equal 12.6 feet downstream and 9.3 feet upstream and appear adequate (see below).
- Toe-downs for bank lining upstream and downstream of the bridge were computed using the wall-scour equations from the Design Guide. Although zero angle of attack was assumed (which may be only approximately correct), the computed depths appear adequate. Toe-downs were increased at the head of the guide banks using the equation in the Design Guide for spurs and abutments. The computed scour depth of 35 feet is conservative.
- As noted above backwater from the bridge during large flood events will result in significant aggradation potential upstream of the bridge. If allowed to occur, contraction scour through the bridge opening could be large enough to increase the conveyance capacity of the bridge, and hence would lower the backwater and aggradation potential (contraction scour potential is very significant at this bridge). This could be accomplished in the design by lowering the elevation of the hardened channel bottom enough to allow a specified amount of scour to occur. Lowering the hardened channel bottom by about 4 feet would result in a significant increase in the conveyance capacity during peak flows, and thus would reduce the aggradation potential upstream of the bridge. The lowered hardened channel bottom would have to tie into the hardened channel banks as in the original design and future inspection of the buried portions of the protection would require excavation.
- Although we did not check the specific dimensions of the guide banks per the design equations in HEC-23 (Lagasse et al. 2001), the orientation and configuration of the guide banks appear reasonable.

We hope the information provided in this letter provides a satisfactory review of the proposed bridge crossing. If you have any questions, please feel free to give us a call.

Sincerely,

Ayres Associates Inc

C. Gary Wolff
Senior Hydraulic Engineer

Lyle Zevenbergen
Manager of River Engineering

CGW/LWZ/sp

MEINZ6L.DOC
32-0395.02

References

Ayres Associates, Inc., 1999. Tijeras Arroyo - Flooding and Erosion Potential in the Hidden Valley Reach, prepared for Albuquerque Metropolitan Arroyo Flood Control Authority.

Mussetter, R.A., Lagasse, P.F., and Harvey, M.D., 1994. Sediment and Erosion Design Guide, prepared for Albuquerque Metropolitan Arroyo Flood Control Authority.

Lagasse, P.F., Zevenbergen, L.W., Schall, J.D., and Clopper, P.E., 2001. "Bridge Scour and Stream Instability Countermeasures," Hydraulic Engineering Circular No. 23, Second Edition, FHWA NHI 01-003, Federal Highway Administration, Washington, D.C.

[redacted]

CALL
DOUG HUGHES
AT GOODWIN

RE: THIS PROJECT

RECEIVED
HYDROLOGY SECTION

MARK GOODWIN
& ASSOCIATES
CONSULTING ENGINEERS
dmg

CITY OF ALBUQUERQUE

April 4, 2005

James D Hughes, PE
Mark Goodwin & Associates
P.O. 90606
Albuquerque, NM 87199

Re: Juan Tabo Hills Blvd Bridge Drainage Report
Engineer's Stamp dated 3-18-05 (M21/D15A)

Dear Mr. Hughes,

Based upon the information provided in your submittal dated 3-18-05, the above referenced report is approved for Work Order requirements. Please keep in mind that this document and the report for the subdivision itself must be submitted to FEMA for the LOMR.

This project requires a National Pollutant Discharge Elimination System (NPDES) permit. Refer to the attachment that is provided with this letter for details. If you have any questions please feel free to call the Municipal Development Department, Hydrology section at 768-3654 (Charles Caruso).

If you have any questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham, PE, CFM
Principal Engineer, Planning Dept.
Development and Building Services

C: file
chuck Caruso, DMD

P.O. Box 1293
Albuquerque
New Mexico 87103
www.cabq.gov

D. Mark Goodwin & Associates, P.A.
Consulting Engineers
P.O. BOX 90606, ALBUQUERQUE, NM 87199
(505) 828-2200 FAX 797-9539

File
M21/D15A

May 27, 2005

Mr. Richard Dourte
City Engineer
City of Albuquerque
PO Box 1293
Albuquerque, NM 87103

Re: Juan Tabo Blvd Improvements – City Project No. 756181 and 756182

Dear Mr. Dourte:

The purpose of this letter is to verify that the drilled shaft piers can be built now as part of the rough grading (see attached April 4, 2005 approval letter M21/D15A) with the understanding that the developer is proceeding at his own risk until the remaining approvals are obtained and the actual Work Order is issued. We further understand that the shafts for the north abutment may not be started until the relocated sanitary sewer line being built by City Project No. 656182 is accepted by the Water Authority and separate permission is received from the Authority to build within that easement.

Please contact our office if you have any questions or comments.

Sincerely,

MARK GOODWIN & ASSOCIATES, PA

James D. Hughes, PE
Senior Engineer

JDH/sr

Concurrence:

Richard Dourte 5-31-05
Date

F:\1-Projects\2002\A02079 - Juan Tabo Hills\Drilled Shaft.doc

DRAINAGE REPORT

for

Juan Tabo Hills Blvd. Improvements
Bridge @ Tijeras Arroyo

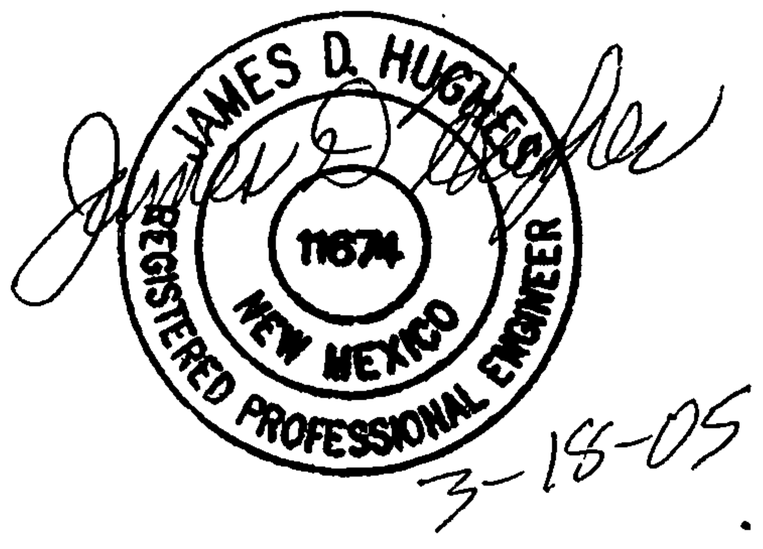
Prepared for

JTH, LLC
4131 Barbara Loop, Suite 2C
Rio Rancho, NM 87124
(505) 892-5533

Prepared by

Mark Goodwin & Associates, PA
P.O. Box 90606
Albuquerque, NM 87199
(505) 828-2200

March 17, 2005



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DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 1/28/2003rd)

M21 / D15A

PROJECT TITLE: Juan Tabo Hills
DRB #: 1001370 EPC#:_____

ZONE MAP/DRG. FILE #: M-23
WORK ORDER#: 756182

LEGAL DESCRIPTION: Juan Tabo Blvd. @ Juan Tabo Hills
CITY ADDRESS: South end of Juan Tabo Blvd.

ENGINEERING FIRM: Mark Goodwin & Associates, PA
ADDRESS: PO Box 90606
CITY, STATE: Albuquerque, NM

CONTACT: James D. Hughes,PE
PHONE: 828-2200
ZIP CODE: 87199

OWNER: JTH, LLC
ADDRESS: 4131 Barbara Loop, Suite 2C
CITY, STATE: Rio Rancho, NM

CONTACT: Robert Lupton
PHONE: 892-5533
ZIP CODE: 87124

ARCHITECT: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE:
ZIP CODE: _____

SURVEYOR: Aldrich Land Surveying
ADDRESS: PO Box 30701
CITY, STATE: Albuquerque, NM

CONTACT: Tim Aldrich
PHONE: 884-1990
ZIP CODE: 87190-0701

CONTRACTOR: _____
ADDRESS: _____
CITY, STATE: _____

CONTACT: _____
PHONE: _____
ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:

- ☒ DRAINAGE REPORT
- ☐ DRAINAGE PLAN 1st SUBMITTAL, ***REQUIRES TCL or equal***
- ☐ DRAINAGE PLAN RESUBMITTAL
- ☐ CONCEPTUAL GRADING & DRAINAGE PLAN
- ☒ GRADING PLAN
- ☐ EROSION CONTROL PLAN
- ☐ ENGINEER'S CERTIFICATION (HYDROLOGY)
- ☐ CLOMR/LOMR
- ☐ TRAFFIC CIRCULATION LAYOUT (TCL)
- ☐ ENGINEERS CERTIFICATION (TCL)
- ☐ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
- ☒ OTHER

CHECK TYPE OF APPROVAL SOUGHT:

- ☐ SIA / FINANCIAL GUARANTEE RELEASE
- ☐ PRELIMINARY PLAT APPROVAL
- ☐ S. DEV. PLAN FOR SUB'D. APPROVAL
- ☐ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ☐ SECTOR PLAN APPROVAL
- ☐ FINAL PLAT APPROVAL
- ☐ FOUNDATION PERMIT APPROVAL
- ☐ BUILDING PERMIT APPROVAL
- ☐ CERTIFICATE OF OCCUPANCY (PERM.)
- ☐ CERTIFICATE OF OCCUPANCY (TEMP.)
- ☒ GRADING PERMIT APPROVAL
- ☐ PAVING PERMIT APPROVAL
- ☒ WORK ORDER APPROVAL
- ☐ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ☐ YES
- ☒ NO
- ☐ COPY PROVIDED

DATE SUBMITTED: 03-18-05 BY: James D. Hughes, PE

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature , location and scope ot the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan**: Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
2. **Drainage Plans**: Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
3. **Drainage Report**: Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

I. PURPOSE & SCOPE

The purpose of this report is to present hydraulic analysis of the proposed Juan Tabo Blvd Bridge over the Tijeras Arroyo to be used for the design of the levees and scour protection upstream and downstream of the Bridge. This report focuses on the Tijeras Arroyo only and not on the rest of the flood plans in the Juan Tabo Hills Subdivision. This report assumes that those flood plans will be conveyed to two water quality ponds located in the over bank of the Tijeras Arroyo and that the Juan Tabo Hills Development will not have a significant impact on peak flows in the Tijeras Arroyo. A separate report will document the adequacy of those conveyance systems and provide details of the two ponds. This report includes the hydraulic impact of the bridge and those two ponds on the Tijeras Arroyo.

II. SUMMARY OF RESULTS

The bridge will cause the water surface up stream of the bridge to increase by:

2.08' during peak 10-YR flows of 6,285 cfs

4.16' during peak 50-YR flows of 13,750 cfs

5.20' during peak 100-YR flows of 18,065 cfs

7.79' during peak 500-YR flows of 30,500 cfs

The bridge and levee are designed for the 500-YR event and the scour depth is for 100-YR flows. The back water effect of the bridge is entirely contained in the Juan Tabo Hills Development and has no adverse impact above section # 50. (900± upstream from the bridge) The velocity below the bridge is increased from:

8.26 fps to 12.23 fps for peak 10-YR flows

10.46 fps to 17.76 fps for peak 50-YR flows

11.14 fps to 19.60 fps for peak 100-YR flows

12.65 fps to 23.33 fps for peak 500-YR flows

The potential lateral immigration is to be checked by future improvements associated with subsequent developments upstream and by the Guide Bank / Levee immediately upstream and downstream of the bridge. This reach of the arroyo is in balance with incoming sediment according to the Leadshill-Herkenhoff Drainage Management Plan of 1987, but the down stream end is expected to degrade. Lateral protection is recommended by that report next to the lower pond in this development.

III. PLANNING HISTORY

· Juan Tabo Hills Subdivision was annexed into the City of Albuquerque in 2004 with the understanding that Juan Tabo Blvd would not be extended south into Kirtland Air Force Base and that no roadway connecting would be made to the Four Hills Community on the East Boundary of Juan Tabo Hills, so Juan Tabo Blvd across the Tijeras Arroyo is classified as a Collector instead of the previous Arterial classification.

· In 1981 a 262', three span, bridge was planned by Meurer Serafini and Meurer Inc. for the City of Albuquerque Transportation Department. The bottom width of the opening was about 200' and top of road of the north end of the bridge would have been only 15'above the arroyo invert. (Compared to the current height of 45'). Subsequent development of the properties on either side of Juan Tabo Blvd has precluded the excavation of the north approach into the existing bank.

· In 1987 Phase I of the "Tijeras Arroyo Drainage Management Plan" was prepared by Leadshill-Herkenhoff Inc. LHI for the City of Albuquerque. Including Hydrology and Hydraulic analysis.

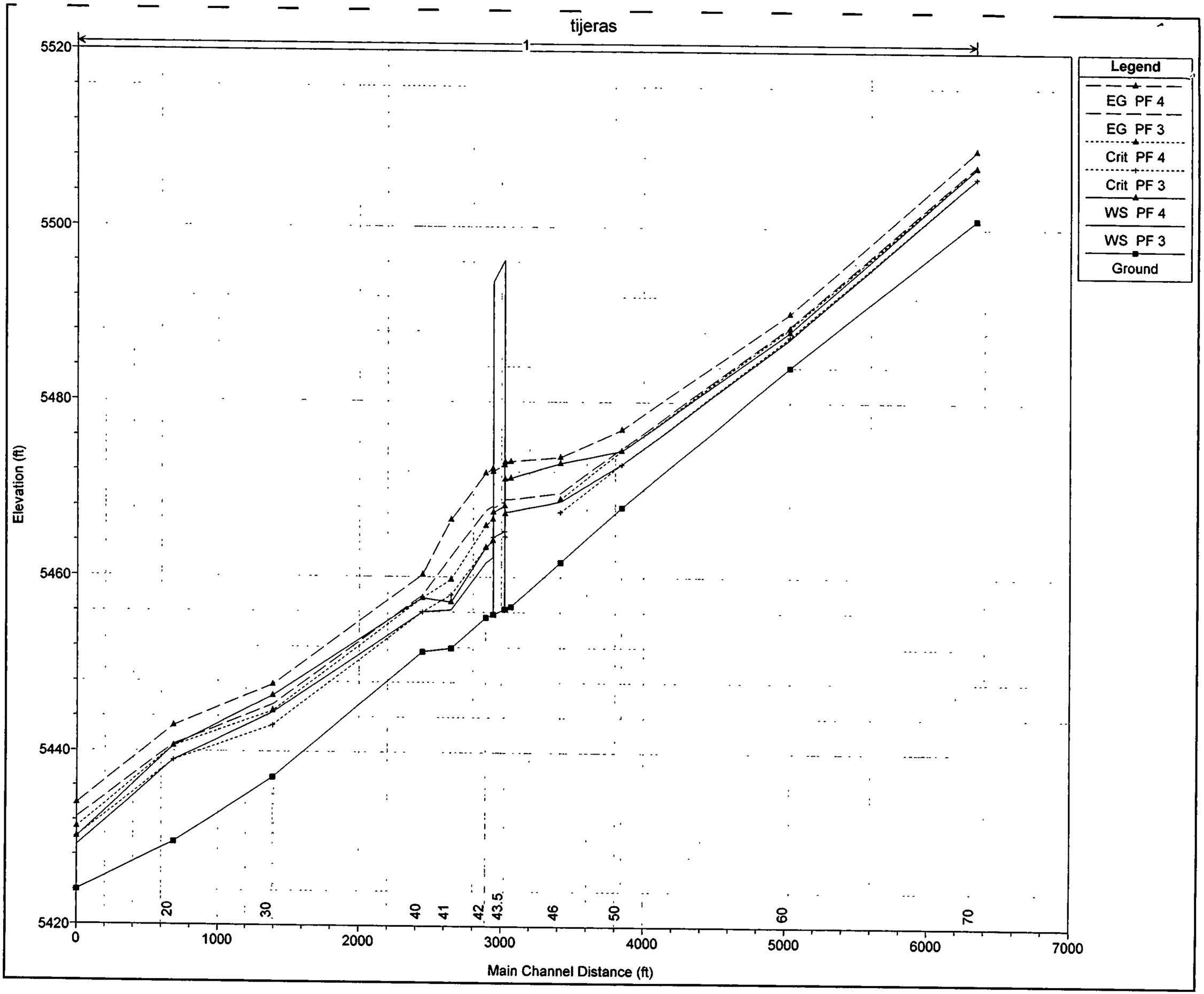
· In 1990 Phase II of the "Tijeras Arroyo Drainage Management Plan" was prepared by Leadshill-Herkenhoff Inc. for the City of Albuquerque, including four potential arroyo treatment alternatives and a recommended treatment. Prudent Limits were also presented.

· In 1996 the Federal Emergency Management Administration FEMA adopted a new Flood Insurance Study FIS and new Flood Insurance Rate Maps FIRM based on information supplied by Resource Technology Inc. RTI used the 1987 LHI hydrology, adding new flows for the 50 and 500yr. events (not previously developed by LHI) The RTI model was modified by PBS & J, FEMA's review agent who replaced RTI's cross sections through this site with their own geometry.

· In 2002 FEMA changed the vertical datum being referenced on the FIRM's from (NAD-29) to Navd 88 and added 3' to all previously published flood plans elevations.

IV. MODELING APPROACH

Six cross sections were added to the "duplicate effective" HEC-RAS model to make a "corrected effective" model of existing conditions. Then the Bridge and pond encroachments were modeled in the "New" model. All cross sections are presented on a color work map which includes a recent ortho photo and one foot contours on the same Datum (NAD-29) as the current effective HEC-2 model as received from PBS & J, FEMA's consultant. The resulting water surface and velocities are illustrated on the "Guide Bank Profile & Detail Sheet" in the construction plans along with the scour calculations.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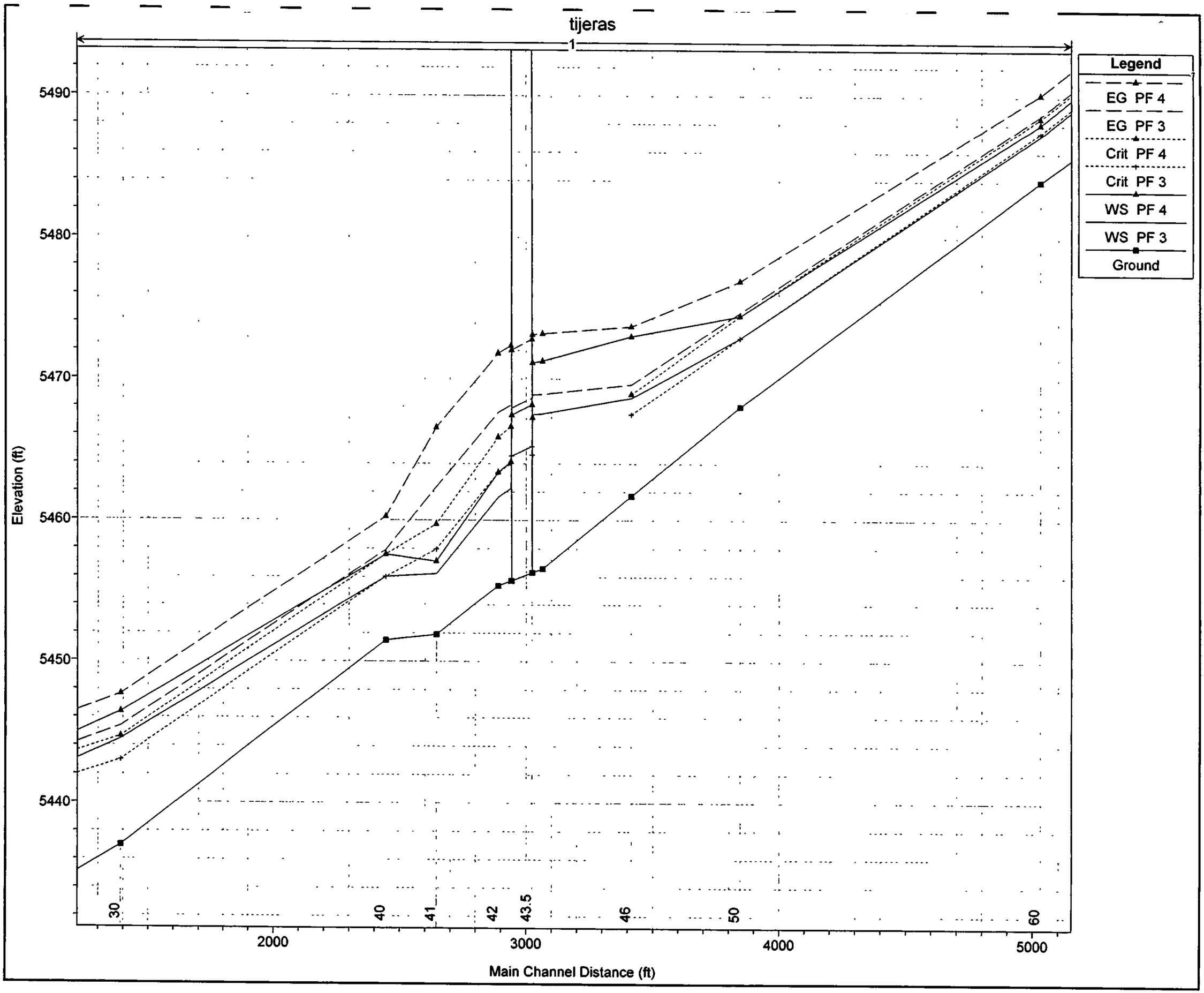
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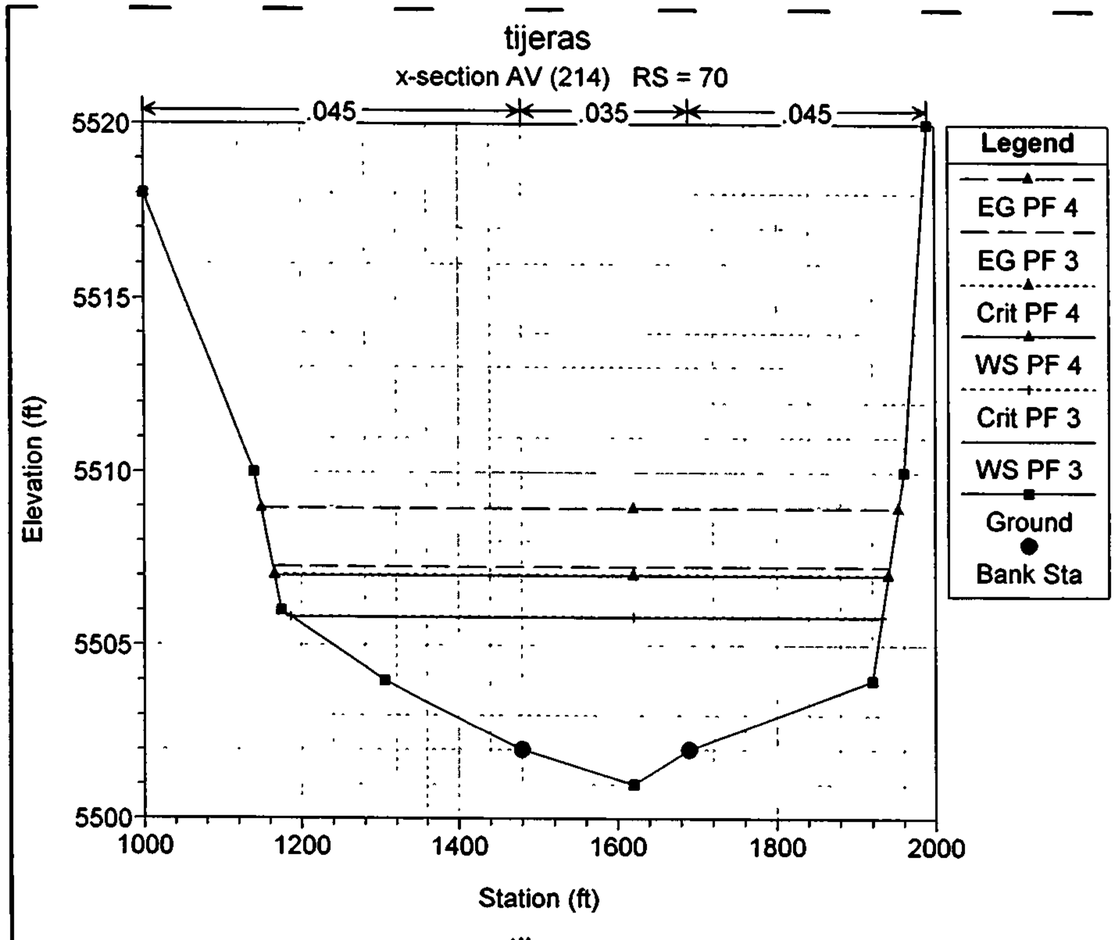
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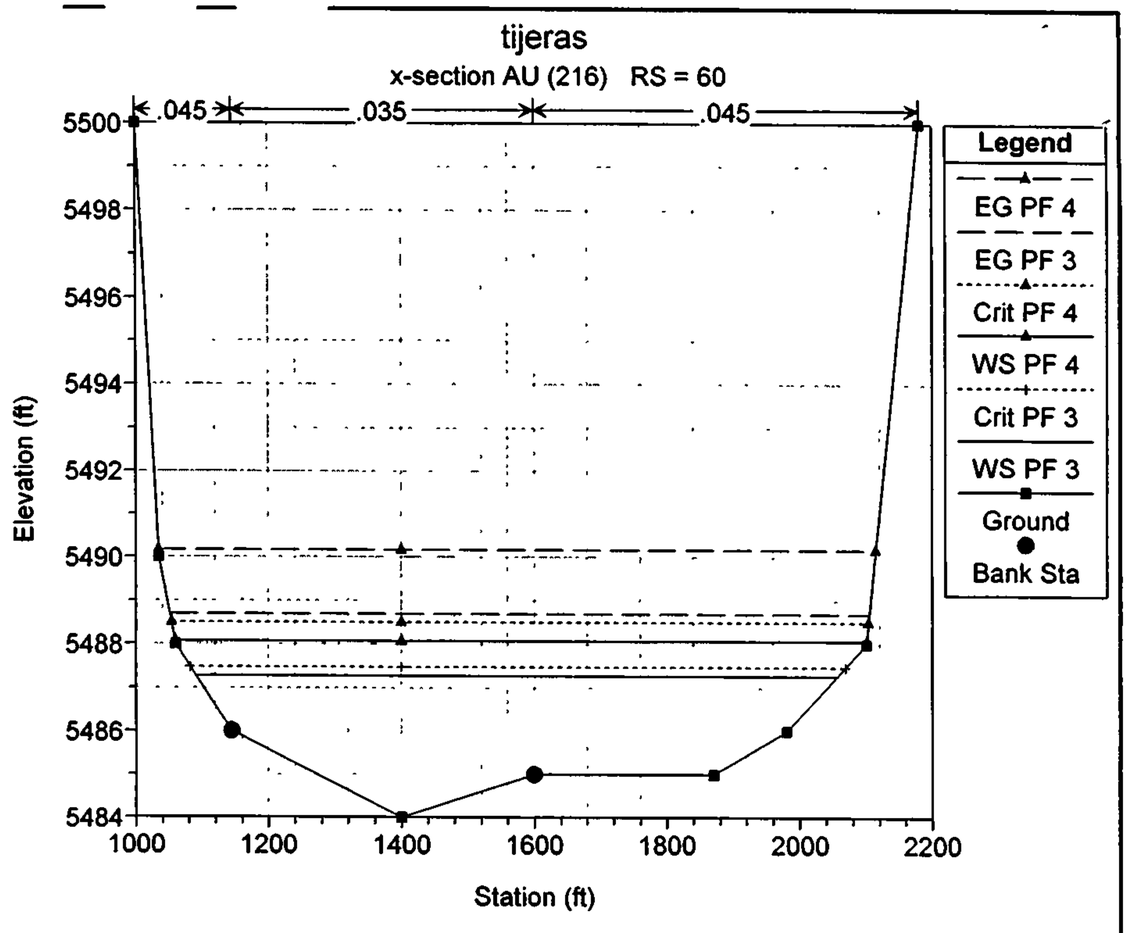
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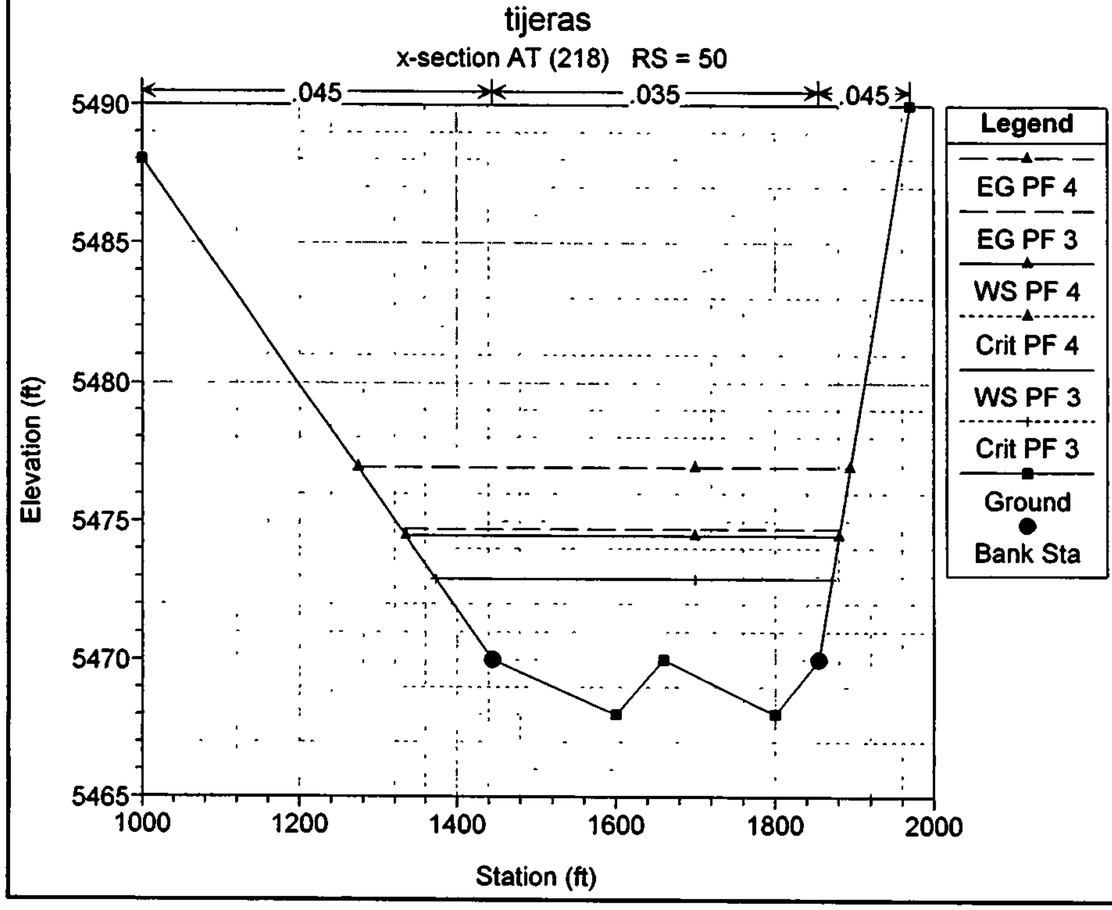
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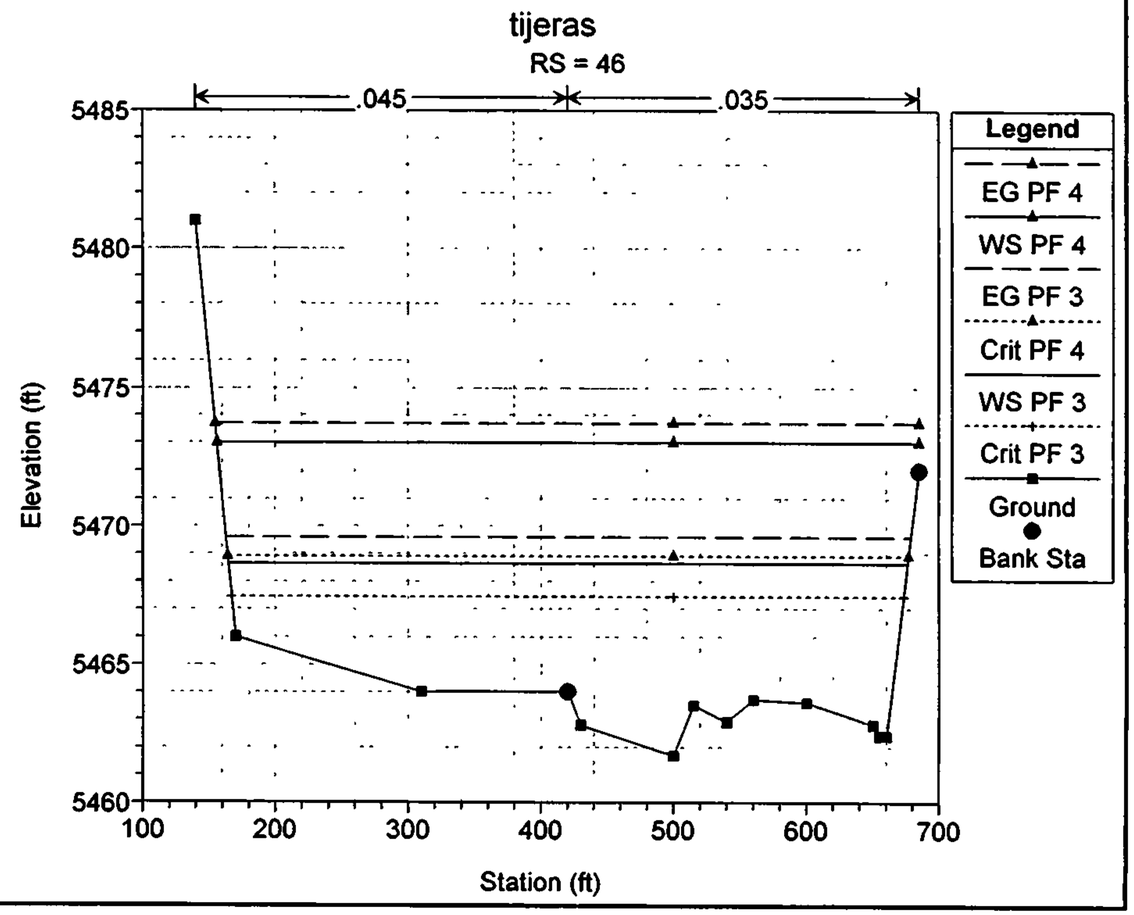
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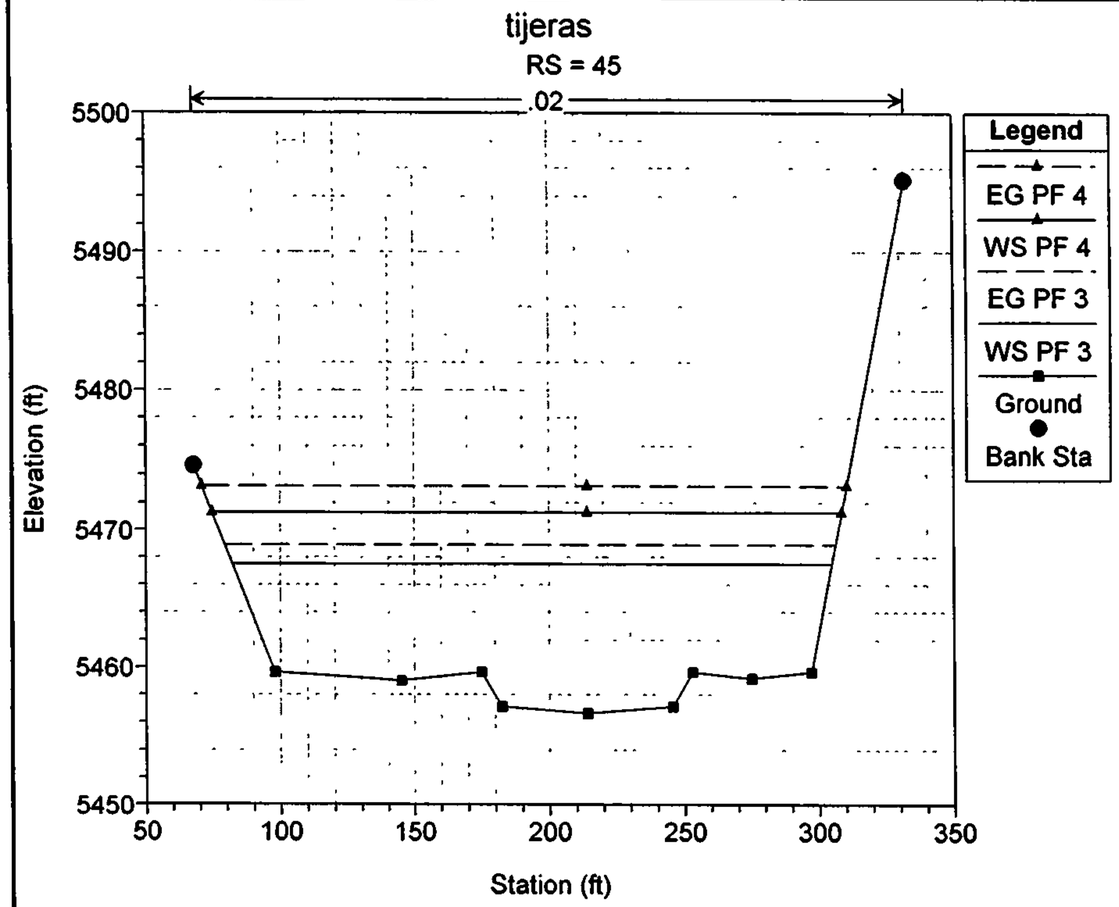
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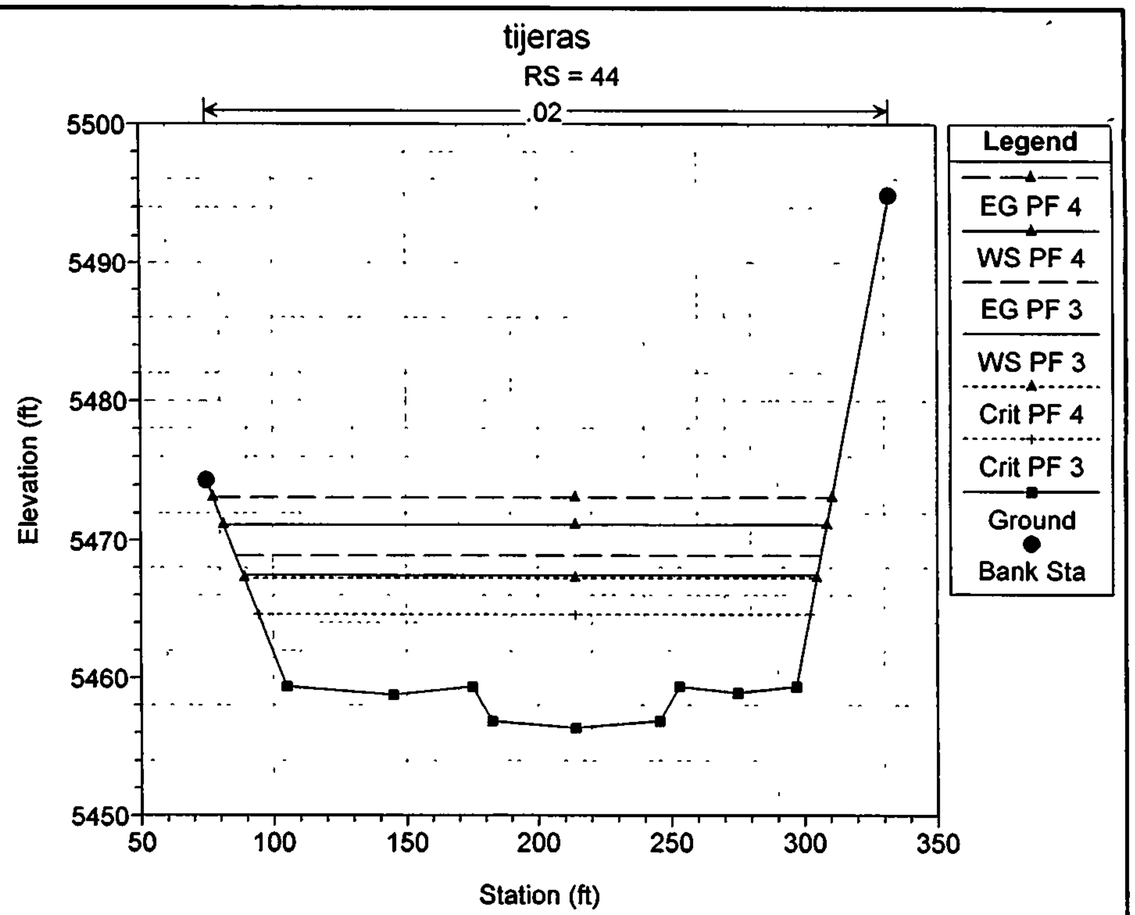
Ground
Bank Sta


tijeras
RS = 44
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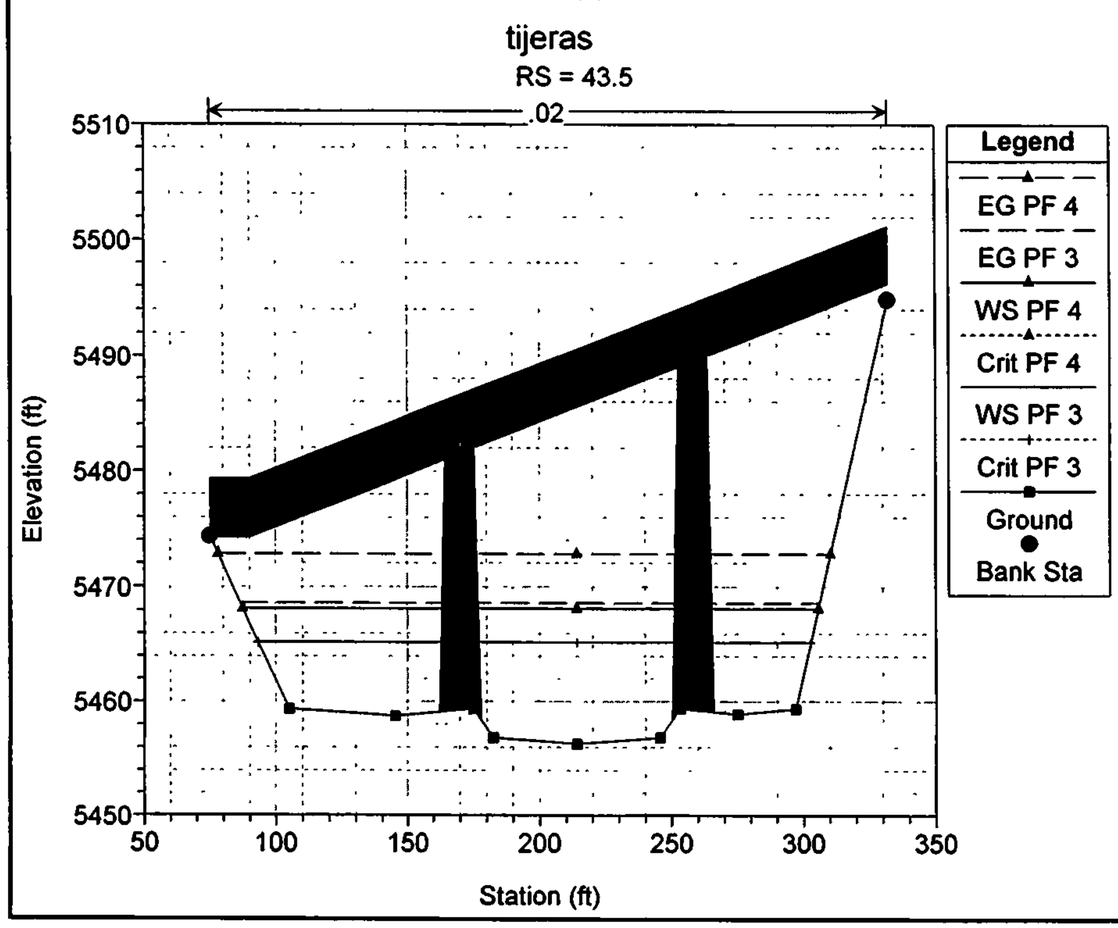
Elevation (ft)
Station (ft)
Legend
EG PF 4
WS PF 4
EG PF 3
WS PF 3
Crit PF 4
Crit PF 3
Ground
Bank Sta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Station (ft)
Legend
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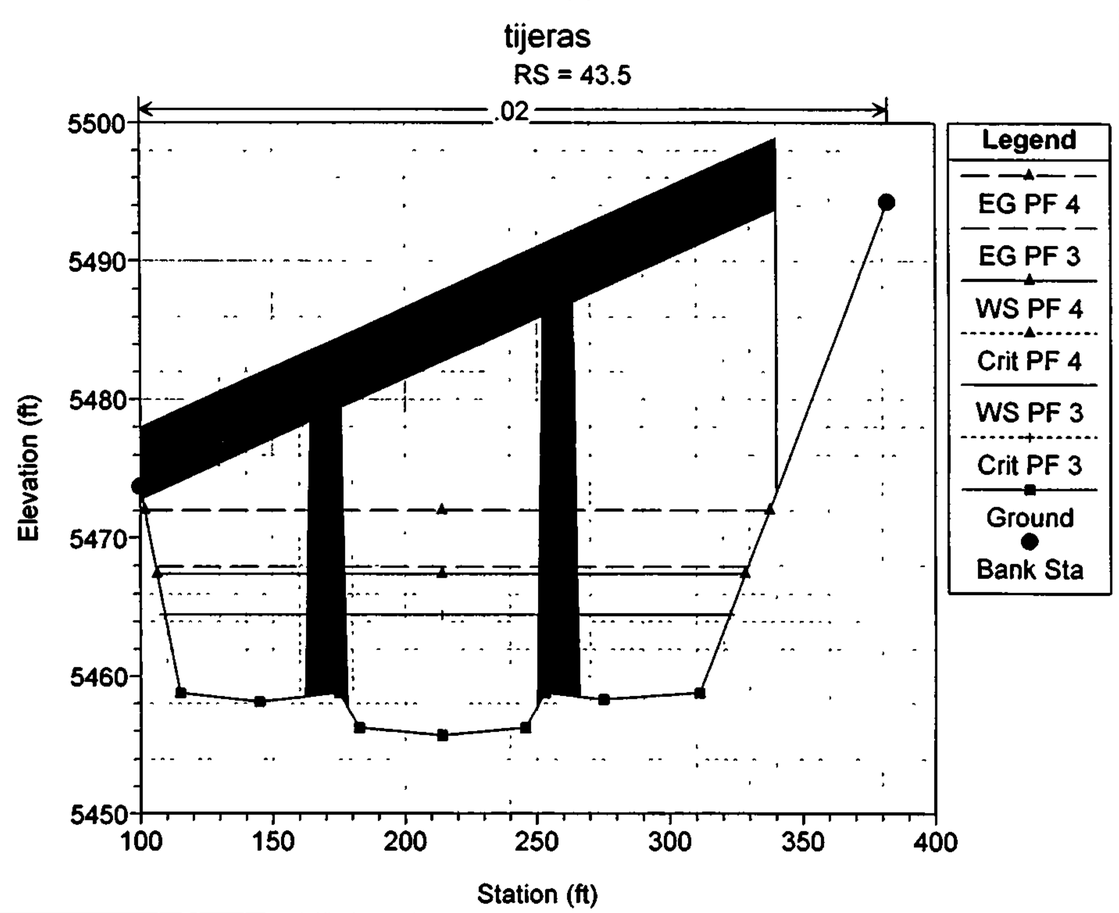
EG PF 3
WS PF 4
Crit PF 4
WS PF 3
Crit PF 3
Ground
Bank Sta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Station (ft)
Legend
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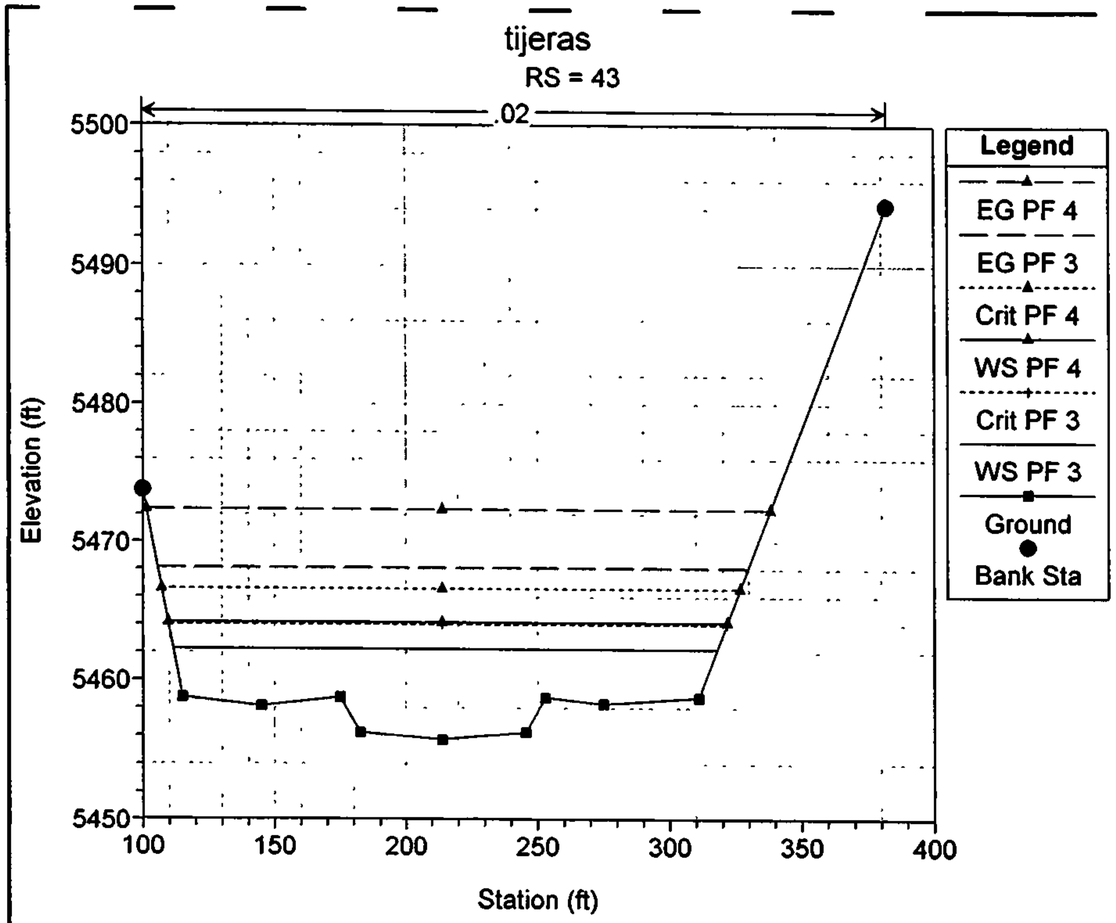
Crit PF 4
WS PF 3
Crit PF 3
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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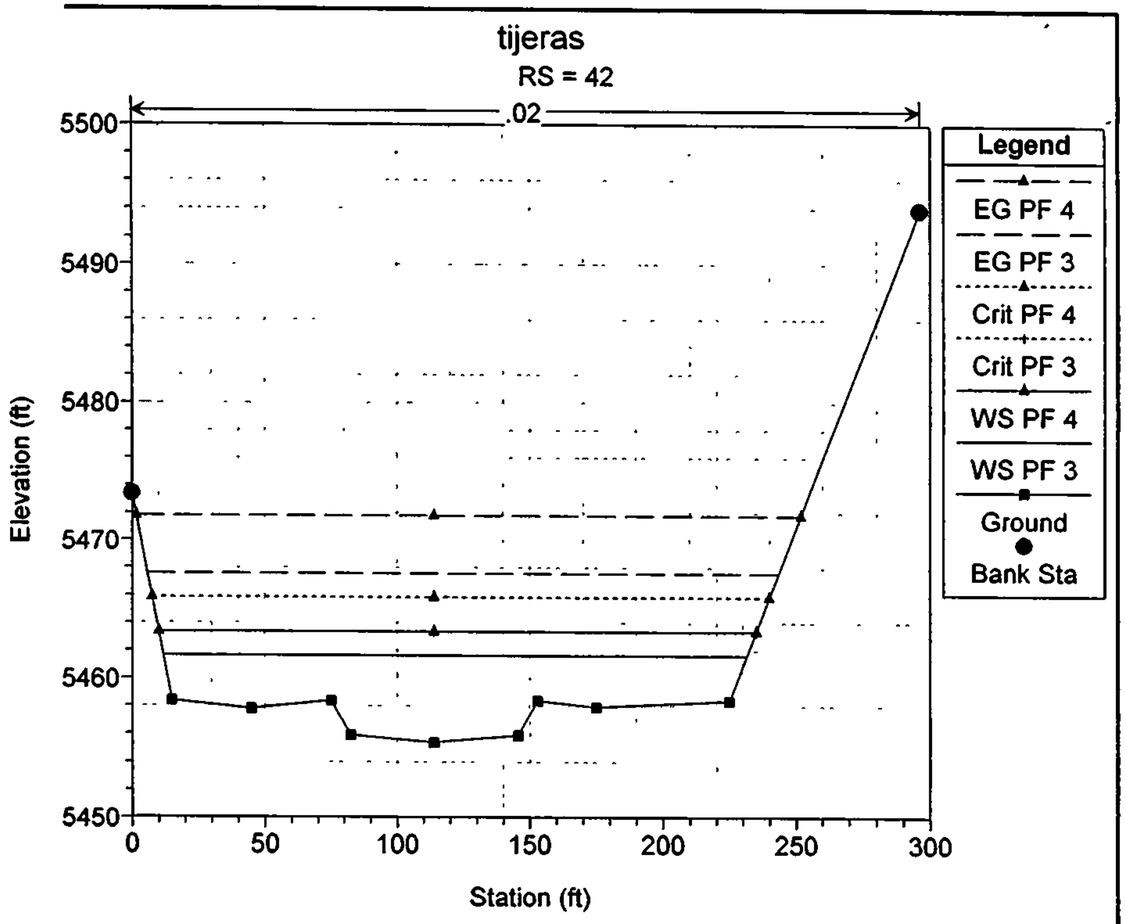
EG PF 3
Crit PF 4
WS PF 4
Crit PF 3
WS PF 3
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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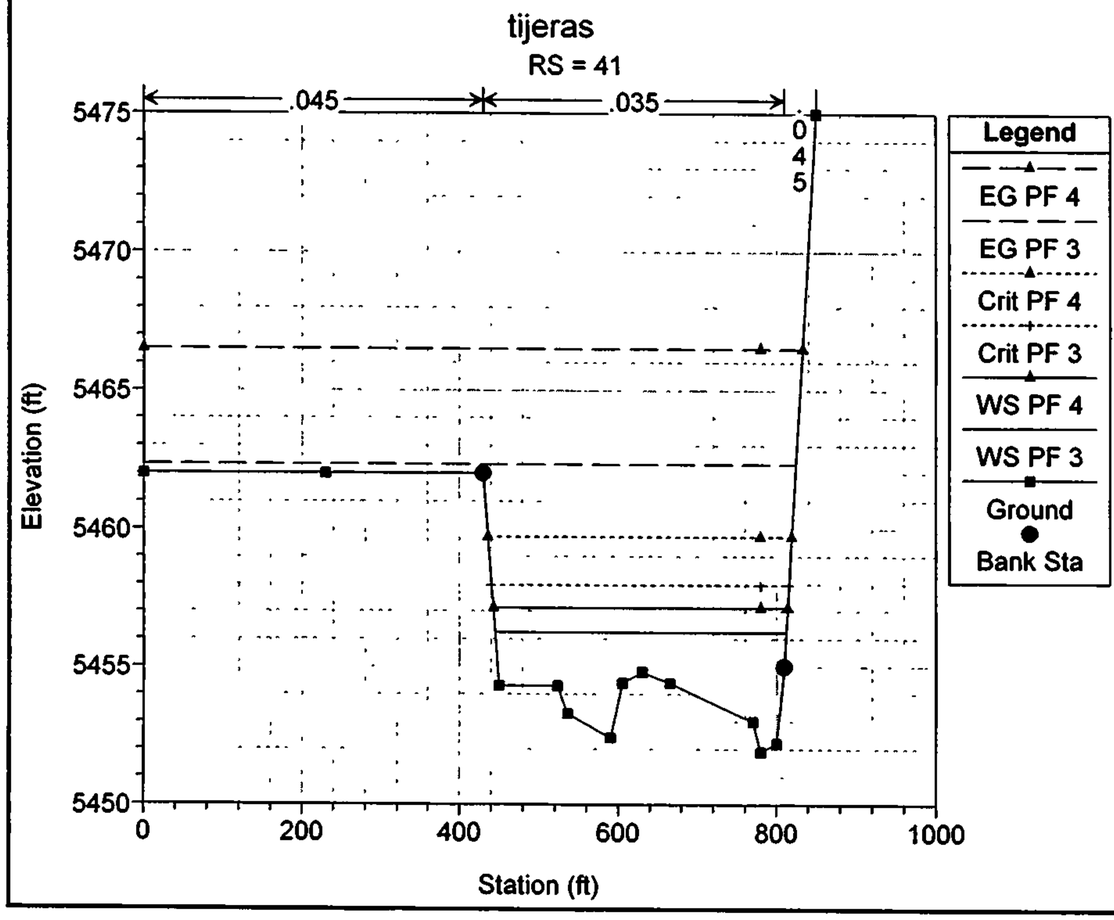
EG PF 3
Crit PF 4
Crit PF 3
WS PF 4
WS PF 3
Ground
Bank Sta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Station (ft)
Legend
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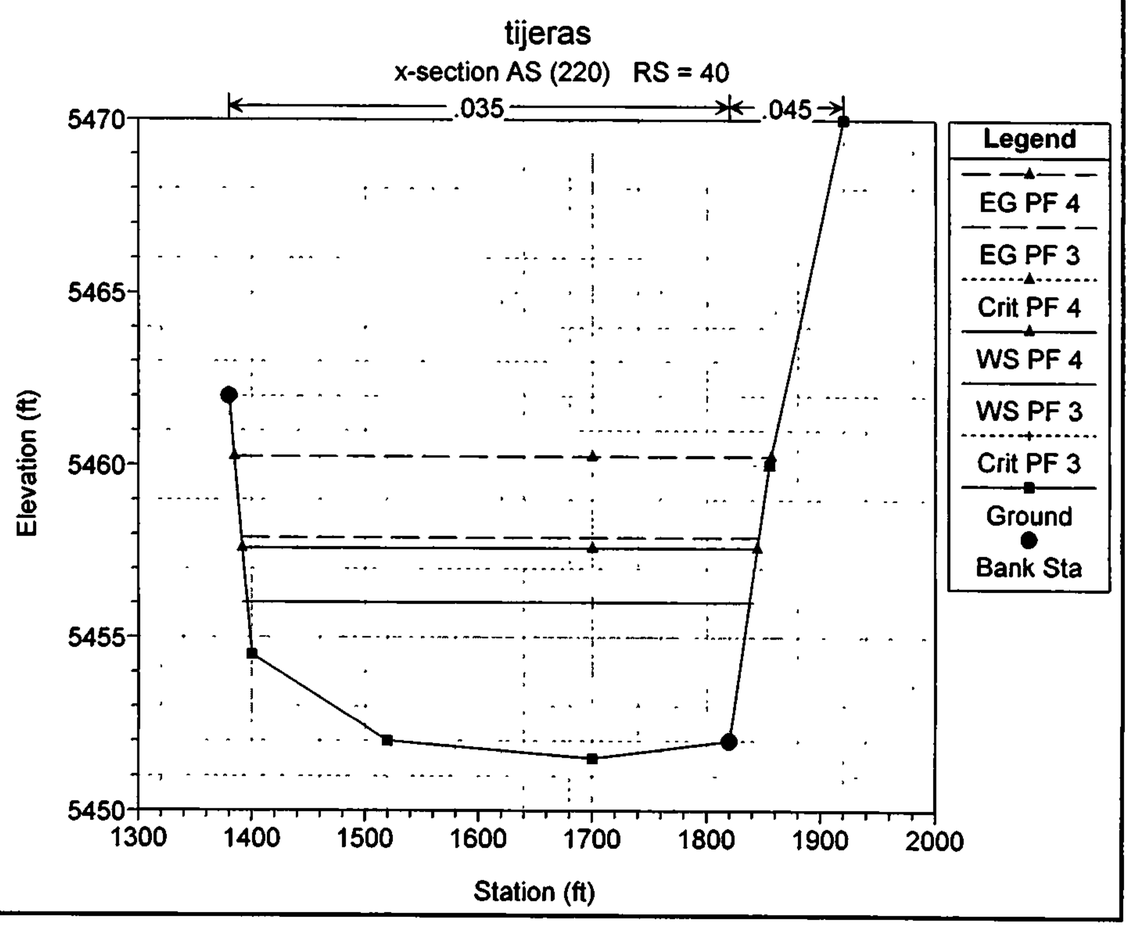
EG PF 3
Crit PF 4
Crit PF 3
WS PF 4
WS PF 3
Ground
Bank Sta


tijeras
x-section AS (220) RS = 40
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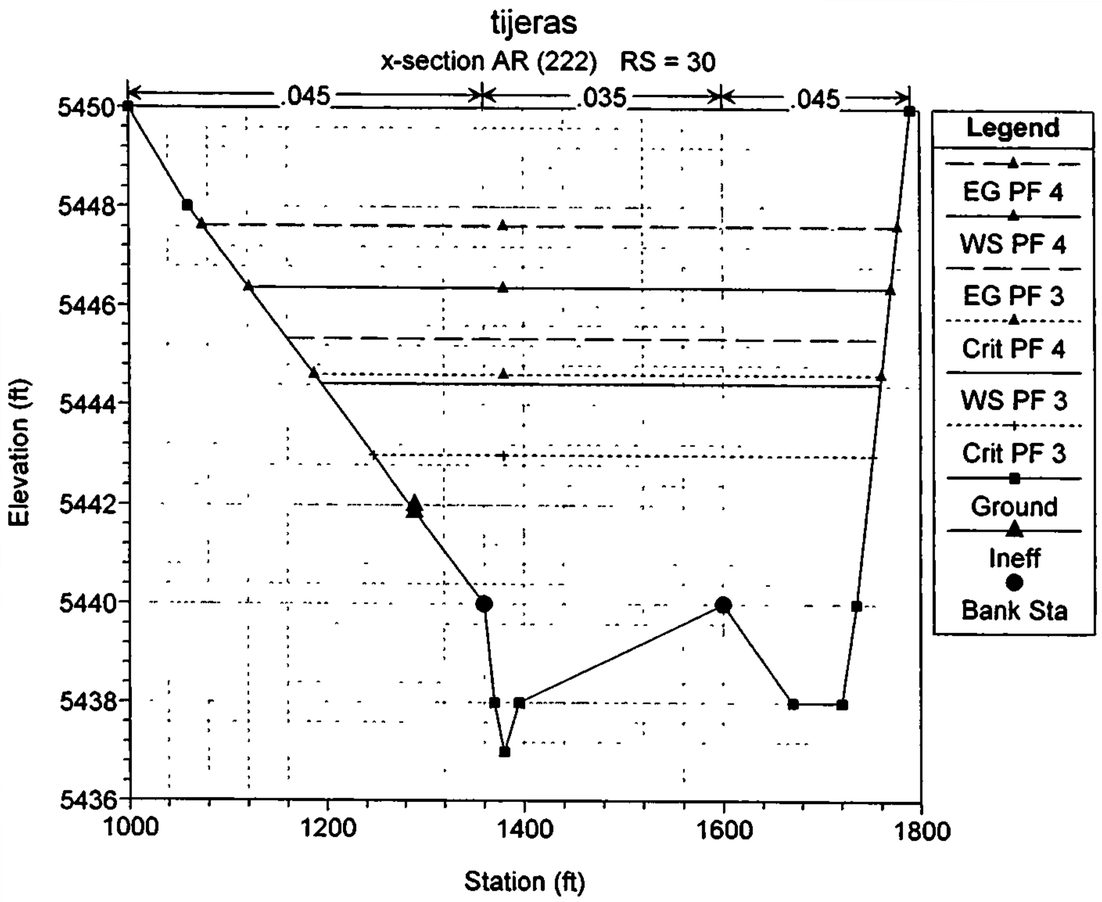
Station (ft)
Legend
EG PF 4
EG PF 3
Crit PF 4
WS PF 4
WS PF 3
Crit PF 3
Ground
Bank Sta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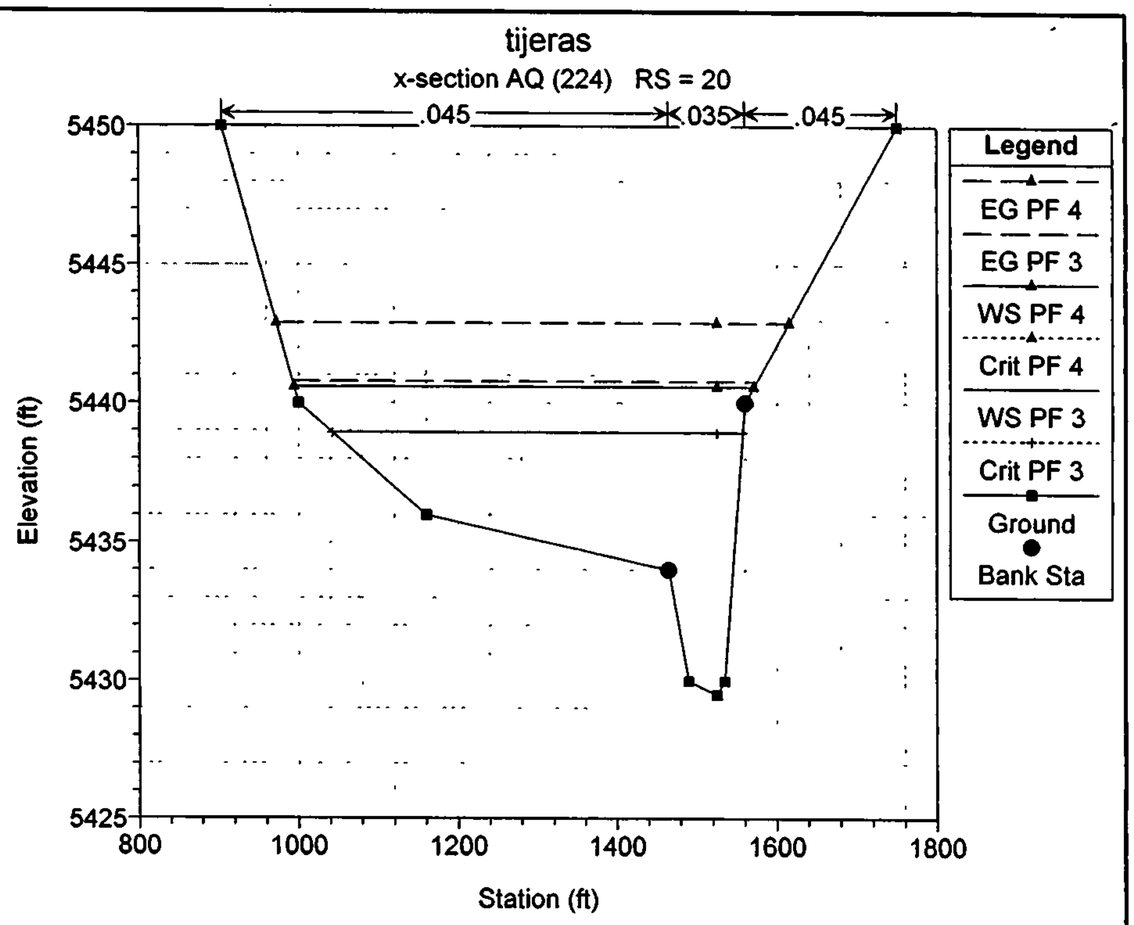
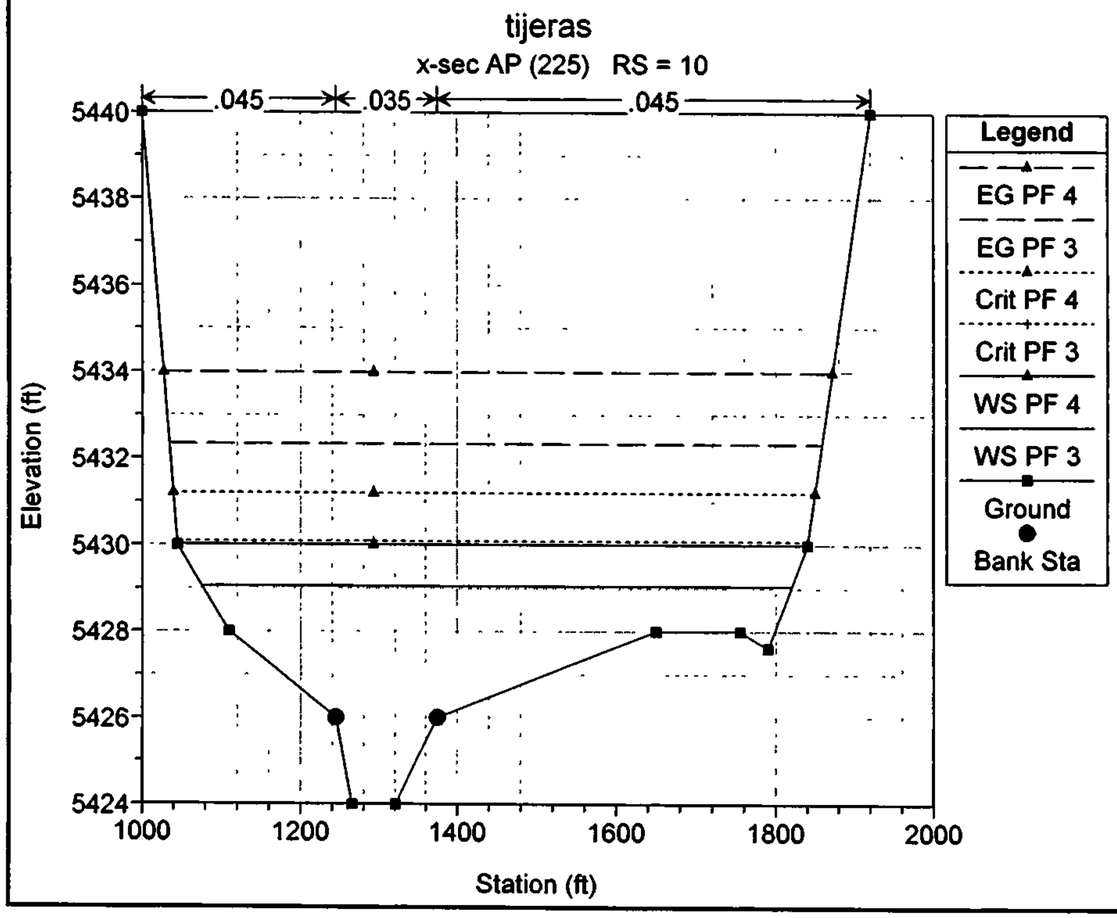
x-section AR (222) RS = 30
.045
.035
.045
5450
5448
5446
5444
5442
5440
5438
5436
1000
1200
1400
1600
1800
Elevation (ft)
Station (ft)
Legend
EG PF 4
WS PF 4
EG PF 3
Crit PF 4
WS PF 3
Crit PF 3
Ground
Ineff
Bank Sta


tijeras
x-section AQ (224) RS = 20
.045
.035
.045
5450
5445
5440
5435
5430
5425
800
1000
1200
1400
1600
1800
Elevation (ft)
Station (ft)
Legend
EG PF 4
EG PF 3
WS PF 4
Crit PF 4
WS PF 3
Crit PF 3
Ground
Bank Sta


tijeras
x-sec AP (225) RS = 10
.045
.035
.045
5440
5438
5436
5434
5432
5430
5428
5426
5424
1000
1200
1400
1600
1800
2000
Elevation (ft)
Station (ft)
Legend
EG PF 4
EG PF 3
Crit PF 4
Crit PF 3
WS PF 4
WS PF 3
Ground
Bank Sta

HEC-RAS Plan: Plan 01 River: Tijeras Arroyo Reach: 1

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	10	6285.00	5424.00	5427.43	5428.48	5430.23	0.028708	14.45	579.13	422.49	1.51
1	10	13750.00	5424.00	5428.63	5429.56	5431.70	0.024450	16.86	1308.17	721.95	1.48
1	10	18065.00	5424.00	5429.05	5430.09	5432.33	0.024430	18.01	1618.58	744.53	1.50
1	10	30500.00	5424.00	5430.01	5431.20	5433.98	0.025135	20.79	2355.15	795.13	1.57
1	20	6285.00	5429.50	5436.60	5436.60	5437.75	0.005596	9.80	972.33	415.44	0.74
1	20	13750.00	5429.50	5438.23	5438.23	5439.85	0.007000	12.65	1706.14	484.73	0.85
1	20	18065.00	5429.50	5438.94	5438.94	5440.77	0.007449	13.76	2062.75	515.05	0.89
1	20	30500.00	5429.50	5440.57	5440.57	5442.90	0.008042	16.03	2955.82	576.28	0.95
1	30	6285.00	5437.00	5441.65	5440.87	5442.16	0.005366	6.18	1137.56	445.74	0.65
1	30	13750.00	5437.00	5443.57	5442.00	5444.35	0.004267	7.80	2074.91	528.48	0.63
1	30	18065.00	5437.00	5444.42	5442.99	5445.34	0.004089	8.53	2542.47	565.25	0.64
1	30	30500.00	5437.00	5446.36	5444.62	5447.63	0.003963	10.25	3718.98	648.60	0.66
1	40	6285.00	5451.50	5454.03	5454.03	5455.02	0.014248	7.97	793.22	406.49	1.00
1	40	13750.00	5451.50	5455.37	5455.37	5456.96	0.012231	10.15	1367.37	437.08	1.00
1	40	18065.00	5451.50	5456.01	5456.01	5457.90	0.011514	11.09	1646.67	441.56	1.00
1	40	30500.00	5451.50	5457.59	5457.59	5460.25	0.010299	13.15	2354.26	452.70	1.00
1	41	6285.00	5451.90	5455.07	5455.82	5457.60	0.060057	12.76	492.63	362.15	1.93
1	41	13750.00	5451.90	5455.90	5457.25	5460.56	0.059280	17.34	793.76	365.95	2.07
1	41	18065.00	5451.90	5456.22	5457.95	5462.32	0.064536	19.81	912.83	367.45	2.21
1	41	30500.00	5451.90	5457.12	5459.72	5466.51	0.066732	24.60	1242.64	371.55	2.36
1	42	6285.00	5455.38	5459.74	5460.33	5462.06	0.008520	12.23	513.91	214.07	1.39
1	42	13750.00	5455.38	5460.94	5462.36	5465.84	0.010690	17.76	774.16	217.68	1.66
1	42	18065.00	5455.38	5461.62	5463.36	5467.58	0.010469	19.60	921.73	219.70	1.69
1	42	30500.00	5455.38	5463.35	5465.85	5471.80	0.009659	23.33	1307.51	224.90	1.70
1	43	6285.00	5455.73	5459.96	5460.79	5462.78	0.010688	13.46	466.99	199.70	1.55
1	43	13750.00	5455.73	5461.48	5462.95	5466.38	0.009848	17.77	773.89	204.25	1.61
1	43	18065.00	5455.73	5462.23	5463.99	5468.12	0.009453	19.47	927.72	206.49	1.62
1	43	30500.00	5455.73	5464.14	5466.59	5472.35	0.008548	22.99	1326.38	212.20	1.62
1	43.5	Bridge									
1	44	6285.00	5456.33	5462.73	5461.37	5463.50	0.001263	7.04	892.94	202.15	0.59
1	44	13750.00	5456.33	5465.91	5463.53	5467.13	0.001033	8.87	1550.89	211.64	0.58
1	44	18065.00	5456.33	5467.43	5464.59	5468.87	0.000978	9.63	1875.93	216.17	0.58
1	44	30500.00	5456.33	5471.14	5467.22	5473.12	0.000897	11.30	2698.69	227.25	0.58
1	45	6285.00	5456.61	5462.76	5461.62	5463.58	0.001451	7.25	866.74	208.40	0.63
1	45	13750.00	5456.61	5465.95	5463.75	5467.18	0.001083	8.89	1546.18	217.92	0.59

HEC-RAS Plan: Plan 01 River: Tijeras Arroyo Reach: 1 (Continued)

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	45	18065.00	5456.61	5467.49		5468.91	0.000997	9.58	1885.64	222.52	0.58
1	45	30500.00	5456.61	5471.27		5473.18	0.000876	11.10	2747.80	233.79	0.57
1	46	6285.00	5461.70	5465.50	5465.50	5466.50	0.011886	8.54	867.40	462.86	0.95
1	46	13750.00	5461.70	5466.62	5466.88	5468.38	0.013762	11.67	1417.72	502.21	1.08
1	46	18065.00	5461.70	5468.63	5467.45	5469.60	0.004407	8.77	2438.59	511.48	0.66
1	46	30500.00	5461.70	5472.99	5468.90	5473.70	0.001548	7.51	4710.82	528.98	0.43
1	50	6285.00	5468.00	5470.98	5470.94	5471.90	0.013267	7.71	825.78	439.82	0.97
1	50	13750.00	5468.00	5472.25	5472.25	5473.80	0.011695	10.08	1411.74	478.70	0.98
1	50	18065.00	5468.00	5472.89	5472.89	5474.71	0.010926	10.98	1722.22	498.07	0.98
1	50	30500.00	5468.00	5474.47	5474.47	5476.92	0.009516	12.85	2546.98	546.20	0.97
1	60	6285.00	5484.00	5486.35	5486.20	5486.85	0.011863	6.24	1178.19	870.83	0.88
1	60	13750.00	5484.00	5487.18	5487.08	5488.08	0.012302	8.45	1939.16	956.22	0.96
1	60	18065.00	5484.00	5487.27	5487.48	5488.69	0.018743	10.67	2020.77	964.93	1.19
1	60	30500.00	5484.00	5488.07	5488.50	5490.17	0.019461	13.10	2827.66	1041.34	1.27
1	70	6285.00	5501.00	5504.17	5504.17	5504.98	0.010046	8.18	1033.09	626.90	0.88
1	70	13750.00	5501.00	5505.29	5505.29	5506.54	0.010529	10.59	1783.01	707.45	0.96
1	70	18065.00	5501.00	5505.79	5505.82	5507.26	0.010768	11.63	2145.69	743.29	0.99
1	70	30500.00	5501.00	5506.99	5507.03	5508.94	0.010666	13.65	3061.82	773.60	1.03

HEC-RAS Plan: Plan 01 River: Tijeras Arroyo Reach: 1

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	10	5430.23	5427.43	2.81	7.35	0.17	306.86	5353.03	625.12	422.49
1	10	5431.70	5428.63	3.07	8.01	0.14	1503.30	8886.90	3359.80	721.95
1	10	5432.33	5429.05	3.27	8.30	0.14	2208.53	10482.70	5373.77	744.53
1	10	5433.98	5430.01	3.97	8.75	0.16	4379.37	14682.94	11437.69	795.13
1	20	5437.75	5436.60	1.15	4.00	0.11	1604.31	4680.69		415.44
1	20	5439.85	5438.23	1.62	4.88	0.15	5880.06	7869.94		484.73
1	20	5440.77	5438.94	1.83	5.17	0.16	8608.43	9456.57		515.05
1	20	5442.90	5440.57	2.33	5.69	0.16	17020.14	13475.88	3.98	576.28
1	30	5442.16	5441.65	0.51	4.34	0.06	107.72	4151.61	2025.67	445.74
1	30	5444.35	5443.57	0.78	4.42	0.08	757.93	8850.12	4141.95	528.48
1	30	5445.34	5444.42	0.92	4.48	0.09	1315.44	11430.66	5318.91	565.25
1	30	5447.63	5446.36	1.27	4.63	0.11	3412.46	18495.71	8591.84	648.60
1	40	5455.02	5454.03	0.98	8.70	0.14		6249.57	35.43	406.49
1	40	5456.96	5455.37	1.59	7.11	0.24		13623.44	126.56	437.08
1	40	5457.90	5456.01	1.89	6.77	0.29		17870.38	194.62	441.56
1	40	5460.25	5457.59	2.65	4.24	2.02		30052.97	447.03	452.70
1	41	5457.60	5455.07	2.53	4.40	0.06		6285.00	0.00	362.15
1	41	5460.56	5455.90	4.67	5.16	0.12		13746.46	3.54	365.95
1	41	5462.32	5456.22	6.09	5.22	0.04		18056.59	8.41	367.45
1	41	5466.51	5457.12	9.39	4.97	0.29		30463.15	36.85	371.55
1	42	5462.06	5459.74	2.32	0.47	0.25		6285.00		214.07
1	42	5465.84	5460.94	4.90	0.51	0.01		13750.00		217.68
1	42	5467.58	5461.62	5.96	0.50	0.03		18065.00		219.70
1	42	5471.80	5463.35	8.45	0.45	0.08		30500.00		224.90
1	43	5462.78	5459.96	2.81				6285.00		199.70
1	43	5466.38	5461.48	4.90				13750.00		204.25
1	43	5468.12	5462.23	5.89				18065.00		206.49
1	43	5472.35	5464.14	8.21				30500.00		212.20
1	43.5	Bridge								
1	44	5463.50	5462.73	0.77				6285.00		202.15
1	44	5467.13	5465.91	1.22				13750.00		211.64
1	44	5468.87	5467.43	1.44				18065.00		216.17
1	44	5473.12	5471.14	1.98				30500.00		227.25
1	45	5463.58	5462.76	0.82	0.05	0.02		6285.00		208.40
1	45	5467.18	5465.95	1.23	0.04	0.00		13750.00		217.92

HEC-RAS Plan: Plan 01 River: Tijeras Arroyo Reach: 1 (Continued)

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	45	5468.91	5467.49	1.43	0.04	0.00		18065.00		222.52
1	45	5473.18	5471.27	1.91	0.04	0.02		30500.00		233.79
1	46	5466.50	5465.50	1.00	1.11	0.05	950.53	5334.47		462.86
1	46	5468.38	5466.62	1.76	5.42	0.02	3210.65	10539.35		502.21
1	46	5469.60	5468.63	0.97	0.64	0.05	5661.42	12403.58		511.48
1	46	5473.70	5472.99	0.71	0.40	0.12	11314.57	19185.43		528.98
1	50	5471.90	5470.98	0.92	5.39	0.01	27.93	6250.63	6.44	439.82
1	50	5473.80	5472.25	1.55	4.76	0.03	242.85	13451.20	55.95	478.70
1	50	5474.71	5472.89	1.82	2.83	0.26	455.27	17504.83	104.90	498.07
1	50	5476.92	5474.47	2.45	1.35	0.52	1359.02	28827.85	313.13	546.20
1	60	5486.85	5486.35	0.50	14.91	0.04	2.92	4459.11	1822.97	870.83
1	60	5488.08	5487.18	0.89	14.21	0.07	76.67	9232.54	4440.79	956.22
1	60	5488.69	5487.27	1.42	18.56	0.01	113.87	12075.86	5875.27	964.93
1	60	5490.17	5488.07	2.10	18.77	0.01	435.34	19607.25	10457.41	1041.34
1	70	5504.98	5504.17	0.81	14.47	0.09	724.12	4580.26	980.63	626.90
1	70	5506.54	5505.29	1.25			2243.97	8428.05	3077.98	707.45
1	70	5507.26	5505.79	1.47			3257.56	10478.42	4329.02	743.29
1	70	5508.94	5506.99	1.95			6915.80	15732.21	7851.99	773.60

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 70 Profile: PF 3

E.G. Elev (ft)	5507.26
Vel Head (ft)	1.47
W.S. Elev (ft)	5505.79
Crit W.S. (ft)	5505.82
E.G. Slope (ft/ft)	0.010768
Q Total (cfs)	18065.00
Top Width (ft)	743.29
Vel Total (ft/s)	8.42
Max Chl Dpth (ft)	4.79
Conv. Total (cfs)	174090.8
Length Wtd. (ft)	1333.48
Min Ch El (ft)	5501.00
Alpha	1.33
Frctn Loss (ft)	
C & E Loss (ft)	

Element	Left OB	Channel	Right OB
Wt. n-Val.	0.045	0.035	0.045
Reach Len. (ft)	1380.00	1310.00	1370.00
Flow Area (sq ft)	592.39	900.91	652.39
Area (sq ft)	592.39	900.91	652.39
Flow (cfs)	3257.56	10478.42	4329.02
Top Width (ft)	291.35	210.00	241.93
Avg. Vel. (ft/s)	5.50	11.63	6.64
Hydr. Depth (ft)	2.03	4.29	2.70
Conv. (cfs)	31392.8	100979.6	41718.3
Wetted Per. (ft)	291.38	210.01	242.08
Shear (lb/sq ft)	1.37	2.88	1.81
Stream Power (lb/ft s)	7.52	33.54	12.02
Cum Volume (acre-ft)	59.36	174.00	60.49
Cum SA (acres)	23.33	43.71	24.18

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 60 Profile: PF 3

E.G. Elev (ft)	5488.69
Vel Head (ft)	1.42
W.S. Elev (ft)	5487.27
Crit W.S. (ft)	5487.48
E.G. Slope (ft/ft)	0.018743
Q Total (cfs)	18065.00
Top Width (ft)	964.93
Vel Total (ft/s)	8.94
Max Chl Dpth (ft)	3.27
Conv. Total (cfs)	131951.9
Length Wtd. (ft)	1185.00
Min Ch El (ft)	5484.00
Alpha	1.15
Frctn Loss (ft)	18.56
C & E Loss (ft)	0.01

Element	Left OB	Channel	Right OB
Wt. n-Val.	0.045	0.035	0.045
Reach Len. (ft)	1185.00	1185.00	1185.00
Flow Area (sq ft)	34.14	1131.75	854.88
Area (sq ft)	34.14	1131.75	854.88
Flow (cfs)	113.87	12075.86	5875.27
Top Width (ft)	53.87	455.00	456.05
Avg. Vel. (ft/s)	3.33	10.67	6.87
Hydr. Depth (ft)	0.63	2.49	1.87
Conv. (cfs)	831.7	88205.5	42914.7
Wetted Per. (ft)	53.89	455.01	456.07
Shear (lb/sq ft)	0.74	2.91	2.19
Stream Power (lb/ft s)	2.47	31.06	15.07
Cum Volume (acre-ft)	49.43	143.43	36.79
Cum SA (acres)	17.87	33.71	13.20

Errors Warnings and Notes

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 50 Profile: PF 3

E.G. Elev (ft)	5474.71
Vel Head (ft)	1.82
W.S. Elev (ft)	5472.89
Crit W.S. (ft)	5472.89
E.G. Slope (ft/ft)	0.010926
Q Total (cfs)	18065.00
Top Width (ft)	498.07
Vel Total (ft/s)	10.49
Max Chl Dpth (ft)	4.89
Conv. Total (cfs)	172821.4
Length Wtd. (ft)	429.17
Min Ch El (ft)	5468.00
Alpha	1.07
Frctn Loss (ft)	2.83
C & E Loss (ft)	0.26

Element	Left OB	Channel	Right OB
Wt. n-Val.	0.045	0.035	0.045
Reach Len. (ft)	425.00	430.00	435.00
Flow Area (sq ft)	103.25	1594.96	24.01
Area (sq ft)	103.25	1594.96	24.01
Flow (cfs)	455.27	17504.83	104.90
Top Width (ft)	71.45	410.00	16.62
Avg. Vel. (ft/s)	4.41	10.98	4.37
Hydr. Depth (ft)	1.45	3.89	1.45
Conv. (cfs)	4355.4	167462.4	1003.5
Wetted Per. (ft)	71.51	410.10	16.87
Shear (lb/sq ft)	0.98	2.65	0.97
Stream Power (lb/ft s)	4.34	29.12	4.24
Cum Volume (acre-ft)	47.56	106.34	24.83
Cum SA (acres)	16.16	21.95	6.78

Errors Warnings and Notes

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Errors Warnings and Notes (Continued)

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 46 Profile: PF 3

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	5469.60				
Vel Head (ft)	0.97	Wt. n-Val.	0.045	0.035	
W.S. Elev (ft)	5468.63	Reach Len. (ft)	340.00	350.00	360.00
Crit W.S. (ft)	5467.45	Flow Area (sq ft)	1024.39	1414.21	
E.G. Slope (ft/ft)	0.004407	Area (sq ft)	1024.39	1414.21	
Q Total (cfs)	18065.00	Flow (cfs)	5661.42	12403.58	
Top Width (ft)	511.48	Top Width (ft)	255.26	256.22	
Vel Total (ft/s)	7.41	Avg. Vel. (ft/s)	5.53	8.77	
Max Chl Dpth (ft)	6.93	Hydr. Depth (ft)	4.01	5.52	
Conv. Total (cfs)	272120.5	Conv. (cfs)	85280.2	186840.3	
Length Wtd. (ft)	348.43	Wetted Per. (ft)	255.89	257.61	
Min Ch El (ft)	5461.70	Shear (lb/sq ft)	1.10	1.51	
Alpha	1.14	Stream Power (lb/ft s)	6.09	13.25	
Frctn Loss (ft)	0.64	Cum Volume (acre-ft)	42.06	91.49	24.71
C & E Loss (ft)	0.05	Cum SA (acres)	14.57	18.66	6.69

Errors Warnings and Notes

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 45 Profile: PF 3

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	5468.91				
Vel Head (ft)	1.43	Wt. n-Val.		0.020	
W.S. Elev (ft)	5467.49	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)		Flow Area (sq ft)		1885.64	
E.G. Slope (ft/ft)	0.000997	Area (sq ft)		1885.64	
Q Total (cfs)	18065.00	Flow (cfs)		18065.00	
Top Width (ft)	222.52	Top Width (ft)		222.52	
Vel Total (ft/s)	9.58	Avg. Vel. (ft/s)		9.58	
Max Chl Dpth (ft)	10.88	Hydr. Depth (ft)		8.47	
Conv. Total (cfs)	572078.2	Conv. (cfs)		572078.2	
Length Wtd. (ft)	40.00	Wetted Per. (ft)		228.51	
Min Ch El (ft)	5456.61	Shear (lb/sq ft)		0.51	
Alpha	1.00	Stream Power (lb/ft s)		4.92	
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	38.07	78.23	24.71
C & E Loss (ft)	0.00	Cum SA (acres)	13.57	16.74	6.69

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 44 Profile: PF 3

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	5468.87				
Vel Head (ft)	1.44	Wt. n-Val.		0.020	
W.S. Elev (ft)	5467.43	Reach Len. (ft)	2.00	2.00	2.00
Crit W.S. (ft)	5464.59	Flow Area (sq ft)		1875.93	
E.G. Slope (ft/ft)	0.000978	Area (sq ft)		1875.93	
Q Total (cfs)	18065.00	Flow (cfs)		18065.00	
Top Width (ft)	216.17	Top Width (ft)		216.17	
Vel Total (ft/s)	9.63	Avg. Vel. (ft/s)		9.63	
Max Chl Dpth (ft)	11.10	Hydr. Depth (ft)		8.68	
Conv. Total (cfs)	577668.3	Conv. (cfs)		577668.3	
Length Wtd. (ft)	2.00	Wetted Per. (ft)		222.32	
Min Ch El (ft)	5456.33	Shear (lb/sq ft)		0.52	
Alpha	1.00	Stream Power (lb/ft s)		4.96	
Frctn Loss (ft)		Cum Volume (acre-ft)	38.07	76.51	24.71
C & E Loss (ft)		Cum SA (acres)	13.57	16.54	6.69

Errors Warnings and Notes (Continued)

additional cross sections.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 43.5 BR U Profile: PF 3

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	5468.62	Wt. n-Val.		0.020	
Vel Head (ft)	3.42	Reach Len. (ft)	80.00	80.00	80.00
W.S. Elev (ft)	5465.20	Flow Area (sq ft)		1216.47	
Crit W.S. (ft)	5465.20	Area (sq ft)		1216.47	
E.G. Slope (ft/ft)	0.003797	Flow (cfs)		18065.00	
Q Total (cfs)	18065.00	Top Width (ft)		180.14	
Top Width (ft)	180.14	Avg. Vel. (ft/s)		14.85	
Vel Total (ft/s)	14.85	Hydr. Depth (ft)		6.75	
Max Chl Dpth (ft)	8.87	Conv. (cfs)		293164.2	
Conv. Total (cfs)	293164.2	Wetted Per. (ft)		208.23	
Length Wtd. (ft)	80.00	Shear (lb/sq ft)		1.38	
Min Ch El (ft)	5456.33	Stream Power (lb/ft s)		20.57	
Alpha	1.00	Cum Volume (acre-ft)	38.07	76.44	24.71
Frctn Loss (ft)		Cum SA (acres)	13.57	16.53	6.69
C & E Loss (ft)					

Errors Warnings and Notes

Note: The momentum method has computed a class B profile.

Note: The energy method has computed a class B profile.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 43.5 BR D Profile: PF 3

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	5467.90	Wt. n-Val.		0.020	
Vel Head (ft)	3.38	Reach Len. (ft)	3.00	3.00	3.00
W.S. Elev (ft)	5464.52	Flow Area (sq ft)		1224.53	
Crit W.S. (ft)	5464.52	Area (sq ft)		1224.53	
E.G. Slope (ft/ft)	0.003793	Flow (cfs)		18065.00	
Q Total (cfs)	18065.00	Top Width (ft)		183.74	
Top Width (ft)	183.74	Avg. Vel. (ft/s)		14.75	
Vel Total (ft/s)	14.75	Hydr. Depth (ft)		6.66	
Max Chl Dpth (ft)	8.79	Conv. (cfs)		293323.2	
Conv. Total (cfs)	293323.2	Wetted Per. (ft)		211.52	
Length Wtd. (ft)	3.00	Shear (lb/sq ft)		1.37	
Min Ch El (ft)	5455.73	Stream Power (lb/ft s)		20.22	
Alpha	1.00	Cum Volume (acre-ft)	38.07	74.19	24.71
Frctn Loss (ft)		Cum SA (acres)	13.57	16.19	6.69
C & E Loss (ft)					

Errors Warnings and Notes

Note: The momentum method has computed a class B profile.

Note: The energy method has computed a class B profile.

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 43 Profile: PF 3

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	5468.12	Wt. n-Val.		0.020	
Vel Head (ft)	5.89	Reach Len. (ft)	50.00	50.00	50.00
W.S. Elev (ft)	5462.23	Flow Area (sq ft)		927.72	
Crit W.S. (ft)	5463.99	Area (sq ft)		927.72	
E.G. Slope (ft/ft)	0.009453	Flow (cfs)		18065.00	
Q Total (cfs)	18065.00	Top Width (ft)		206.49	
Top Width (ft)	206.49	Avg. Vel. (ft/s)		19.47	
Vel Total (ft/s)	19.47	Hydr. Depth (ft)		4.49	
Max Chl Dpth (ft)	6.50	Conv. (cfs)		185801.6	
Conv. Total (cfs)	185801.6	Wetted Per. (ft)		209.61	
Length Wtd. (ft)	50.00	Shear (lb/sq ft)		2.61	
Min Ch El (ft)	5455.73				

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 43 Profile: PF 3 (Continued)

Alpha	1.00	Stream Power (lb/ft s)			50.86
Frctn Loss (ft)		Cum Volume (acre-ft)	38.07	74.12	24.71
C & E Loss (ft)		Cum SA (acres)	13.57	16.18	6.69

Errors Warnings and Notes

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 42 Profile: PF 3

E.G. Elev (ft)	5467.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	5.96	Wt. n-Val.		0.020	
W.S. Elev (ft)	5461.62	Reach Len. (ft)	200.00	245.00	275.00
Crit W.S. (ft)	5463.36	Flow Area (sq ft)		921.73	
E.G. Slope (ft/ft)	0.010469	Area (sq ft)		921.73	
Q Total (cfs)	18065.00	Flow (cfs)		18065.00	
Top Width (ft)	219.70	Top Width (ft)		219.70	
Vel Total (ft/s)	19.60	Avg. Vel. (ft/s)		19.60	
Max Chl Dpth (ft)	6.24	Hydr. Depth (ft)		4.20	
Conv. Total (cfs)	176561.1	Conv. (cfs)		176561.1	
Length Wtd. (ft)	245.01	Wetted Per. (ft)		222.65	
Min Ch El (ft)	5455.38	Shear (lb/sq ft)		2.71	
Alpha	1.00	Stream Power (lb/ft s)		53.03	
Frctn Loss (ft)	0.50	Cum Volume (acre-ft)	38.07	73.06	24.71
C & E Loss (ft)	0.03	Cum SA (acres)	13.57	15.93	6.69

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 41 Profile: PF 3

E.G. Elev (ft)	5462.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	6.09	Wt. n-Val.		0.035	0.045
W.S. Elev (ft)	5456.22	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	5457.95	Flow Area (sq ft)		911.33	1.50
E.G. Slope (ft/ft)	0.064536	Area (sq ft)		911.33	1.50
Q Total (cfs)	18065.00	Flow (cfs)		18056.59	8.41
Top Width (ft)	367.45	Top Width (ft)		365.00	2.45
Vel Total (ft/s)	19.79	Avg. Vel. (ft/s)		19.81	5.61
Max Chl Dpth (ft)	4.32	Hydr. Depth (ft)		2.50	0.61
Conv. Total (cfs)	71111.3	Conv. (cfs)		71078.2	33.1
Length Wtd. (ft)	200.00	Wetted Per. (ft)		366.00	2.74
Min Ch El (ft)	5451.90	Shear (lb/sq ft)		10.03	2.21
Alpha	1.00	Stream Power (lb/ft s)		198.77	12.38
Frctn Loss (ft)	5.22	Cum Volume (acre-ft)	38.07	67.90	24.71
C & E Loss (ft)	0.04	Cum SA (acres)	13.57	14.29	6.68

Errors Warnings and Notes

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 40 Profile: PF 3

E.G. Elev (ft)	5457.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.89	Wt. n-Val.		0.035	0.045
W.S. Elev (ft)	5456.01	Reach Len. (ft)	1010.00	1055.00	1060.00
Crit W.S. (ft)	5456.01	Flow Area (sq ft)		1611.52	35.15
E.G. Slope (ft/ft)	0.011514	Area (sq ft)		1611.52	35.15
Q Total (cfs)	18065.00	Flow (cfs)		17870.38	194.62
Top Width (ft)	441.56	Top Width (ft)		424.02	17.54
Vel Total (ft/s)	10.97	Avg. Vel. (ft/s)		11.09	5.54
Max Chl Dpth (ft)	4.51	Hydr. Depth (ft)		3.80	2.00
Conv. Total (cfs)	168354.9	Conv. (cfs)		166541.2	1813.7
Length Wtd. (ft)	1054.12	Wetted Per. (ft)		424.32	17.99
Min Ch El (ft)	5451.50	Shear (lb/sq ft)		2.73	1.40

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 40 Profile: PF 3 (Continued)

Alphal	1.01	Stream Power (lb/ft s)		30.27	7.78
Frctn Loss (ft)	6.77	Cum Volume (acre-ft)	38.07	62.11	24.62
C & E Loss (ft)	0.29	Cum SA (acres)	13.57	12.48	6.64

Errors Warnings and Notes

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 30 Profile: PF 3

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	5445.34	Wt. n-Val.	0.045	0.035	0.045
Vel Head (ft)	0.92	Reach Len. (ft)	1000.00	705.00	1000.00
W.S. Elev (ft)	5444.42	Flow Area (sq ft)	367.02	1339.34	836.11
Crit W.S. (ft)	5442.99	Area (sq ft)	367.02	1339.34	836.11
E.G. Slope (ft/ft)	0.004089	Flow (cfs)	1315.44	11430.66	5318.91
Q Total (cfs)	18065.00	Top Width (ft)	165.91	240.00	159.33
Top Width (ft)	565.25	Avg. Vel. (ft/s)	3.58	8.53	6.36
Vel Total (ft/s)	7.11	Hydr. Depth (ft)	2.21	5.58	5.25
Max Chl Dpth (ft)	7.42	Conv. (cfs)	20570.8	178752.2	83176.9
Conv. Total (cfs)	282499.8	Wetted Per. (ft)	165.97	240.29	159.89
Length Wtd. (ft)	829.46	Shear (lb/sq ft)	0.56	1.42	1.33
Min Ch El (ft)	5437.00	Stream Power (lb/ft s)	2.02	12.14	8.49
Alpha	1.17	Cum Volume (acre-ft)	33.81	26.38	14.02
Frctn Loss (ft)	4.48	Cum SA (acres)	11.65	4.44	4.49
C & E Loss (ft)	0.09				

Errors Warnings and Notes

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 20 Profile: PF 3

		Element	Left OB	Channel	Right OB
E.G. Elev (ft)	5440.77	Wt. n-Val.	0.045	0.035	
Vel Head (ft)	1.83	Reach Len. (ft)	720.00	685.00	520.00
W.S. Elev (ft)	5438.94	Flow Area (sq ft)	1375.58	687.17	
Crit W.S. (ft)	5438.94	Area (sq ft)	1375.58	687.17	
E.G. Slope (ft/ft)	0.007449	Flow (cfs)	8608.43	9456.57	
Q Total (cfs)	18065.00	Top Width (ft)	422.70	92.36	
Top Width (ft)	515.05	Avg. Vel. (ft/s)	6.26	13.76	
Vel Total (ft/s)	8.76	Hydr. Depth (ft)	3.25	7.44	
Max Chl Dpth (ft)	9.44	Conv. (cfs)	99741.8	109568.8	
Conv. Total (cfs)	209310.6	Wetted Per. (ft)	422.74	94.41	
Length Wtd. (ft)	670.94	Shear (lb/sq ft)	1.51	3.38	
Min Ch El (ft)	5429.50	Stream Power (lb/ft s)	9.47	46.58	
Alpha	1.54	Cum Volume (acre-ft)	13.81	9.98	4.42
Frctn Loss (ft)	5.17	Cum SA (acres)	4.89	1.75	2.66
C & E Loss (ft)	0.16				

Errors Warnings and Notes

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

Errors Warnings and Notes (Continued)

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 10 Profile: PF 3

E.G. Elev (ft)	5432.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.27	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	5429.05	Reach Len. (ft)			
Crit W.S. (ft)	5430.09	Flow Area (sq ft)	295.29	581.98	741.30
E.G. Slope (ft/ft)	0.024430	Area (sq ft)	295.29	581.98	741.30
Q Total (cfs)	18065.00	Flow (cfs)	2208.53	10482.70	5373.77
Top Width (ft)	744.53	Top Width (ft)	169.25	130.00	445.28
Vel Total (ft/s)	11.16	Avg. Vel. (ft/s)	7.48	18.01	7.25
Max Chl Dpth (ft)	5.05	Hydr. Depth (ft)	1.74	4.48	1.66
Conv. Total (cfs)	115578.4	Conv. (cfs)	14130.0	67067.4	34381.0
Length Wtd. (ft)		Wetted Per. (ft)	169.28	130.14	445.33
Min Ch El (ft)	5424.00	Shear (lb/sq ft)	2.66	6.82	2.54
Alpha	1.69	Stream Power (lb/ft s)	19.90	122.85	18.40
Frctn Loss (ft)	8.30	Cum Volume (acre-ft)			
C & E Loss (ft)	0.14	Cum SA (acres)			

Errors Warnings and Notes

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

HEC-RAS Plan: Plan 01 River: Tijeras Arroyo Reach: 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	10	6285.00	5424.00	5428.48	5428.48	5429.26	0.006323	8.36	1199.50	713.88	0.75
1	10	13750.00	5424.00	5429.60	5429.56	5430.73	0.007665	10.89	2033.34	773.67	0.86
1	10	18065.00	5424.00	5430.09	5430.09	5431.40	0.008133	11.95	2421.58	796.17	0.90
1	10	30500.00	5424.00	5431.20	5431.20	5433.00	0.009177	14.33	3306.99	809.95	0.98
1	20	6285.00	5429.50	5436.60	5436.60	5437.75	0.005596	9.80	972.33	415.44	0.74
1	20	13750.00	5429.50	5438.23	5438.23	5439.85	0.007000	12.65	1706.14	484.73	0.85
1	20	18065.00	5429.50	5438.94	5438.94	5440.77	0.007449	13.76	2062.75	515.05	0.89
1	20	30500.00	5429.50	5440.57	5440.57	5442.90	0.008042	16.03	2955.82	576.28	0.95
1	30	6285.00	5437.00	5441.65		5442.16	0.005366	6.18	1137.56	445.74	0.65
1	30	13750.00	5437.00	5443.57		5444.35	0.004267	7.80	2074.91	528.48	0.63
1	30	18065.00	5437.00	5444.42		5445.34	0.004089	8.53	2542.47	565.25	0.64
1	30	30500.00	5437.00	5446.36		5447.63	0.003963	10.25	3718.98	648.60	0.66
1	40	6285.00	5451.50	5454.08	5454.08	5455.15	0.012965	8.50	788.45	385.82	0.98
1	40	13750.00	5451.50	5455.59	5455.59	5457.26	0.010750	10.79	1416.00	447.92	0.97
1	40	18065.00	5451.50	5456.29	5456.29	5458.23	0.010122	11.72	1743.00	477.08	0.97
1	40	30500.00	5451.50	5458.00	5458.00	5460.55	0.009018	13.68	2618.57	547.58	0.96
1	41	6285.00	5451.90	5456.34	5455.85	5456.92	0.006123	6.56	1111.20	499.47	0.69
1	41	13750.00	5451.90	5457.91	5457.17	5458.84	0.005585	8.45	1963.89	581.51	0.71
1	41	18065.00	5451.90	5458.68	5457.79	5459.73	0.005218	9.11	2422.48	609.79	0.71
1	41	30500.00	5451.90	5460.58		5461.92	0.004542	10.48	3639.98	675.82	0.70
1	42	6285.00	5454.90	5458.59	5458.59	5459.43	0.015347	8.26	926.19	569.63	1.04
1	42	13750.00	5454.90	5459.77	5459.77	5461.05	0.013436	10.46	1659.53	674.68	1.05
1	42	18065.00	5454.90	5460.35	5460.35	5461.78	0.012192	11.14	2062.63	709.77	1.02
1	42	30500.00	5454.90	5461.75	5461.59	5463.55	0.010229	12.65	3098.13	768.60	0.99
1	43	6285.00	5455.60	5459.38	5459.38	5460.14	0.012448	7.96	1014.77	651.89	0.95
1	43	13750.00	5455.60	5460.60		5461.66	0.010128	9.65	1857.58	728.42	0.92
1	43	18065.00	5455.60	5461.06	5460.95	5462.36	0.010638	10.77	2200.74	757.37	0.97
1	43	30500.00	5455.60	5462.34	5462.18	5464.07	0.009980	12.63	3225.42	837.88	0.98
1	44	6285.00	5456.80	5460.44		5460.87	0.005677	5.91	1336.42	702.54	0.66
1	44	13750.00	5456.80	5461.62		5462.35	0.006161	7.96	2253.62	828.94	0.73
1	44	18065.00	5456 80	5462.23		5463.06	0.005855	8.59	2771.03	874.70	0.73
1	44	30500.00	5456.80	5463.65		5464.74	0.005469	10.04	4092.33	981.92	0.74
1	45	6285.00	5457.00	5460.68	5460.68	5461.47	0.011168	8.44	1047.16	647.14	0.92
1	45	13750.00	5457.00	5461.79	5461.79	5462.97	0.011294	10.77	1819.30	737.65	0.99
1	45	18065.00	5457.00	5462.29	5462.29	5463.67	0.011333	11.74	2198.89	773.31	1.01
1	45	30500.00	5457.00	5463.48	5463.48	5465.33	0.011398	13.90	3168.08	857.66	1.06

CORRECTED EFFECTIVE

D. Mark Goodwin & Associates, P.A.
Consulting Engineers
P.O. BOX 90606, ALBUQUERQUE,NM 87199
(505) 828-2200 FAX 797-9539

September 8, 2005

Mr. John Kelly
Executive Director
AMAFCA
2600 Prospect Avenue NE
Albuquerque, NM 87107

Re: Juan Tabo Bridge

Dear Mr. Kelly:

The purpose of this letter is to provide the additional information requested in the AMAFCA letter dated August 3, 2005 (see attached). Please find attached two copies of the HEC RAS printouts and digital copies on CD, including the latest geometry model of 4' sediment accumulation immediately upstream of the bridge. The backwater effects are illustrated both on an attached Plan and Profile, and on the inundation map. The analysis shows that there will be no change in water surface elevations on the upstream off-site properties for the 100-year and/or the 500-year events. All of the increased water surface elevations will be properly contained within this development.

Since the backwater pool does not spread off the property, we are not inclined to pursue the more expensive suggestions recommended in the August 3rd letter. The shot-crete lining under the bridge extends all the way up the side slopes to the abutments, and the lining of the arroyo under the bridge will act as a grade control structure that will serve to protect the upstream utilities.

This analysis concludes this phase of the Juan Tabo Subdivision. The bridge analysis will be combined with a separate report on the Four Hills Arroyo to request CLOMR and LOMR approval for Unit 1 of the Subdivision. Then at a later date we will develop a plan to stabilize banks and reclaim floodplain next to Unit 3, east of the bridge.

Please contact our office if you have any questions.

Sincerely,

MARK GOODWIN & ASSOCIATES, P.A.

James D. Hughes, PE
Project Engineer

JDH/wp

Attachments

xc: Robert Lupton – JTH, LLC
Brad Bingham – Floodplain Administrator

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HYDROLOGY SECTION

Ronald D. Brown, Chair
Daniel F. Lyon, Vice Chair
Tim Eichenberg, Secretary-Treasurer
Janet Saiers, Asst. Secretary-Treasurer
Danny Hernandez, Director

John P. Kelly, P.E.
Executive Engineer

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority
2600 Prospect N.E., Albuquerque, NM 87107
Phone: (505) 884-2215 Fax: (505) 884-0214

August 3, 2005

Doug Hughes, P.E.
Mark Goodwin & Associates
P.O. Box 90606
Albuquerque, NM 87199

Re: Juan Tabo Boulevard Bridge Crossing at Tijeras Arroyo

Dear Doug:

Following AMAFCA's initial comments on the proposed bridge crossing of the Tijeras Arroyo, we received from Ayres and Associates a report on potential sediment issues regarding the design of the bridge crossing. A copy of that report was forwarded to your office. A particular concern on the part of the sediment analysis was the potential for additional aggradation in the Tijeras Arroyo caused by the backwater pool associated with the bridge structure. As indicated in your initial report, the upstream water surface for the 100 year event immediately above the bridge could increase by as much as 5.2 feet, which obviously would cause a backwater pool that eventually could deposit sediment. Conclusions by Ayres and Associates was that up to 4 feet of accumulated sediment is possible in the backwater pool since there is available sediment for that deposition in the upper Tijeras Arroyo.

Per your letter of June 17th, you indicated that additional HEC-RAS information was modeled, assuming a 4 foot sediment accumulation at the bridge opening. Results were that if a 4 foot accumulation occurred immediately above the bridge, that the upstream water elevation would increase by 4 feet. Please submit that HEC-RAS analysis as additional information for the Drainage Report as soon as possible, in the normal form showing input data and the input cross-sections, and the resulting output information, so that we have a complete HEC-RAS file on the information that has been accumulated to date. I am not aware that the additional HEC-RAS information has been submitted to date.

As indicated in my original comments, please submit an inundation map that would provide data for the extent of the inundation pool upstream of the proposed crossing, for the 100 year and 500 year events. An additional inundation map including the additional 4 feet of water elevation increase should also be prepared and submitted to determine the upstream effect of the potential 4 foot deposition of sediment. The information submitted to date on your indicated sheets 3 and 8 is not sufficient to identify where the upstream water pool elevation increases will occur, relative to the upstream properties. The inundation map should reflect the water surface elevations for those areas that would receive an increase in water elevation above the normal 100 and 500 year water elevations for the existing channel. The inundation map should show the existing flood plain areas that will be impacted by the backwater from the bridge.

It would appear from the Ayres report that scour depths, and in general the hydraulic analysis of the bridge, is reasonable. Ayres suggested a design modification to lower the hard surfacing under

the bridge 4 feet to allow for additional scour through the bridge opening in the case of a very large event. There appears to be no reason why the hard lining under the bridge could not be lowered and then backfilled to the current flow elevation, using typical erosive bed materials that would provide the suggested bed erosion to increase conveyance capacity for very large events. The upstream utilities can be protected with a hard-lined capping over those utilities to prevent possible washout in the case of such an erosive event. It may also be possible that, in lieu of capping, a cutoff wall downstream of those utilities could be installed that would effectively prevent erosion below a certain elevation to act as a protection barrier for those utilities. For a bridge of this type, crossing a major arroyo like the Tijeras, with potential flows in the 20,000 cfs range, and lacking any additional input for design for the sediment/erosion potentials for the Tijeras Arroyo, AMAFCA recognizes the information from Ayres and Associates as a significant contribution to a conservative design that should be incorporated into the final plan.

The original data prepared by Leedshill-Herkenhoff for sediment and erosion analysis of the Tijeras Arroyo is still valid. Keep in mind, however, the bridge structure will totally change the character of this section of the arroyo upstream and downstream, and will result in significant changes to the erosion characteristics identified by Leedshill-Herkenhoff.

It would appear on the cross-section of the bridge, plan sheet S3, that the backspans provide significantly less channel opening than the mainspan with the low-flow channel. With the narrower opening, the potential for debris clogging may become a reality. Please provide a HEC-RAS analysis of the main bridge area, assuming that the backspans are blocked out, and the center span low-flow channel is the only area available for conveyance. This condition should be analyzed only for the low-flow, using the 10-year flow, since significantly higher flows would most likely push potential debris downstream. Also, reviewing the layout of the shotcrete immediately adjacent to the bridge structure, it is somewhat difficult to determine the vertical extent of the shotcrete. I assume that, from the data presented, the shotcrete extends all the way up the slope to the bridge abutments, so that no scour under the bridge will occur. Please verify that this is the case, and final plans should reflect the extent of the backslope protection with shotcrete.

Since the 100 year floodplain will be altered by the project, coordinate with the City Floodplain Administrator on meeting FEMA requirements for map revision.

If you have any questions, please contact me at 884-2215.

Sincerely,
AMAFCA

Loren D. Meinz, P.E.
Drainage Engineer

Cc: Brad Bingham, City of Albuquerque

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HYDROLOGY SECTION

D. Mark Goodwin & Associates, P.A.
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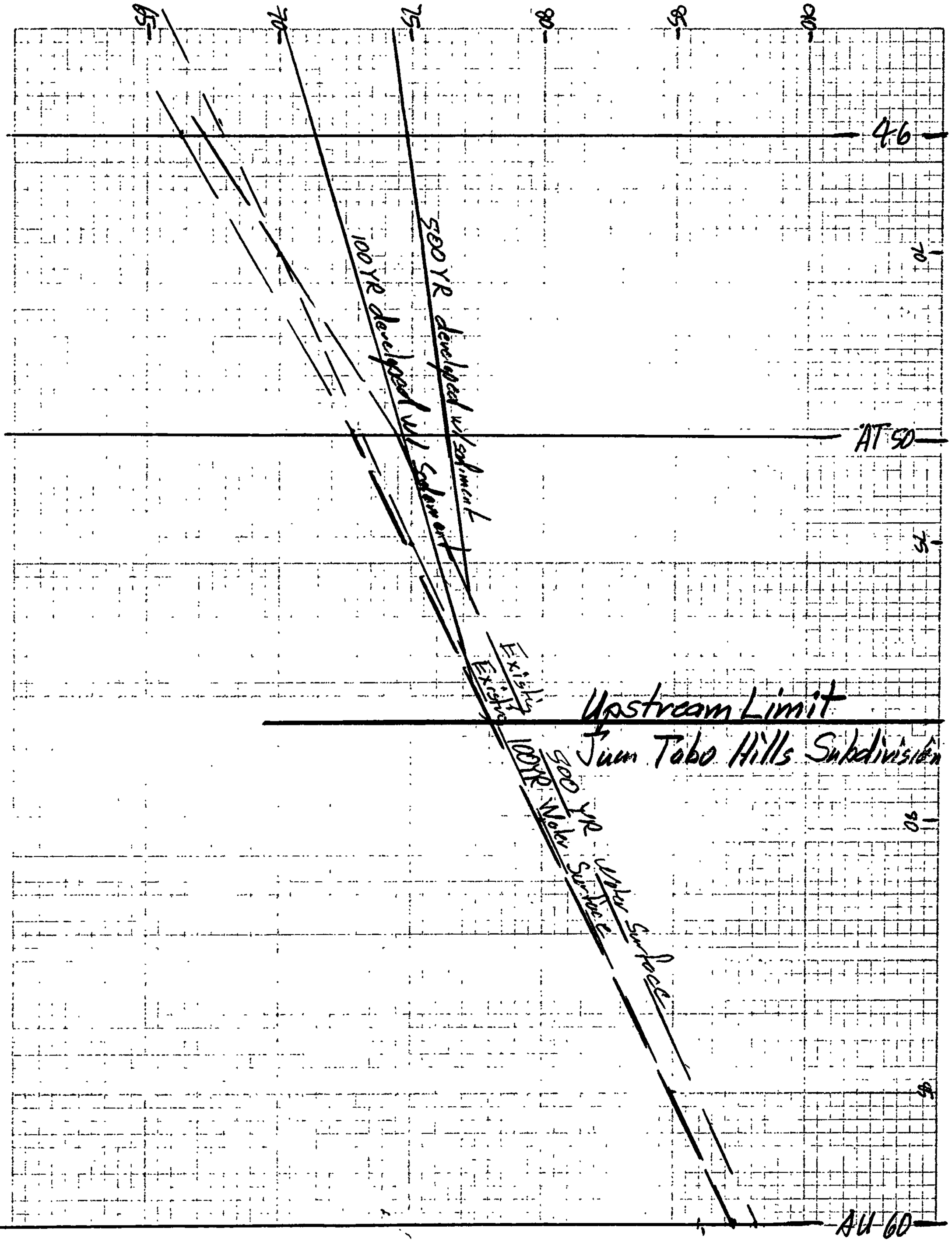
e-mail: goodwinengrs@comcast.net

PROJECT Juan Tabo Hills
SUBJECT Bridge Backwater w/ Sediment
BY TQH DATE 9-6-05
CHECKED _____ DATE _____
SHEET ___ OF ___



HEC-RAS Plan: sed6-10-05 River: Tijeras Arroyo Reach: 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1	10	PF 3	18065.00	5424.00	5429.05	5430.09	5432.33	0.024444	18.02	1618.21	744.50	1.50
1	10	PF 4	30500.00	5424.00	5430.01	5431.20	5433.99	0.025159	20.80	2354.37	795.12	1.57
1	20	PF 3	18065.00	5429.50	5438.94	5438.94	5440.77	0.007449	13.76	2062.75	515.05	0.89
1	20	PF 4	30500.00	5429.50	5440.57	5440.57	5442.90	0.008042	16.03	2955.82	576.28	0.95
1	30	PF 3	18065.00	5437.00	5444.42	5442.99	5445.34	0.004089	8.53	2542.47	565.25	0.64
1	30	PF 4	30500.00	5437.00	5446.36	5444.62	5447.63	0.003963	10.25	3718.98	648.60	0.66
1	40	PF 3	18065.00	5451.50	5456.01	5456.01	5457.90	0.011529	11.09	1646.02	441.55	1.00
1	40	PF 4	30500.00	5451.50	5457.53	5457.60	5460.25	0.010682	13.30	2327.74	452.29	1.02
1	41	PF 3	18065.00	5451.90	5456.21	5457.95	5462.39	0.066020	19.95	906.55	367.37	2.23
1	41	PF 4	30500.00	5451.90	5457.16	5459.72	5466.33	0.064268	24.32	1256.97	371.73	2.32
1	42	PF 3	18065.00	5455.38	5462.00	5463.36	5467.01	0.007896	17.96	1005.63	220.84	1.48
1	42	PF 4	30500.00	5455.38	5463.91	5465.87	5470.94	0.007205	21.29	1432.72	226.57	1.49
1	43	PF 3	18065.00	5455.73	5462.77	5463.96	5467.46	0.006560	17.39	1039.06	208.10	1.37
1	43	PF 4	30500.00	5455.73	5464.89	5466.56	5471.42	0.005927	20.50	1487.95	214.47	1.37
1	43.5		Bridge									
1	44	PF 3	18065.00	5456.33	5467.44	5464.60	5468.88	0.000973	9.62	1878.68	216.21	0.57
1	44	PF 4	30500.00	5456.33	5471.16	5467.25	5473.14	0.000892	11.28	2703.57	227.31	0.58
1	45	PF 3	18065.00	5459.61	5467.38	5467.76	5470.85	0.004103	14.94	1208.81	213.25	1.11
1	45	PF 4	30500.00	5459.61	5470.33	5470.33	5474.55	0.003015	16.48	1850.70	222.05	1.01
1	46	PF 3	18065.00	5465.70	5471.44	5471.44	5473.20	0.010757	11.77	1834.21	506.01	0.99
1	46	PF 4	30500.00	5465.70	5474.75		5476.03	0.003878	10.09	3534.11	521.25	0.65
1	50	PF 3	18065.00	5468.00	5474.68	5472.89	5475.47	0.002924	7.31	2662.60	552.62	0.54
1	50	PF 4	30500.00	5468.00	5476.33	5474.47	5477.58	0.003384	9.31	3613.78	602.79	0.61
1	60	PF 3	18065.00	5484.00	5487.27	5487.48	5488.69	0.018664	10.66	2023.60	965.23	1.19
1	60	PF 4	30500.00	5484.00	5488.08	5488.50	5490.16	0.019309	13.07	2834.78	1041.47	1.27

NEW BRIDGE W/ SEDIMENT

(Bed raised at section 45 & 46)

HEC-RAS Plan: sed6-10-05 River: Tijeras Arroyo Reach: 1 (Continued)

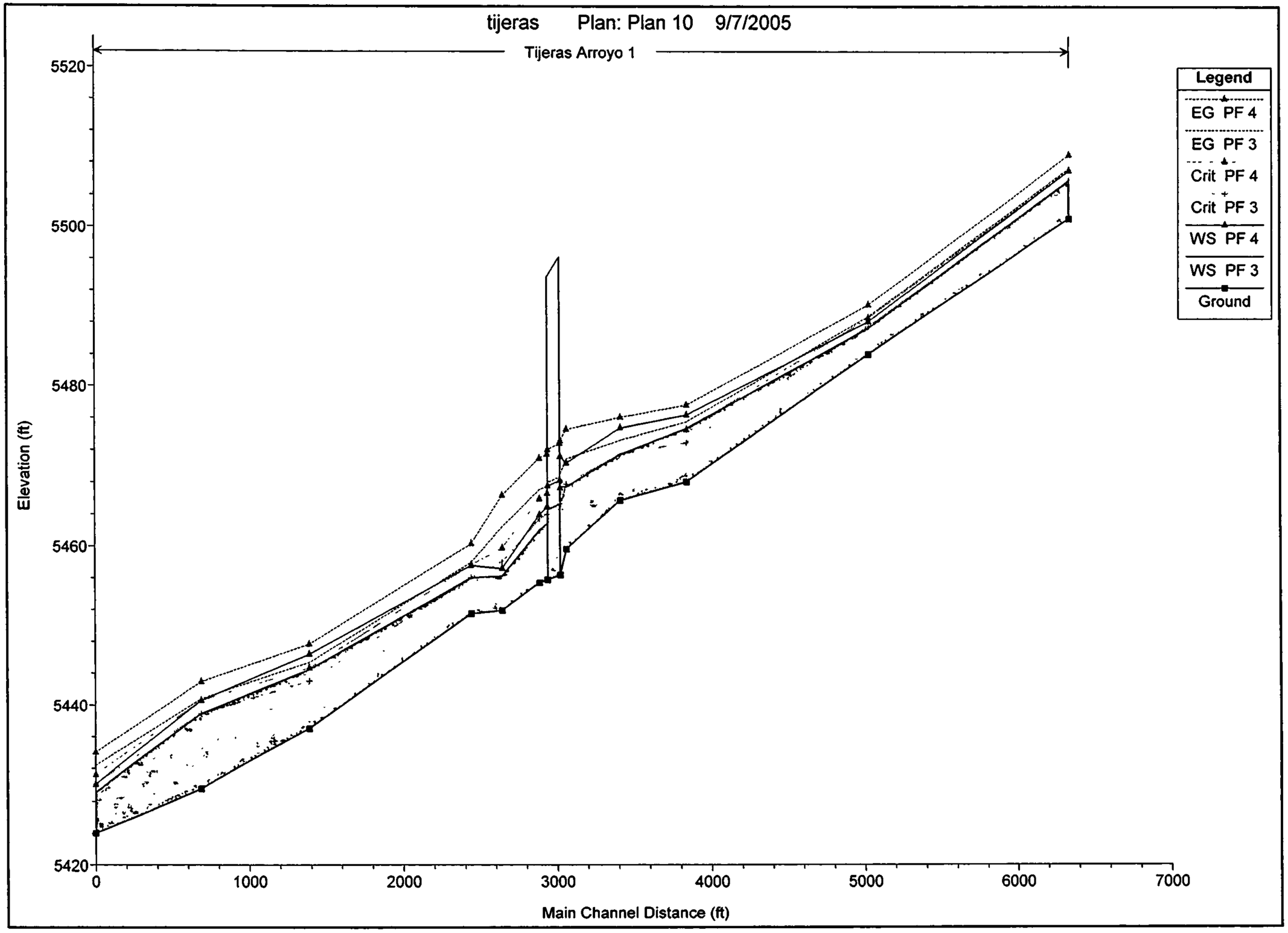
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	70	PF 3	18065.00	5501.00	5505.79	5505.83	5507.26	0.010768	11.63	2145.69	743.29	0.99
1	70	PF 4	30500.00	5501.00	5506.99	5507.03	5508.94	0.010666	13.65	3061.82	773.60	1.03

HEC-RAS Plan: sed6-10-05 River: Tijeras Arroyo Reach: 1

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	10	PF 3	5432.33	5429.05	3.27	8.30	0.14	2208.29	10483.89	5372.82	744.50
1	10	PF 4	5433.99	5430.01	3.98	8.75	0.16	4378.51	14685.56	11435.93	795.12
1	20	PF 3	5440.77	5438.94	1.83	5.17	0.16	8608.43	9456.57		515.05
1	20	PF 4	5442.90	5440.57	2.33	5.69	0.16	17020.14	13475.88	3.98	576.28
1	30	PF 3	5445.34	5444.42	0.92	4.48	0.09	1315.44	11430.65	5318.91	565.25
1	30	PF 4	5447.63	5446.36	1.27	4.63	0.11	3412.46	18495.71	8591.84	648.60
1	40	PF 3	5457.90	5456.01	1.90	6.77	0.29		17870.45	194.55	441.55
1	40	PF 4	5460.25	5457.53	2.71	4.19	1.96		30057.34	442.66	452.29
1	41	PF 3	5462.39	5456.21	6.18	4.27	0.35		18056.81	8.19	367.37
1	41	PF 4	5466.33	5457.16	9.18	3.96	0.64		30462.06	37.94	371.73
1	42	PF 3	5467.01	5462.00	5.01	0.36	0.10		18065.00		220.84
1	42	PF 4	5470.94	5463.91	7.04	0.33	0.15		30500.00		226.57
1	43	PF 3	5467.46	5462.77	4.69				18065.00		208.10
1	43	PF 4	5471.42	5464.89	6.52				30500.00		214.47
1	43.5		Bridge								
1	44	PF 3	5468.88	5467.44	1.44				18065.00		216.21
1	44	PF 4	5473.14	5471.16	1.98				30500.00		227.31
1	45	PF 3	5470.85	5467.38	3.47	2.19	0.17		18065.00		213.25
1	45	PF 4	5474.55	5470.33	4.22	0.06	1.12		30500.00		222.05
1	46	PF 3	5473.20	5471.44	1.76	1.92	0.13	4978.14	13086.86		506.01
1	46	PF 4	5476.03	5474.75	1.28	1.19	0.29	10693.42	19806.58		521.25
1	50	PF 3	5475.47	5474.68	0.79	2.17	0.10	851.64	17017.13	196.23	552.62
1	50	PF 4	5477.58	5476.33	1.26	1.55	0.00	2046.91	27981.46	471.63	602.79
1	60	PF 3	5488.69	5487.27	1.42	18.55	0.01	114.33	12074.03	5876.64	965.23

HEC-RAS Plan: sed6-10-05 River: Tijeras Arroyo Reach: 1 (Continued)

Reach	River Sta	Profile	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	60	PF 4	5490.16	5488.08	2.09	18.76	0.01	438.02	19598.19	10463.79	1041.47
1	70	PF 3	5507.26	5505.79	1.47			3257.56	10478.42	4329.02	743.29
1	70	PF 4	5508.94	5506.99	1.95			6915.80	15732.21	7851.99	773.60


tijeras Plan: Plan 10 9/7/2005
Tijeras Arroyo 1
Legend
EG PF 4
EG PF 3
Crit PF 4
Crit PF 3
WS PF 4
WS PF 3
Ground
Elevation (ft)
5520
5500
5480
5460
5440
5420
0
1000
2000
3000
4000
5000
6000
7000
Main Channel Distance (ft)

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 70 Profile: PF 3

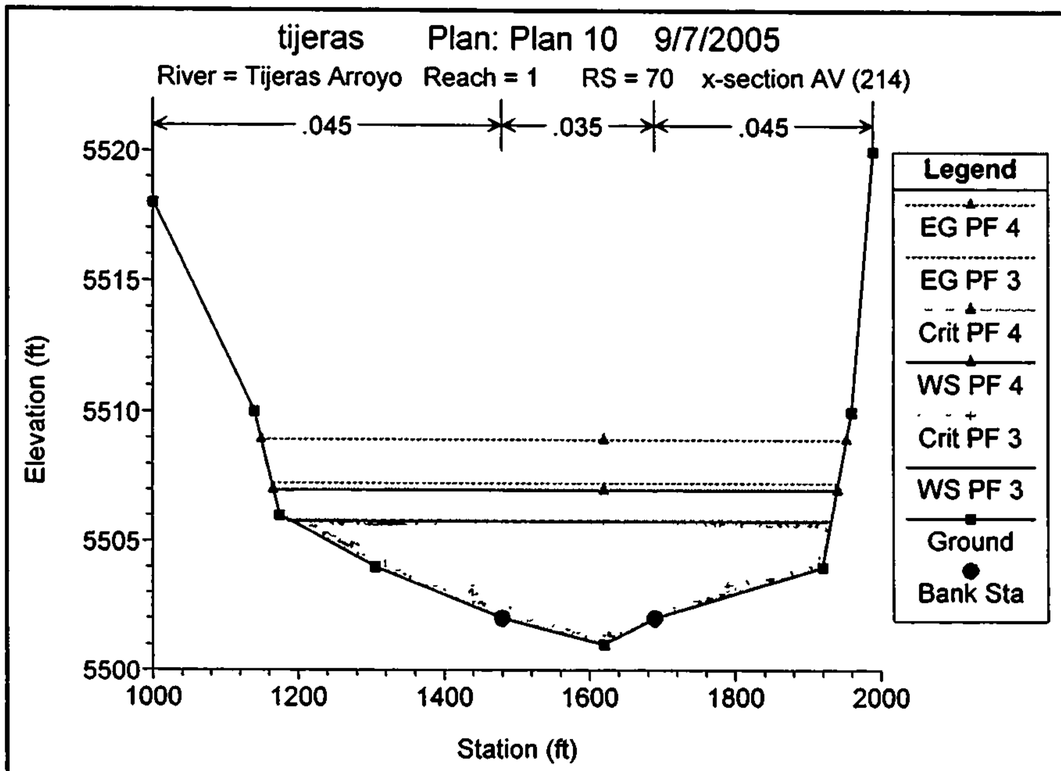
E.G. Elev (ft)	5507.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.47	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	5505.79	Reach Len. (ft)	1380.00	1310.00	1370.00
Crit W.S. (ft)	5505.83	Flow Area (sq ft)	592.39	900.91	652.39
E.G. Slope (ft/ft)	0.010768	Area (sq ft)	592.39	900.91	652.39
Q Total (cfs)	18065.00	Flow (cfs)	3257.56	10478.42	4329.02
Top Width (ft)	743.29	Top Width (ft)	291.35	210.00	241.93
Vel Total (ft/s)	8.42	Avg. Vel. (ft/s)	5.50	11.63	6.64
Max Chl Dpth (ft)	4.79	Hydr. Depth (ft)	2.03	4.29	2.70
Conv. Total (cfs)	174090.8	Conv. (cfs)	31392.8	100979.6	41718.3
Length Wtd. (ft)	1333.48	Wetted Per. (ft)	291.38	210.01	242.08
Min Ch El (ft)	5501.00	Shear (lb/sq ft)	1.37	2.88	1.81
Alpha	1.33	Stream Power (lb/ft s)	7.52	33.54	12.02
Frctn Loss (ft)		Cum Volume (acre-ft)	59.81	182.24	61.25
C & E Loss (ft)		Cum SA (acres)	24.14	43.65	24.38

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 60 Profile: PF 3

E.G. Elev (ft)	5488.69	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.42	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	5487.27	Reach Len. (ft)	1185.00	1185.00	1185.00
Crit W.S. (ft)	5487.48	Flow Area (sq ft)	34.30	1133.08	856.22
E.G. Slope (ft/ft)	0.018664	Area (sq ft)	34.30	1133.08	856.22
Q Total (cfs)	18065.00	Flow (cfs)	114.33	12074.03	5876.64
Top Width (ft)	965.23	Top Width (ft)	54.00	455.00	456.23
Vel Total (ft/s)	8.93	Avg. Vel. (ft/s)	3.33	10.66	6.86
Max Chl Dpth (ft)	3.27	Hydr. Depth (ft)	0.64	2.49	1.88
Conv. Total (cfs)	132231.1	Conv. (cfs)	836.9	88378.8	43015.5
Length Wtd. (ft)	1185.00	Wetted Per. (ft)	54.01	455.01	456.25
Min Ch El (ft)	5484.00	Shear (lb/sq ft)	0.74	2.90	2.19
Alpha	1.15	Stream Power (lb/ft s)	2.47	30.92	15.01
Frctn Loss (ft)	18.55	Cum Volume (acre-ft)	49.88	151.65	37.53
C & E Loss (ft)	0.01	Cum SA (acres)	18.66	33.65	13.40

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 50 Profile: PF 3

E.G. Elev (ft)	5475.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	5474.68	Reach Len. (ft)	425.00	430.00	435.00
Crit W.S. (ft)	5472.89	Flow Area (sq ft)	270.76	2328.87	62.97
E.G. Slope (ft/ft)	0.002924	Area (sq ft)	270.76	2328.87	62.97
Q Total (cfs)	18065.00	Flow (cfs)	851.64	17017.13	196.23
Top Width (ft)	552.62	Top Width (ft)	115.70	410.00	26.91
Vel Total (ft/s)	6.78	Avg. Vel. (ft/s)	3.15	7.31	3.12
Max Chl Dpth (ft)	6.68	Hydr. Depth (ft)	2.34	5.68	2.34
Conv. Total (cfs)	334090.3	Conv. (cfs)	15750.1	314711.2	3629.0
Length Wtd. (ft)	429.22	Wetted Per. (ft)	115.80	410.10	27.31
Min Ch El (ft)	5468.00	Shear (lb/sq ft)	0.43	1.04	0.42
Alpha	1.11	Stream Power (lb/ft s)	1.34	7.57	1.31
Frctn Loss (ft)	2.17	Cum Volume (acre-ft)	45.73	104.56	25.02
C & E Loss (ft)	0.10	Cum SA (acres)	16.36	21.88	6.83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River = Tijeras Arroyo Reach = 1 RS = 70 x-section AV (214)
.045
.035
.045
Elevation (ft)
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5515
5510
5505
5500
1000
1200
1400
1600
1800
2000
Station (ft)
Legend
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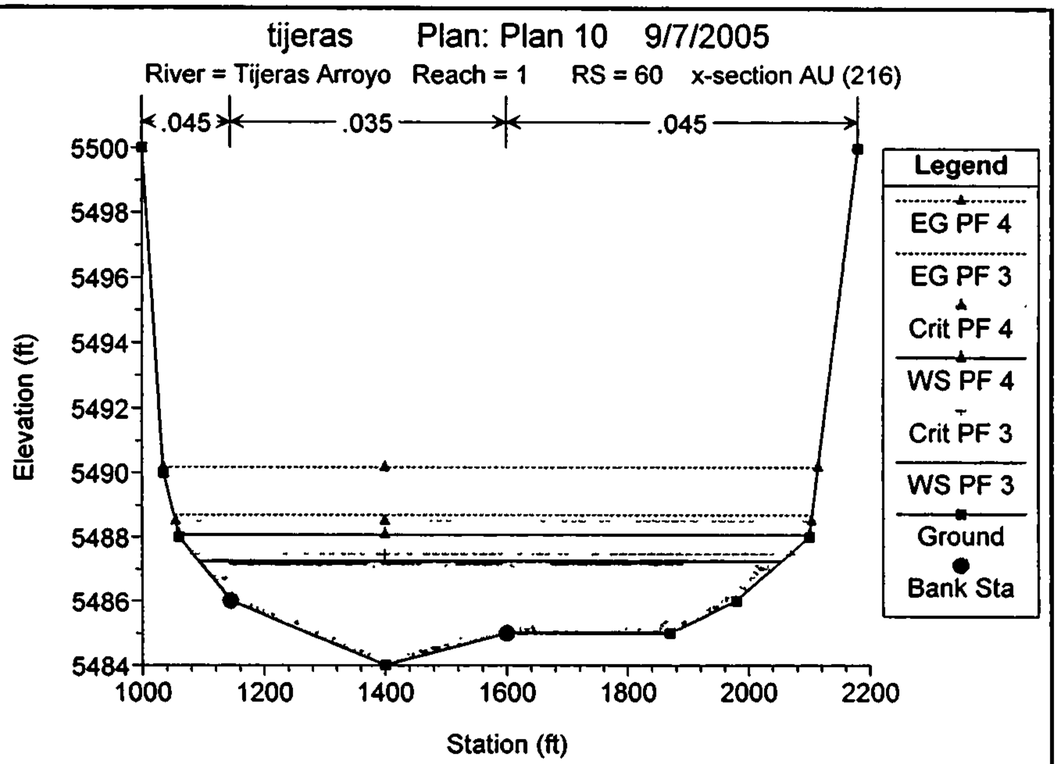
EG PF 3
Crit PF 4
WS PF 4
Crit PF 3
WS PF 3
Ground
Bank Sta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.035
.045
Elevation (ft)
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5496
5494
5492
5490
5488
5486
5484
1000
1200
1400
1600
1800
2000
2200
Station (ft)
Legend
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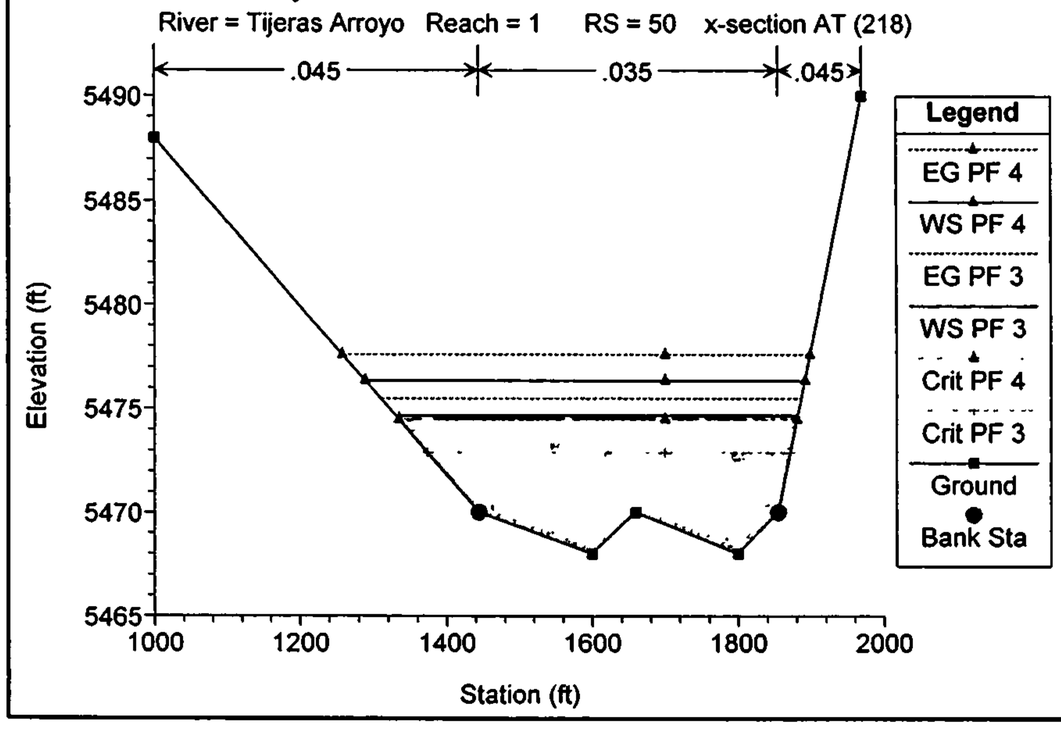
EG PF 3
Crit PF 4
WS PF 4
Crit PF 3
WS PF 3
Ground
Bank Sta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River = Tijeras Arroyo Reach = 1 RS = 50 x-section AT (218)
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.035
.045
Elevation (ft)
5490
5485
5480
5475
5470
5465
1000
1200
1400
1600
1800
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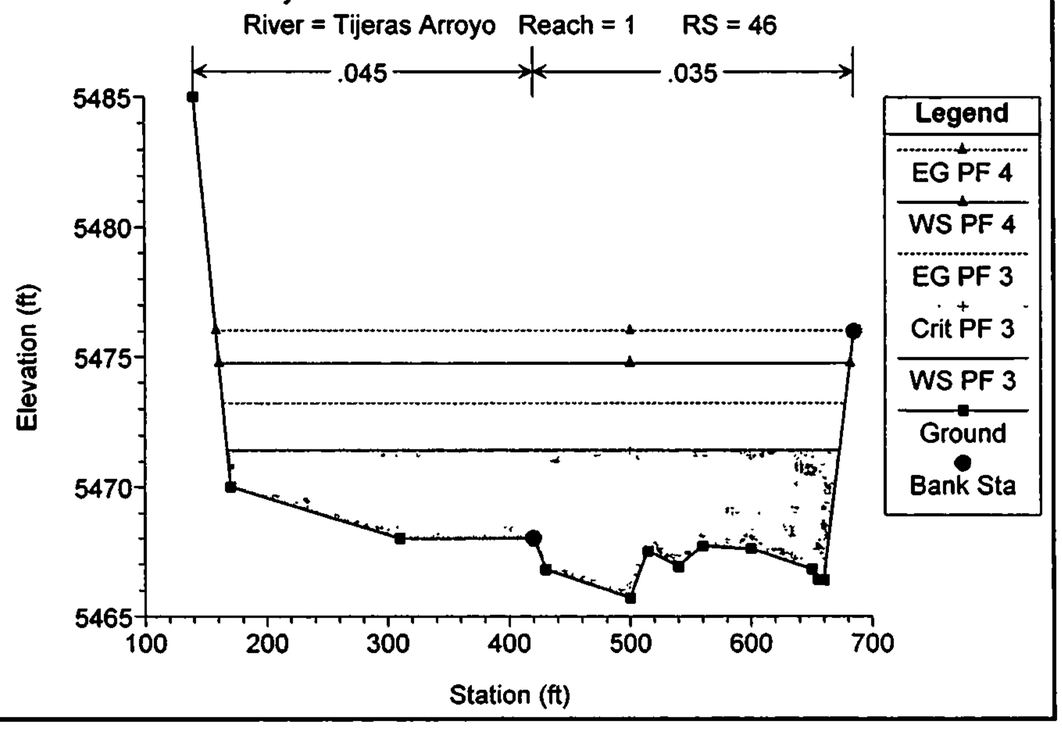
Station (ft)
Legend
EG PF 4
WS PF 4
EG PF 3
WS PF 3
Crit PF 4
Crit PF 3
Ground
Bank Sta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River = Tijeras Arroyo Reach = 1 RS = 46
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.035
Elevation (ft)
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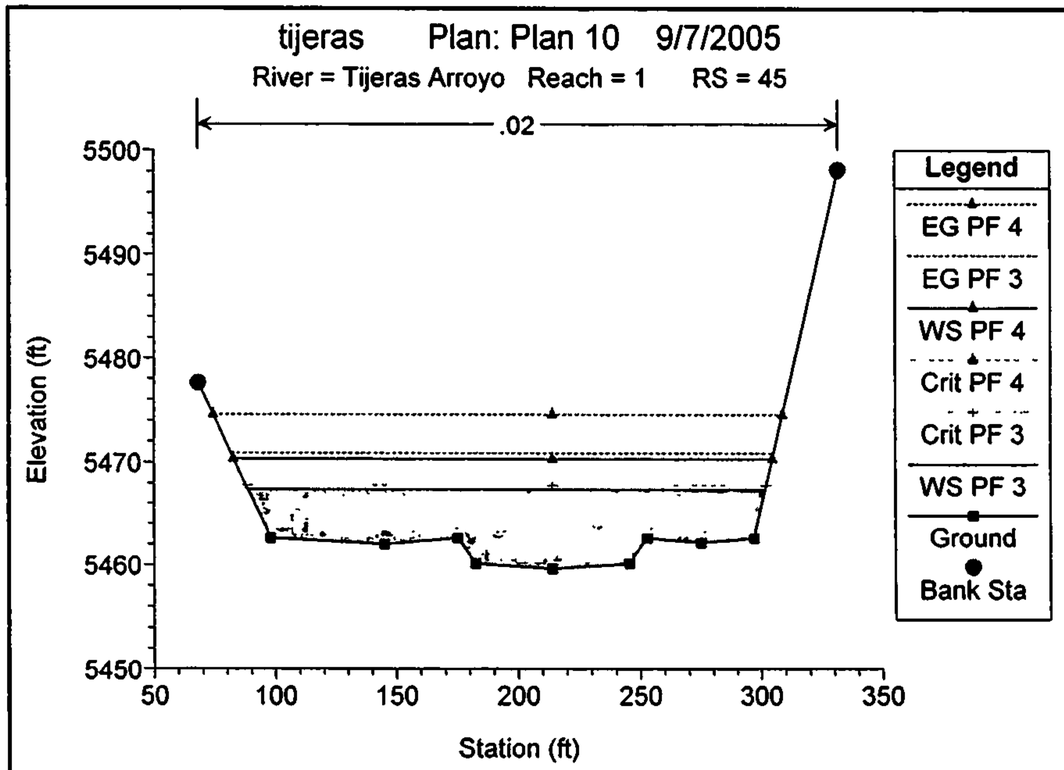
5480
5475
5470
5465
100
200
300
400
500
600
700
Station (ft)
Legend
EG PF 4
WS PF 4
EG PF 3
Crit PF 3
WS PF 3
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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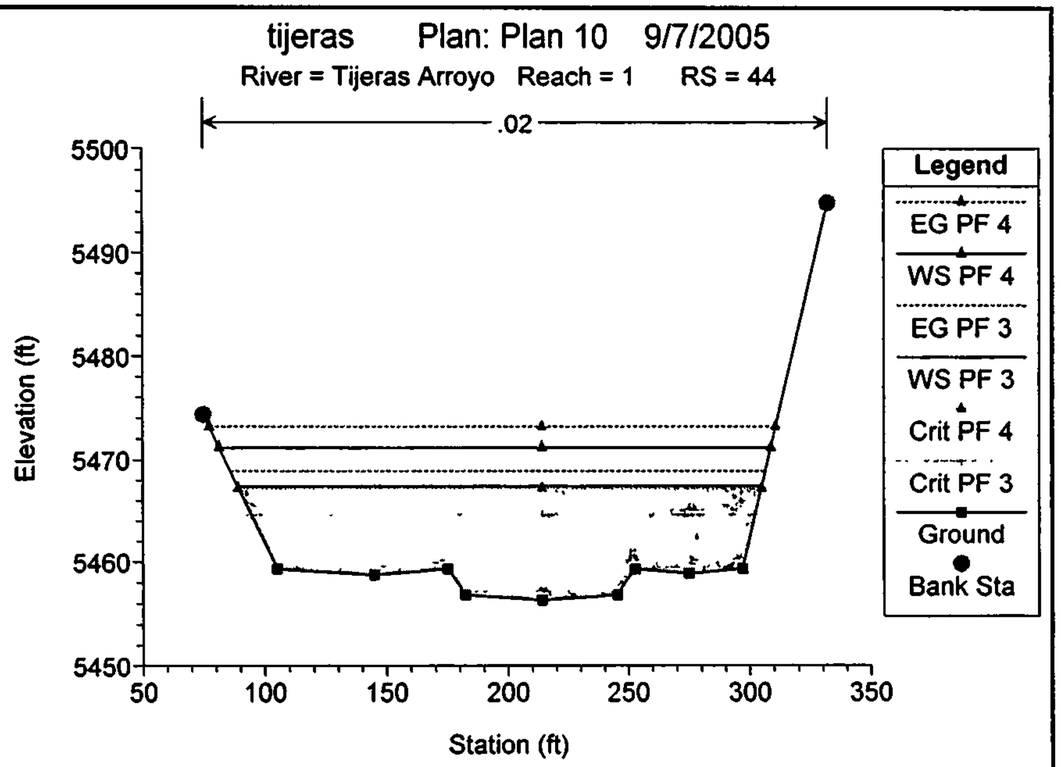
EG PF 3
WS PF 4
Crit PF 4
Crit PF 3
WS PF 3
Ground
Bank Sta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River = Tijeras Arroyo Reach = 1 RS = 44
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Elevation (ft)
Station (ft)
Legend
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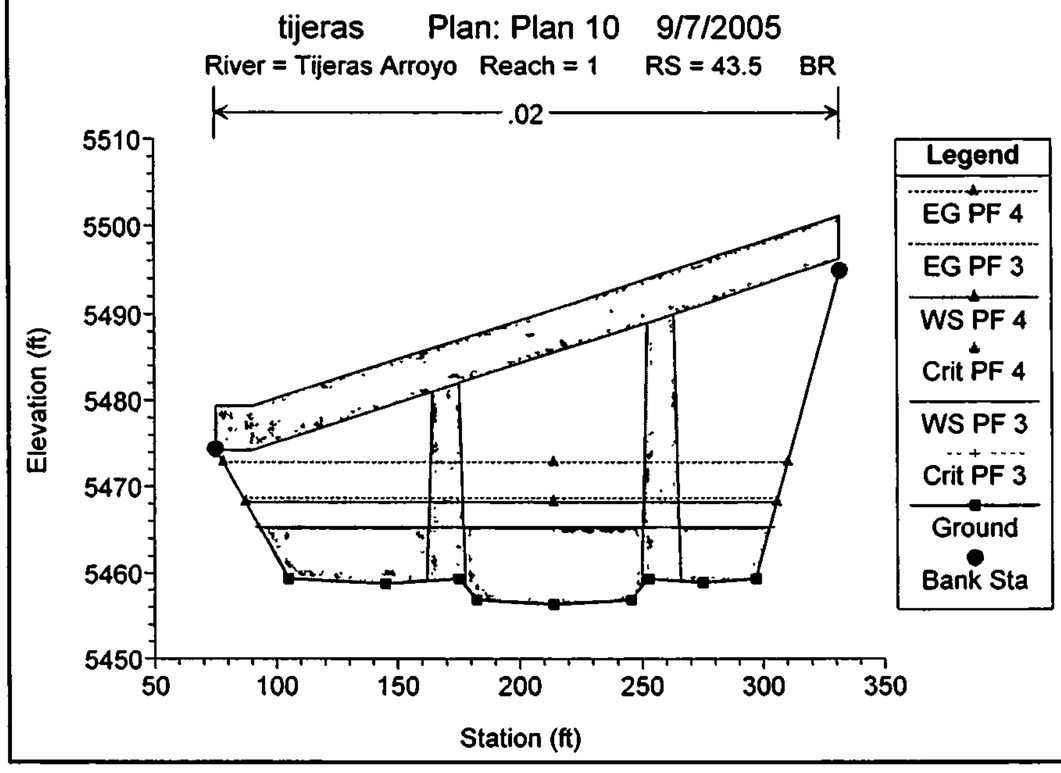
WS PF 4
EG PF 3
WS PF 3
Crit PF 4
Crit PF 3
Ground
Bank Sta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River = Tijeras Arroyo Reach = 1 RS = 43.5 BR
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Elevation (ft)
Station (ft)
Legend
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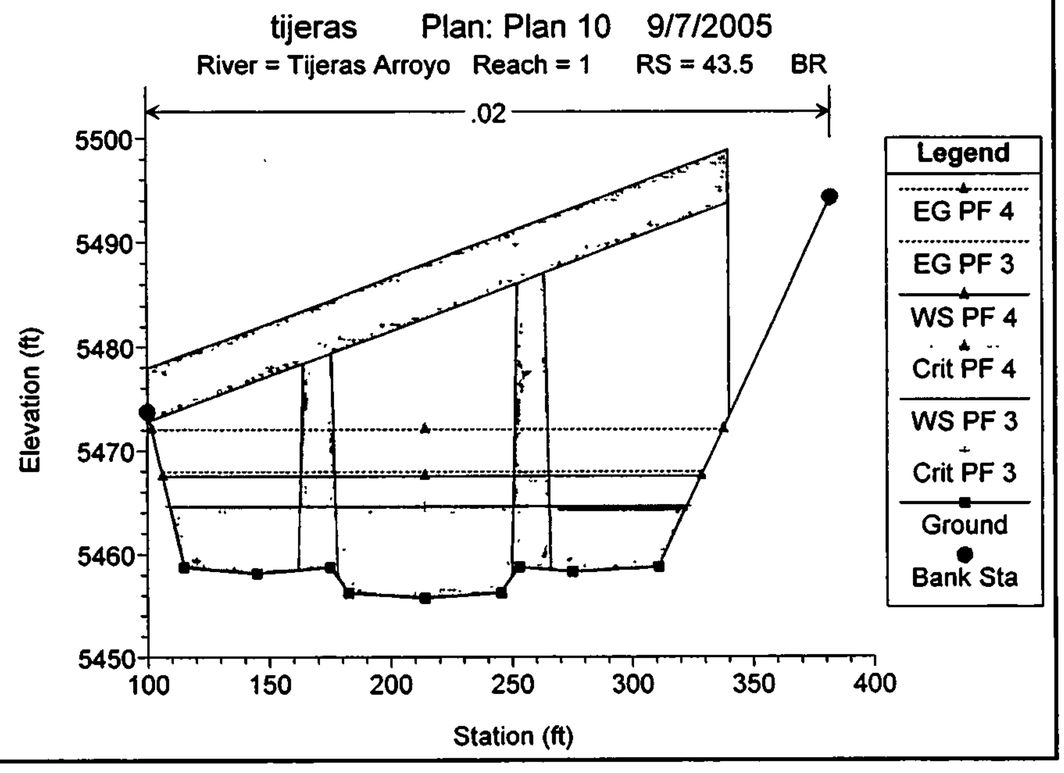
EG PF 3
WS PF 4
Crit PF 4
WS PF 3
Crit PF 3
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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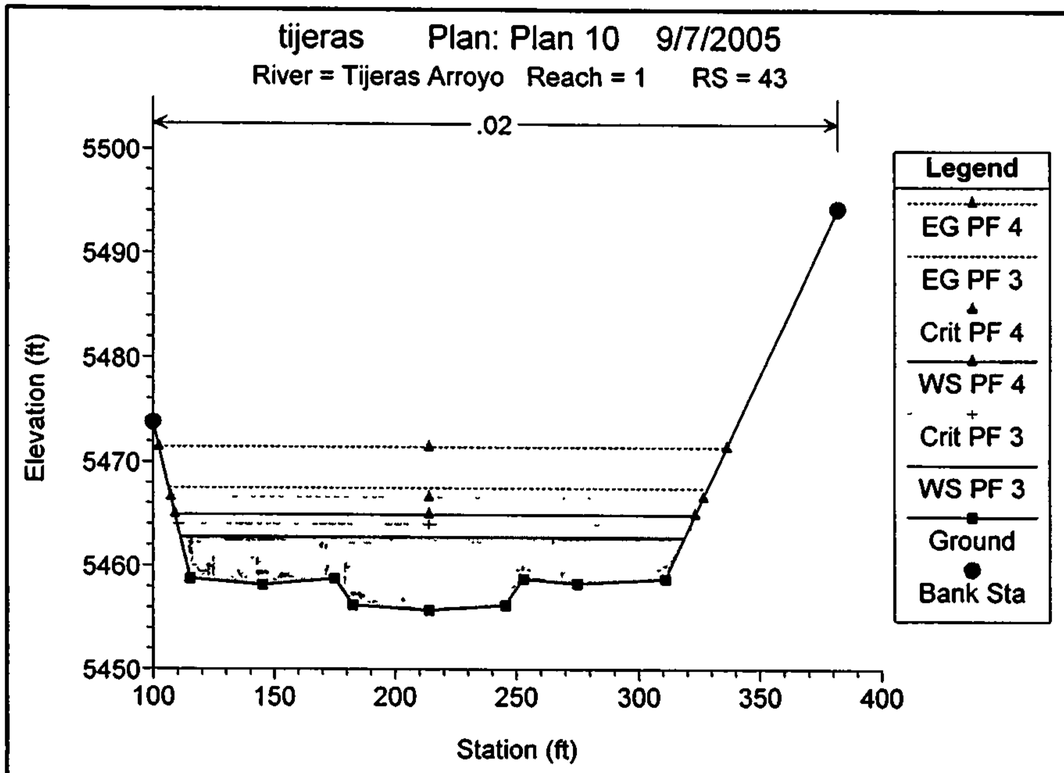
EG PF 3
WS PF 4
Crit PF 4
WS PF 3
Crit PF 3
Ground
Bank Sta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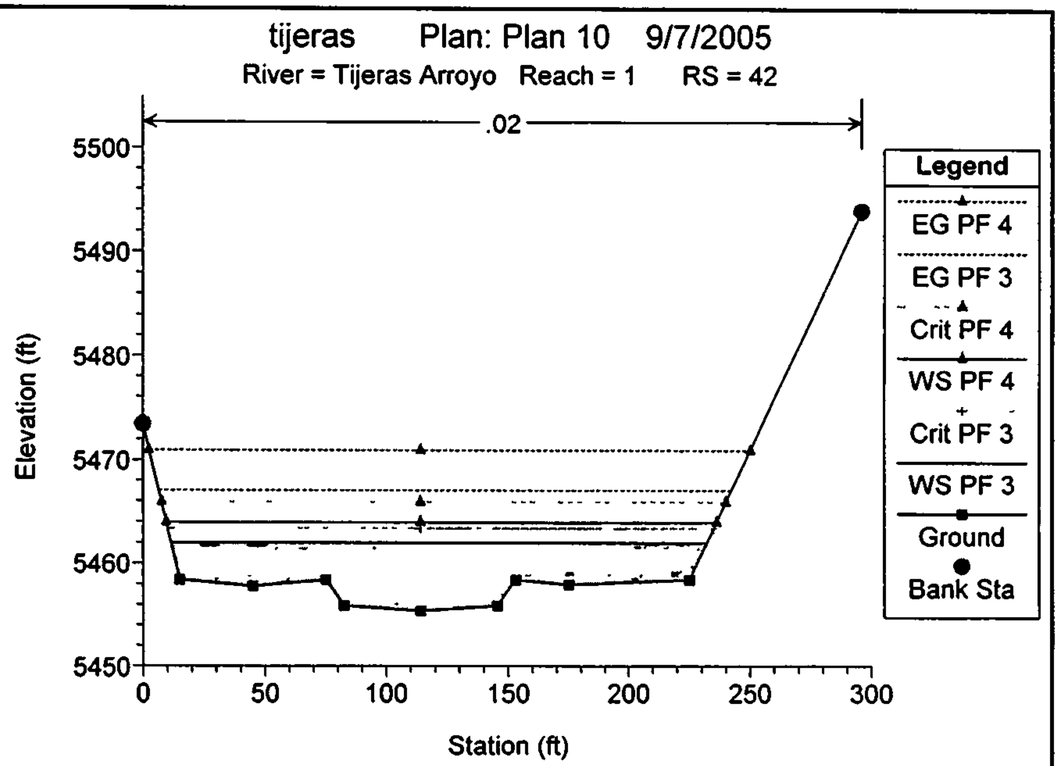
River = Tijeras Arroyo Reach = 1 RS = 43
.02
Elevation (ft)
Station (ft)
Legend
EG PF 4
EG PF 3
Crit PF 4
WS PF 4
Crit PF 3
WS PF 3
Ground
Bank Sta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River = Tijeras Arroyo Reach = 1 RS = 42
.02
Elevation (ft)
Station (ft)
Legend
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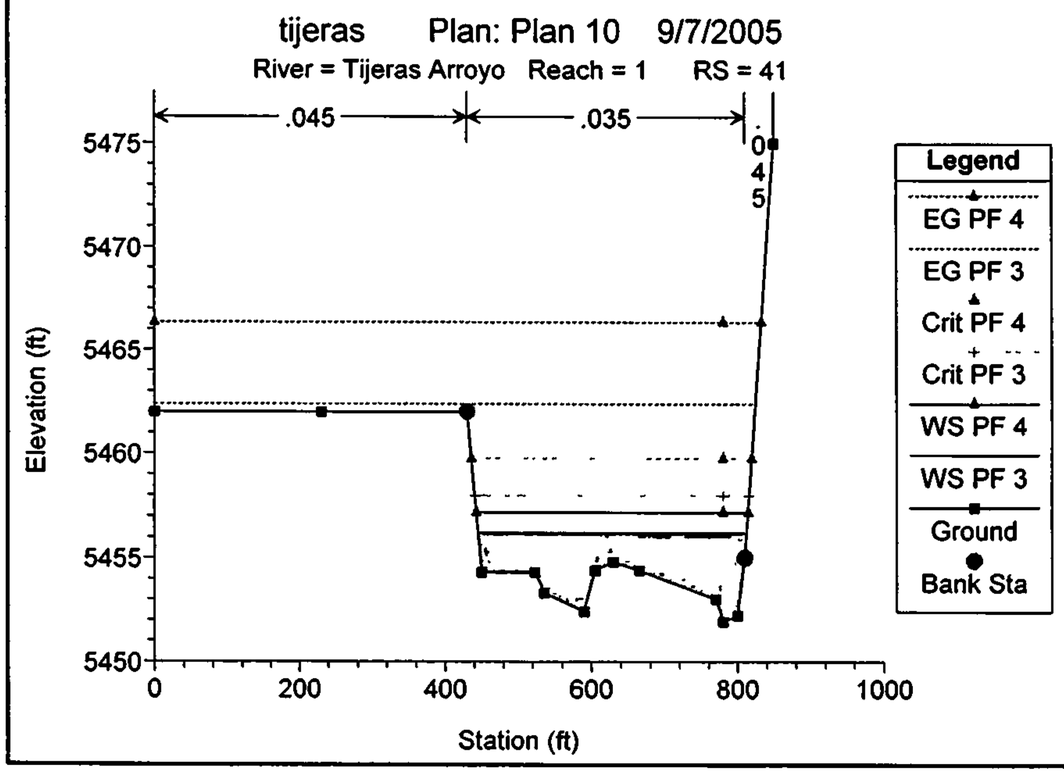
EG PF 3
Crit PF 4
WS PF 4
Crit PF 3
WS PF 3
Ground
Bank Sta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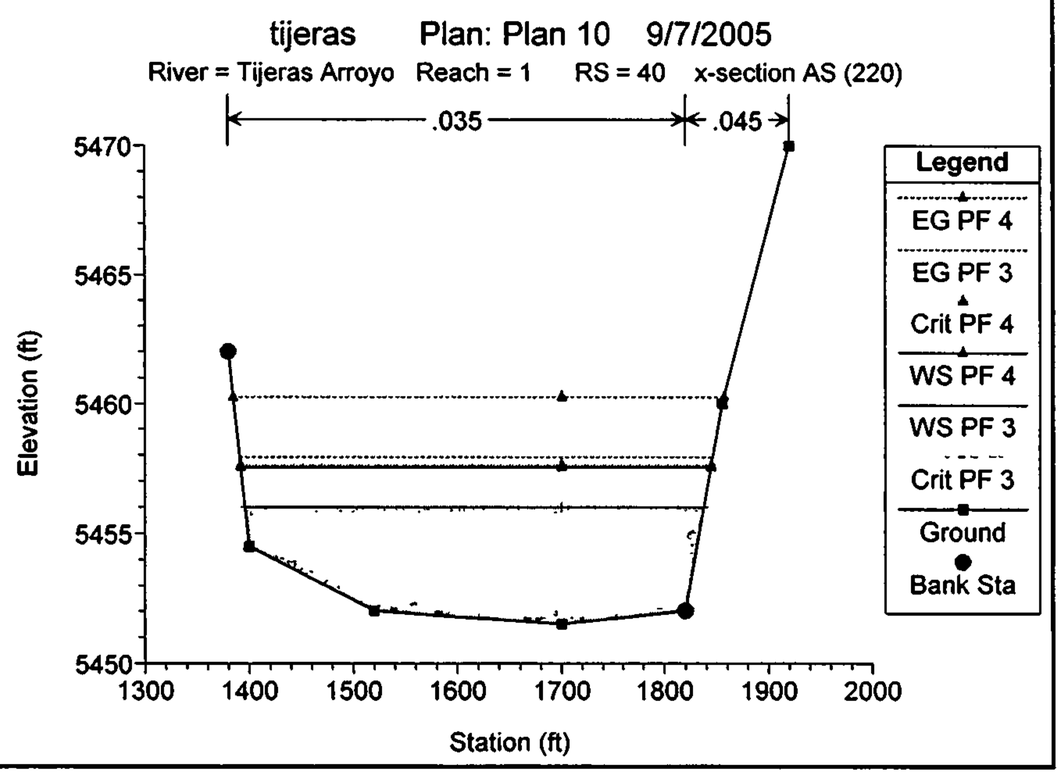
River = Tijeras Arroyo Reach = 1 RS = 41
.045
.035
Elevation (ft)
Station (ft)
Legend
EG PF 4
EG PF 3
Crit PF 4
WS PF 4
Crit PF 3
WS PF 3
Ground
Bank Sta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River = Tijeras Arroyo Reach = 1 RS = 40 x-section AS (220)
.035
.045
Elevation (ft)
Station (ft)
Legend
EG PF 4
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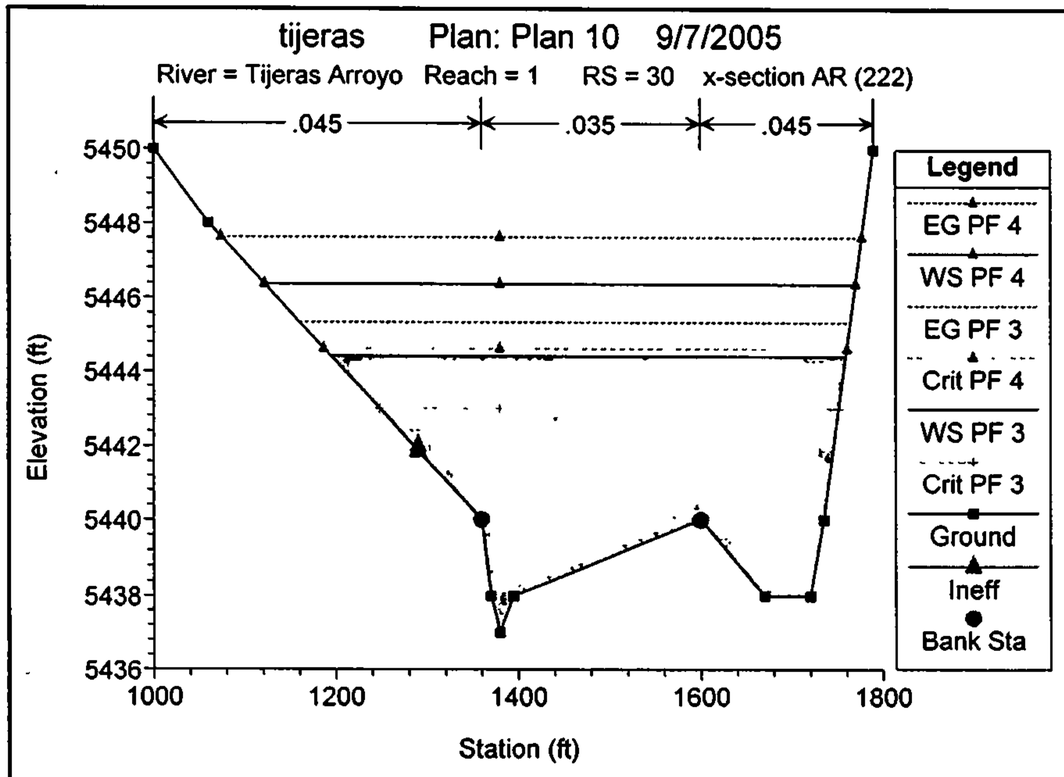
Crit PF 4
WS PF 4
WS PF 3
Crit PF 3
Ground
Bank Sta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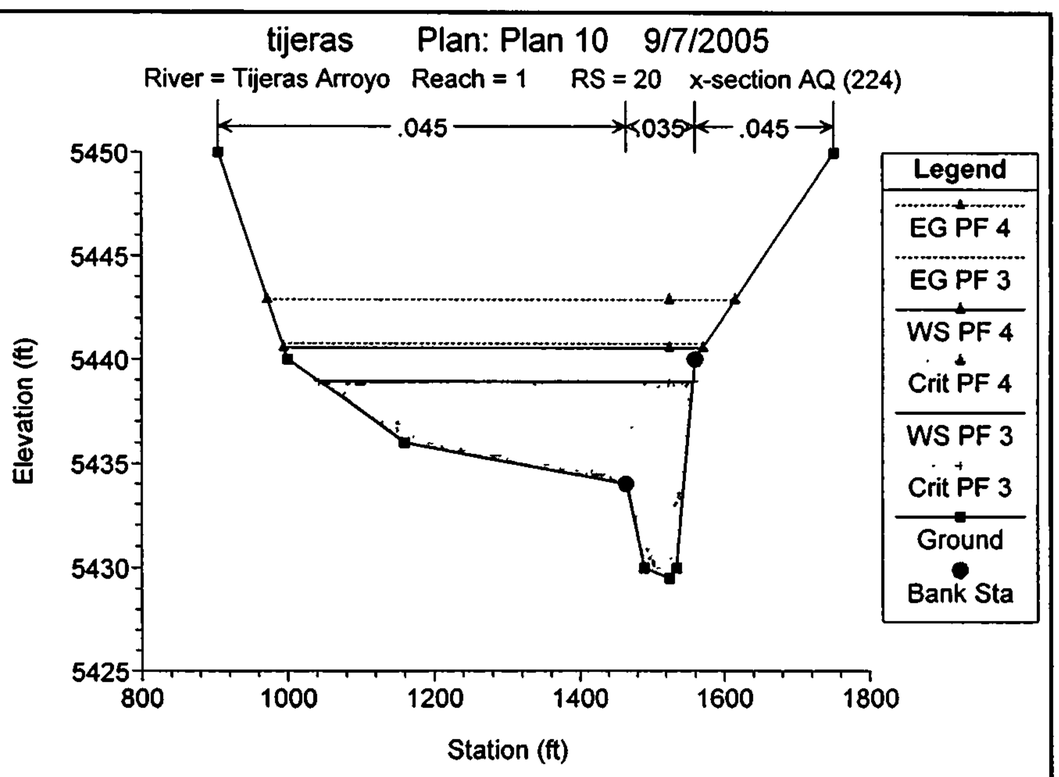
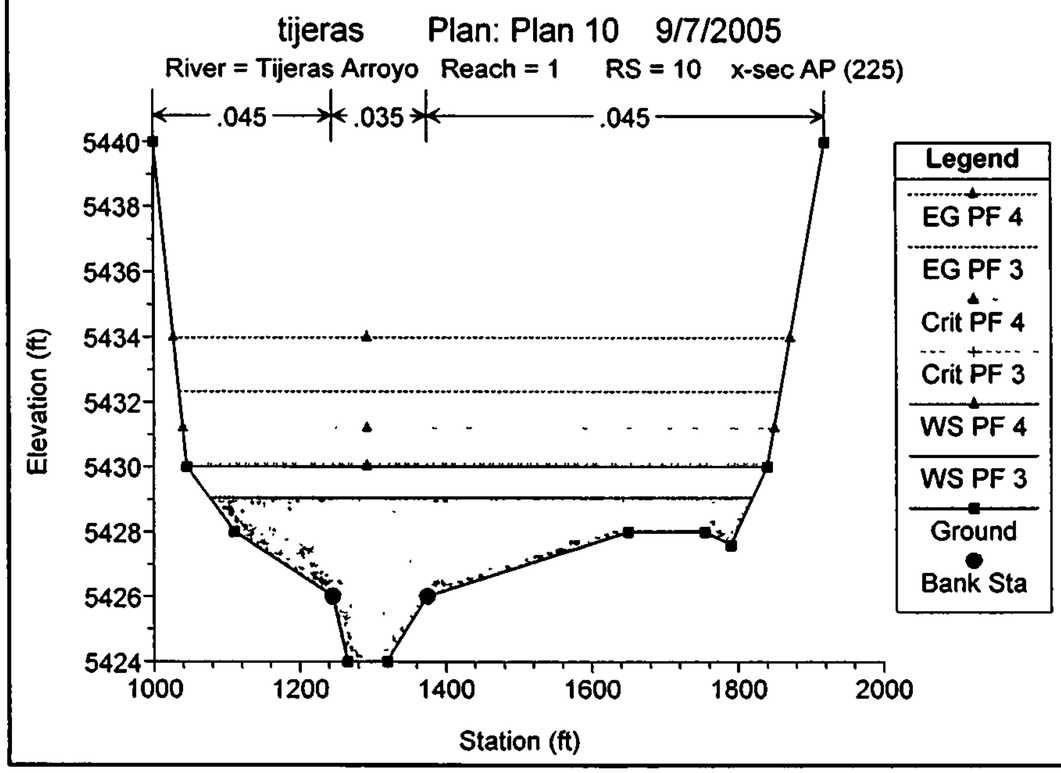
River = Tijeras Arroyo Reach = 1 RS = 30 x-section AR (222)
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG PF 4
WS PF 4
EG PF 3
Crit PF 4
WS PF 3
Crit PF 3
Ground
Ineff
Bank Sta


tijeras Plan: Plan 10 9/7/2005
River = Tijeras Arroyo Reach = 1 RS = 20 x-section AQ (224)
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG PF 4
EG PF 3
WS PF 4
Crit PF 4
WS PF 3
Crit PF 3
Ground
Bank Sta


tijeras Plan: Plan 10 9/7/2005
River = Tijeras Arroyo Reach = 1 RS = 10 x-sec AP (225)
.045
.035
.045
Elevation (ft)
Station (ft)
Legend
EG PF 4
EG PF 3
Crit PF 4
Crit PF 3
WS PF 4
WS PF 3
Ground
Bank Sta

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 46 Profile: PF 3

E.G. Elev (ft)	5473.20	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.76	Wt. n-Val.	0.045	0.035	
W.S. Elev (ft)	5471.44	Reach Len. (ft)	340.00	350.00	360.00
Crit W.S. (ft)	5471.44	Flow Area (sq ft)	722.55	1111.65	
E.G. Slope (ft/ft)	0.010757	Area (sq ft)	722.55	1111.65	
Q Total (cfs)	18065.00	Flow (cfs)	4978.14	13086.86	
Top Width (ft)	506.01	Top Width (ft)	252.88	253.13	
Vel Total (ft/s)	9.85	Avg. Vel. (ft/s)	6.89	11.77	
Max Chl Dpth (ft)	5.74	Hydr. Depth (ft)	2.86	4.39	
Conv. Total (cfs)	174173.7	Conv. (cfs)	47996.8	126176.9	
Length Wtd. (ft)	348.62	Wetted Per. (ft)	253.24	254.30	
Min Ch El (ft)	5465.70	Shear (lb/sq ft)	1.92	2.94	
Alpha	1.17	Stream Power (lb/ft s)	13.20	34.56	
Frctn Loss (ft)	1.92	Cum Volume (acre-ft)	40.89	87.58	24.71
C & E Loss (ft)	0.13	Cum SA (acres)	14.56	18.61	6.69

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 45 Profile: PF 3

E.G. Elev (ft)	5470.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.47	Wt. n-Val.		0.020	
W.S. Elev (ft)	5467.38	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)	5467.76	Flow Area (sq ft)		1208 81	
E.G. Slope (ft/ft)	0.004103	Area (sq ft)		1208.81	
Q Total (cfs)	18065.00	Flow (cfs)		18065.00	
Top Width (ft)	213.25	Top Width (ft)		213.25	
Vel Total (ft/s)	14.94	Avg. Vel. (ft/s)		14.94	
Max Chl Dpth (ft)	7.77	Hydr. Depth (ft)		5.67	
Conv. Total (cfs)	282039.4	Conv. (cfs)		282039.4	
Length Wtd. (ft)	40.00	Wetted Per. (ft)		217.21	
Min Ch El (ft)	5459.61	Shear (lb/sq ft)		1.43	
Alpha	1.00	Stream Power (lb/ft s)		21.30	
Frctn Loss (ft)	2.19	Cum Volume (acre-ft)	38.07	78.26	24.71
C & E Loss (ft)	0.17	Cum SA (acres)	13.57	16.74	6.69

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 44 Profile: PF 3

E.G. Elev. (ft)	5468.88	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.44	Wt. n-Val.		0.020	
W.S. Elev (ft)	5467.44	Reach Len. (ft)	2.00	2.00	2.00
Crit W.S. (ft)	5464.60	Flow Area (sq ft)		1878.68	
E.G. Slope (ft/ft)	0.000973	Area (sq ft)		1878.68	
Q Total (cfs)	18065.00	Flow (cfs)		18065.00	
Top Width (ft)	216.21	Top Width (ft)		216.21	
Vel Total (ft/s)	9.62	Avg. Vel. (ft/s)		9.62	
Max Chl Dpth (ft)	11.11	Hydr. Depth (ft)		8.69	
Conv. Total (cfs)	578997.4	Conv. (cfs)		578997.4	
Length Wtd. (ft)	2.00	Wetted Per. (ft)		222.36	
Min Ch El (ft)	5456.33	Shear (lb/sq ft)		0.51	
Alpha	1.00	Stream Power (lb/ft s)		4.94	
Frctn Loss (ft)		Cum Volume (acre-ft)	38.07	76.84	24.71
C & E Loss (ft)		Cum SA (acres)	13.57	16.54	6.69

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 70 Profile: PF 3

E.G. Elev (ft)	5507.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.47	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	5505.79	Reach Len. (ft)	1380.00	1310.00	1370.00
Crit W.S. (ft)	5505.83	Flow Area (sq ft)	592.39	900.91	652.39
E.G. Slope (ft/ft)	0.010768	Area (sq ft)	592.39	900.91	652.39
Q Total (cfs)	18065.00	Flow (cfs)	3257.56	10478.42	4329.02
Top Width (ft)	743.29	Top Width (ft)	291.35	210.00	241.93
Vel Total (ft/s)	8.42	Avg. Vel. (ft/s)	5.50	11.63	6.64
Max Chl Dpth (ft)	4.79	Hydr. Depth (ft)	2.03	4.29	2.70
Conv. Total (cfs)	174090.8	Conv. (cfs)	31392.8	100979.6	41718.3
Length Wtd. (ft)	1333.48	Wetted Per. (ft)	291.38	210.01	242.08
Min Ch El (ft)	5501.00	Shear (lb/sq ft)	1.37	2.88	1.81
Alpha	1.33	Stream Power (lb/ft s)	7.52	33.54	12.02
Frctn Loss (ft)		Cum Volume (acre-ft)	59.81	182.24	61.25
C & E Loss (ft)		Cum SA (acres)	24.14	43.65	24.38

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 70 Profile: PF 3

E.G. Elev (ft)	5507.26	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.47	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	5505.79	Reach Len. (ft)	1380.00	1310.00	1370.00
Crit W.S. (ft)	5505.83	Flow Area (sq ft)	592.39	900.91	652.39
E.G. Slope (ft/ft)	0.010768	Area (sq ft)	592.39	900.91	652.39
Q Total (cfs)	18065.00	Flow (cfs)	3257.56	10478.42	4329.02
Top Width (ft)	743.29	Top Width (ft)	291.35	210.00	241.93
Vel Total (ft/s)	8.42	Avg Vel. (ft/s)	5.50	11.63	6.64
Max Chl Dpth (ft)	4.79	Hydr. Depth (ft)	2.03	4.29	2.70
Conv. Total (cfs)	174090.8	Conv. (cfs)	31392.8	100979.6	41718.3
Length Wtd. (ft)	1333.48	Wetted Per. (ft)	291.38	210.01	242.08
Min Ch El (ft)	5501.00	Shear (lb/sq ft)	1.37	2.88	1.81
Alpha	1.33	Stream Power (lb/ft s)	7.52	33.54	12.02
Frctn Loss (ft)		Cum Volume (acre-ft)	59.81	182.24	61.25
C & E Loss (ft)		Cum SA (acres)	24.14	43.65	24.38

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 43 Profile: PF 3

E.G. Elev (ft)	5467.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	4.69	Wt. n-Val.		0.020	
W.S. Elev (ft)	5462.77	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	5463.96	Flow Area (sq ft)		1039.06	
E.G. Slope (ft/ft)	0.006560	Area (sq ft)		1039.06	
Q Total (cfs)	18065.00	Flow (cfs)		18065.00	
Top Width (ft)	208.10	Top Width (ft)		208.10	
Vel Total (ft/s)	17.39	Avg. Vel. (ft/s)		17.39	
Max Chl Dpth (ft)	7.04	Hydr. Depth (ft)		4.99	
Conv. Total (cfs)	223047.3	Conv. (cfs)		223047.3	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		211.57	
Min Ch El (ft)	5455.73	Shear (lb/sq ft)		2.01	
Alpha	1.00	Stream Power (lb/ft s)		34.97	
Frctn Loss (ft)		Cum Volume (acre-ft)	38.07	74.43	24.71
C & E Loss (ft)		Cum SA (acres)	13.57	16.18	6.69

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 42 Profile: PF 3

E.G. Elev (ft)	5467.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	5.01	Wt. n-Val.		0.020	
W.S. Elev (ft)	5462.00	Reach Len. (ft)	200.00	245.00	275.00
Crit W.S. (ft)	5463.36	Flow Area (sq ft)		1005.63	
E.G. Slope (ft/ft)	0.007896	Area (sq ft)		1005.63	
Q Total (cfs)	18065.00	Flow (cfs)		18065.00	
Top Width (ft)	220.84	Top Width (ft)		220.84	
Vel Total (ft/s)	17.96	Avg. Vel. (ft/s)		17.96	
Max Chl Dpth (ft)	6.62	Hydr. Depth (ft)		4.55	
Conv. Total (cfs)	203304.3	Conv. (cfs)		203304.3	
Length Wtd. (ft)	245.01	Wetted Per. (ft)		224.04	
Min Ch El (ft)	5455.38	Shear (lb/sq ft)		2.21	
Alpha	1.00	Stream Power (lb/ft s)		39.75	
Frctn Loss (ft)	0.36	Cum Volume (acre-ft)	38.07	73.25	24.71
C & E Loss (ft)	0.10	Cum SA (acres)	13.57	15.94	6.69

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 41 Profile: PF 3

E.G. Elev (ft)	5462.39	Element	Left OB	Channel	Right OB
Vel Head (ft)	6.18	Wt. n-Val.		0.035	0.045
W.S. Elev (ft)	5456.21	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)	5457.95	Flow Area (sq ft)		905.09	1.46
E.G. Slope (ft/ft)	0.066020	Area (sq ft)		905.09	1.46
Q Total (cfs)	18065.00	Flow (cfs)		18056.81	8.19
Top Width (ft)	367.37	Top Width (ft)		364.95	2.41
Vel Total (ft/s)	19.93	Avg. Vel. (ft/s)		19.95	5.62
Max Chl Dpth (ft)	4.31	Hydr. Depth (ft)		2.48	0.60
Conv. Total (cfs)	70307.2	Conv. (cfs)		70275.3	31.9
Length Wtd. (ft)	200.00	Wetted Per. (ft)		365.95	2.70
Min Ch El (ft)	5451.90	Shear (lb/sq ft)		10.19	2.22
Alpha	1.00	Stream Power (lb/ft s)		203.37	12.51
Frctn Loss (ft)	4.27	Cum Volume (acre-ft)	38.07	67.88	24.70
C & E Loss (ft)	0.35	Cum SA (acres)	13.57	14.29	6.68

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 40 Profile: PF 3

E.G. Elev (ft)	5457.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.90	Wt. n-Val.		0.035	0.045
W.S. Elev (ft)	5456.01	Reach Len. (ft)	1010.00	1055.00	1060.00
Crit W.S. (ft)	5456 01	Flow Area (sq ft)		1610.90	35.12
E.G. Slope (ft/ft)	0.011529	Area (sq ft)		1610.90	35.12
Q Total (cfs)	18065.00	Flow (cfs)		17870.45	194.55
Top Width (ft)	441.55	Top Width (ft)		424.02	17.53
Vel Total (ft/s)	10.97	Avg. Vel. (ft/s)		11.09	5.54
Max Chl Dpth (ft)	4.51	Hydr. Depth (ft)		3.80	2.00
Conv. Total (cfs)	168247.3	Conv. (cfs)		166435.3	1811.9
Length Wtd. (ft)	1054.13	Wetted Per. (ft)		424.32	17.98
Min Ch El (ft)	5451.50	Shear (lb/sq ft)		2.73	1.41
Alpha	1.01	Stream Power (lb/ft s)		30.31	7.79
Frctn Loss (ft)	6.77	Cum Volume (acre-ft)	38.07	62.10	24.62
C & E Loss (ft)	0.29	Cum SA (acres)	13.57	12.48	6.64

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 30 Profile: PF 3

E.G. Elev (ft)	5445.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.92	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	5444.42	Reach Len. (ft)	1000.00	705.00	1000.00
Crit W.S. (ft)	5442.99	Flow Area (sq ft)	367 02	1339.34	836.11
E.G. Slope (ft/ft)	0.004089	Area (sq ft)	367.02	1339.34	836.11
Q Total (cfs)	18065.00	Flow (cfs)	1315.44	11430.65	5318.91
Top Width (ft)	565.25	Top Width (ft)	165.91	240.00	159.33
Vel Total (ft/s)	7.11	Avg. Vel. (ft/s)	3.58	8.53	6.36
Max Chl Dpth (ft)	7.42	Hydr. Depth (ft)	2.21	5.58	5.25
Conv. Total (cfs)	282499.8	Conv. (cfs)	20570.8	178752.2	83176.9
Length Wtd. (ft)	829.46	Wetted Per. (ft)	165.97	240.29	159.89
Min Ch El (ft)	5437.00	Shear (lb/sq ft)	0.56	1.42	1.33
Alpha	1.17	Stream Power (lb/ft s)	2.02	12.14	8.49
Frctn Loss (ft)	4.48	Cum Volume (acre-ft)	33.81	26.38	14.02
C & E Loss (ft)	0.09	Cum SA (acres)	11.65	4.44	4.49

Plan: sed6-10-05 Tijeras Arroyo 1 RS: 20 Profile: PF 3

E.G. Elev (ft)	5440.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.83	Wt. n-Val.	0.045	0.035	
W.S. Elev (ft)	5438.94	Reach Len. (ft)	720.00	685.00	520.00
Crit W.S. (ft)	5438.94	Flow Area (sq ft)	1375.58	687.17	
E.G. Slope (ft/ft)	0.007449	Area (sq ft)	1375.58	687.17	
Q Total (cfs)	18065.00	Flow (cfs)	8608.43	9456.57	
Top Width (ft)	515.05	Top Width (ft)	422.70	92.36	
Vel Total (ft/s)	8.76	Avg. Vel. (ft/s)	6.26	13.76	
Max Chl Dpth (ft)	9.44	Hydr. Depth (ft)	3.25	7.44	
Conv. Total (cfs)	209310.6	Conv. (cfs)	99741.8	109568.8	
Length Wtd. (ft)	670.94	Wetted Per. (ft)	422.74	94.41	
Min Ch El (ft)	5429.50	Shear (lb/sq ft)	1.51	3.38	
Alpha	1.54	Stream Power (lb/ft s)	9.47	46.58	
Frctn Loss (ft)	5.17	Cum Volume (acre-ft)	13.81	9.98	4.42
C & E Loss (ft)	0.16	Cum SA (acres)	4.89	1.75	2.66

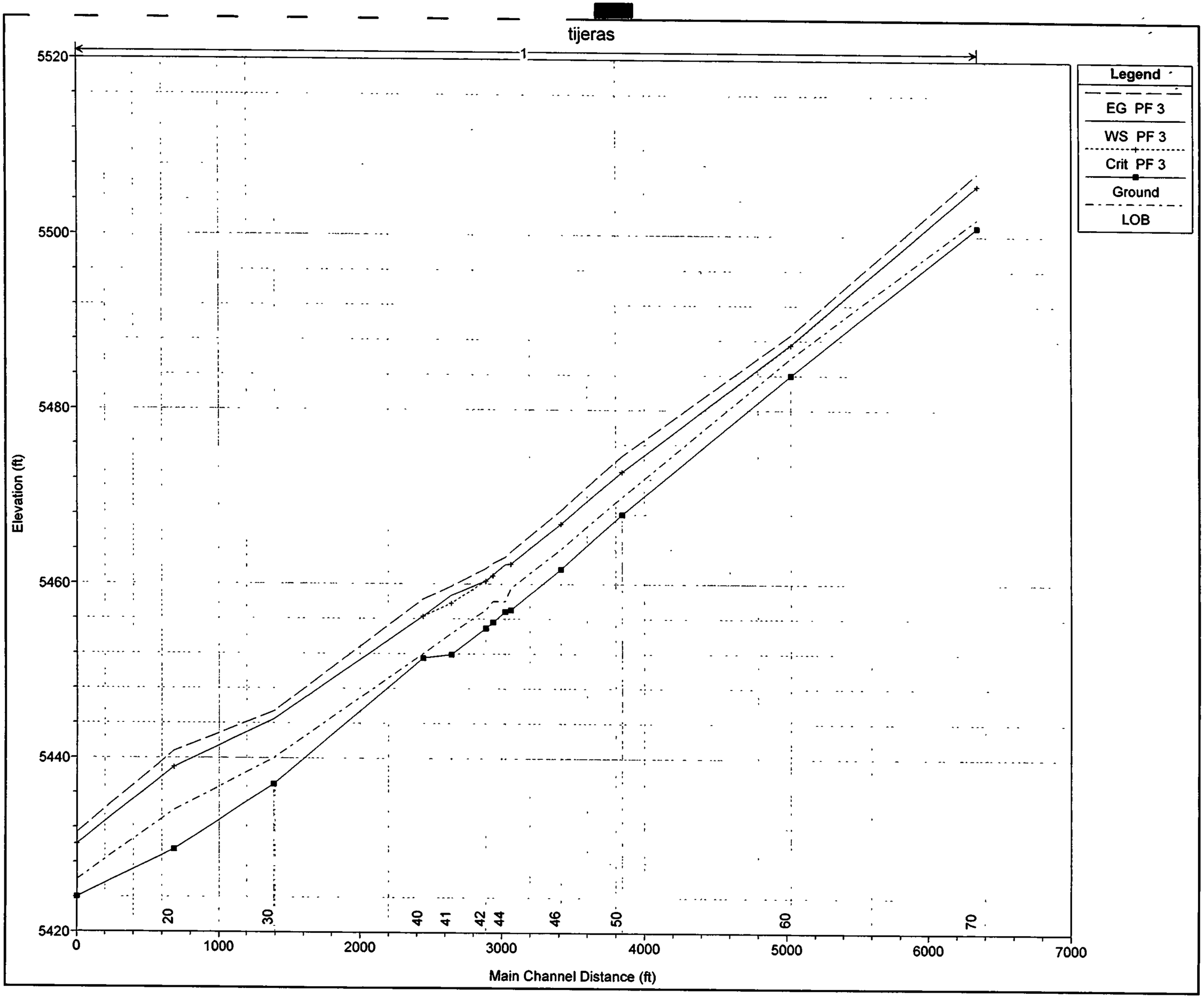
Plan: sed6-10-05 Tijeras Arroyo 1 RS: 10 Profile: PF 3

E.G. Elev (ft)	5432.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	3.27	Wt. n-Val.	0.045	0.035	0.045
W.S. Elev (ft)	5429.05	Reach Len. (ft)			
Crit W.S. (ft)	5430.09	Flow Area (sq ft)	295.21	581.92	741.08
E.G. Slope (ft/ft)	0.024444	Area (sq ft)	295.21	581.92	741.08
Q Total (cfs)	18065.00	Flow (cfs)	2208.29	10483.89	5372.82
Top Width (ft)	744.50	Top Width (ft)	169.23	130.00	445.27
Vel Total (ft/s)	11.16	Avg. Vel. (ft/s)	7.48	18.02	7.25
Max Chl Dpth (ft)	5.05	Hydr. Depth (ft)	1.74	4.48	1.66
Conv. Total (cfs)	115544.2	Conv. (cfs)	14124.3	67055.2	34364.7
Length Wtd. (ft)		Wetted Per. (ft)	169.26	130.14	445.32
Min Ch El (ft)	5424.00	Shear (lb/sq ft)	2.66	6.82	2.54
Alpha	1.69	Stream Power (lb/ft s)	19.91	122.94	18.41
Frctn Loss (ft)	8.30	Cum Volume (acre-ft)			
C & E Loss (ft)	0.14	Cum SA (acres)			

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	46	6285.00	5461.70	5465.09	5465.09	5465.97	0.011971	7.88	917.91	555.31	0.93
1	46	13750.00	5461.70	5466.33	5466.33	5467.65	0.010622	9.99	1670.71	659.61	0.95
1	46	18065.00	5461.70	5466.90	5466.90	5468.41	0.010245	10.86	2058.51	707.37	0.95
1	46	30500.00	5461.70	5468.35	5468.35	5470.19	0.008739	12.31	3165.35	802.31	0.93
1	50	6285.00	5468.00	5470.94	5470.94	5471.90	0.014262	7.88	807.34	438.54	1.00
1	50	13750.00	5468.00	5472.25	5472.25	5473.80	0.011695	10.08	1411.74	478.70	0.98
1	50	18065.00	5468.00	5472.89	5472.89	5474.71	0.010926	10.98	1722.22	498.07	0.98
1	50	30500.00	5468.00	5474.47	5474.47	5476.92	0.009516	12.85	2546.98	546.20	0.97
1	60	6285.00	5484.00	5486.38	5486.20	5486.86	0.011038	6.10	1205.88	874.09	0.85
1	60	13750.00	5484.00	5487.18	5487.08	5488.08	0.012302	8.45	1939.16	956.22	0.96
1	60	18065.00	5484.00	5487.55	5487.48	5488.66	0.012658	9.43	2302.04	994.36	1.00
1	60	30500.00	5484.00	5488.50	5488.50	5490.05	0.012279	11.29	3275.86	1049.56	1.03
1	70	6285.00	5501.00	5504.17	5504.17	5504.98	0.010046	8.18	1033.09	626.90	0.88
1	70	13750.00	5501.00	5505.29	5505.29	5506.54	0.010471	10.57	1786.46	707.80	0.96
1	70	18065.00	5501.00	5505.82	5505.82	5507.26	0.010489	11.53	2165.68	745.21	0.98
1	70	30500.00	5501.00	5507.03	5507.03	5508.94	0.010321	13.49	3095.07	774.26	1.01

HEC-RAS Plan: Plan 01 River: Tijeras Arroyo Reach: 1

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	10	5429.26	5428.48	0.78			652.55	4241.56	1390.89	713.88
1	10	5430.73	5429.60	1.13			1860.78	7114.12	4775.10	773.67
1	10	5431.40	5430.09	1.30			2636.50	8567.05	6861.45	796.17
1	10	5433.00	5431.20	1.80			5161.59	12329.23	13009.18	809.95
1	20	5437.75	5436.60	1.15	4.00	0.11	1604.31	4680.69		415.44
1	20	5439.85	5438.23	1.62	4.88	0.15	5880.06	7869 94		484.73
1	20	5440.77	5438.94	1 83	5.17	0.16	8608.43	9456.57		515.05
1	20	5442.90	5440.57	2.33	5.69	0.16	17020.14	13475.88	3.98	576.28
1	30	5442.16	5441.65	0.51	4.34	0.06	107.72	4151.61	2025.67	445.74
1	30	5444.35	5443.57	0.78	4.42	0.08	757.93	8850.12	4141.95	528.48
1	30	5445.34	5444.42	0.92	4.48	0.09	1315.44	11430.66	5318.91	565.25
1	30	5447.63	5446 36	1.27	4.63	0.11	3412.46	18495.71	8591.84	648.60
1	40	5455.15	5454.08	1.07	8.38	0.17	308.00	5941.06	35.94	385.82
1	40	5457.26	5455.59	1.67	6.76	0.27	1197.65	12412.61	139.74	447.92
1	40	5458.23	5456.29	1.94	6.43	0.31	1877.94	15967.95	219.11	477.08
1	40	5460.55	5458.00	2.55	6.02	0.39	4332.09	25662.46	505.45	547.58
1	41	5456.92	5456.34	0.59	1.72	0.05	1046.19	5235.54	3.27	499.47
1	41	5458.84	5457.91	0.92	1.51	0.07	3150.86	10574.15	24.99	581.51
1	41	5459.73	5458.68	1.05	1.41	0.09	4620.19	13399.70	45.11	609.79
1	41	5461.92	5460.58	1.34	1.24	0.12	9260.23	21112.49	127.28	675.82
1	42	5459.43	5458.59	0.84			2053.49	4231.51		569.63
1	42	5461.05	5459.77	1.28			5172.26	8577.74		674.68
1	42	5461.78	5460.35	1.43			7216.40	10848.47	0 13	709.77
1	42	5463.55	5461.75	1.79	1.49	0.14	13469.60	17021.68	8.72	768.60
1	43	5460.14	5459.38	0.77			1837.75	4429.70	17.55	651.89
1	43	5461.66	5460.60	1.06	0.58	0.02	5323.22	8378.95	47.83	728.42
1	43	5462.36	5461.06	1.30	0.57	0.01	7381.13	10616.21	67.66	757.37
1	43	5464.07	5462.34	1.72	0.50	0.01	13776.69	16586.89	136.42	837.88
1	44	5460.87	5460.44	0.43	0.69	0.03	1910.58	4374.25	0.16	702.54
1	44	5462.35	5461.62	0.73	0.66	0.03	5074.00	8670.49	5.51	828.94
1	44	5463.06	5462.23	0.83	0.66	0.05	7158.44	10894.01	12.55	874.70
1	44	5464.74	5463.65	1.09	0.61	0.06	13499.34	16955.43	45.23	981.92
1	45	5461.47	5460.68	0.79	0.31	0.11	2206.75	3949.30	128.95	647.14
1	45	5462.97	5461.79	1.18	0.33	0.14	6226.53	7197 49	325.98	737.65
1	45	5463.67	5462.29	1.37	0 32	0.16	8692.42	8917.56	455 02	773.31
1	45	5465.33	5463.48	1.85			16073.01	13551.62	875.36	857.66
1	46	5465.97	5465.09	0.88	4.02	0.03	541.85	5577.28	165.87	555.31
1	46	5467.65	5466.33	1.31	3.80	0.04	2181.79	11028.19	540.02	659.61
1	46	5468.41	5466.90	1.51			3335.48	13958.02	771.51	707.37
1	46	5470.19	5468 35	1.84			7510.25	21523.64	1466.10	802.31
1	50	5471.90	5470.94	0.96			25.77	6253.30	5.94	438.54
1	50	5473.80	5472.25	1.55	4.79	0.07	242.85	13451.20	55.95	478.70
1	50	5474.71	5472.89	1.82			455.27	17504.83	104.90	498.07
1	50	5476.92	5474.47	2.45	3.91	0.18	1359.02	28827.85	313.13	546.20
1	60	5486.86	5486.38	0.48	14.92	0.05	3.55	4447.11	1834.34	874.09
1	60	5488.08	5487.18	0.89	14.21	0.07	76.67	9232.54	4440.79	956.22
1	60	5488.66	5487.55	1.10	13.87	0.07	161.29	11905.53	5998.18	994.36
1	60	5490.05	5488.50	1.55			593.89	19102.25	10803.87	1049.56
1	70	5504.98	5504.17	0.81	13.97	0.10	724.12	4580.26	980.63	626.90
1	70	5506.54	5505.29	1.24	15.10	0.10	2246.39	8423.11	3080.50	707.80
1	70	5507.26	5505.82	1.44	15.34	0.10	3273.35	10450.02	4341.63	745.21
1	70	5508.94	5507.03	1.90	15.02	0.11	6957.30	15678.21	7864.49	774.26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Crit PF 3
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5440
5420
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44
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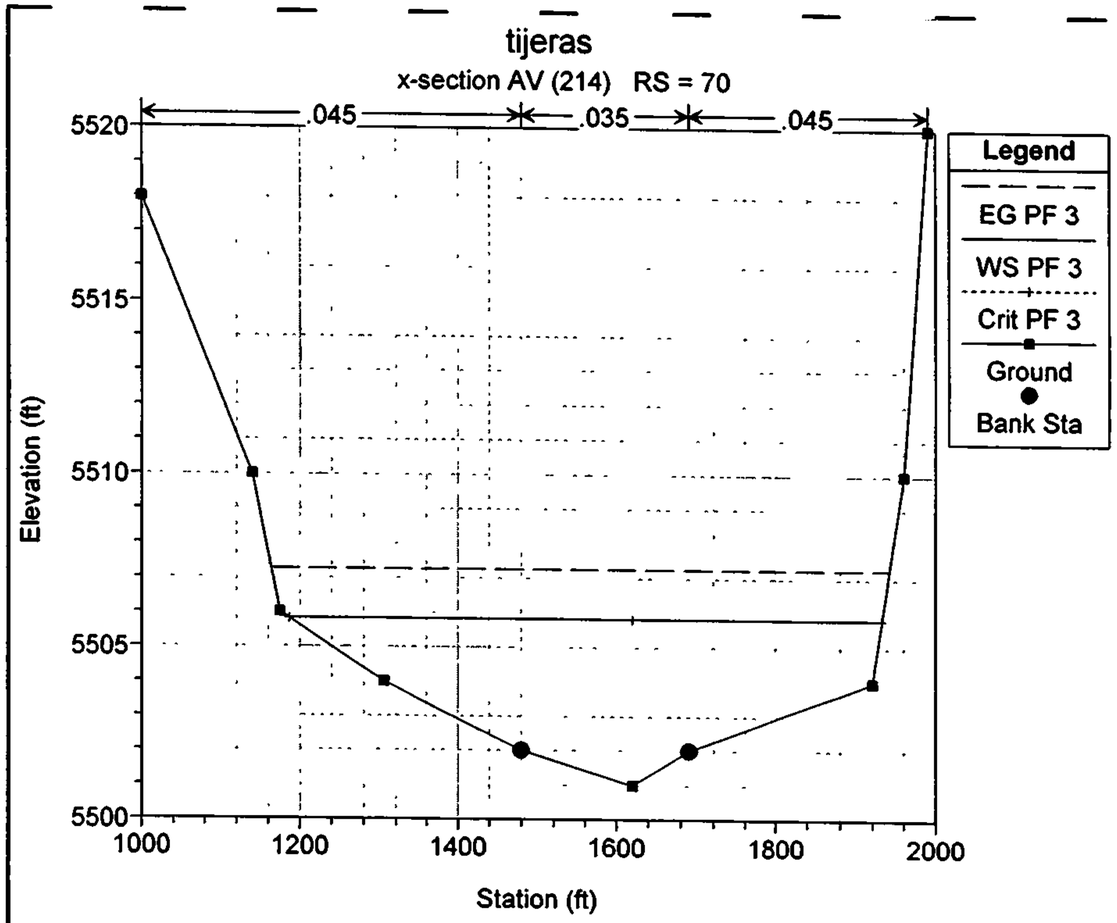
Main Channel Distance (ft)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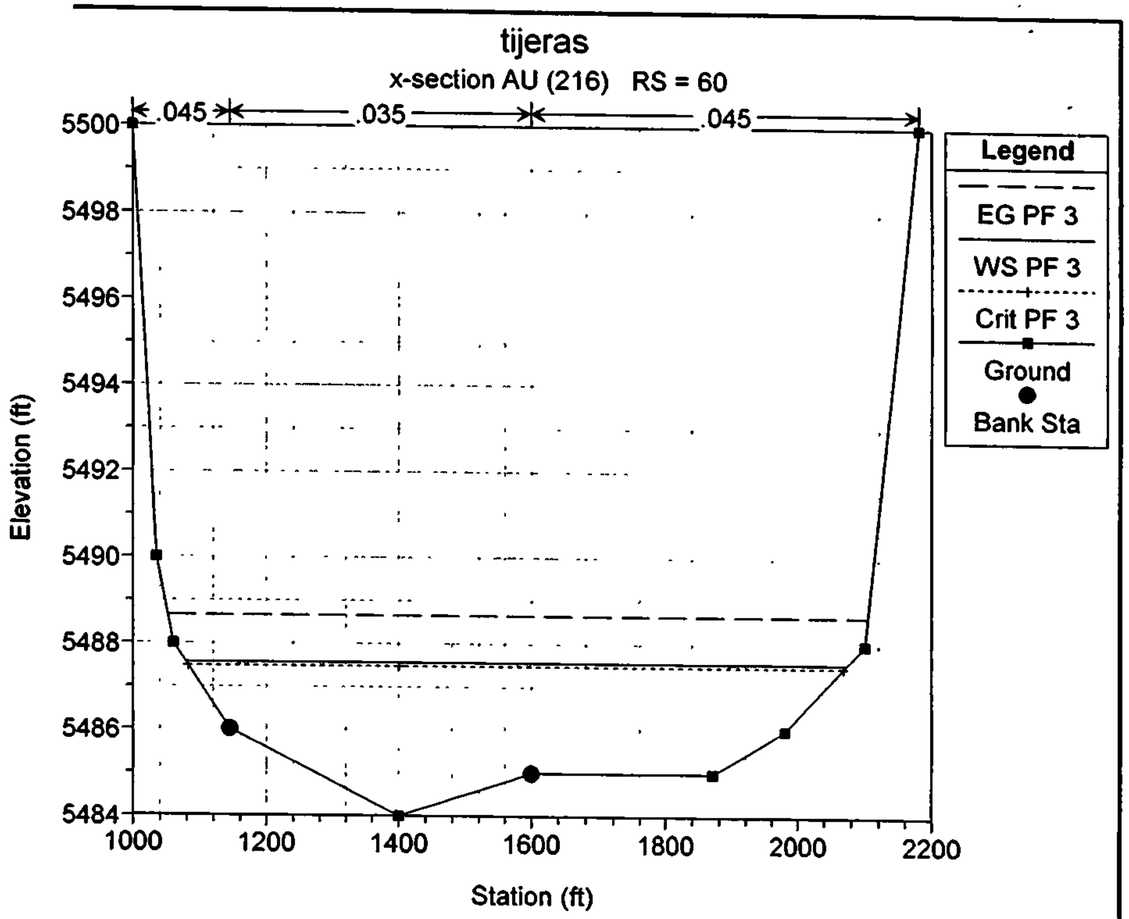
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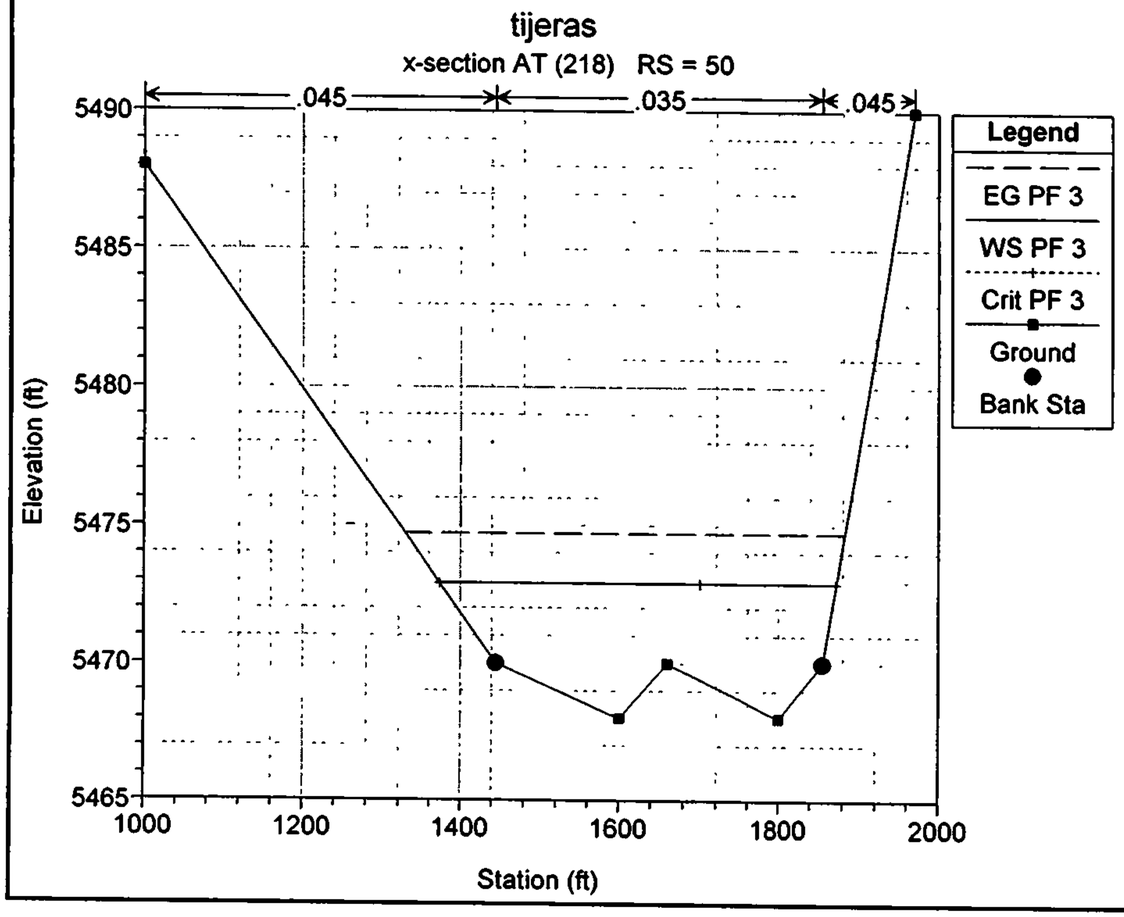
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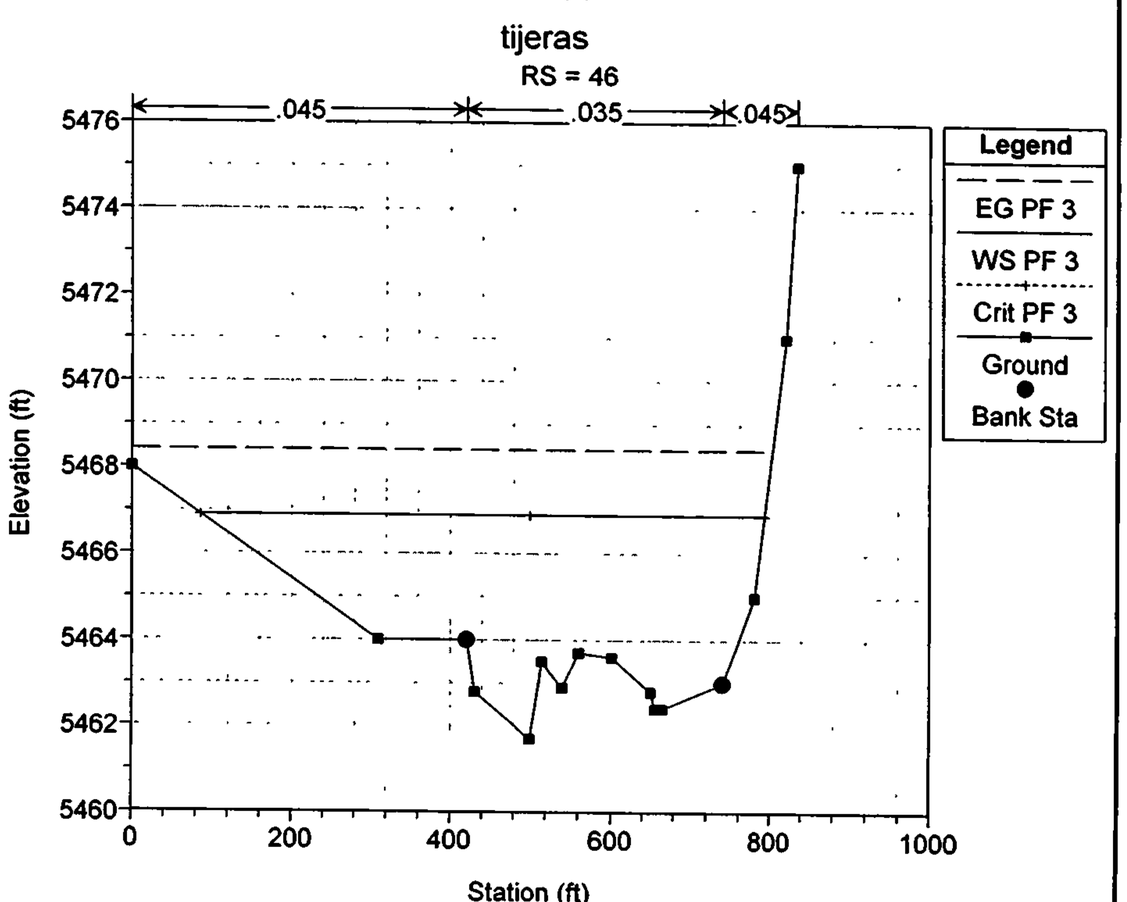
Station (ft)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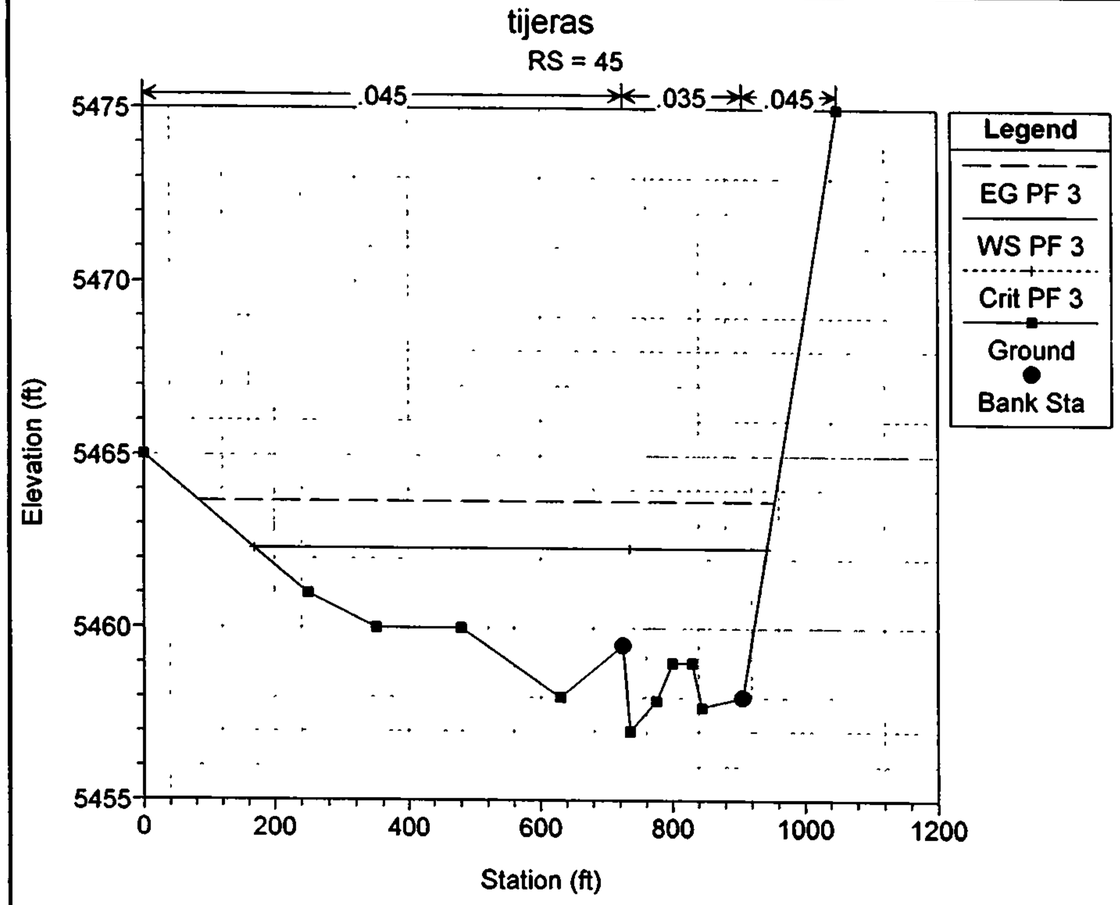
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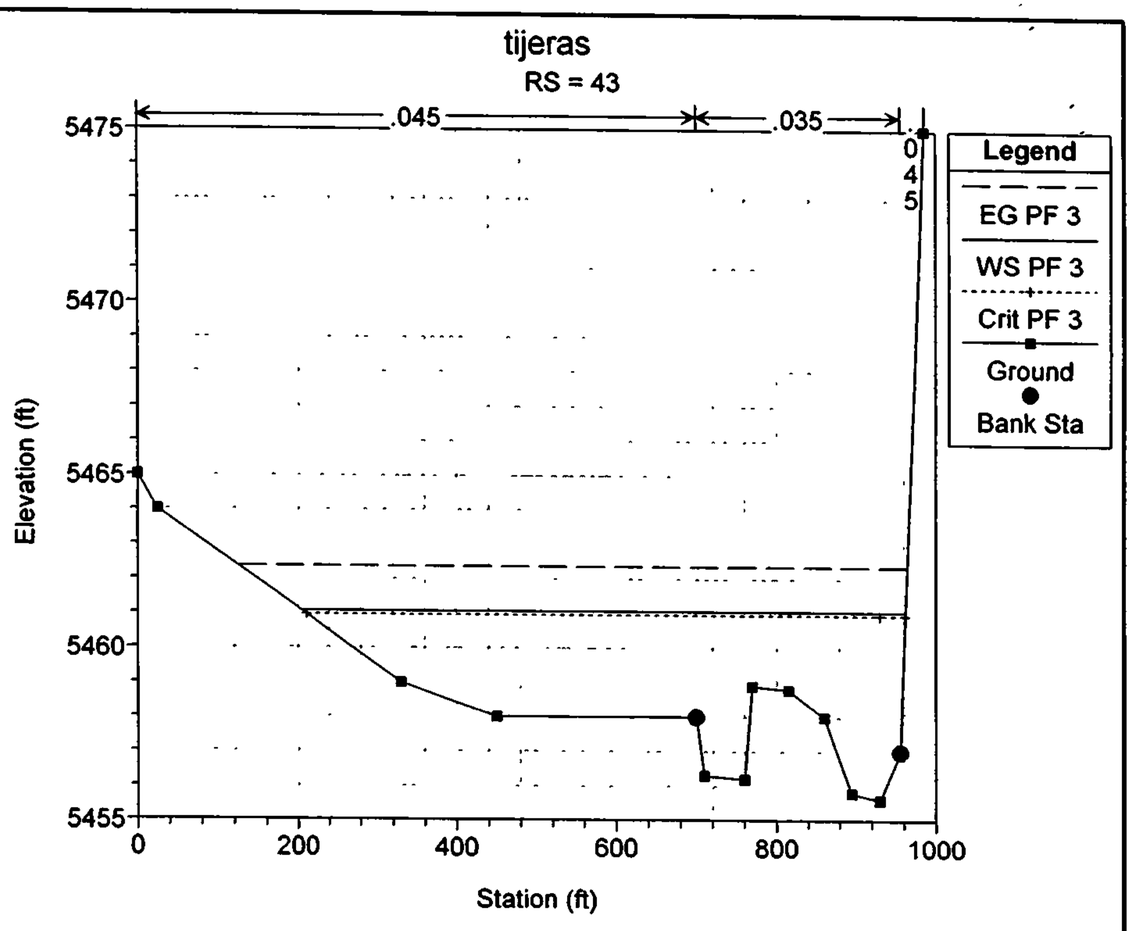
Bank Sta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Crit PF 3
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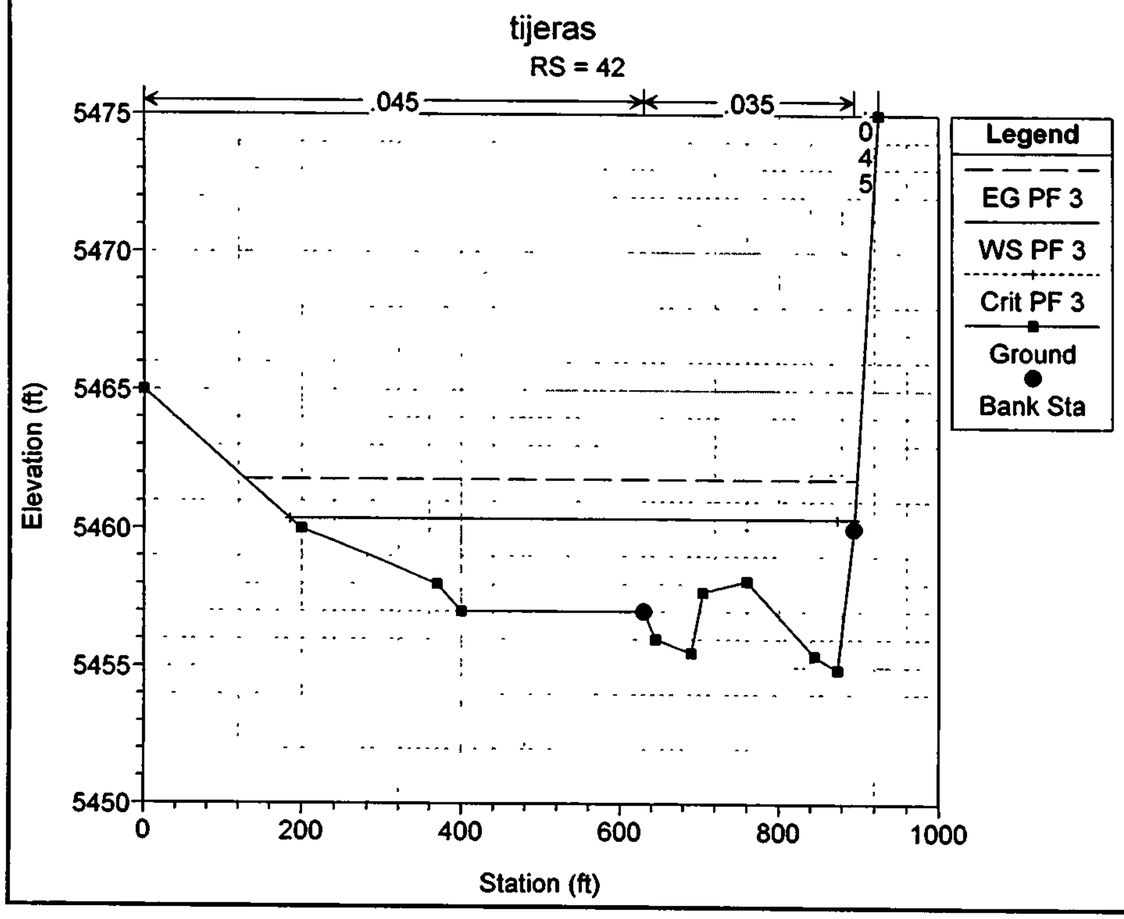
Bank Sta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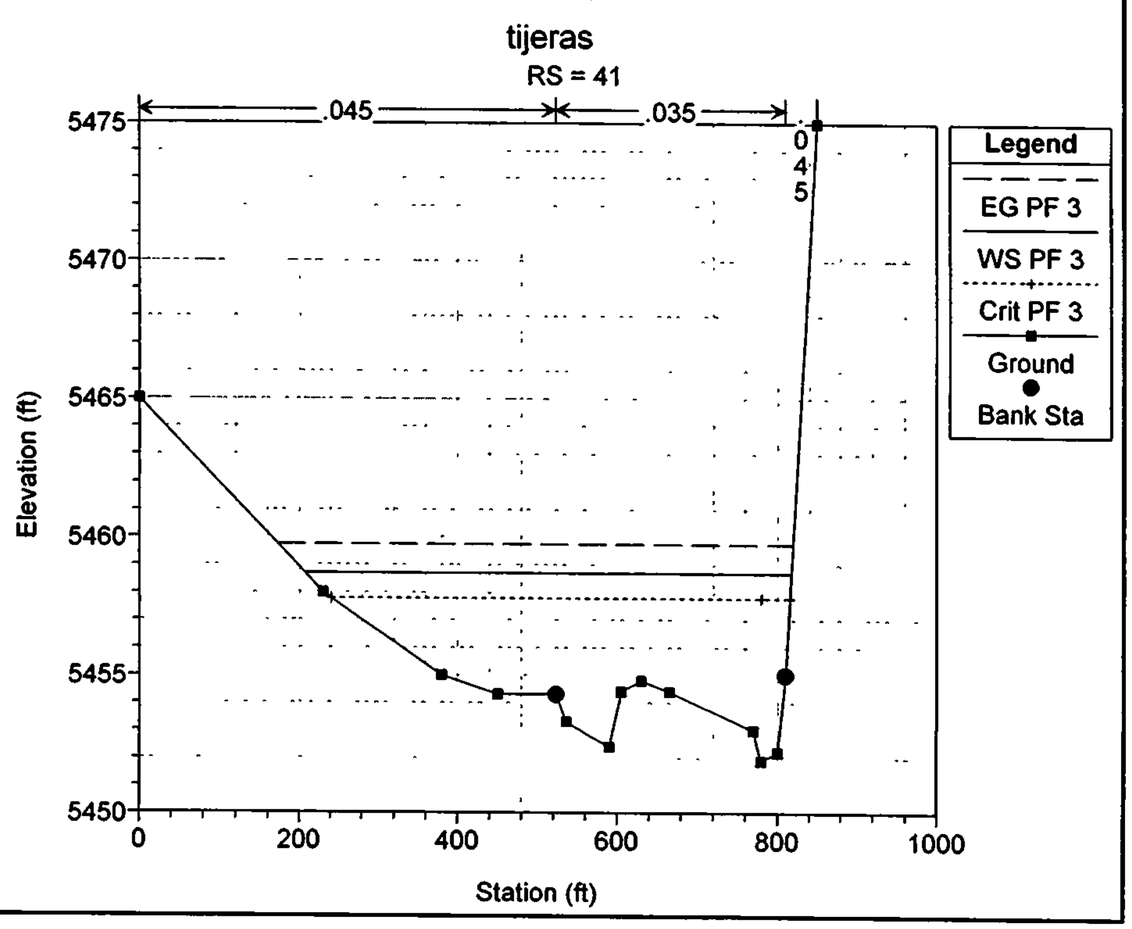
600
800
1000
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta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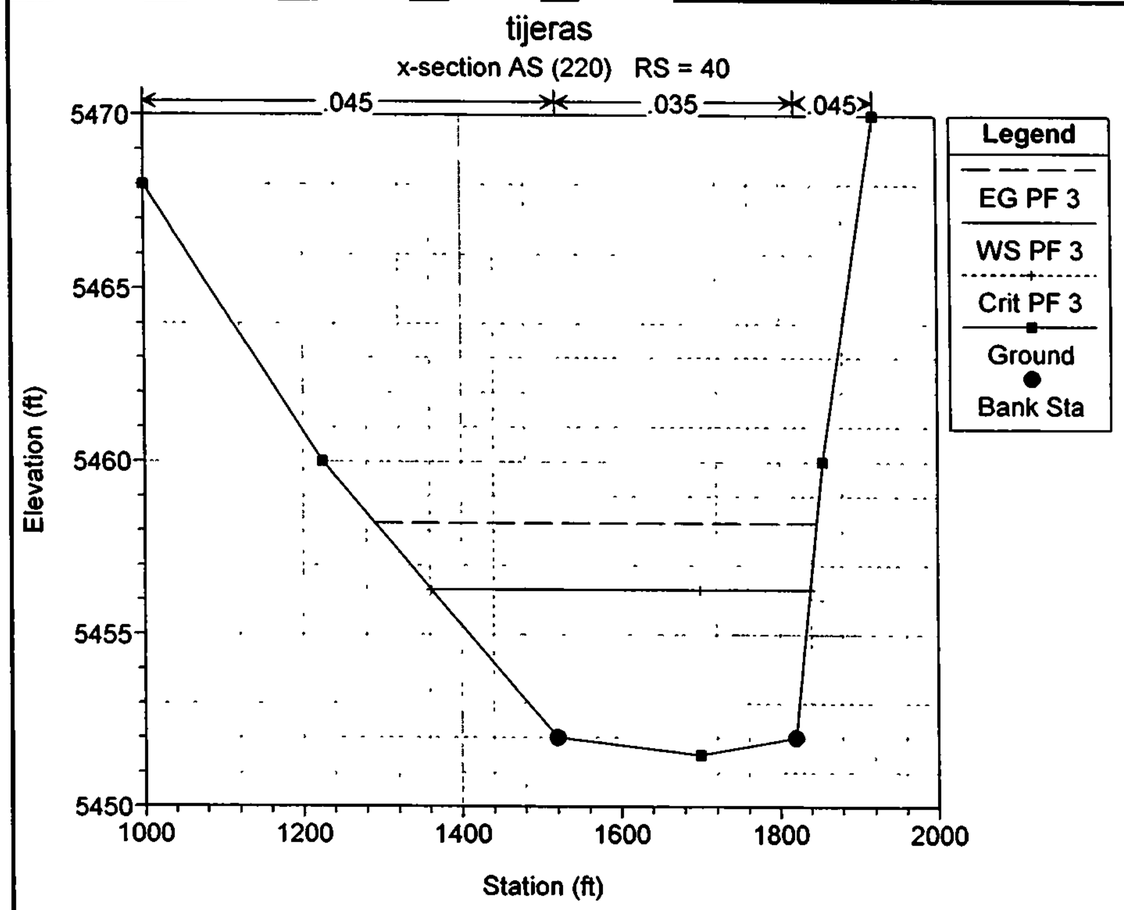
400
600
800
1000
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta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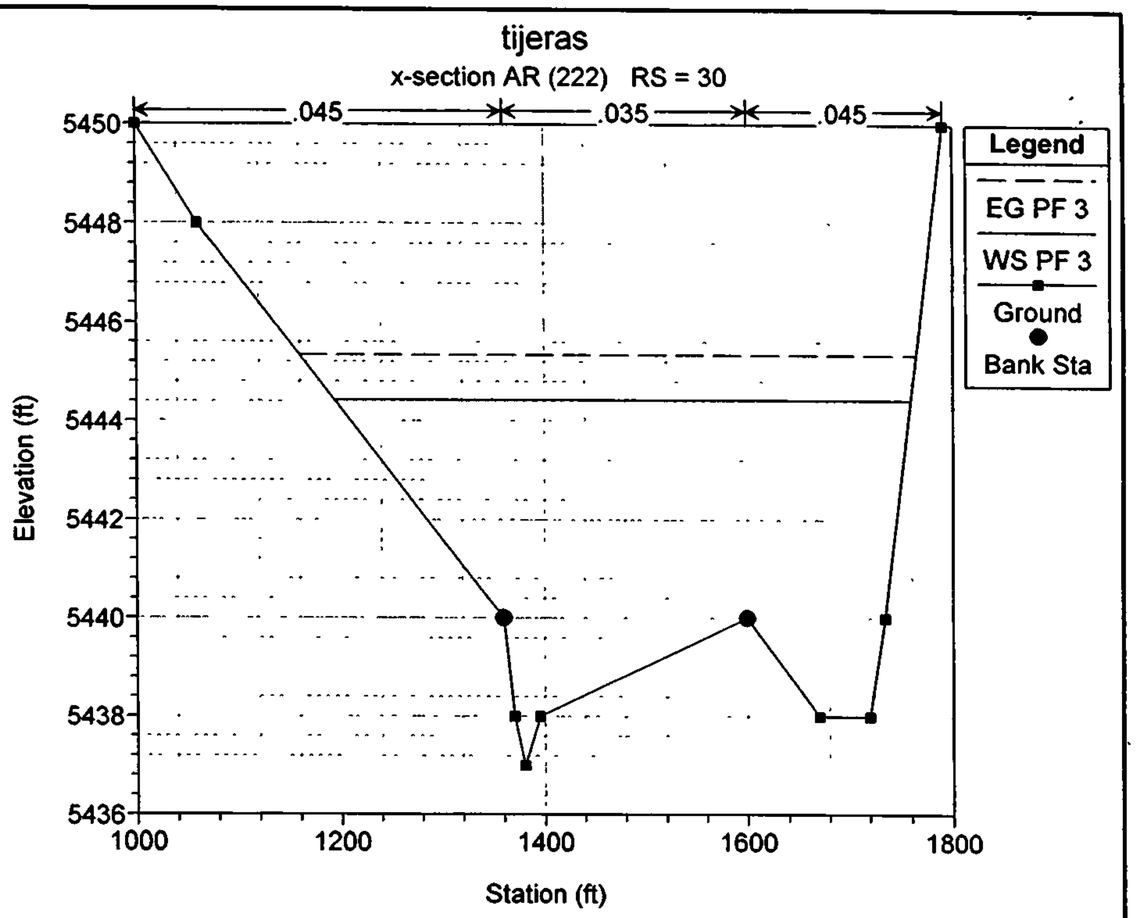
.035
.045
5470
5465
5460
5455
5450
1000
1200
1400
1600
1800
2000
Elevation (ft)
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta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.035
.045
5450
5448
5446
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5442
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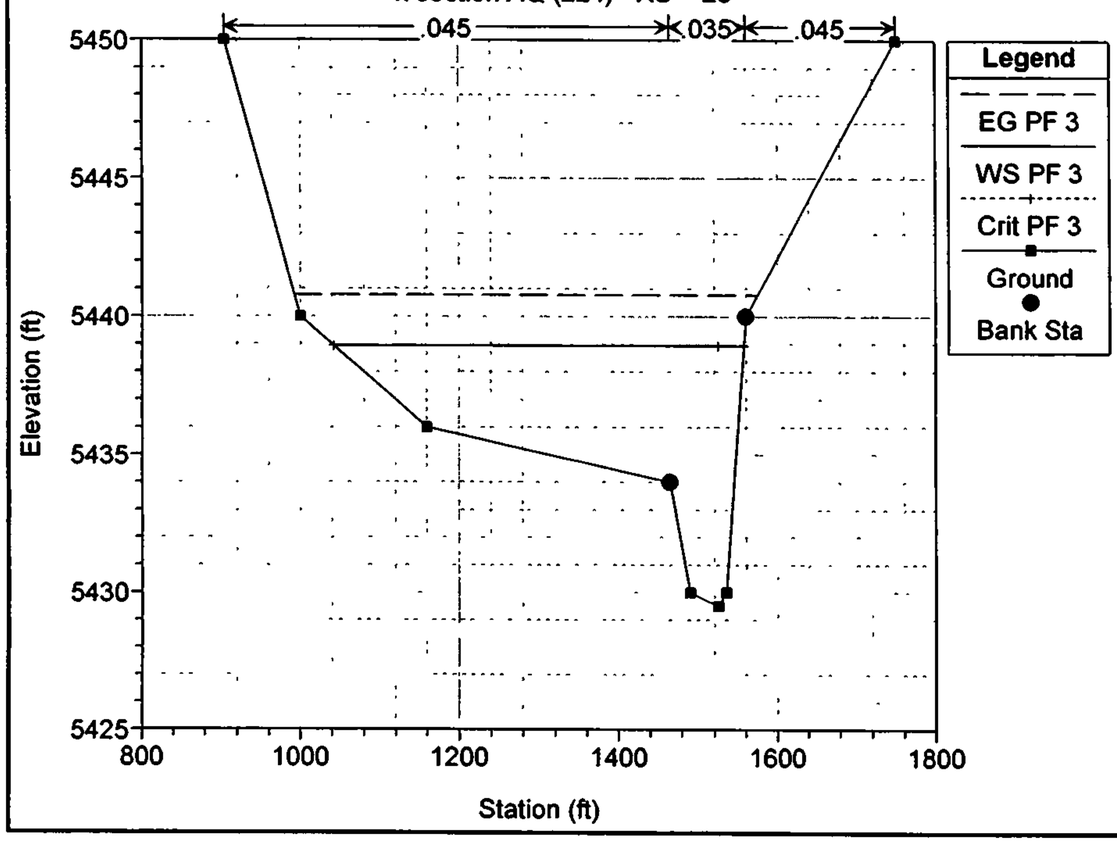
1200
1400
1600
1800
Elevation (ft)
Station (ft)
Legend
EG PF 3
WS PF 3
Ground
Bank Sta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.045
5450
5445
5440
5435
5430
5425
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1400
1600
1800
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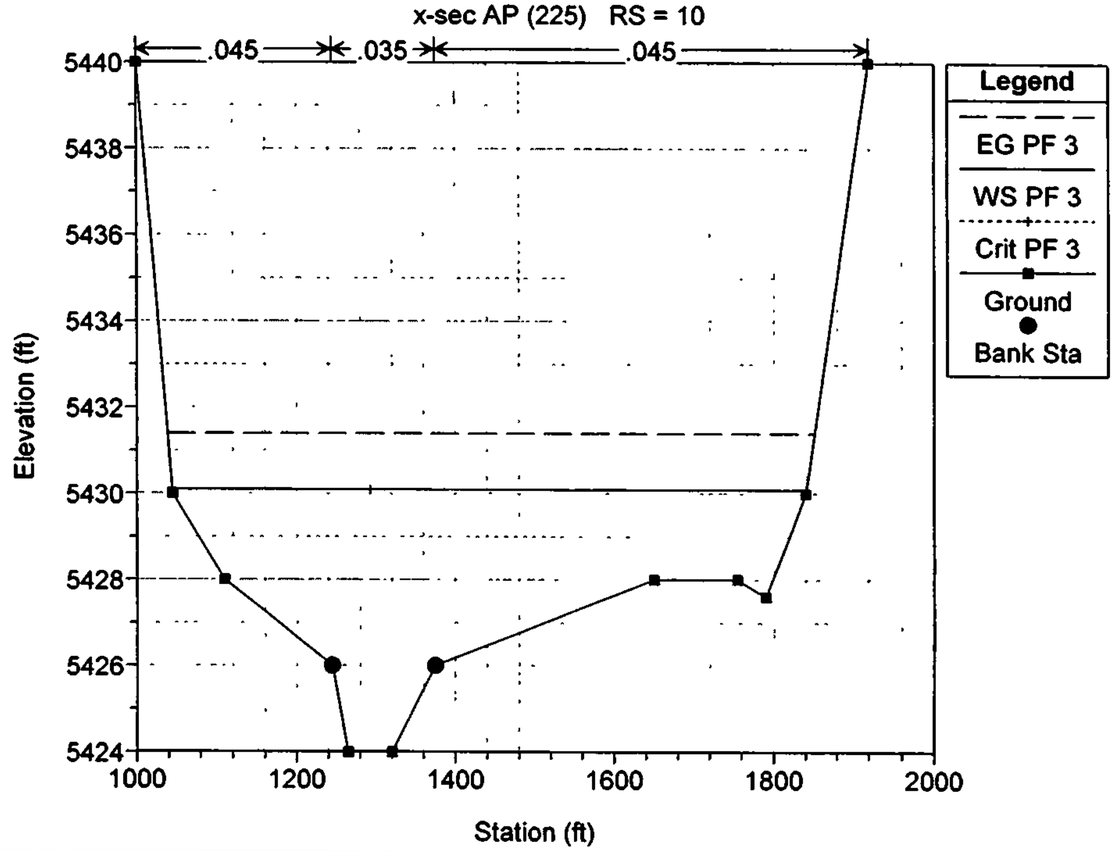
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta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.035
.045
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5436
5434
5432
5430
5428
5426
5424
1000
1200
1400
1600
1800
2000
Elevation (ft)
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 70 Profile: PF 3

E.G. Elev. (ft)	5507.26				
Vel. Head (ft)	1.44				
W.S. Elev. (ft)	5505.82				
Crit. W.S. (ft)	5505.82				
E.G. Slope (ft/ft)	0.010489				
Q Total (cfs)	18065.00				
Top Width (ft)	745.21				
Vel. Total (ft/s)	8.34				
Max. Chl. Dpth. (ft)	4.82				
Conv. Total (cfs)	176389.0				
Length Wtd. (ft)	1333.83				
Min. Ch. El. (ft)	5501.00				
Alpha	1.33				
Frctn. Loss (ft)	15.34				
C. & E. Loss (ft)	0.10				

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to
	critical depth, the calculated water surface came back below critical depth. This indicates
	that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 60 Profile: PF 3

E.G. Elev (ft)	5488.66				
Vel Head (ft)	1.10				
W.S. Elev (ft)	5487.55				
Crit W.S. (ft)	5487.48				
E.G. Slope (ft/ft)	0.012658				
Q Total (cfs)	18065.00				
Top Width (ft)	994.36				
Vel Total (ft/s)	7.85				
Max Chl Dpth (ft)	3.55				
Conv. Total (cfs)	160566.1				
Length Wtd. (ft)	1185.00				
Min Ch El (ft)	5484.00				
Alpha	1.15				
Frctn Loss (ft)	13.87				
C & E Loss (ft)	0.07				

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

	section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 50 Profile: PF 3

E.G. Elev (ft)	5474.71				
Vel Head (ft)	1.82				
W.S. Elev (ft)	5472.89				
Crit W.S. (ft)	5472.89				
E.G. Slope (ft/ft)	0.010926				
Q Total (cfs)	18065.00				
Top Width (ft)	498.07				
Vel Total (ft/s)	10.49				
Max Chl Dpth (ft)	4.89				
Conv. Total (cfs)	172821.4				
Length Wtd. (ft)					
Min Ch El (ft)	5468.00				
Alpha	1.07				
Frctn Loss (ft)					
C & E Loss (ft)					

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 46 Profile: PF 3

E.G. Elev (ft)	5468.41				
Vel Head (ft)	1.51				
W.S. Elev (ft)	5466.90				
Crit W.S. (ft)	5466.90				
E.G. Slope (ft/ft)	0.010245				
Q Total (cfs)	18065.00				
Top Width (ft)	707.37				
Vel Total (ft/s)	8.78				
Max Chl Dpth (ft)	5.20				
Conv. Total (cfs)	178480.8				
Length Wtd. (ft)					
Min Ch El (ft)	5461.70				
Alpha	1.27				
Frctn Loss (ft)					
C & E Loss (ft)					

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

	section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 45 Profile: PF 3

E.G. Elev (ft)	5463.67				
Vel Head (ft)	1.37				
W.S. Elev (ft)	5462.29				
Crit W.S. (ft)	5462.29				
E.G. Slope (ft/ft)	0.011333				
Q Total (cfs)	18065.00				
Top Width (ft)	773.31				
Vel Total (ft/s)	8.22				
Max Chl Dpth (ft)	5.29				
Conv. Total (cfs)	169694.4				
Length Wtd. (ft)	40.00				
Min Ch El (ft)	5457.00				
Alpha	1.31				
Frctn Loss (ft)	0.32				
C & E Loss (ft)	0.16				

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program selected the water surface that had the least amount of error between computed
	and assumed values.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to
	critical depth, the calculated water surface came back below critical depth. This indicates
	that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 44 Profile: PF 3

E.G. Elev (ft)	5463.06				
Vel Head (ft)	0.83				
W.S. Elev (ft)	5462.23				
Crit W.S. (ft)					
E.G. Slope (ft/ft)	0.005855				
Q Total (cfs)	18065.00				
Top Width (ft)	874.70				
Vel Total (ft/s)	6.52				
Max Chl Dpth (ft)	5.43				
Conv. Total (cfs)	236087.2				
Length Wtd. (ft)	85.00				
Min Ch El (ft)	5456.80				
Alpha	1.26				
Frctn Loss (ft)	0.66				
C & E Loss (ft)	0.05				

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 43 Profile: PF 3

E.G. Elev (ft)	5462.36				
Vel Head (ft)	1.30				
W.S. Elev (ft)	5461.06				
Crit W.S. (ft)	5460.95				
E.G. Slope (ft/ft)	0.010638				
Q Total (cfs)	18065.00				
Top Width (ft)	757.37				
Vel Total (ft/s)	8.21				
Max Chl Dpth (ft)	5.46				
Conv. Total (cfs)	175148.3				
Length Wtd. (ft)	50.00				
Min Ch El (ft)	5455.60				
Alpha	1.24				
Frctn Loss (ft)	0.57				
C & E Loss (ft)	0.01				

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 42 Profile: PF 3

E.G. Elev (ft)	5461.78				
Vel Head (ft)	1.43				
W.S. Elev (ft)	5460.35				
Crit W.S. (ft)	5460.35				
E.G. Slope (ft/ft)	0.012192				
Q Total (cfs)	18065.00				
Top Width (ft)	709.77				
Vel Total (ft/s)	8.76				
Max Chl Dpth (ft)	5.45				
Conv. Total (cfs)	163603.4				
Length Wtd. (ft)					
Min Ch El (ft)	5454.90				
Alpha	1.20				
Frctn Loss (ft)					
C & E Loss (ft)					

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
	than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 41 Profile: PF 3

E.G. Elev (ft)	5459.73				
Vel Head (ft)	1.05				
W.S. Elev (ft)	5458.68				
Crit W.S. (ft)	5457.79				
E.G. Slope (ft/ft)	0.005218				
Q Total (cfs)	18065.00				
Top Width (ft)	609.79				
Vel Total (ft/s)	7.46				
Max Chl Dpth (ft)	6.78				
Conv. Total (cfs)	250094.3				
Length Wtd. (ft)	200.00				
Min Ch El (ft)	5451.90				
Alpha	1.22				
Frctn Loss (ft)	1.41				
C & E Loss (ft)	0.09				

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 40 Profile: PF 3

E.G. Elev (ft)	5458.23				
Vel Head (ft)	1.94				
W.S. Elev (ft)	5456.29				
Crit W.S. (ft)	5456.29				
E.G. Slope (ft/ft)	0.010122				
Q Total (cfs)	18065.00				
Top Width (ft)	477.08				
Vel Total (ft/s)	10.36				
Max Chl Dpth (ft)	4.79				
Conv. Total (cfs)	179556.8				
Length Wtd. (ft)	1051.79				
Min Ch El (ft)	5451.50				
Alpha	1.16				
Frctn Loss (ft)	6.43				
C & E Loss (ft)	0.31				

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
	than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to
	critical depth, the calculated water surface came back below critical depth. This indicates
	that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 30 Profile: PF 3

E.G. Elev (ft)	5445.34				
Vel Head (ft)	0.92				
W.S. Elev (ft)	5444.42				
Crit W.S. (ft)					
E.G. Slope (ft/ft)	0.004089				
Q Total (cfs)	18065.00				
Top Width (ft)	565.25				
Vel Total (ft/s)	7.11				
Max Chl Dpth (ft)	7.42				
Conv. Total (cfs)	282499.8				
Length Wtd. (ft)	829.46				
Min Ch El (ft)	5437.00				
Alpha	1.17				
Frctn Loss (ft)	4.48				
C & E Loss (ft)	0.09				

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 20 Profile: PF 3

E.G. Elev (ft)	5440.77				
Vel Head (ft)	1.83				
W.S. Elev (ft)	5438.94				
Crit W.S. (ft)	5438.94				
E.G. Slope (ft/ft)	0.007449				
Q Total (cfs)	18065.00				
Top Width (ft)	515.05				
Vel Total (ft/s)	8.76				
Max Chl Dpth (ft)	9.44				
Conv. Total (cfs)	209310.6				
Length Wtd. (ft)	664.56				
Min Ch El (ft)	5429.50				
Alpha	1.54				
Frctn Loss (ft)	5.17				
C & E Loss (ft)	0.16				

	program used critical depth for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to
	critical depth, the calculated water surface came back below critical depth. This indicates
	that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 10 Profile: PF 3

E.G. Elev (ft)	5431.40				
Vel Head (ft)	1.30				
W.S. Elev (ft)	5430.09				
Crit W.S. (ft)	5430.09				
E.G. Slope (ft/ft)	0.008133				
Q Total (cfs)	18065.00				
Top Width (ft)	796.17				
Vel Total (ft/s)	7.46				
Max Chl Dpth (ft)	6.09				
Conv. Total (cfs)	200319.5				
Length Wtd. (ft)					
Min Ch El (ft)	5424.00				
Alpha	1.51				
Frctn Loss (ft)					
C & E Loss (ft)					

Errors Warnings and Notes

Warning:	User specified water surface is not possible for the specified flow regime. The program used
	critical depth as the starting water surface.

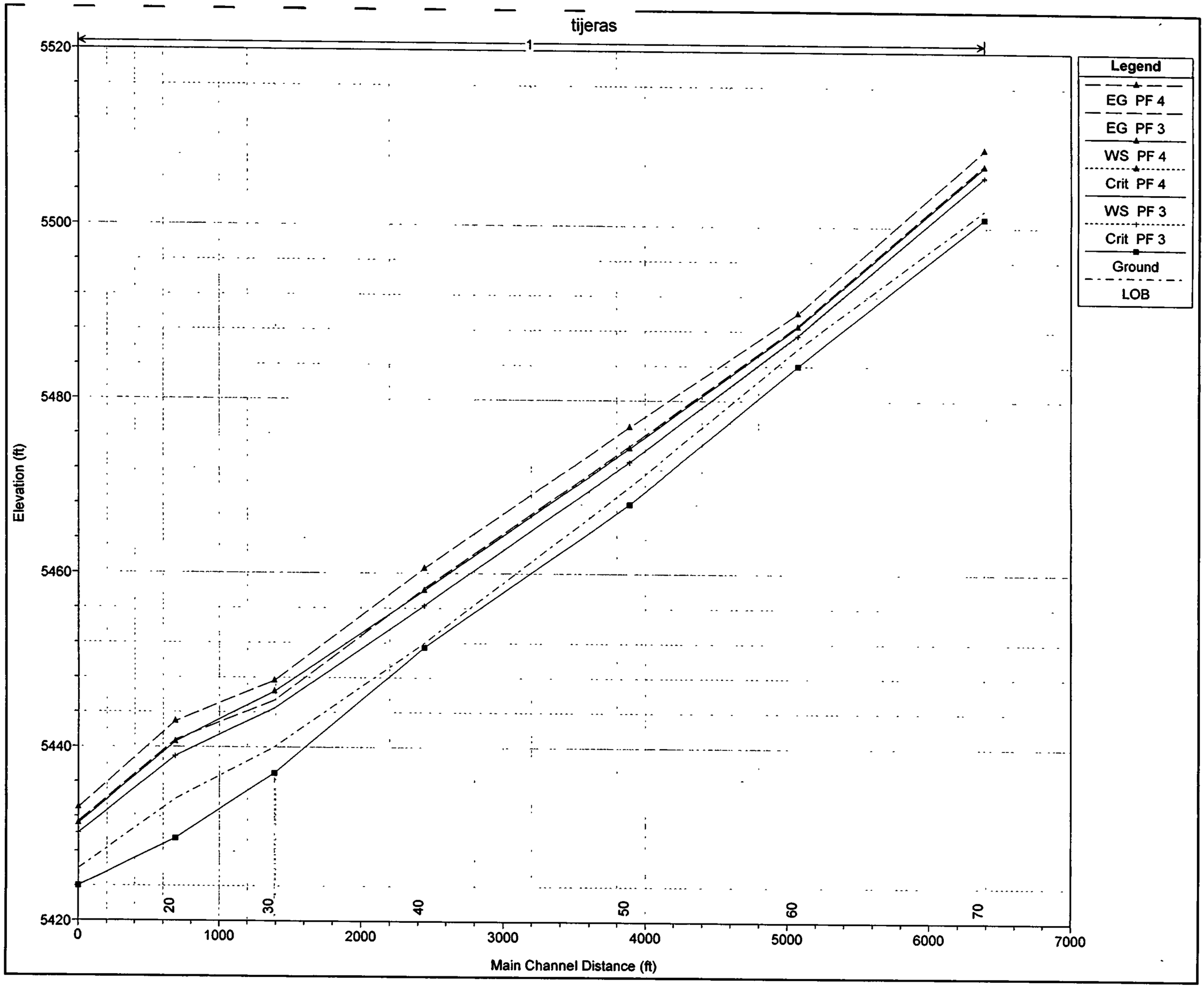
HEC-RAS Plan: Plan 01 River: Tijeras Arroyo Reach: 1

Reach	River Sta	E.G. Elev (ft)	W.S. Elev (ft)	Vel Head (ft)	Frctn Loss (ft)	C & E Loss (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Top Width (ft)
1	10	5429.26	5428.48	0.78			652.55	4241.56	1390.89	713.88
1	10	5430.73	5429.60	1.13			1860.78	7114.12	4775.10	773.67
1	10	5431.40	5430.09	1.30			2636.50	8567.05	6861.45	796.17
1	10	5433.00	5431.20	1.80			5161.59	12329.23	13009.18	809.95
1	20	5437.75	5436.60	1.15	4.00	0.11	1604.31	4680.69		415.44
1	20	5439.85	5438.23	1.62	4.88	0.15	5880.06	7869.94		484.73
1	20	5440.77	5438.94	1.83	5.17	0.16	8608.43	9456.57		515.05
1	20	5442.90	5440.57	2.33	5.69	0.16	17020.14	13475.88	3.98	576.28
1	30	5442.16	5441.65	0.51	4.34	0.06	107.72	4151.61	2025.67	445.74
1	30	5444.35	5443.57	0.78	4.42	0.08	757.93	8850.12	4141.95	528.48
1	30	5445.34	5444.42	0.92	4.48	0.09	1315.44	11430.66	5318.91	565.25
1	30	5447.63	5446.36	1.27	4.63	0.11	3412.46	18495.71	8591.84	648.60
1	40	5455.15	5454.08	1.07	8.38	0.17	308.00	5941.06	35.94	385.82
1	40	5457.26	5455.59	1.67	6.76	0.27	1197.65	12412.61	139.74	447.92
1	40	5458.23	5456.29	1.94	6.43	0.31	1877.94	15967.95	219.11	477.08
1	40	5460.55	5458.00	2.55	6.02	0.39	4332.09	25662.46	505.45	547.58
1	50	5471.92	5471.13	0.79	16.73	0.03	35.92	6240.80	8.28	444.28
1	50	5473.80	5472.25	1.55	16.23	0.01	242.85	13451.20	55.95	478.70
1	50	5474.71	5472.89	1.82	15.23	0.01	455.27	17504.83	104.90	498.07
1	50	5476.92	5474.47	2.45	13.44	0.01	1359.02	28827.85	313.13	546.20
1	60	5486.83	5486.23	0.60	14.89	0.02	1.10	4507.90	1775.99	858.57
1	60	5488.08	5487.18	0.89	14.21	0.07	76.67	9232.54	4440.79	956.22
1	60	5488.66	5487.55	1.10	13.87	0.07	161.29	11905.53	5998.18	994.36
1	60	5490.05	5488.50	1.55			593.89	19102.25	10803.87	1049.56
1	70	5504.98	5504.17	0.81	16.50	0.06	724.12	4580.26	980.63	626.90
1	70	5506.54	5505.29	1.24	15.10	0.10	2246.39	8423.11	3080.50	707.80
1	70	5507.26	5505.82	1.44	15.34	0.10	3273.35	10450.02	4341.63	745.21
1	70	5508.94	5507.03	1.90	15.02	0.11	6957.30	15678.21	7864.49	774.26

DUPLICATE EFFECTIVE

HEC-RAS Plan: Plan 01 River: Tijeras Arroyo Reach: 1

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
1	10	6285.00	5424.00	5428.48	5428.48	5429.26	0.006323	8.36	1199.50	713.88	0.75
1	10	13750.00	5424.00	5429.60	5429.56	5430.73	0.007665	10.89	2033.34	773.67	0.86
1	10	18065.00	5424.00	5430.09	5430.09	5431.40	0.008133	11.95	2421.58	796.17	0.90
1	10	30500.00	5424.00	5431.20	5431.20	5433.00	0.009177	14.33	3306.99	809.95	0.98
1	20	6285.00	5429.50	5436.60	5436.60	5437.75	0.005596	9.80	972.33	415.44	0.74
1	20	13750.00	5429.50	5438.23	5438.23	5439.85	0.007000	12.65	1706.14	484.73	0.85
1	20	18065.00	5429.50	5438.94	5438.94	5440.77	0.007449	13.76	2062.75	515.05	0.89
1	20	30500.00	5429.50	5440.57	5440.57	5442.90	0.008042	16.03	2955.82	576.28	0.95
1	30	6285.00	5437.00	5441.65		5442.16	0.005366	6.18	1137.56	445.74	0.65
1	30	13750.00	5437.00	5443.57		5444.35	0.004267	7.80	2074.91	528.48	0.63
1	30	18065.00	5437.00	5444.42		5445.34	0.004089	8.53	2542.47	565.25	0.64
1	30	30500.00	5437.00	5446.36		5447.63	0.003963	10.25	3718.98	648.60	0.66
1	40	6285.00	5451.50	5454.08	5454.08	5455.15	0.012965	8.50	788.45	385.82	0.98
1	40	13750.00	5451.50	5455.59	5455.59	5457.26	0.010750	10.79	1416.00	447.92	0.97
1	40	18065.00	5451.50	5456.29	5456.29	5458.23	0.010122	11.72	1743.00	477.08	0.97
1	40	30500.00	5451.50	5458.00	5458.00	5460.55	0.009018	13.68	2618.57	547.58	0.96
1	50	6285.00	5468.00	5471.13	5470.94	5471.92	0.010423	7.16	890.53	444.28	0.87
1	50	13750.00	5468.00	5472.25	5472.25	5473.80	0.011695	10.08	1411.74	478.70	0.98
1	50	18065.00	5468.00	5472.89	5472.89	5474.71	0.010926	10.98	1722.22	498.07	0.98
1	50	30500.00	5468.00	5474.47	5474.47	5476.92	0.009516	12.85	2546.98	546.20	0.97
1	60	6285.00	5484.00	5486.23	5486.20	5486.83	0.015792	6.83	1074.74	858.57	1.00
1	60	13750.00	5484.00	5487.18	5487.08	5488.08	0.012302	8.45	1939.16	956.22	0.96
1	60	18065.00	5484.00	5487.55	5487.48	5488.66	0.012658	9.43	2302.04	994.36	1.00
1	60	30500.00	5484.00	5488.50	5488.50	5490.05	0.012279	11.29	3275.86	1049.56	1.03
1	70	6285.00	5501.00	5504.17	5504.17	5504.98	0.010046	8.18	1033.09	626.90	0.88
1	70	13750.00	5501.00	5505.29	5505.29	5506.54	0.010471	10.57	1786.46	707.80	0.96
1	70	18065.00	5501.00	5505.82	5505.82	5507.26	0.010489	11.53	2165.68	745.21	0.98
1	70	30500.00	5501.00	5507.03	5507.03	5508.94	0.010321	13.49	3095.07	774.26	1.01


tijeras
1
Legend
EG PF 4
EG PF 3
WS PF 4
Crit PF 4
WS PF 3
Crit PF 3
Ground
LOB
Elevation (ft)
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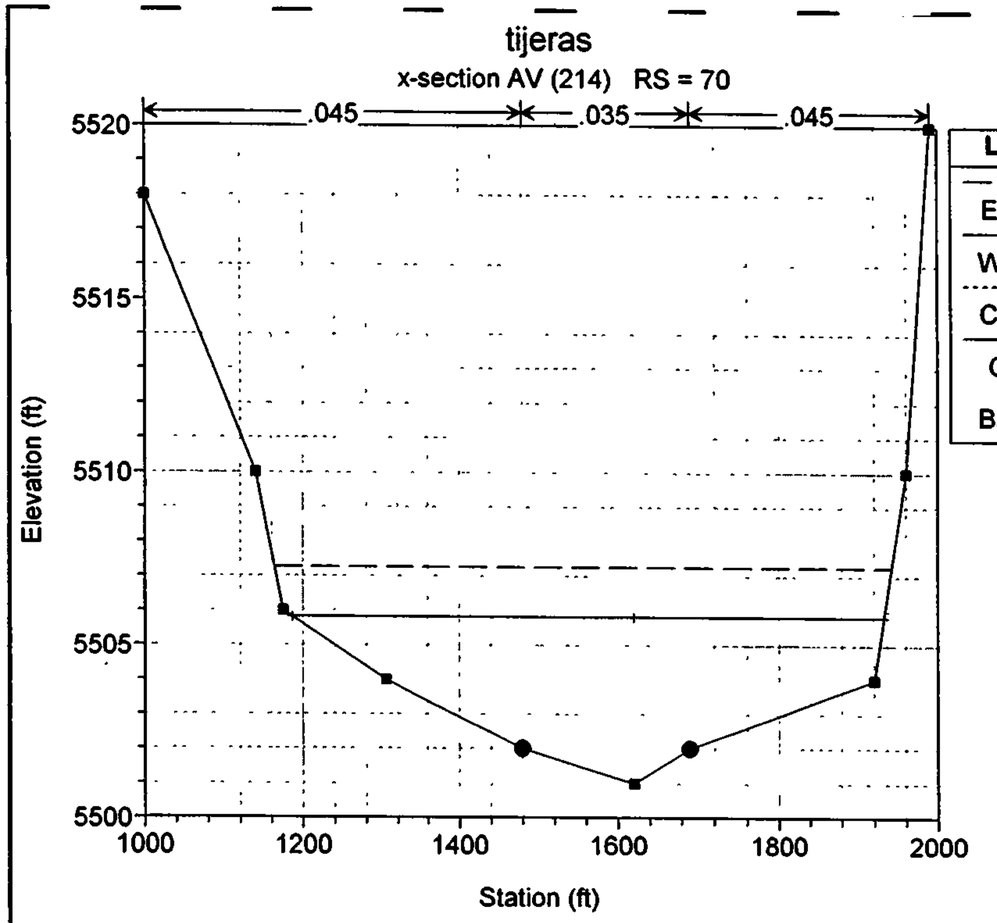
5500
5480
5460
5440
5420
20
30
40
50
60
70
0
1000
2000
3000
4000
5000
6000
7000
Main Channel Distance (ft)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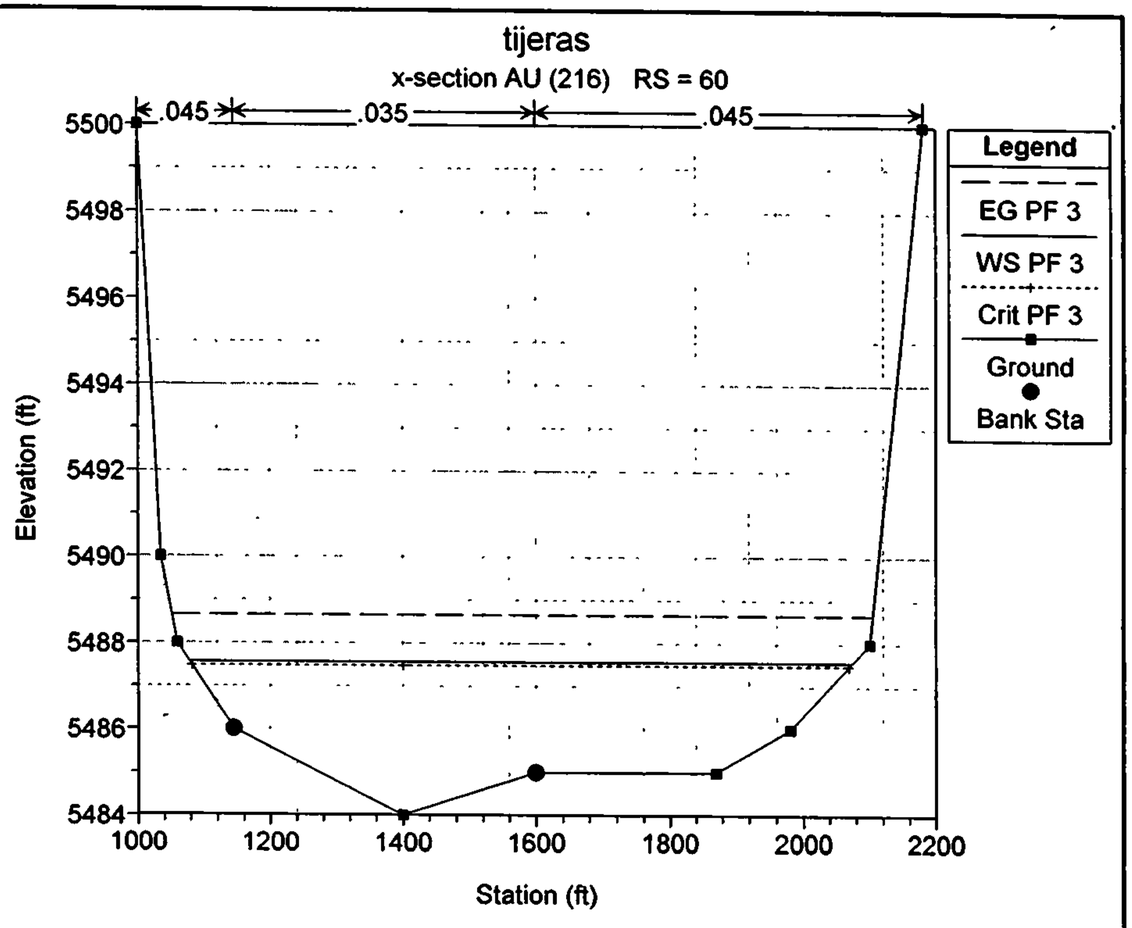
.035
.045
5520
5515
5510
5505
5500
Elevation (ft)
1000
1200
1400
1600
1800
2000
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta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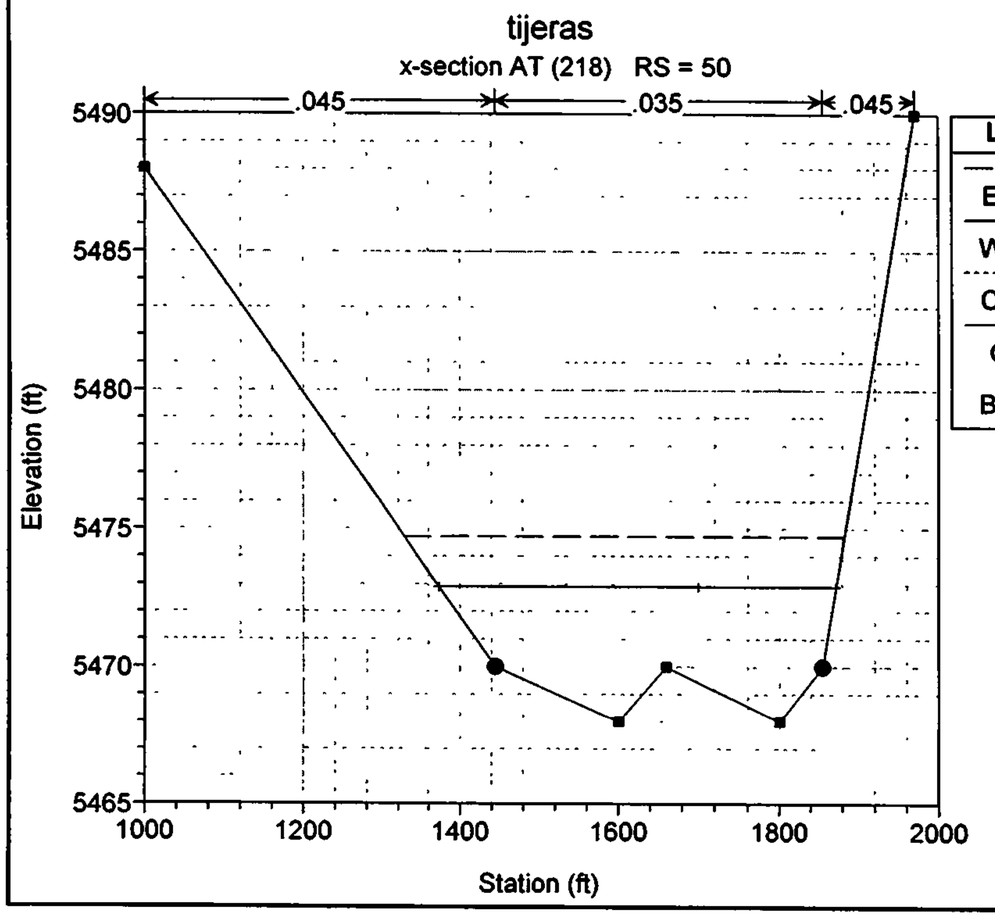
.035
.045
5500
5498
5496
5494
5492
5490
5488
5486
5484
Elevation (ft)
1000
1200
1400
1600
1800
2000
2200
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta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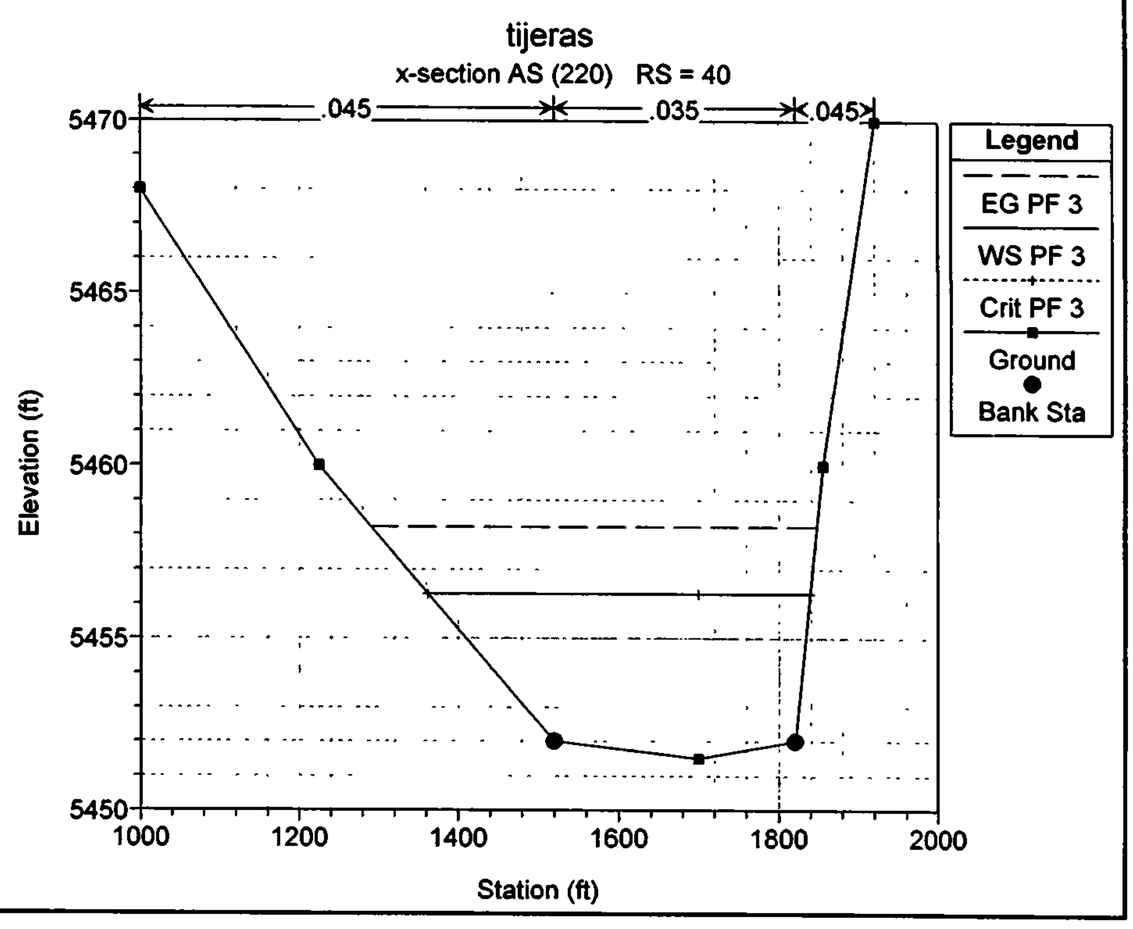
.035
.045
5490
5485
5480
5475
5470
5465
Elevation (ft)
1000
1200
1400
1600
1800
2000
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta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x-section AS (220) RS = 40
.045
.035
.045
5470
5465
5460
5455
5450
Elevation (ft)
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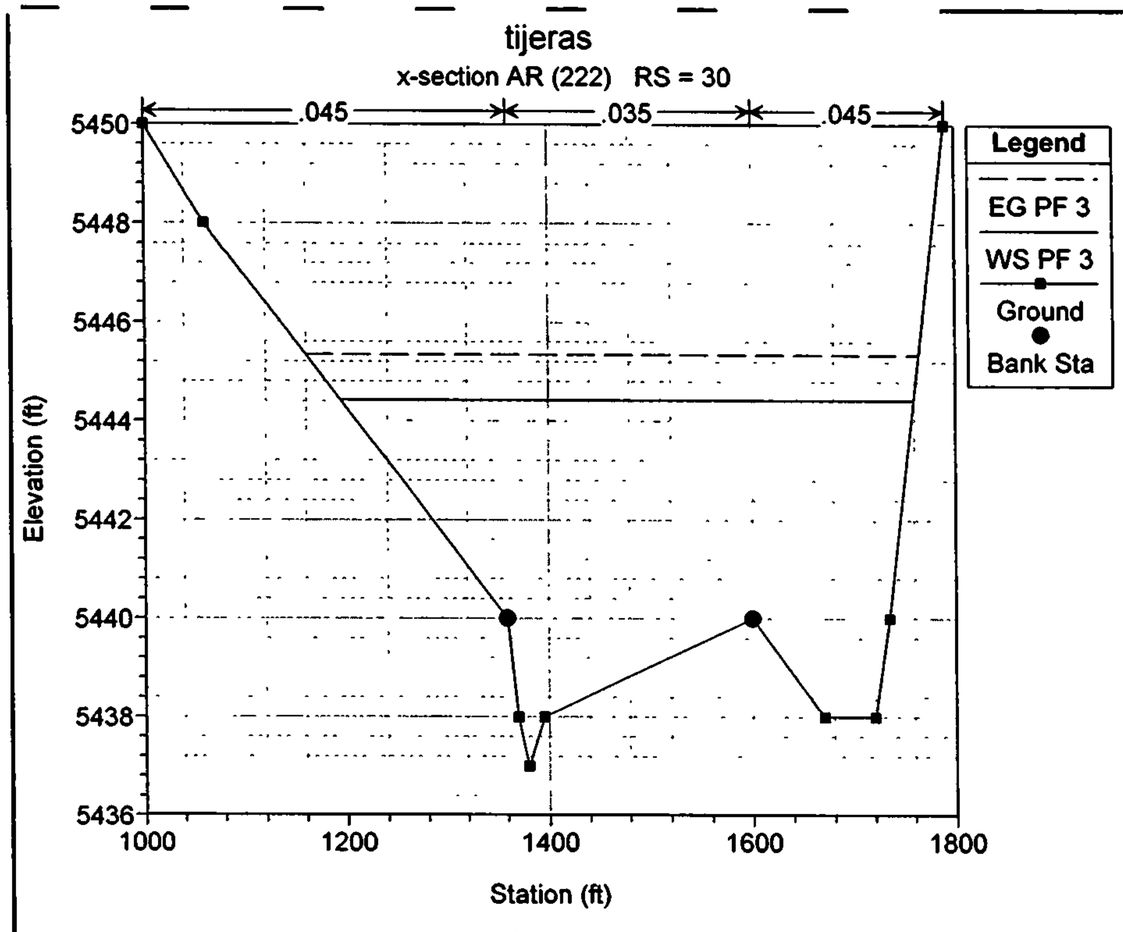
1200
1400
1600
1800
2000
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta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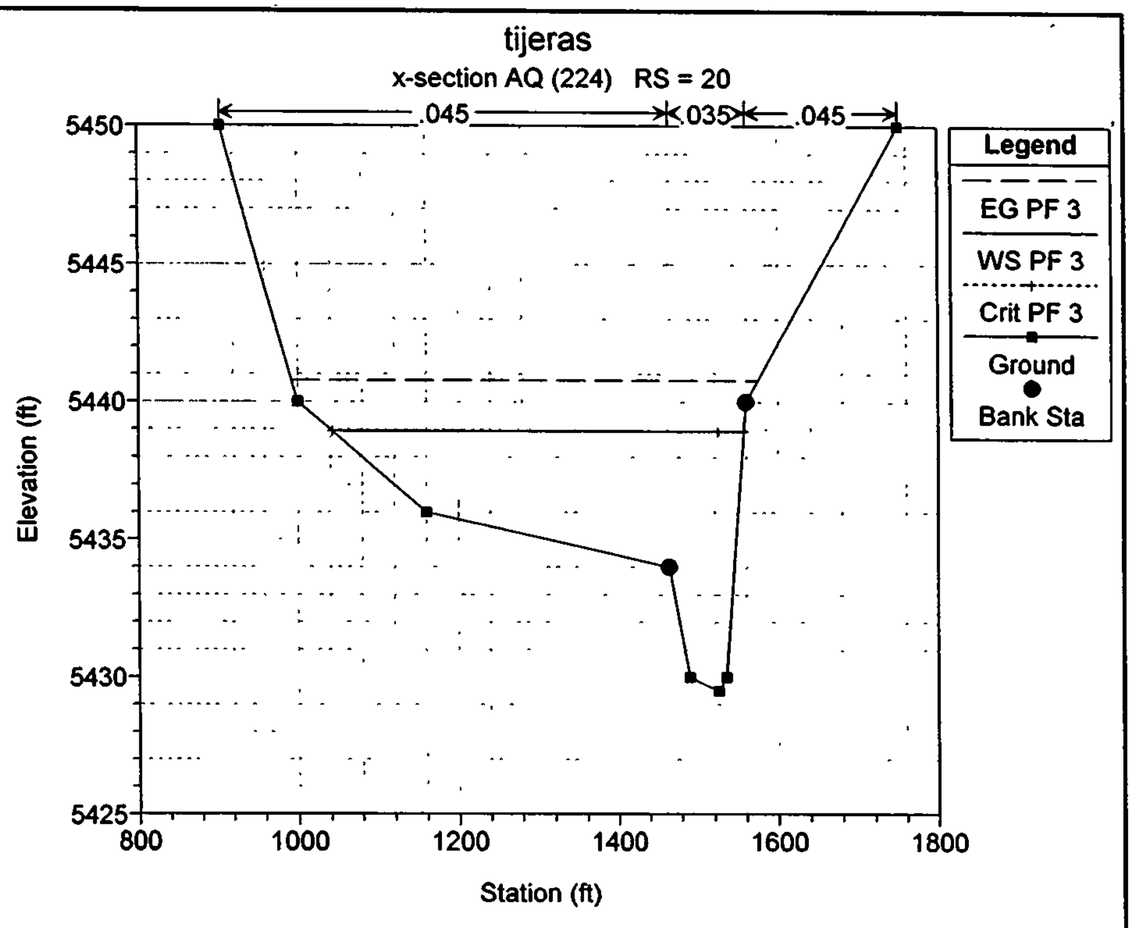
.045
.035
.045
5450
5448
5446
5444
5442
5440
5438
5436
1000
1200
1400
1600
1800
Elevation (ft)
Station (ft)
Legend
EG PF 3
WS PF 3
Ground
Bank Sta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.035
.045
5450
5445
5440
5435
5430
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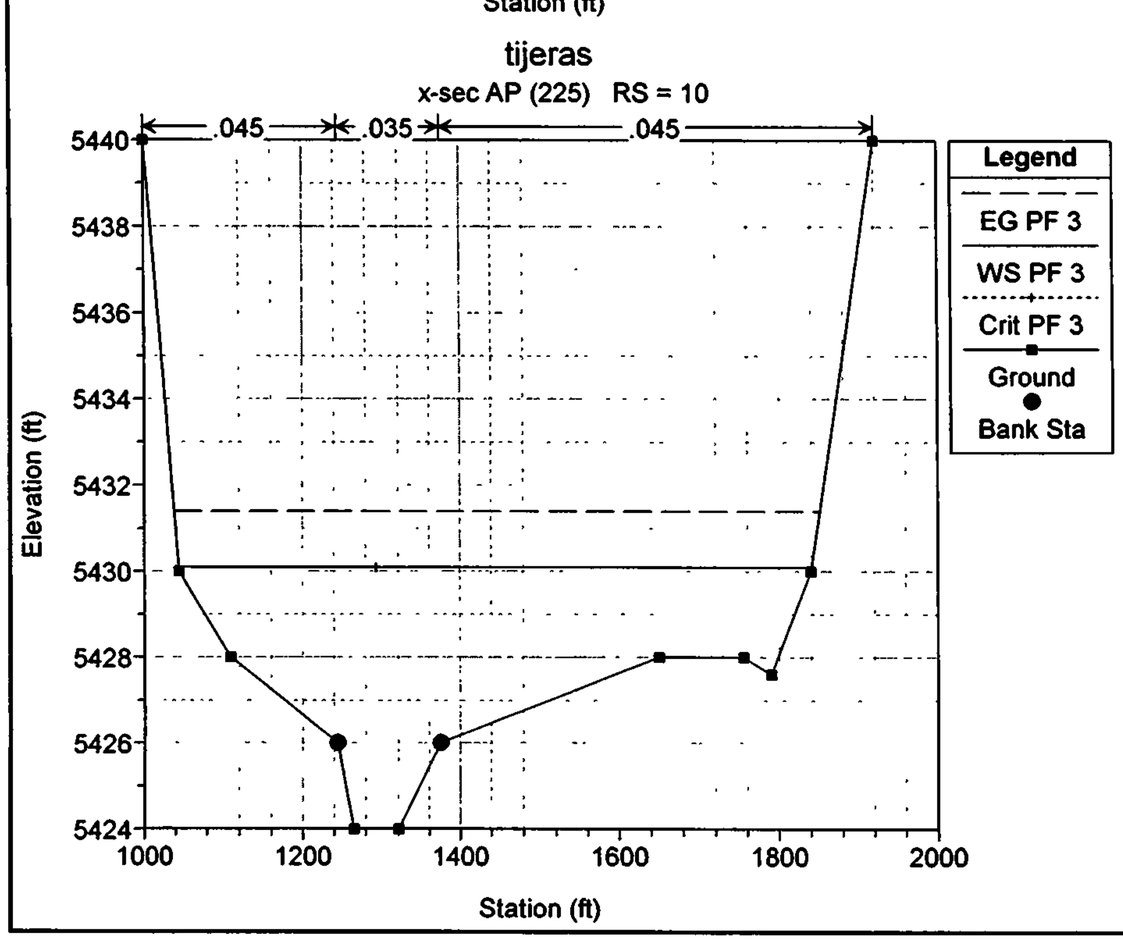
1200
1400
1600
1800
Elevation (ft)
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta


tijeras
x-sec AP (225) RS = 10
.045
.035
.045
5440
5438
5436
5434
5432
5430
5428
5426
5424
1000
1200
1400
1600
1800
2000
Elevation (ft)
Station (ft)
Legend
EG PF 3
WS PF 3
Crit PF 3
Ground
Bank Sta

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 70 Profile: PF 3

E.G. Elev (ft)	5507.26				
Vel Head (ft)	1.44				
W.S. Elev (ft)	5505.82				
Crit W.S. (ft)	5505.82				
E.G. Slope (ft/ft)	0.010489				
Q Total (cfs)	18065.00				
Top Width (ft)	745.21				
Vel Total (ft/s)	8.34				
Max Chl Dpth (ft)	4.82				
Conv. Total (cfs)	176389.0				
Length Wtd. (ft)	1333.83				
Min Ch El (ft)	5501.00				
Alpha	1.33				
Frctn Loss (ft)	15.34				
C & E Loss (ft)	0.10				

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to
	critical depth, the calculated water surface came back below critical depth. This indicates
	that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 60 Profile: PF 3

E.G. Elev (ft)	5488.66				
Vel Head (ft)	1.10				
W.S. Elev (ft)	5487.55				
Crit W.S. (ft)	5487.48				
E.G. Slope (ft/ft)	0.012658				
Q Total (cfs)	18065.00				
Top Width (ft)	994.36				
Vel Total (ft/s)	7.85				
Max Chl Dpth (ft)	3.55				
Conv. Total (cfs)	160566.1				
Length Wtd. (ft)	1185.00				
Min Ch El (ft)	5484.00				
Alpha	1.15				
Frctn Loss (ft)	13.87				
C & E Loss (ft)	0.07				

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross

	section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 50 Profile: PF 3

E.G. Elev (ft)	5474.71				
Vel Head (ft)	1.82				
W.S. Elev (ft)	5472.89				
Crit W.S. (ft)	5472.89				
E.G. Slope (ft/ft)	0.010926				
Q Total (cfs)	18065.00				
Top Width (ft)	498.07				
Vel Total (ft/s)	10.49				
Max Chl Dpth (ft)	4.89				
Conv. Total (cfs)	172821.4				
Length Wtd. (ft)	1449.12				
Min Ch El (ft)	5468.00				
Alpha	1.07				
Frctn Loss (ft)	15.23				
C & E Loss (ft)	0.01				

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to
	critical depth, the calculated water surface came back below critical depth. This indicates
	that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 40 Profile: PF 3

E.G. Elev (ft)	5458.23				
Vel Head (ft)	1.94				
W.S. Elev (ft)	5456.29				
Crit W.S. (ft)	5456.29				
E.G. Slope (ft/ft)	0.010122				
Q Total (cfs)	18065.00				
Top Width (ft)	477.08				
Vel Total (ft/s)	10.36				
Max Chl Dpth (ft)	4.79				
Conv. Total (cfs)	179556.8				
Length Wtd. (ft)	1051.79				
Min Ch El (ft)	5451.50				
Alpha	1.16				
Frctn Loss (ft)	6.43				
C & E Loss (ft)	0.31				

Errors Warnings and Notes

	program used critical depth for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The conveyance ratio (upstream conveyance divided by downstream conveyance) is less
	than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to
	critical depth, the calculated water surface came back below critical depth. This indicates
	that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 30 Profile: PF 3

E.G. Elev (ft)	5445.34				
Vel Head (ft)	0.92				
W.S. Elev (ft)	5444.42				
Crit W.S. (ft)					
E.G. Slope (ft/ft)	0.004089				
Q Total (cfs)	18065.00				
Top Width (ft)	565.25				
Vel Total (ft/s)	7.11				
Max Chl Dpth (ft)	7.42				
Conv. Total (cfs)	282499.8				
Length Wtd. (ft)	829.46				
Min Ch El (ft)	5437.00				
Alpha	1.17				
Frctn Loss (ft)	4.48				
C & E Loss (ft)	0.09				

Errors Warnings and Notes

Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 20 Profile: PF 3

E.G. Elev (ft)	5440.77				
Vel Head (ft)	1.83				
W.S. Elev (ft)	5438.94				
Crit W.S. (ft)	5438.94				
E.G. Slope (ft/ft)	0.007449				
Q Total (cfs)	18065.00				
Top Width (ft)	515.05				
Vel Total (ft/s)	8.76				
Max Chl Dpth (ft)	9.44				
Conv. Total (cfs)	209310.6				
Length Wtd. (ft)	664.56				

Min Ch El (ft)	5429.50				
Alpha	1.54				
Frctn Loss (ft)	5.17				
C & E Loss (ft)	0.16				

Errors Warnings and Notes

Warning:	The energy equation could not be balanced within the specified number of iterations. The
	program used critical depth for the water surface and continued on with the calculations.
Warning:	The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for
	additional cross sections.
Warning:	The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross
	section. This may indicate the need for additional cross sections.
Warning:	During the standard step iterations, when the assumed water surface was set equal to
	critical depth, the calculated water surface came back below critical depth. This indicates
	that there is not a valid subcritical answer. The program defaulted to critical depth.

Plan: Plan 01 River: Tijeras Arroyo Reach:1 Riv Sta: 10 Profile: PF 3

E.G. Elev (ft)	5431.40				
Vel Head (ft)	1.30				
W.S. Elev (ft)	5430.09				
Crit W.S. (ft)	5430.09				
E.G. Slope (ft/ft)	0.008133				
Q Total (cfs)	18065.00				
Top Width (ft)	796.17				
Vel Total (ft/s)	7.46				
Max Chl Dpth (ft)	6.09				
Conv. Total (cfs)	200319.5				
Length Wtd (ft)					
Min Ch El (ft)	5424.00				
Alpha	1.51				
Frctn Loss (ft)					
C & E Loss (ft)					

Errors Warnings and Notes

Warning:	User specified water surface is not possible for the specified flow regime. The program used
	critical depth as the starting water surface.

MARK GOODWIN & ASSOCIATES, P.A.
CONSULTING ENGINEERS
P.O. BOX 90606
ALBUQUERQUE, NEW MEXICO 87199
(505) 828-2200, FAX (505) 797-9539

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT

TITLE: JUAN TABO BOULEVARD S.E. - PHASE II
GUIDE BANK PLAN

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.

CITY PROJECT NO.	ZONE MAP NO.	SHEET	OF
756182	M-21/N-21	8	10

NO.	DATE	REMARKS
		REVISIONS

DESIGNED BY JDH DATE 12/04
DESIGN DER
DRAWN BY JBY DATE 12/04
CHECKED BY

ENGINEER'S SEAL
JAMES D. HUGHES
NEW MEXICO
REGISTERED PROFESSIONAL ENGINEER
3-18-05

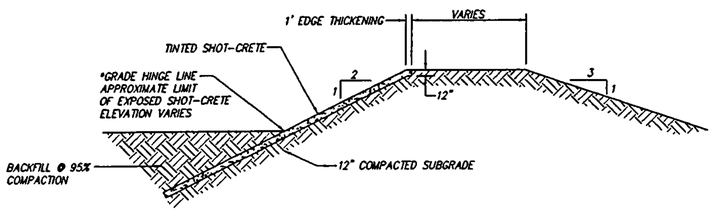
SURVEY INFORMATION
FIELD NOTES BY DATE

BENCH MARKS

AS BUILT INFORMATION
CONTRACTOR
WORK STARTED BY
INSPECTOR'S
FIELD CHANGES BY
VERIFICATION BY
CORRECTED BY
MICRO-FILM INFORMATION
RECORDED BY

NO. DATE

A02jobs\A2079.2 MCLS\Bridge Plans\A2079-Bridge-50.dwg 03-18-05 DER

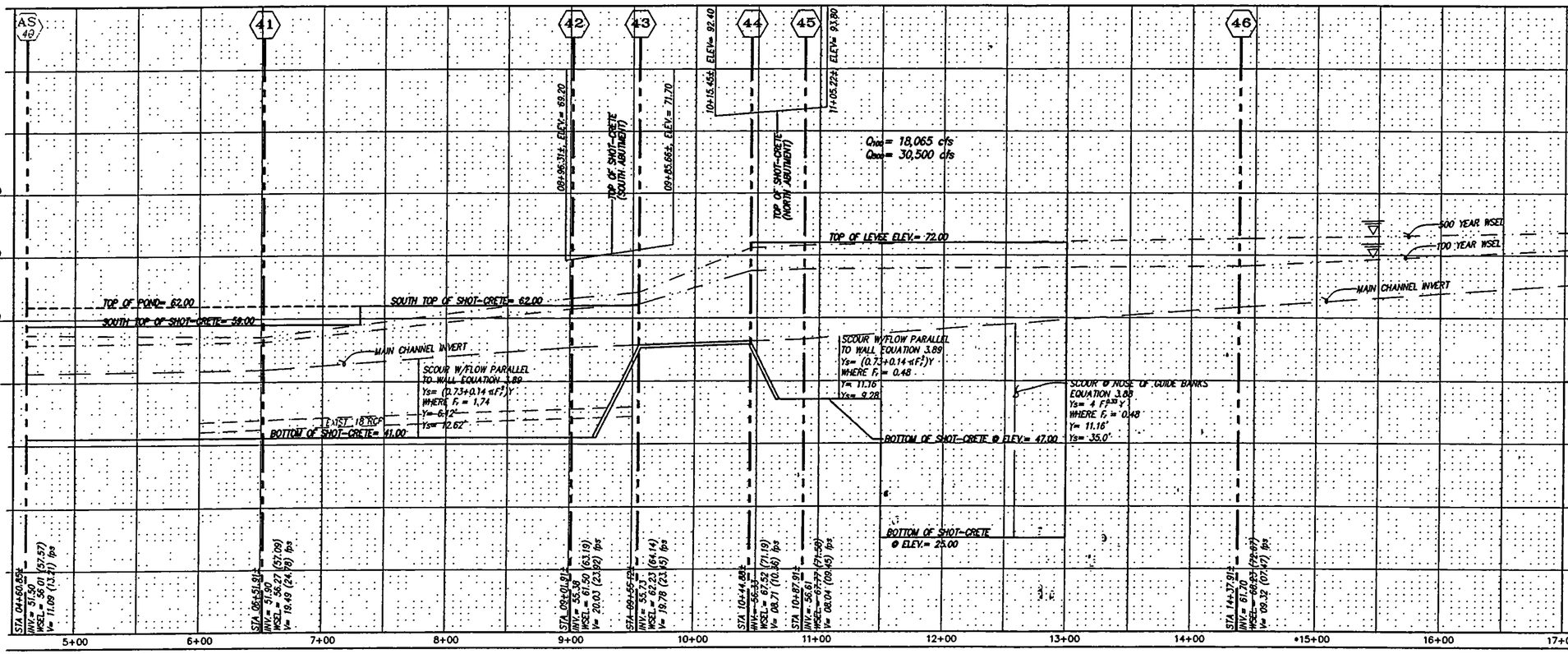


SECTION A-A

N.T.S.

LEGEND

WATER SURFACE ELEVATION	WSEL= 100YR (500YR)
VELOCITY	V= 100YR (500YR)



TIJERAS ARROYO- GUIDE BANK
STA. 4+50.00 TO STA. 19+00.00
SCALE: HORZ. 1" = 50'
VERT. 1" = 10'

A02jobs\A2079 4 HILLS\Bridge Plans\A2079-Bridge-50.dwg\03-18-05\DER

AS BUILT INFORMATION

CONTRACTOR	DAT
STAKED BY	
INSPECTOR'S ACCEPTANCE BY	DAT
FIELD VERIFICATION BY	DAT
DRAWINGS CORRECTED BY	DAT
MICRO-FILM INFORMATION	
RECORDED BY	DAT
NO	

BENCH MARKS

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

ENGINEER'S SEAL

JAMES D. HUGHES — 12-16-05
NEW MEXICO — REGISTERED PROFESSIONAL ENGINEER

NO.	DATE	REMARKS	BY
		REVISIONS	
		DESIGN	
		DESIGNED BY JDH	DATE 03/05
		DRAWN BY DER	DATE 03/05
		CHECKED BY DMG	DATE

dmg
MARK GOODWIN & ASSOCIATES, P.A.
CONSULTING ENGINEERS
P.O. BOX 90606
ALBUQUERQUE, NEW MEXICO 87199
(505) 828-2200, FAX (505) 797-9539

CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT

TITLE: JUAN TABO BLVD. S.E. - PHASE II
GUIDE BANK PROFILE & DETAILS

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO /DAY/YR.	MO /DAY/YR.

CITY PROJECT NO. 756182

ZONE MAP NO. M-21/N-21

SHEET 9 OF 10

Ronald D. Brown, Chair
Daniel F. Lyon, Vice Chair
Tim Eichenberg, Secretary-Treasurer
Janet Saiers, Asst. Secretary-Treasurer
Danny Hernandez, Director

John P Kelly, P.E.
Executive Engineer

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority
2600 Prospect N.E., Albuquerque, NM 87107
Phone: (505) 884-2215 Fax: (505) 884-0214

File: M21/D15A

May 6, 2005

Doug Hughes, P.E.
Mark Goodwin & Associates
P.O. Box 90606
Albuquerque, NM 87199

Re: Drainage Report for Juan Tabo Boulevard Bridge Crossing at Tijeras Arroyo (dated March 17, 2005)

Dear Doug:

The following are initial comments by AMAFCA on the drainage report associated with the referenced project. Since no floodplain information has been submitted, the comments are on the content of the report, which is primarily hydraulic information on the bridge structure and the Tijeras Arroyo itself.

Comment 1: No sediment analysis data is included in the initial report, and AMAFCA is primarily concerned about the impacts of the changes in the cross sectional area of the entire Tijeras floodplain due to construction of the bridge. Sediment analysis upstream will be important to identify the extent of impact to the floodplain and the resulting cross sections that may impact the water surface elevations upstream, and potential impacts to upstream private properties. AMAFCA has requested our on-call consultant, Owen Ayres & Associates, to provide AMAFCA with additional preliminary information on the potential for significant sediment impacts that may result from construction of this bridge. AMAFCA will communicate back to Mark Goodwin & Associates and the City of Albuquerque on any sediment information generated by Owen Ayres & Associates in their preliminary investigation.

Comment 2: Additional information on proposed bank grading by the development along the south side of the Tijeras floodplain will be necessary in order to adequately predict the hydraulic characteristics that may be needed for the sediment analysis.

Comment 3: It would appear that most of the erosion protection and scour computations are based on the 100 year flow. Considering the significance of the bridge structure, and the size of the Tijeras Arroyo, it may be prudent to use a higher flow than the 100 year in computing scour potential.

Comment 4: A proposed inundation map of upstream may be necessary in order to properly identify potential sediment deposition from the upstream pool.

Comment 5: Please provide scour calculations for the bridge abutments.

Comment 6: Stream bed scour for low flow needs to be addressed, both upstream and downstream of the bridge structure. For low flow analysis, the ineffective flow area between the piers and abutments should be blocked out in the HEC-RES model analysis.

Comment 7: The output of the HEC-RES model is showing warning statements indicating insufficient cross sections for water surface analysis. Additional cross sections may have to be added in order to get a true representation of the water surface, particularly near the upstream area of the bridge.

Comment 8: Please provide input as well as output files for the HEC-RES analysis.

Ultimately, a FEMA map revision will be necessary for alterations of the floodplain for the project. Please provide additional information for the FEMA submittal for the LOMR.

If you have any questions, please contact me at 884-2215.

Sincerely,
AMAFCA

Loren D. Meinz, P.E.
Drainage Engineer

Cc: Brad Bingham, City of Albuquerque

AMAFCA
2600 Prospect Ave., NE
Albuquerque, NM 87107
(505) 884-2215
(505) 884-0214 Fax

File
M21/D15A

FAX

To: Brad Bingham, COA From: Loren Wiens

Fax: 924-3864 Pages, Including cover sheet: 5

Phone: Date: 3 June 2005

Re: Juan Tabo @ Tijeras Arroyo Bridge

___ Urgent ___ For Review ___ Please Comment ___ Please Reply

AYRES ASSOCIATES

RECEIVED
JUN 0 2 2005

June 1, 2005

Mr. Loren Meinz
Albuquerque Metropolitan Arroyo
Flood Control Authority
2600 Prospect Avenue NE
Albuquerque, New Mexico 87101

Re: Review of Proposed Juan Tabo Boulevard Crossing of Tijeras Arroyo

Dear Loren,

This letter summarized our review of the proposed 3-span Juan Tabo Boulevard bridge crossing of Tijeras Arroyo. The review was carried out to address concerns about potential flooding impacts to the Hidden Valley subdivision caused by deposition due to the extreme backwater from the proposed bridge. There were also concerns about long-term maintenance of the channel if the deposition persists. The following steps were carried out as part of our review:

1. Initial review of the proposed bridge design and identification of potential problems
2. Brief review of the HEC-RAS model
3. Sediment continuity analysis to evaluate potential sedimentation problems associated with bridge backwater
4. Review of bridge plans with respect to scour mitigation measures

Initial Review

Bridge plans and hydraulic modeling results were reviewed to become familiar with the bridge design and to identify potential problems. The following general observations resulted from the review:

- Proposed bridge is a 3-span structure with pile-supported abutments and two pile-supported piers
- Bridge width is 280 feet (measured along the alignment of the bridge) and the bridge is skewed 26°16'16" with the alignment of the arroyo (piers are aligned with the flow)
- Bridge and approach embankment create a significant encroachment of the arroyo
- Encroachment causes significant backwater that begins at flows greater than about a 2-year event; flow depths are approximately doubled just upstream of the bridge for the 100-year event
- Model is predicting Class B low flow through the bridge opening (flow passes through critical depth at the bridge) with very severe hydraulic conditions and, therefore, very high scour potential
- Guide banks consisting of shot-crete lined levees direct flow into and through the bridge opening; the levees appear to be aligned well and tied back adequately upstream of the bridge
- Channel bottom is lined with shot-crete beneath the bridge opening

Ayres Associates Inc
Engineers/Scientists/Surveyors
3665 JFK Parkway, Building 2, Suite 200, P.O. Box 270460, Fort Collins, CO 80527
(970) 223-5556, Denver Metro (303) 572-1600, FAX (970) 223-5578

Review of HEC-RAS Model

A brief review of the HEC-RAS hydraulic model developed to support the bridge design was carried out to identify any significant modeling deficiencies. The following are general comments and observations regarding the modeling:

- Cross-section spacing in the model is too high; there are many warnings related to this in the output. To determine the potential effects of the cross section spacing on the results, we re-ran the model with interpolated cross sections and compared the results with the original model. In general the results with the interpolated cross sections did not change significantly, although there were three or four cross sections with significant differences (computed water-surface elevations of the 100-year event up to 1.6 feet different).
- The model was run in "mixed" flow-regime mode; there were some very high Froude Numbers downstream of the bridge (up to 2.2 for the 100-year event). This is unlikely for a sand-bed channel bed such as Tijeras Arroyo, and water-surface elevations should be based on the sequent depth as described in the AMAFCA Sediment and Erosion Design Guide (Design Guide, Musselter et al. 1994, Chapter 3).
- Selection of bank stations seemed inconsistent.
- Selected main-channel Manning's n = 0.035 and overbank n = 0.045 are reasonable. The main-channel n was lowered to 0.02 through the bridge opening, presumably to reflect the shot-crete lined channel. This may not be a good assumption (at least for evaluating water-surface rise) as sediment will likely cover the shot-crete from transport upstream.
- Bridge deck is significantly above the computed water-surface elevations so there is no pressure or weir flow. The low-flow hydraulics through the bridge were modeled by selecting the highest energy solution between the energy, momentum, and Yarnell methods. The momentum equation governed which is reasonable for the flow conditions. The Yarnell method is not appropriate for the flow conditions at this location.

Sediment Continuity Analysis

We performed a simple sediment continuity analysis to evaluate sediment transport rates and potential aggradation volumes in the backwater area upstream of the bridge. Flow hydrographs for the 2- through 100-year events were taken from a previous Ayres study of Tijeras Arroyo just upstream (Ayres Associates 1999). Hydraulics were based on the HEC-RAS model provided to us, but run in subcritical mode with additional flows to capture the entire range of flows up through the 100-year peak. By running the model in subcritical mode the solution at many of the cross sections defaults to critical depth, which we believe to be more representative of actual hydraulic conditions than the supercritical solution that results at many of these cross sections when the model is run in "mixed" flow-regime mode.

Three subreaches were identified for carrying out the sediment continuity analysis: Sub-reach 1: "supply" reach upstream of bridge backwater; Sub-reach 2: backwater area upstream of bridge; and Sub-reach 3: representative reach downstream of bridge encroachment. The hydraulic results in each sub-reach were averaged for use in the sediment transport calculations. We used the MPM-Woo regression equation from the Design Guide to compute sediment transport rates. A median diameter sediment size of 2.45mm was used in the calculations based on the Ayres study just upstream (Ayres Associates 1999).

Sub-reach 1 was used to estimate the sediment supply to the backwater area upstream of the bridge (Sub-reach 2). This reach represents current conditions upstream of the backwater area, and provides a reasonable means to estimate the short-term sediment supply to the bridge. Due to upstream watershed conditions this reach is currently degrading, which means that long-term sediment supply will decrease. There is a significant volume of sediment stored in the reach between the proposed bridge and a grade-control structure located upstream, however, and the short-term sediment supply based on current conditions provides a reasonable, if somewhat conservative, estimate of what could occur in a single storm event in the short- to medium-term future.

Table 1 summarizes the sediment continuity results. The following general observations can be drawn from the data:

- Due to the short duration of the storm hydrographs (6 hours), the sediment volumes are not that significant when compared to typical representative reaches along the arroyo.
- Due to the short reach length of the backwater area upstream of the bridge (Sub-reach 2), there is a potential for significant local aggradation in this area for the larger flood events (greater than about the 10-year event). Computed average aggradation depths are greater than 4 feet for the 50- and 100-year events. This amount of aggradation would result in significant changes in computed water-surface elevations.
- Due to the relatively small sediment volumes, downstream impacts of the stored sediment upstream of the bridge are not likely to be significant (Sub-reach 3). This is especially true as accumulated sediment would likely flush through during low flows (there is a net degradational potential in Sub-reach 2 for the 2-year flood).

Table 1. Summary of Sediment Continuity Calculations.

Sub-reach	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	Average Annual*
Sediment Transport Capacity (ft^3, bulked)							
1 (Supply)	35,400	107,300	246,500	599,000	1,101,500	1,158,100	113,200
2 (Backwater Area)	50,800	86,300	155,400	294,600	334,900	329,500	71,700
3 (Downstream)	64,400	140,900	232,700	461,300	777,600	810,800	114,800
Aggradation/Degradation Volume (ft^3, bulked)							
2 (Backwater Area)	-15,400	21,000	91,100	304,400	766,500	828,600	41,400
3 (Downstream)	-13,700	-54,600	-77,300	-166,700	-442,700	-481,400	-43,100
Approximate Aggradation/Degradation Depth (feet)**							
2 (Backwater Area)	-0.1	0.1	0.5	1.6	4.1	4.4	0.2
3 (Downstream)	0.0	-0.1	-0.1	-0.3	-0.8	-0.9	-0.1

*From Equation 1.1 in the Dosign Guide.

**Aggradation/Degradation volume divided by average effective width and approximate reach length.

Review of Scour Mitigation Measures

We reviewed the design of the scour mitigation measures as shown on the bridge plans. The following are our observations and comments:

- Scour mitigation consists of tinted shot-crete. It is our understanding that the shot-crete application being considered will consist of a rebar cage and a concrete thickness that would be durable and sufficient to resist the very high velocities expected in the vicinity of the bridge.
- The channel bed is lined underneath the bridge, which will mitigate for potential contraction scour and scour at the bridge piers. The bed lining is toed-down at the upstream and downstream ends of the bridge to match toe-downs for bank lining upstream and downstream of the bridge. These toe-downs equal 12.6 feet downstream and 9.3 feet upstream and appear adequate (see below).
- Toe-downs for bank lining upstream and downstream of the bridge were computed using the wall-scour equations from the Design Guide. Although zero angle of attack was assumed (which may be only approximately correct), the computed depths appear adequate. Toe-downs were increased at the head of the guide banks using the equation in the Design Guide for spurs and abutments. The computed scour depth of 35 feet is conservative.
- As noted above backwater from the bridge during large flood events will result in significant aggradation potential upstream of the bridge. If allowed to occur, contraction scour through the bridge opening could be large enough to increase the conveyance capacity of the bridge, and hence would lower the backwater and aggradation potential (contraction scour potential is very significant at this bridge). This could be accomplished in the design by lowering the elevation of the hardened channel bottom enough to allow a specified amount of scour to occur. Lowering the hardened channel bottom by about 4 feet would result in a significant increase in the conveyance capacity during peak flows, and thus would reduce the aggradation potential upstream of the bridge. The lowered hardened channel bottom would have to tie into the hardened channel banks as in the original design and future inspection of the buried portions of the protection would require excavation.
- Although we did not check the specific dimensions of the guide banks per the design equations in HEC-23 (Lagasse et al. 2001), the orientation and configuration of the guide banks appear reasonable.

We hope the information provided in this letter provides a satisfactory review of the proposed bridge crossing. If you have any questions, please feel free to give us a call.

Sincerely,

Ayres Associates Inc

C. Gary Wolff
Senior Hydraulic Engineer

Lyle Zevenbergen
Manager of River Engineering

CGW/LWZ/sp

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32-0395.02

References

Ayres Associates, Inc., 1999. Tijeras Arroyo - Flooding and Erosion Potential in the Hidden Valley Reach, prepared for Albuquerque Metropolitan Arroyo Flood Control Authority.

Mussetter, R.A., Lagasse, P.F., and Harvey, M.D., 1994. Sediment and Erosion Design Guide, prepared for Albuquerque Metropolitan Arroyo Flood Control Authority.

Lagasse, P.F., Zevenbergen, L.W., Schall, J.D., and Clopper, P.E., 2001. "Bridge Scour and Stream Instability Countermeasures," Hydraulic Engineering Circular No. 23, Second Edition, FHWA NHI 01-003, Federal Highway Administration, Washington, D.C.

Tim Eichenberg, Chair
Linda Stover, Vice-Chair /
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Daniel Hernandez, Director
Daniel Lyon, Director

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Post-it® Fax Note 7671	Date 1-24	# of pages ▶ 3
To BRAD BINGHAM	From LYNN MAZUR	
Co./Dept. HYDROLOGY	Co. AMAFCA	
Phone #	Phone #	
Fax #	Fax #	

File M21/D15A

January 24, 2005

Mr. Doug Hughes, P.E.
D. Mark Goodwin & Associates, P.A.
P.O. Box 90606
Albuquerque, NM 87199

Re: Construction Plans for Juan Tabo Boulevard Improvements, ZAP M-21

Dear Mr. Hughes:

AMAFCA received the referenced plans that include a bridge crossing over the Tijeras Arroyo. AMAFCA will not review the plans until a complete hydraulic analysis report is sumbitted. I am sending notes from our most recent coordination meeting with the previous consultant.

If you have any questions, please call me at 884-2215.

Sincerely,
AMAFCA

Lynn M. Mazur

Lynn M. Mazur, P.E., C.F.M.
Development Review Engineer

Cc: Brad Bingham, City Hydrology

7/6/04
fax to: Robert Lupton, Cook/Wilson, 822-6301
Rex Wilson, Cook/Wilson, 822-6301
John Kelly, AMAFCA, 884-0214
Lynn Mazur, AMAFCA, 884-0214
Loren Meinz, AMAFCA, 884-0214
Brad Bingham, COA, 924-3864

MEMORANDUM

TO: FILE, MEETING ATTENDEES, ROBERT LUPTON, REX WILSON

FROM: NINA LEUNG

MEETING DATE: JUNE 3, 2004

RE: MEETING WITH AMAFCA REGARDING JUAN TABO HILLS MASTER DRAINAGE PLAN

ATTENDEES: CRAIG HOOVER, RICK BELTRAMO, NINA LEUNG, JOHN KELLY, LYNN MAZUR, LOREN MEINZ, BRAD BINGHAM

This meeting was conducted to discuss initial design concepts for Juan Tabo Hills. Juan Tabo Hills is a proposed 600-acre development owned by Cook-Wilson. Approximately 1200 residential lots and 15 acres of mixed-use property are planned for development. A site plan and annexation plat have been processed and approved by EPC. Juan Tabo Hills is bounded by the Tijeras Arroyo to the north, the existing Four Hills subdivision to the east, and the Kirtland Air Force Base property to the south. More specifically, the purpose of this meeting is to address the drainage management plan.

Major points of discussion:

- Juan Tabo Blvd. Extension over Tijeras Arroyo: Design flood improvements to convey the 500-year storm event within the 100-year freeboard depth; AMAFCA will not allow box culverts; AMAFCA stated that the bridge can encroach into the floodplain
- Use 100-year design storm for erosion and scour
- Two smaller arroyos near the southern boundary may only discharge historic flows to the west, across private land. Therefore, onsite retention ponds will be required unless a drainage easement can be obtained from the private property owner to the west.
- AMAFCA will allow free discharge directly into the Tijeras Arroyo and the Four Hills Arroyo from Juan Tabo Hills.
- Juan Tabo Hills is allowed free discharge to Kirtland Airforce Base property. Currently, a small natural arroyo near the southern boundary crosses into the Base boundary.
- Prudent line by Tijeras Arroyo Drainage Management Plan is not officially accepted by AMAFCA since it was determined using outdated hydrology methods. It should be used only as a guideline. A rigorous prudent line analysis will not be necessary. Instead, a maximum erosion envelope may be determined for developable areas.
- FEMA floodplain: The Juan Tabo crossing is allowed in the floodplain. A CLOMR and LOMR will be required for any development areas in the floodplain. The floodplain has been established for the Tijeras Arroyo and the Four Hills Arroyo.
- Water quality: Juan Tabo Hills is required to control floatables only for the proposed development and does not have to include offsite amounts. This may be accomplished with ponds and/or drainage devices.
- Refer to El Viado and Hidden Valley reports for examples of flood protection structures
- The 100-year design storm flowrate of the Tijeras Arroyo is 18065 cfs according to the Leedshill-Herkenhoff drainage management plan of 1988.
- Four Hills Arroyo: AMAFCA will accept either a "naturalistic channel" (limited bank protection, drop structures, etc.) or a concrete-lined channel.
- Tijeras Arroyo: Along the south bank, continuous protection will need to be provided, but not necessarily a continuous lining. Strategically placed spur dikes, guide dikes, and bank protection based on an approved engineering analysis is acceptable in lieu of continuous lining.

JUAN TABB HILLS - PREL. COMP. MTG. 6-3-04

RICK BOLTANOFF, CRAIG HUNTER, NINA LEUNG - BLI
BRAD BUCHHAM - CDA
TAMI KELLY, LAURIE MEINZ, LYNN MAZUR - AMEC

1. P.L. in Tijeras arroyo will extend along the south, more flat & gradient. P.L. based on 13,000 cfs from Bypass report. Local-Ark.
2. Consider plan where riprap ends at P.L. Most protect for 500-yr. Smaller areas designed for 100-yr.
3. Is bridge adequate for 13,000 cfs? Freeboard w/ 500-yr.
4. Is new main channel the Dry Bed. Also will be main channel for smaller events.
5. Hwy 66 model LOMR.
6. Comp with Prel. ESD using SCS to compare.
7. How will channel in conn w/ riprap plunge pool at end, connect w/ existing?
8. How analyze to match exist. main chan. w/ bank to P.L.
No bottom armor, use design flood to history.
9. Ave. discharge in Tijeras.
10. University Blvd. bridge is about 200' to 250' wide.

CITY OF ALBUQUERQUE

April 4, 2005

James D Hughes, PE
Mark Goodwin & Associates
P.O. 90606
Albuquerque, NM 87199

Re: Juan Tabo Hills Blvd Bridge Drainage Report
Engineer's Stamp dated 3-18-05 (M21/D15A)

Dear Mr. Hughes,

Based upon the information provided in your submittal dated 3-18-05, the above referenced report is approved for Work Order requirements. Please keep in mind that this document and the report for the subdivision itself must be submitted to FEMA for the LOMR.

This project requires a National Pollutant Discharge Elimination System (NPDES) permit. Refer to the attachment that is provided with this letter for details. If you have any questions please feel free to call the Municipal Development Department, Hydrology section at 768-3654 (Charles Caruso).

If you have any questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham, PE, CFM
Principal Engineer, Planning Dept.
Development and Building Services

C: file
chuck Caruso, DMD

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Mark Goodwin & Associates, PA

Fax

To: Loren Meinz
Brad Bingham
Robert Lupton
Owen Ayres

From: Doug Hughes, PE

File
M21/D15A

Fax: 884-0214
924-3864
892-4212
970-223-5578

Pages: 5

Re: Juan Tabo Blvd. Bridge @ Tijeras Arroyo **Date:** 5/11/2005

Please contact our office if you have any questions.

D. Mark Goodwin & Associates, P.A.
Consulting Engineers
P.O. BOX 90606, ALBUQUERQUE,NM 87199
(505) 828-2200 FAX 797-9539

May 10, 2005

Mr. Loren Meinz
AMAFCA
2600 Prospect Avenue NE
Albuquerque, NM 87107

Re: Juan Tabo Blvd. Bridge @ Tijeras Arroyo

Mr. Meinz:

Thank you for your prompt comments on the 03/18/05 report.

The purpose of this letter is to explain the consideration previously given to the concerns expressed in your letter dated May 6, 2005. Please note the bridge is a separate stand alone project already under construction. The subdivision report will address upstream and downstream concerns in a separate report and construction plan set at a later date.

1. Sediment Transport Analysis is contained in the 1987 Drainage Management Plan by Leadshill Herkenhof which determined that the reach with the bridge is stable and the downstream Reach at the south east corner of the landfill is degradational. The Bridge with its hard lined opening will prevent headcutting from the lower reach from moving any further up stream. The pool upstream of the bridge will probably cause some deposition upstream of the bridge during high flows, but that is not likely to impact the hydraulic capacity of the Bridge since the opening is 17' to 35' high, and the levee on the south contains the 500YR elevation (more than just 100YR plus freeboard). Deposition will increase the slope of the channel bed at the entrance to the bridge until it approaches equilibrium, but that will have little impact on the upstream water surface elevation. Frequent low flows will be the bed forming event and should move enough sediment so the City Maintenance won't have to.

2. Bank grading and floodplain reclamation up and down stream of the bridge will be addressed in a separate report for that separate development. We are just building the bridge and associated Guide Banks with the currant project.

3. The bridge structure is designed to withstand the 500YR peak flow. The 100-YR Scour protection 9.28' to 35' below the invert of the arroyo seems over conservative. Additional depth if needed can be provided at a later date.

4. Inundation limits are shown both on the work map in the report and on sheets 3 & 8 of the construction plans.

5. The bridge piers and abutments are not subject to scour because the entire opening is hard lined with tinted shot-crete.

6. Scour design is for peak 100YR flow rate which is as conservative as the guide banks warrant.

7. Additional cross – sections are not in the current effective model. The bridge opening is modeled with the number of cross-sections that HEC-RAS recommends. Warning statements were reviewed but no further action is warranted. Note there are no "Error" Statements.

8. Digital HEC-RAS file was E-mailed on 05-05-05, and will be updated by separate analysis of bank fill and protection upstream and downstream of the bridge by that separate project and its associated CLOMR.

Please contact our office if you have any questions. I look forward to receiving the sediment transport analysis and any suggestions for improving the design.

Sincerely,

Mark Goodwin & Associates, PA

James D. Hughes, PE

JDH/kh

xc: Brad Bingham
Robert Lupton
Owen Ayres

Ronald D. Brown, Chair
Daniel F. Lyon, Vice Chair
Tim Eichenberg, Secretary-Treasurer
Janet Saiers, Asst. Secretary-Treasurer
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May 6, 2005

Doug Hughes, P.E.
Mark Goodwin & Associates
P.O. Box 90606
Albuquerque, NM 87199

Re: Drainage Report for Juan Tabo Boulevard Bridge Crossing at Tijeras Arroyo (dated March 17, 2005)

Dear Doug:

The following are initial comments by AMAFCA on the drainage report associated with the referenced project. Since no floodplain information has been submitted, the comments are on the content of the report, which is primarily hydraulic information on the bridge structure and the Tijeras Arroyo itself.

Comment 1: No sediment analysis data is included in the initial report, and AMAFCA is primarily concerned about the impacts of the changes in the cross sectional area of the entire Tijeras floodplain due to construction of the bridge. Sediment analysis upstream will be important to identify the extent of impact to the floodplain and the resulting cross sections that may impact the water surface elevations upstream, and potential impacts to upstream private properties. AMAFCA has requested our on-call consultant, Owen Ayres & Associates, to provide AMAFCA with additional preliminary information on the potential for significant sediment impacts that may result from construction of this bridge. AMAFCA will communicate back to Mark Goodwin & Associates and the City of Albuquerque on any sediment information generated by Owen Ayres & Associates in their preliminary investigation.

Comment 2: Additional information on proposed bank grading by the development along the south side of the Tijeras floodplain will be necessary in order to adequately predict the hydraulic characteristics that may be needed for the sediment analysis.

Comment 3: It would appear that most of the erosion protection and scour computations are based on the 100 year flow. Considering the significance of the bridge structure, and the size of the Tijeras Arroyo, it may be prudent to use a higher flow than the 100 year in computing scour potential.

Comment 4: A proposed inundation map of upstream may be necessary in order to properly identify potential sediment deposition from the upstream pool.

Comment 5: Please provide scour calculations for the bridge abutments.

Comment 6: Stream bed scour for low flow needs to be addressed, both upstream and downstream of the bridge structure. For low flow analysis, the ineffective flow area between the piers and abutments should be blocked out in the HEC-RES model analysis.

Comment 7: The output of the HEC-RES model is showing warning statements indicating insufficient cross sections for water surface analysis. Additional cross sections may have to be added in order to get a true representation of the water surface, particularly near the upstream area of the bridge.

Comment 8: Please provide input as well as output files for the HEC-RES analysis.

Ultimately, a FEMA map revision will be necessary for alterations of the floodplain for the project. Please provide additional information for the FEMA submittal for the LOMR.

If you have any questions, please contact me at 884-2215.

Sincerely,
AMAFCA

Loren D. Meinz, P.E.
Drainage Engineer

Cc: Brad Bingham, City of Albuquerque