

**FINAL ENVIRONMENTAL IMPACT STATEMENT**

**408 PERMISSION AND 404 PERMIT TO THREE RIVERS  
LEVEE IMPROVEMENT AUTHORITY**

**FOR THE**

**FEATHER RIVER LEVEE REPAIR PROJECT, CALIFORNIA  
SEGMENT 2**

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**APPENDIX J – TECHNICAL MEMORANDUM: CUMULATIVE  
HYDRAULIC IMPACTS OF ADDING SUTTER COUNTY'S  
PROPOSED FEATHER RIVER WEST LEVEE SETBACK  
NEAR STAR BEND TO TRLIA'S FEATHER RIVER EAST  
LEVEE SETBACK**

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October 2008

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Technical Memorandum: Cumulative Hydraulic Impacts of Adding  
Sutter County's Proposed Feather River West Levee Setback near Star  
Bend to TRLIA's Feather River East Levee Setback

## Technical Memorandum

**DATE:** December 12, 2007

**TO:** Ric Reinhardt

**FROM:** Ben Tustison

**SUBJECT:** Cumulative Hydraulic Impacts of Adding Sutter County's Proposed Feather River West Levee Setback near Star Bend to TRLIA's Feather River East Levee Setback

### **Purpose**

The purpose of this memorandum is to report the computed cumulative hydraulic impacts of Sutter County's proposed setback, the Feather River west levee near Star Bend (between Lower Feather River Floodplain Mapping Study River Miles 16.5 and 18.25), and the TRLIA Feather River east levee setback (River Miles 17.0 to 24.3). Figure 1 shows a plan view of the Star Bend area with the existing and proposed Feather River west levee alignments and the locations of the model cross-sections affected by the setback. The TRLIA Feather River east levee setback is also shown on this figure. Figure 2 shows the profile views of these eight cross-sections. The distance which the west levee is set back for each section is specified on these plots.

### **Analysis**

This analysis relied on the hydraulic model developed by the U.S. Army Corps of Engineers for the report entitled "Amended Draft Lower Feather River Floodplain Mapping Study – Revised February 17, 2005". This model was developed using the software HEC-RAS, developed by the Corps' Hydrologic Engineering Center. The model has been revised by MBK Engineers. MBK Version 9 of this model was utilized for this analysis. The details of this model can be found in the MBK report "Hydraulic and Hydrologic Documentation for FEMA Certification of the Three River's Levee Improvement Authority Project" from March 2007.

### Assumptions

#### *Levee Performance*

An important assumption in performing hydraulic simulations of leveed systems on a regional basis is defining if, when, and how levee failures will occur. The analysis as presented herein assumes that levees would not fail before or after overtopping. Top-of-levee profiles were compared to calculated 1-in-200 water surface profiles to determine low spots where levee overtopping may occur. The locations were defined in the HEC-RAS model.

#### *Storm Centering*

The Feather River at Shanghai with Yuba River emphasis storm centering was used for this analysis.

### *Unsteady Flow Analysis*

The 1-in-2, 1-in-10, 1-in-25, 1-in-50, 1-in-100 and 1-in-200 annual exceedence probability (AEP) water surfaces were evaluated for the unsteady flow analysis.

### *Steady Flow Analysis*

For each reach in the hydraulic model with a specified 1957 Design Flood Plane flow rate, the respective 1957 Design Flood Plane flow rates were used. 300,000 cfs is the specified 1957 Design Flood Plane flow rate for the project reach (Feather River between Yuba River and Bear River). At the downstream boundaries of the model on the Sacramento River and Yolo Bypass, the specified 1957 Design Flood Plane water surface elevations were adopted for this analysis.

### Scenarios

Two scenarios were evaluated for this analysis: an Existing conditions scenario and a Project conditions scenario.

#### *Existing Conditions*

This represents the existing condition (December 2006) of the flood control system of the Yuba-Feather-Bear Rivers and their tributaries. Channel and levee conditions were represented with the best estimate of present conditions. This scenario also contains the proposed Feather River Setback Levee Project, which consists of setting back the Feather River east levee from River Mile 17.0 to 24.3 and habitat enhancement in the setback levee area.

#### *Project Conditions*

This represents the existing conditions scenario (TRLIA setback) plus Sutter County's proposed set back of the Feather River west levee from River Mile 16.5 to 18.25. The setback configuration and hydraulic parameters for model cross-sections 16.5 to 18.25 were provided by Wood Rodgers. For cross-sections 17.0 to 18.25, roughness values for the channel and overbank of 0.039 and 0.088, respectively, were adopted as opposed to the values of 0.035 and 0.08 provided by Wood Rodgers. This was done to retain consistency with the roughness characteristics of the remainder of the Feather River east levee setback, represented in the cross-sections between 18.25 and 24.25.

### **Summary**

Table 1 shows the maximum water surface elevations for the Existing and Project conditions, respectively, within and surrounding the project reach for the 1-in-2 AEP through 1-in-200 AEP flood events and the 1957 Design Flood Plane flow analysis.

Figure 3 shows the maximum water surface profiles for the Existing and Project conditions, respectively, within and surrounding the project reach.

For the 1-in-100 AEP and 1-in-200 AEP flood events, the maximum water surface additional reductions due to the Project (Star Bend Setback Levee) are 0.21 feet and 0.25 feet, respectively. Both of these maximum additional reductions occur at River Mile 18.25. The maximum water surface increases due to the Project for the 1-in-100 AEP and 1-in-200 AEP flood events are 0.02 feet and 0.04 feet, respectively, both occurring at River Mile 16.50. There are no measurable water surface changes due to the Project below River Mile 15.0.

For the 1957 Design Flood Plane steady state flow analysis, the maximum additional water surface reduction due to the Project (Star Bend Setback levee) is 0.24 feet at River Mile 18.25. The maximum water surface increase due to the Project is 0.05 feet at River Mile 16.75. There are no measurable water surface changes due to the Project below River Mile 15.0.

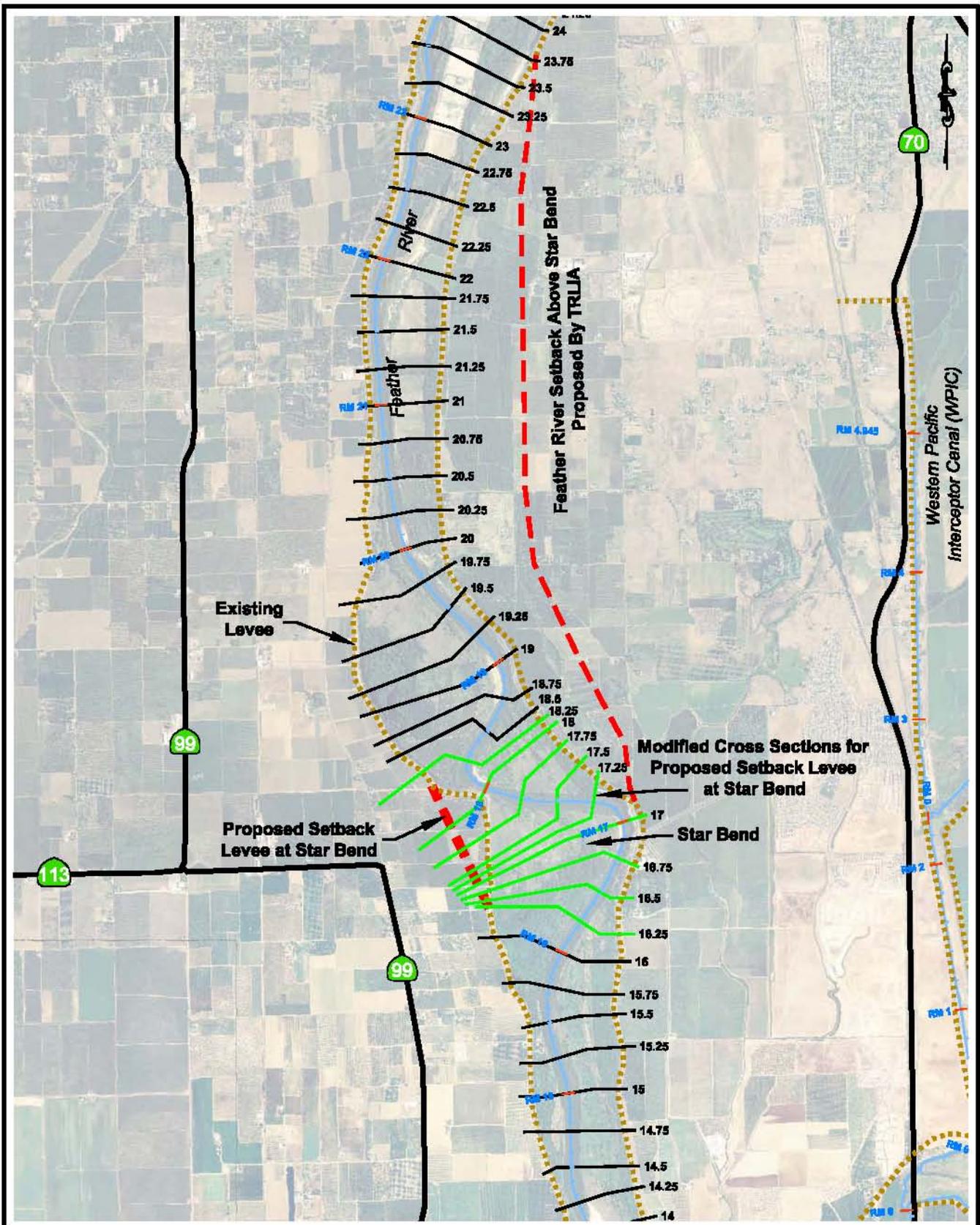
Sincerely,

A handwritten signature in black ink, appearing to read 'B. Tustison', with a stylized flourish extending to the right.

Ben Tustison, P.E.

**Table 1. Existing and Proposed Feather River Water Surface Elevations, River Miles 15.0 to 23.0.**

Lower Feather River Floodplain Mapping Study River Mile	Unsteady Flow												Steady Flow	
	1-in-2 AEP		1-in-10 AEP		1-in-25 AEP		1-in-50 AEP		1-in-100 AEP		1-in-200 AEP		1957 Design Flow	
	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed	Existing	Proposed
23.00	51.14	51.09	60.25	60.16	63.44	63.34	64.73	64.63	65.03	64.92	68.25	68.12	66.13	66.01
22.75	50.78	50.72	59.93	59.84	63.13	63.02	64.42	64.31	64.71	64.60	67.93	67.79	65.84	65.72
22.50	50.25	50.19	59.45	59.35	62.66	62.55	63.95	63.83	64.25	64.13	67.47	67.32	65.32	65.19
22.25	49.93	49.87	59.05	58.94	62.26	62.14	63.55	63.43	63.86	63.73	67.08	66.92	64.94	64.80
22.00	49.62	49.56	58.77	58.66	61.98	61.86	63.28	63.14	63.58	63.45	66.80	66.63	64.71	64.56
21.75	49.21	49.14	58.34	58.21	61.58	61.44	62.88	62.74	63.19	63.04	66.42	66.25	64.25	64.09
21.50	48.84	48.76	57.98	57.84	61.24	61.09	62.55	62.40	62.86	62.71	66.09	65.91	63.97	63.80
21.25	48.41	48.32	57.53	57.39	60.83	60.67	62.15	61.99	62.46	62.30	65.72	65.53	63.57	63.39
21.00	48.18	48.09	57.23	57.07	60.53	60.36	61.85	61.68	62.17	62.00	65.42	65.22	63.29	63.10
20.75	47.97	47.88	57.01	56.84	60.30	60.13	61.62	61.45	61.94	61.77	65.19	64.99	63.09	62.89
20.50	47.84	47.74	56.84	56.67	60.12	59.94	61.43	61.26	61.76	61.58	64.99	64.78	62.91	62.71
20.25	47.69	47.59	56.65	56.48	59.93	59.75	61.24	61.06	61.57	61.39	64.79	64.57	62.72	62.52
20.00	47.53	47.43	56.48	56.30	59.75	59.57	61.06	60.87	61.39	61.20	64.60	64.38	62.56	62.35
19.75	47.37	47.26	56.30	56.12	59.57	59.38	60.88	60.69	61.21	61.02	64.42	64.20	62.39	62.17
19.50	47.23	47.12	56.15	55.96	59.43	59.23	60.74	60.55	61.08	60.88	64.29	64.06	62.26	62.04
19.25	47.13	47.02	56.03	55.84	59.31	59.11	60.63	60.43	60.96	60.76	64.17	63.94	62.15	61.93
19.00	47.01	46.89	55.93	55.73	59.21	59.01	60.53	60.32	60.86	60.66	64.07	63.83	62.07	61.84
18.75	46.81	46.69	55.77	55.56	59.05	58.84	60.37	60.16	60.70	60.50	63.91	63.66	61.89	61.66
18.50	46.70	46.57	55.67	55.46	58.95	58.74	60.27	60.06	60.61	60.40	63.81	63.56	61.79	61.55
18.25	46.61	46.48	55.56	55.35	58.84	58.63	60.16	59.94	60.50	60.29	63.69	63.45	61.64	61.40
18.00	46.39	46.27	55.31	55.14	58.57	58.42	59.88	59.73	60.23	60.08	63.39	63.22	61.39	61.23
17.75	46.22	46.11	55.13	54.98	58.39	58.26	59.69	59.57	60.04	59.92	63.20	63.06	61.21	61.07
17.50	46.07	45.91	55.00	54.81	58.26	58.08	59.56	59.39	59.92	59.75	63.07	62.88	61.05	60.86
17.25	45.76	45.61	54.74	54.57	58.02	57.86	59.33	59.17	59.69	59.54	62.84	62.66	60.73	60.58
17.00	45.15	45.02	54.20	54.05	57.51	57.38	58.83	58.71	59.20	59.09	62.35	62.22	60.15	60.05
16.75	44.68	44.76	53.75	53.76	57.10	57.10	58.43	58.43	58.82	58.82	61.97	61.94	59.84	59.88
16.50	44.56	44.57	53.49	53.50	56.81	56.82	58.13	58.15	58.53	58.54	61.65	61.70	59.59	59.62
16.25	44.42	44.42	53.31	53.31	56.63	56.63	57.95	57.95	58.35	58.35	61.46	61.46	59.44	59.44
16.00	44.18	44.19	53.02	53.02	56.33	56.33	57.65	57.65	58.05	58.05	61.14	61.14	59.06	59.06
15.75	43.86	43.86	52.51	52.51	55.77	55.77	57.08	57.08	57.49	57.49	60.50	60.50	58.29	58.29
15.50	43.60	43.60	52.08	52.08	55.30	55.29	56.58	56.58	57.01	57.01	59.96	59.96	57.74	57.74
15.25	43.34	43.34	51.71	51.71	54.90	54.90	56.18	56.18	56.62	56.62	59.53	59.53	57.34	57.34
15.00	43.15	43.15	51.35	51.35	54.49	54.49	55.76	55.76	56.20	56.20	59.06	59.06	56.93	56.93

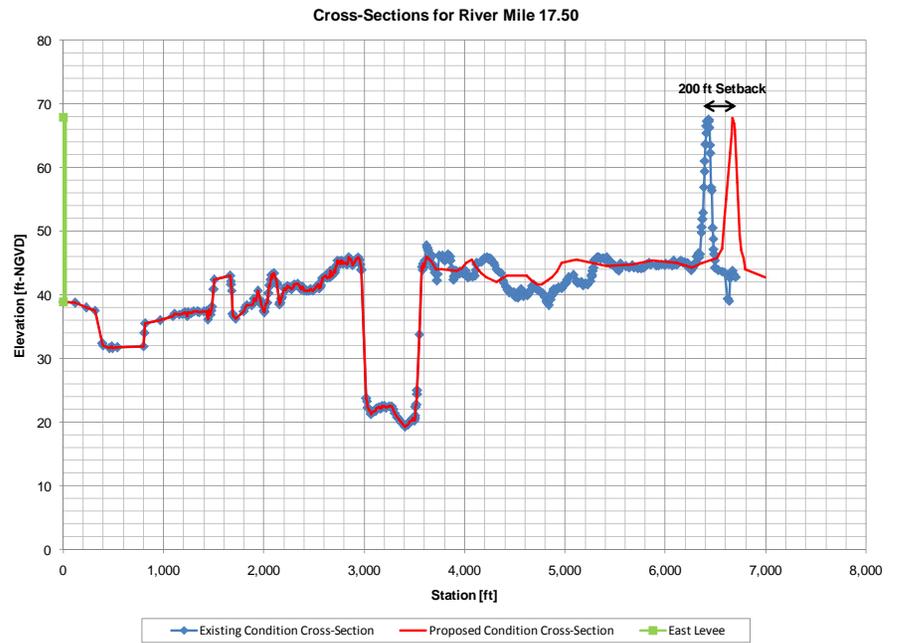
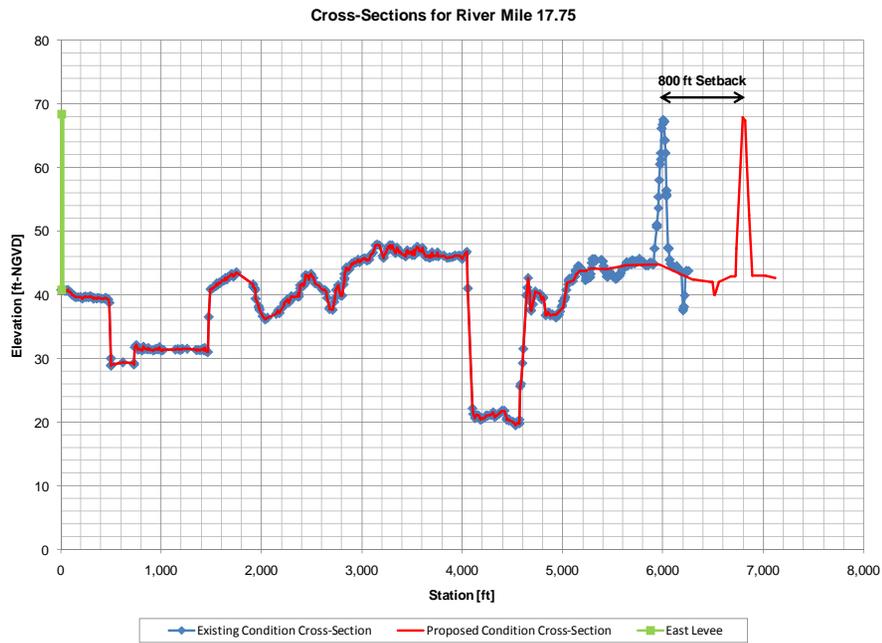
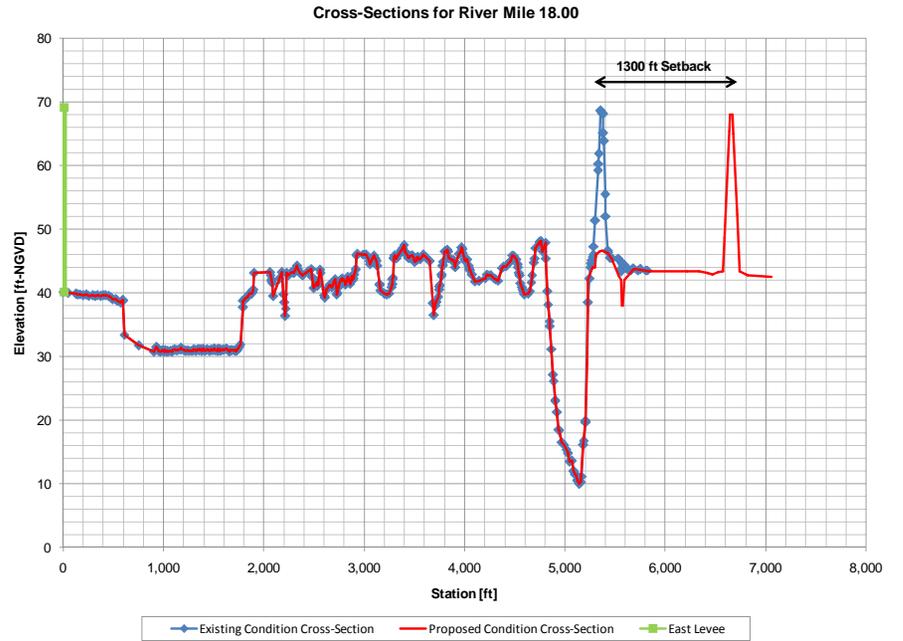


**Figure 1**  
**Feather River at Star Bend Setback Levee Analysis**  
**Cross-Section Location Map**

**MBK**  
**ENGINEERS**  
 2450 Alhambra Boulevard, 2nd Floor  
 Sacramento, California 95817  
 Phone: (916) 456-4400 • Fax: (916) 456-0253

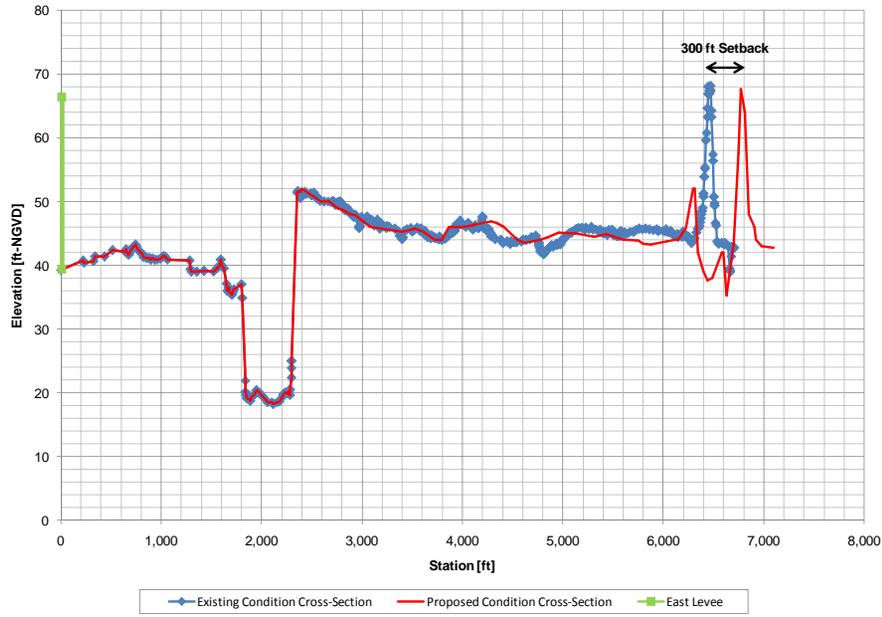
SCALE:	1" = 200'	SHEET:	1
JOB NUMBER:	MBE 7	OF	1
DRAWN BY:	MS		
DATE:	December 2007		
<small>See Length On Original Drawing Equals One Inch. Adjust Scale Accordingly</small>			

**Figure 2. Model Cross-Sections for Existing and Proposed Conditions.**

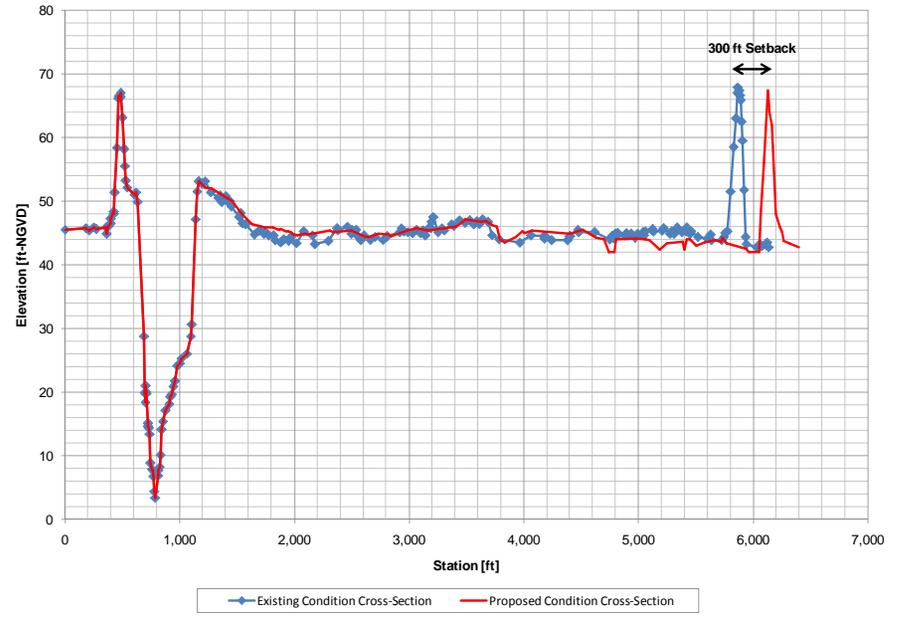


# Figure 2 Continued

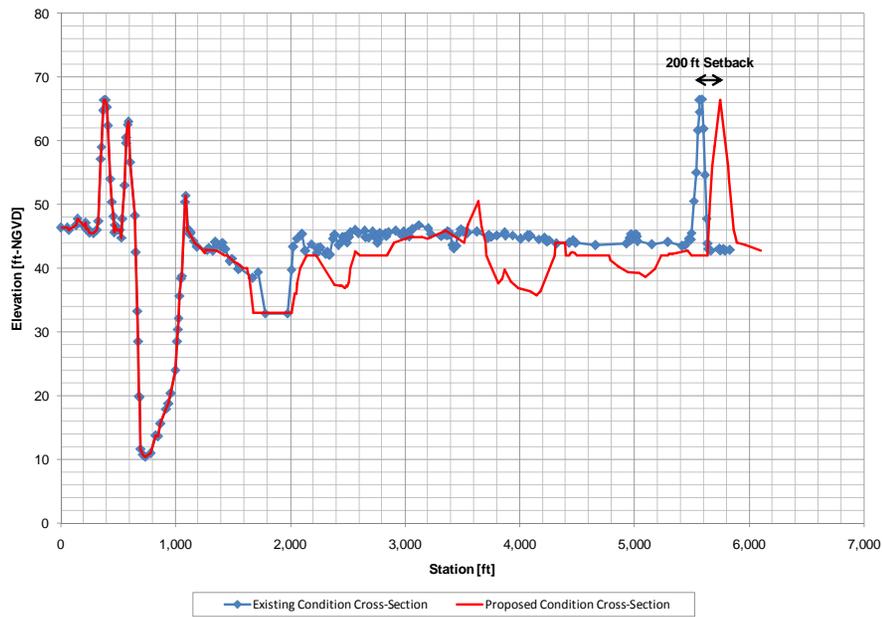
### Cross-Sections for River Mile 17.25



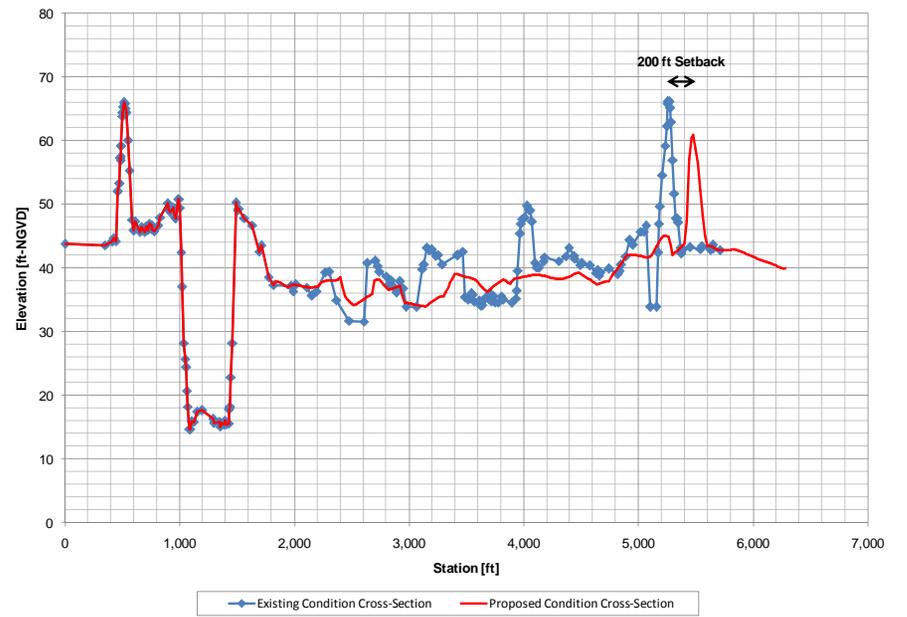
### Cross-Sections for River Mile 17.00



### Cross-Sections for River Mile 16.75



### Cross-Sections for River Mile 16.50



**Figure 3:  
1-in-100 AEP and 1-in-200 AEP Feather River Water Surface Profiles  
for Existing and Proposed Conditions (River Miles 15.0-23.0)**

