

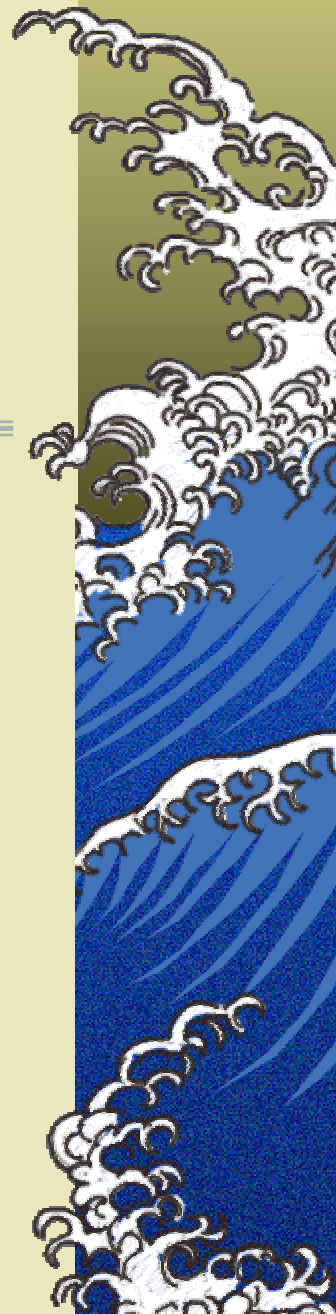
# Two-Dimensional Hydraulic Modeling to Support Riparian Restoration Planning

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*Upper Sacramento River*

*RM 193 to 203*

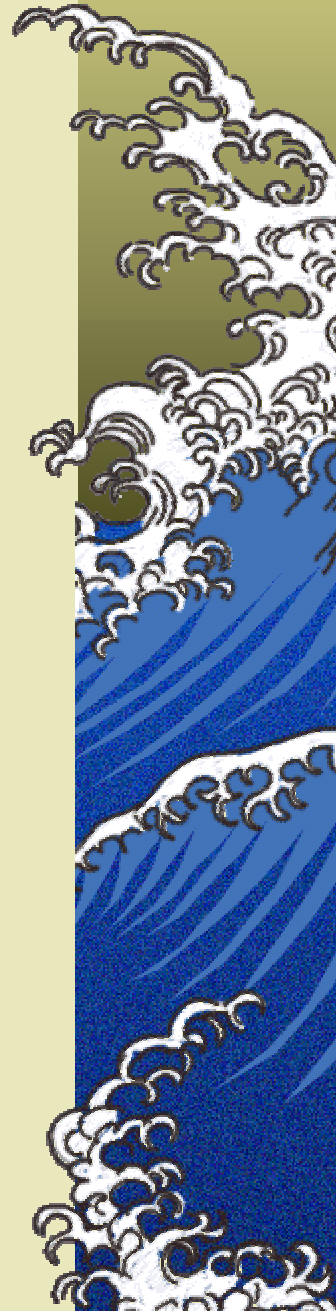
*Butte Basin*



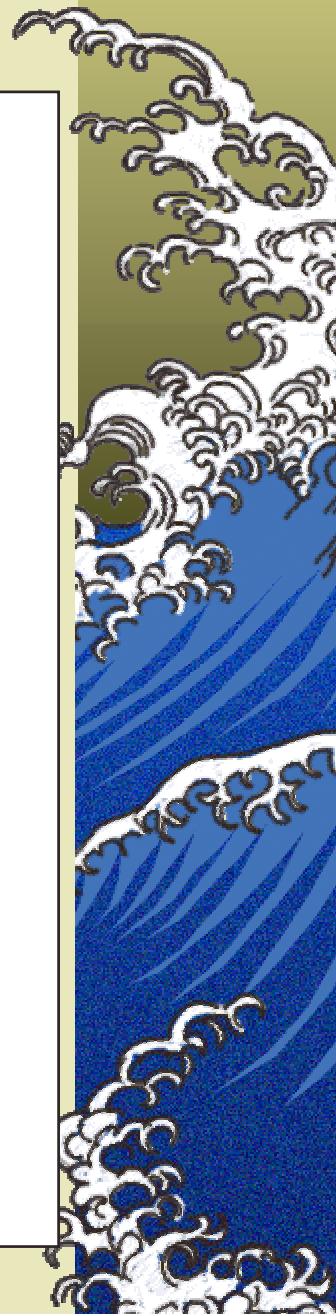
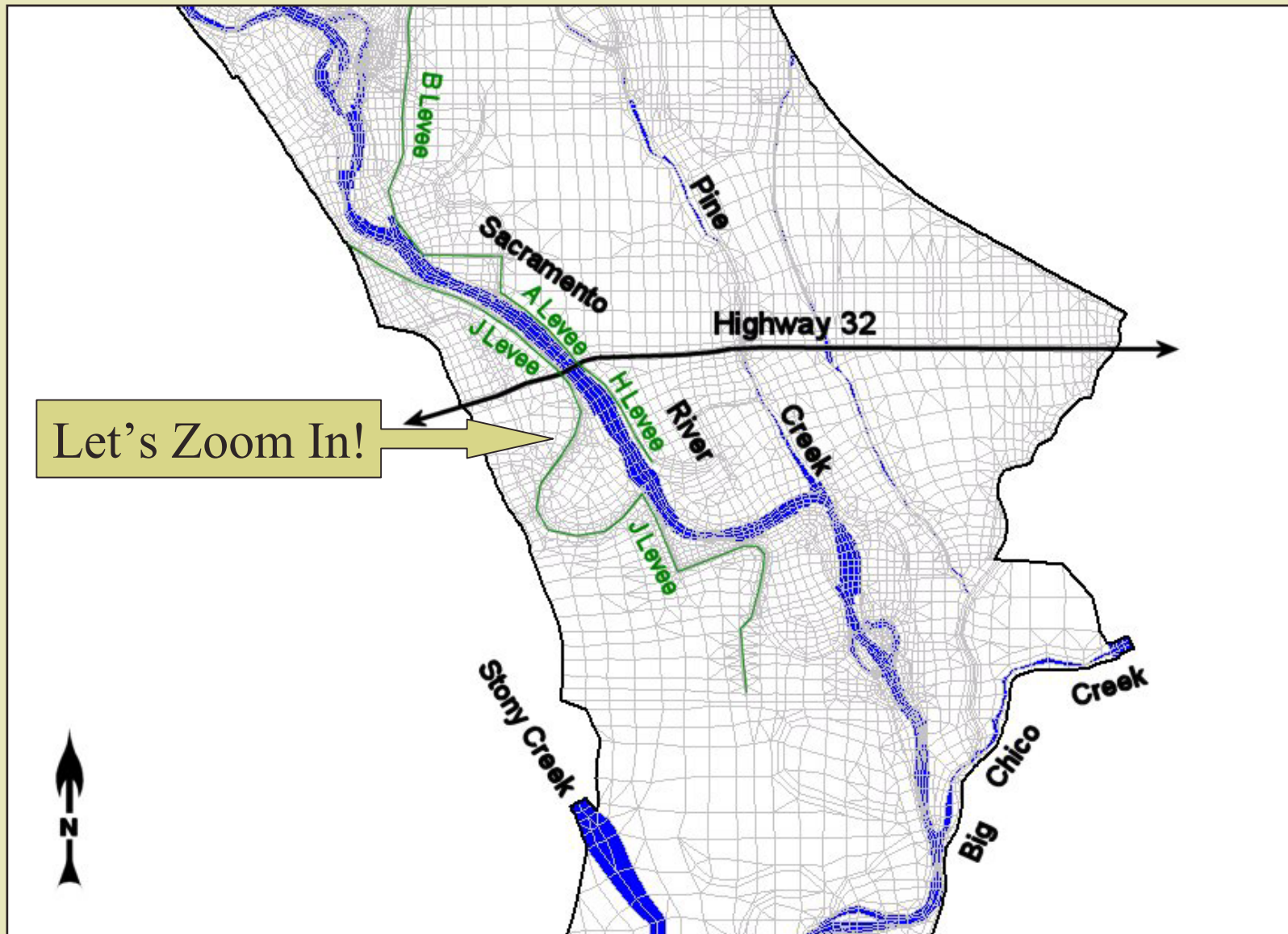
# Project Objective

*To determine the cumulative hydraulic effects of the following landscape modifications:*

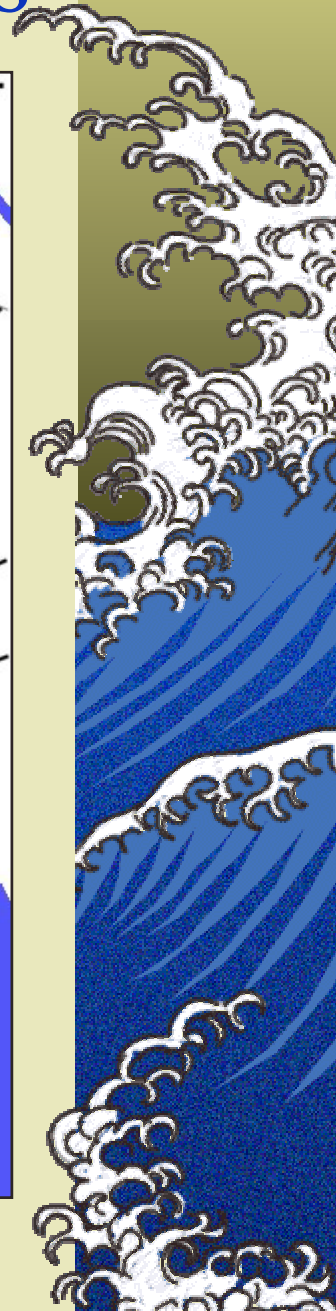
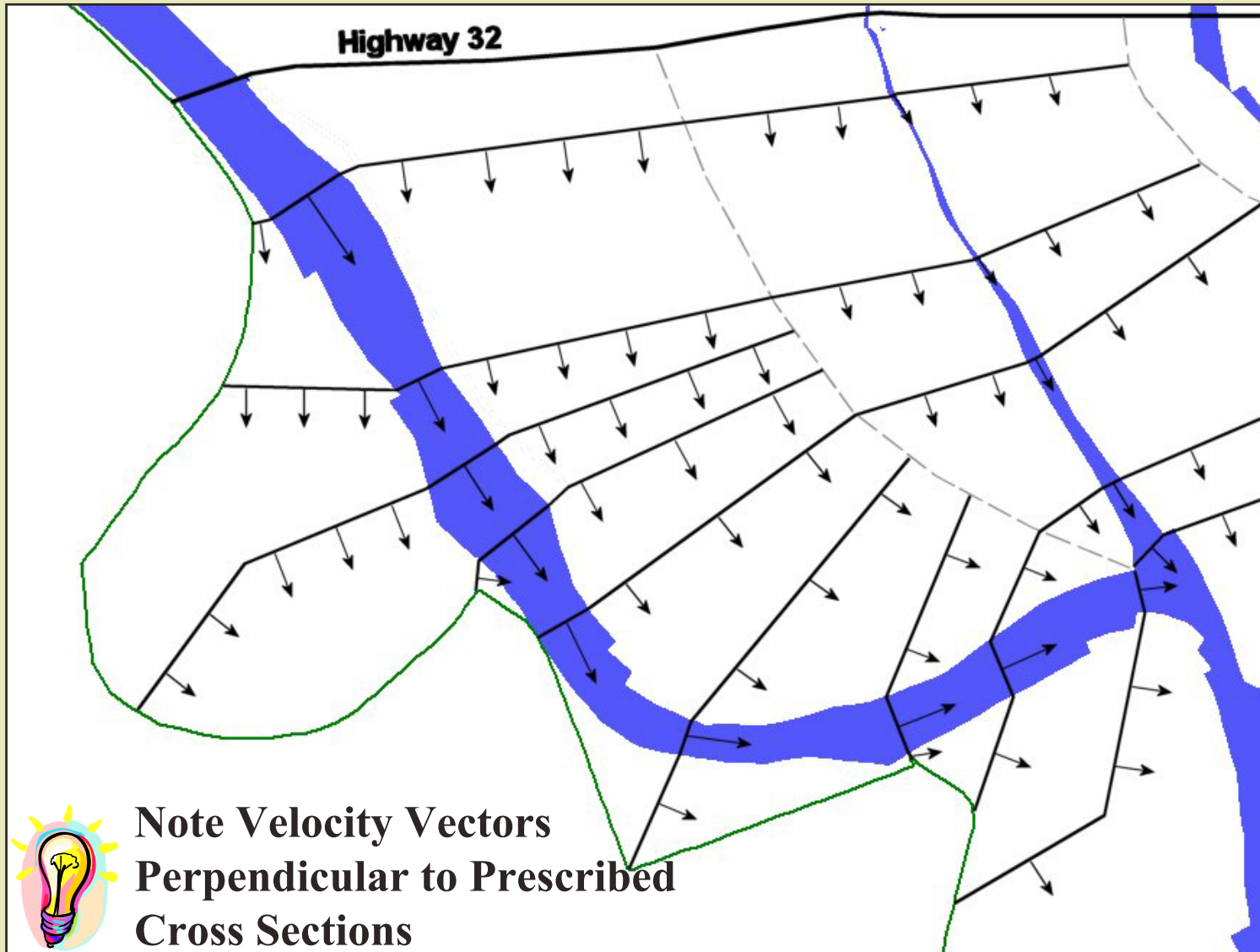
- 1. Land use changes along the Sacramento River between the confluence with Big Chico Creek and Highway 32*
- 2. Setback of the west levee between RM 193 and 201*
- 3. Removal of east levees between RM 198 and 199*



# Why 2-Dimensional Modeling?

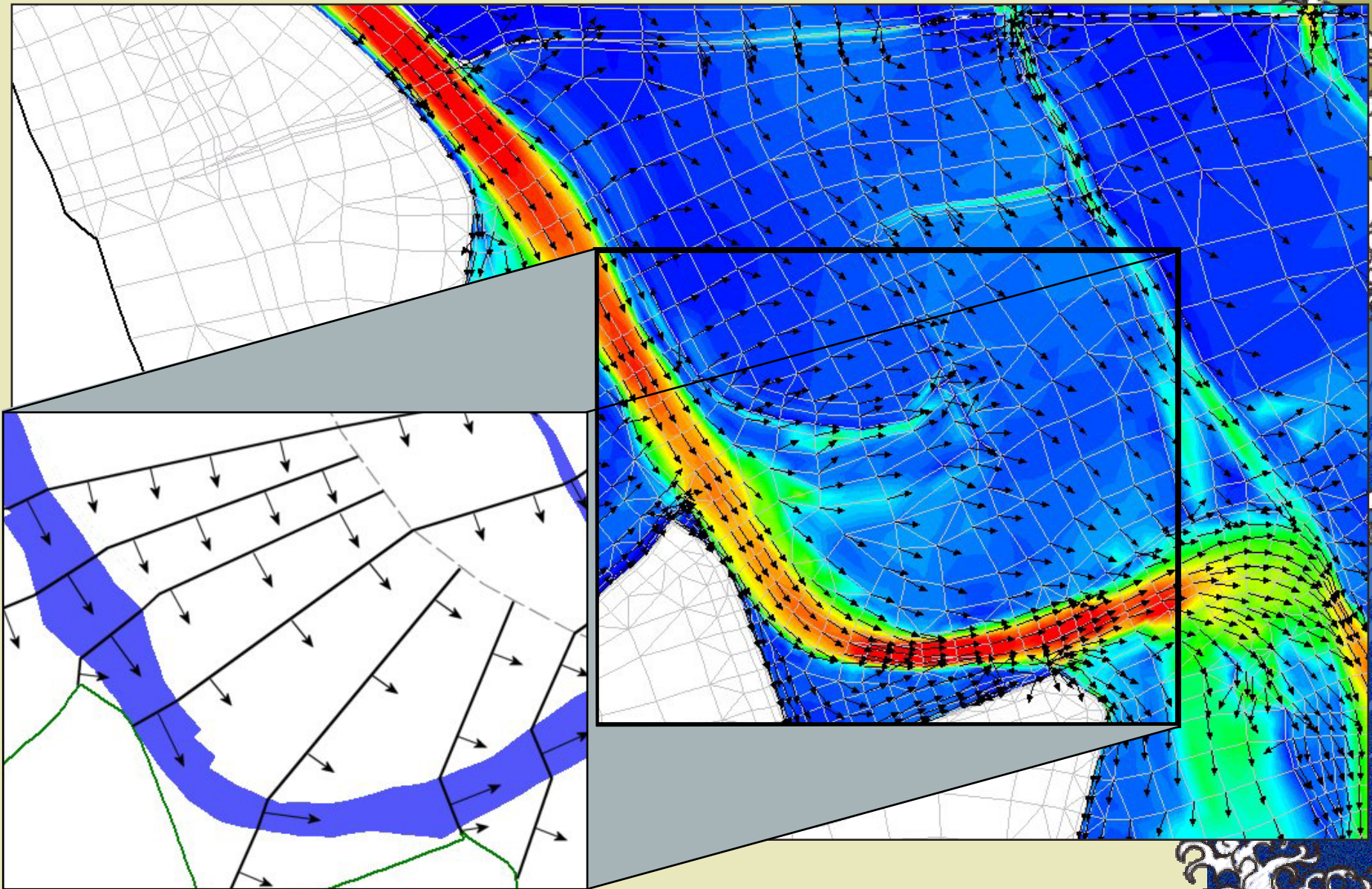


# 1-Dimensional Velocity Results

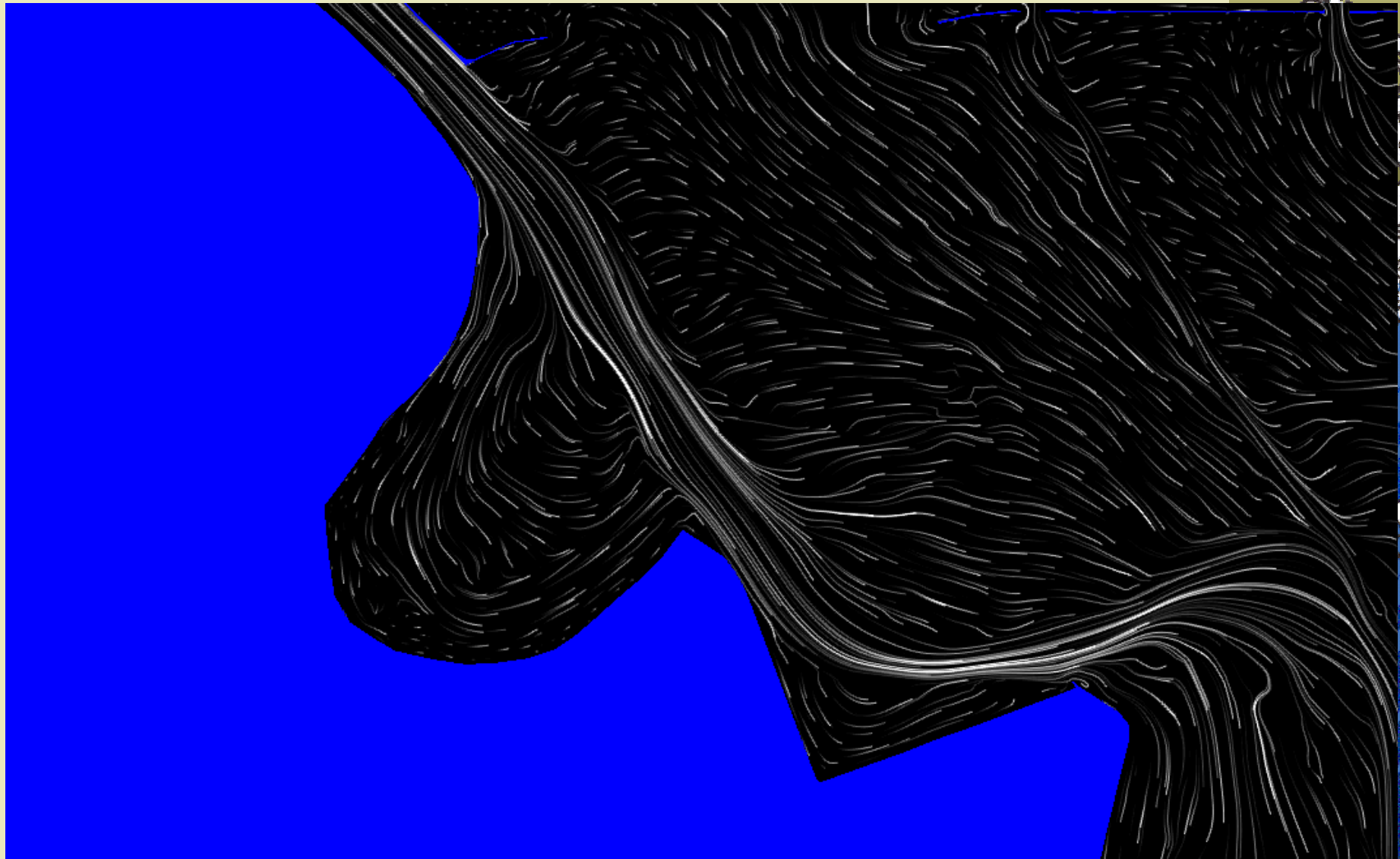




# 2-Dimensional Velocity Results

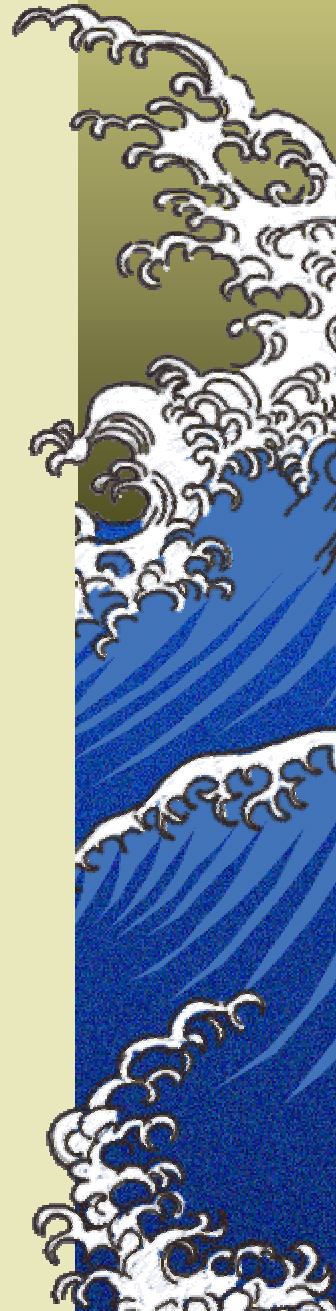


# 2-Dimensional Velocity Results



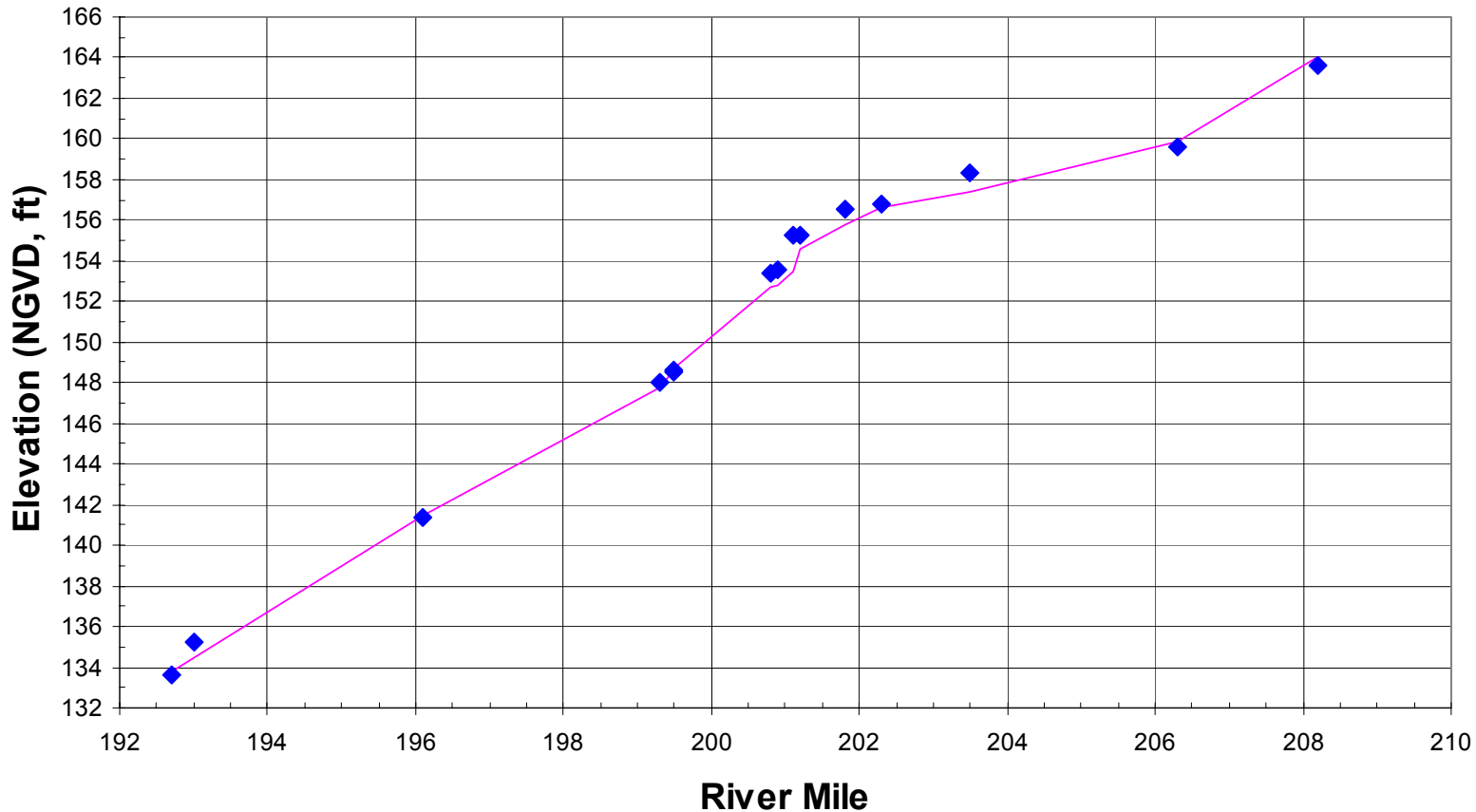
# Model Calibration

- ▶ *Calibrated to January 1995 flood*
- ▶ *Flow of 170,000 cfs on the Sacramento River at Hamilton City*
- ▶ *High water marks provided by USGS and others*
- ▶ *Roughness coefficients were fine-tuned to converge the water surface profile with observed high water marks*





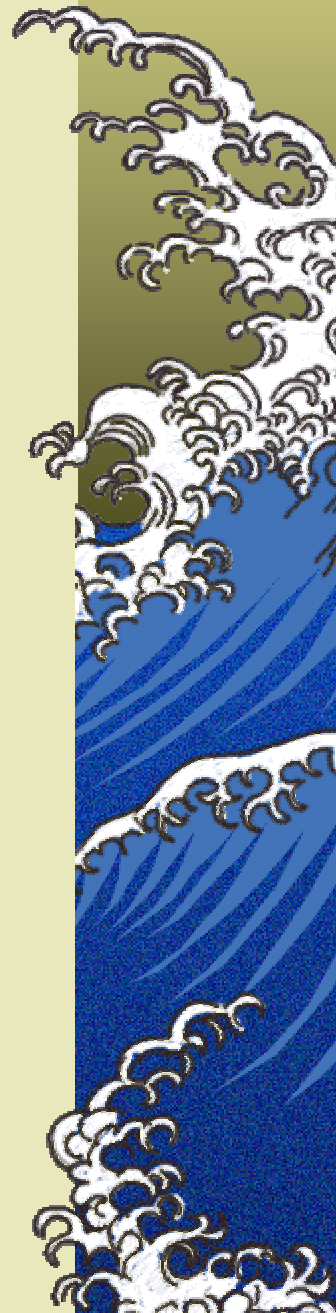
# Model Calibration Results



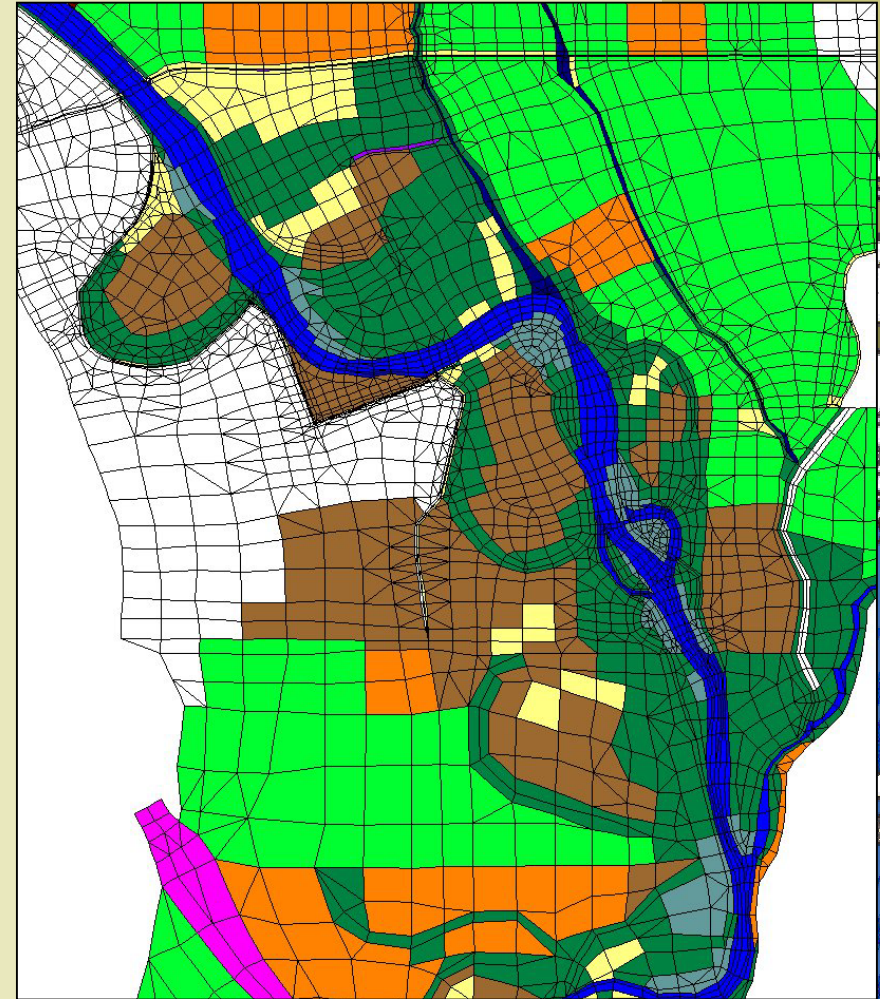
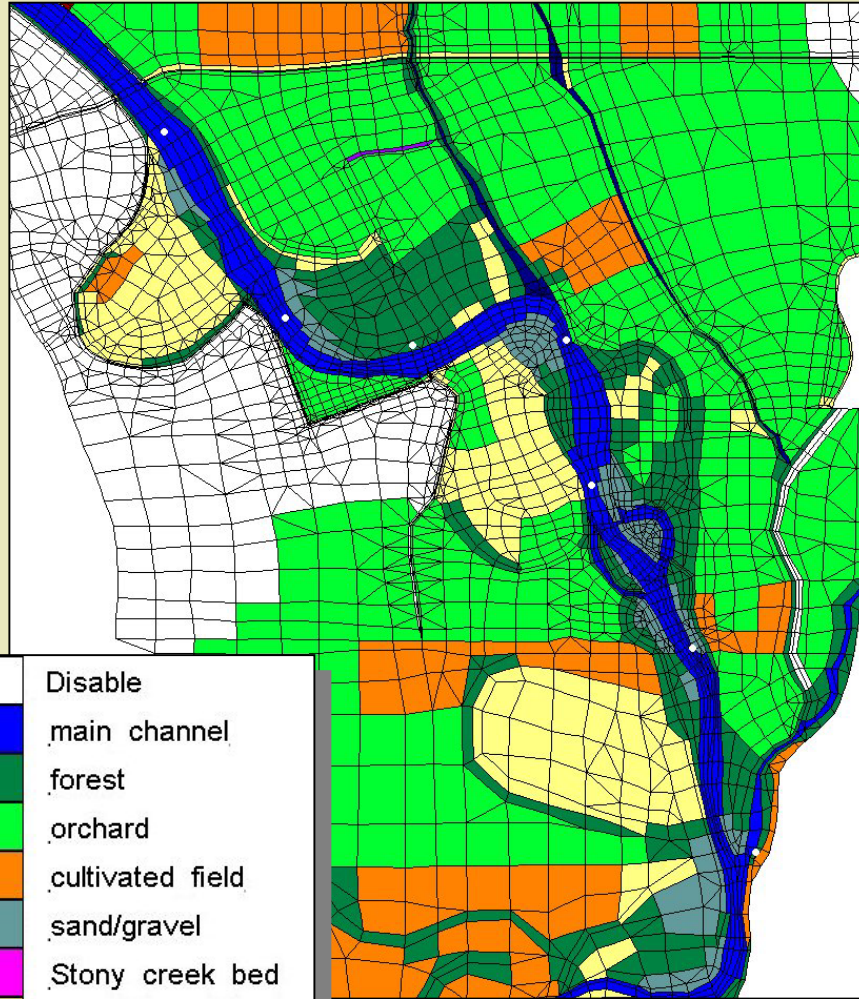
- ◆ 1995 High Water Marks
- WSE Profile, estimated pre - January 1995 river configuration

# Model Representing Land Use Changes

- ▶ *Convert struggling orchards into grasslands*
- ▶ *Re-establish riparian forests where possible*
- ▶ *Establish savannah type landscape in transitional regions*



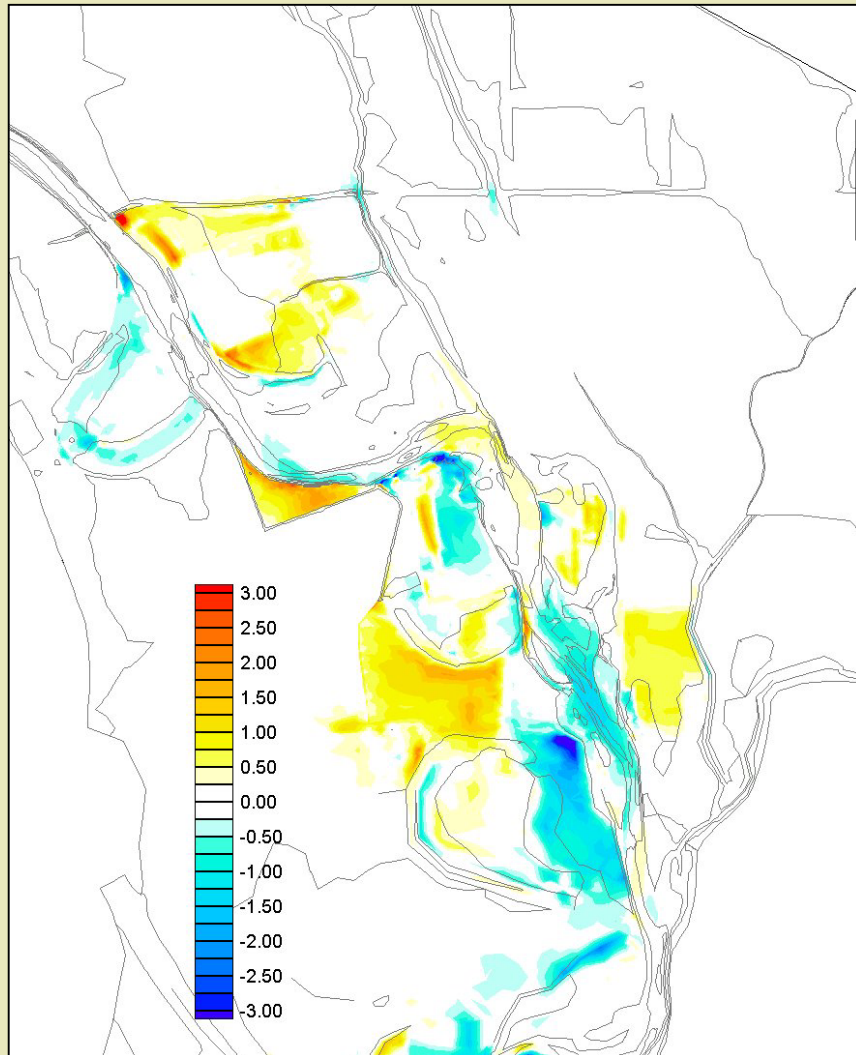




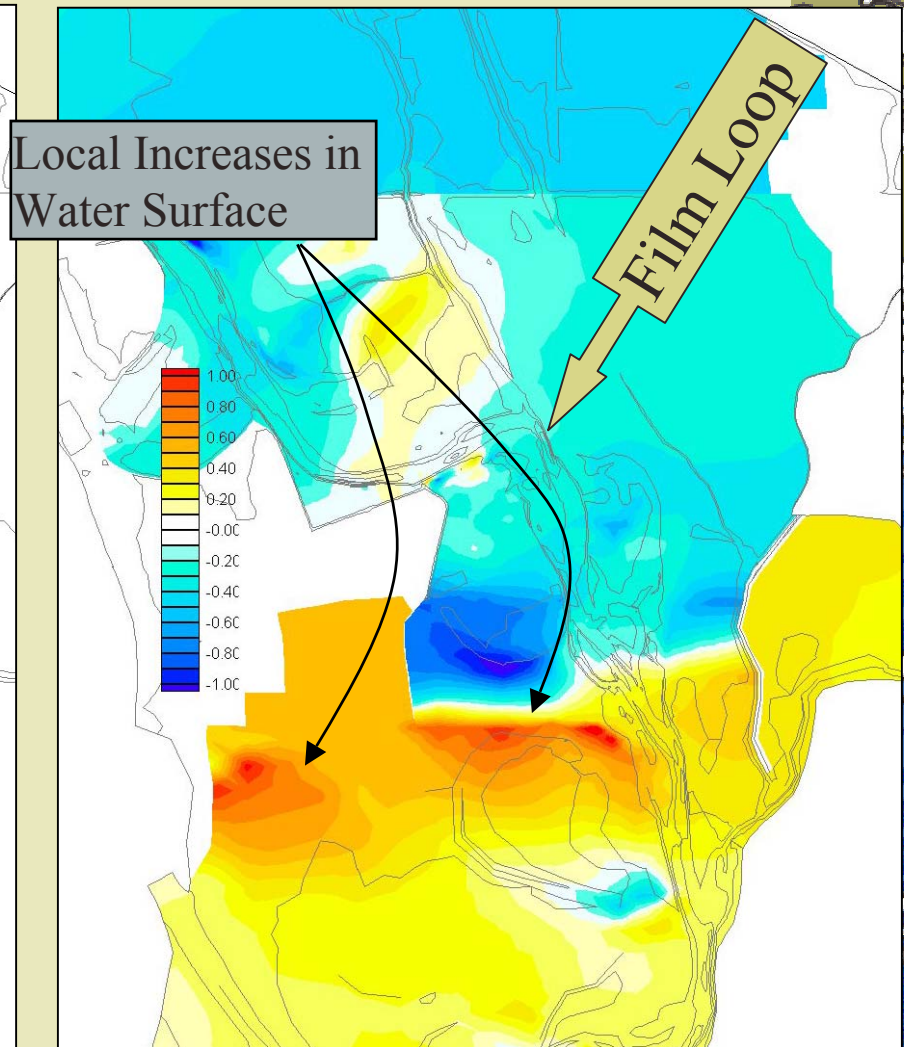
# Land Use Changes



# Resulting Changes in Hydraulics



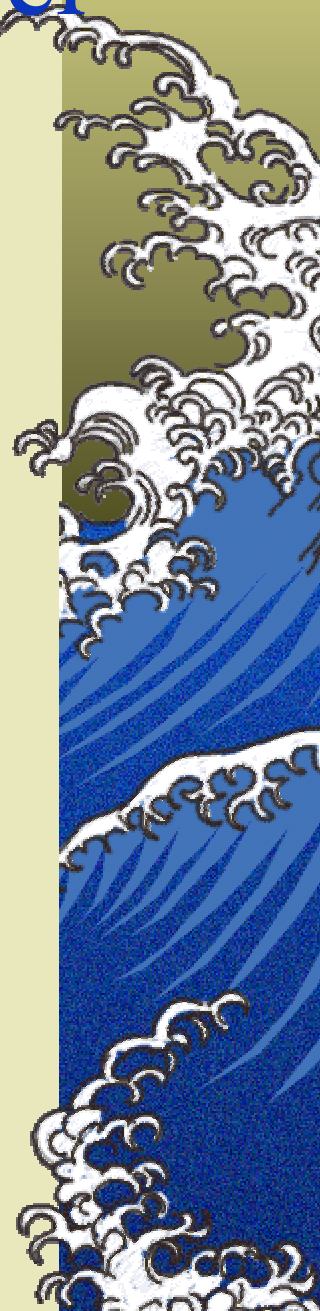
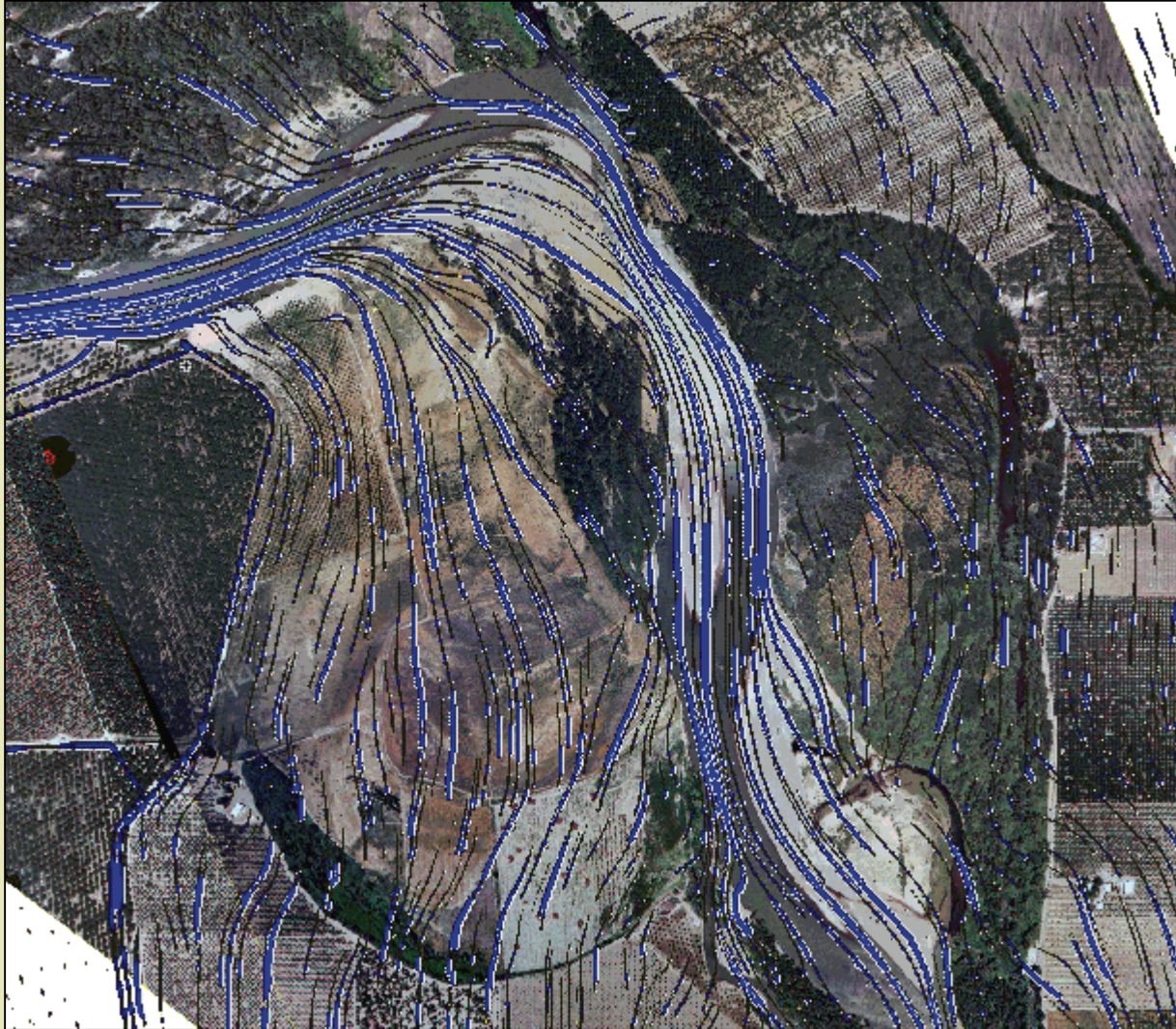
Change In Velocity, fps



Change In Water Surface, ft

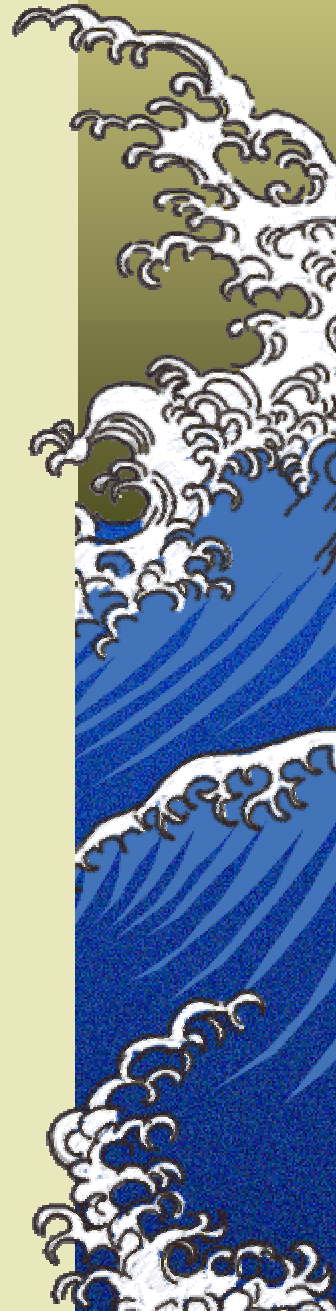


# Flow out of the Sacramento River Towards the RX Ranch



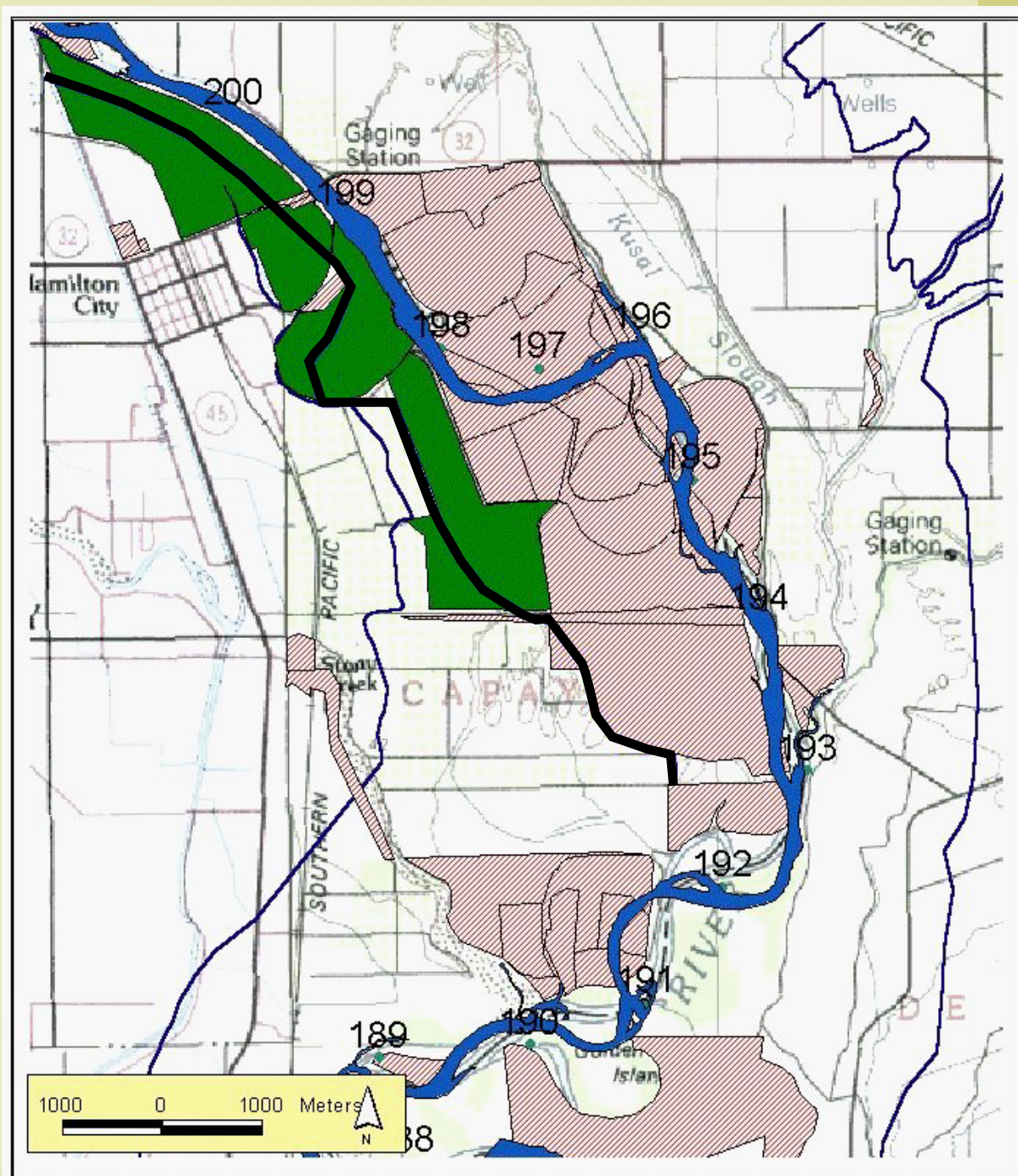
# Model Representing Setback Levee

- ▶ *Incorporated the land use changes*
- ▶ *Setback west levee (J Levee)*
- ▶ *Extended levee to the south*



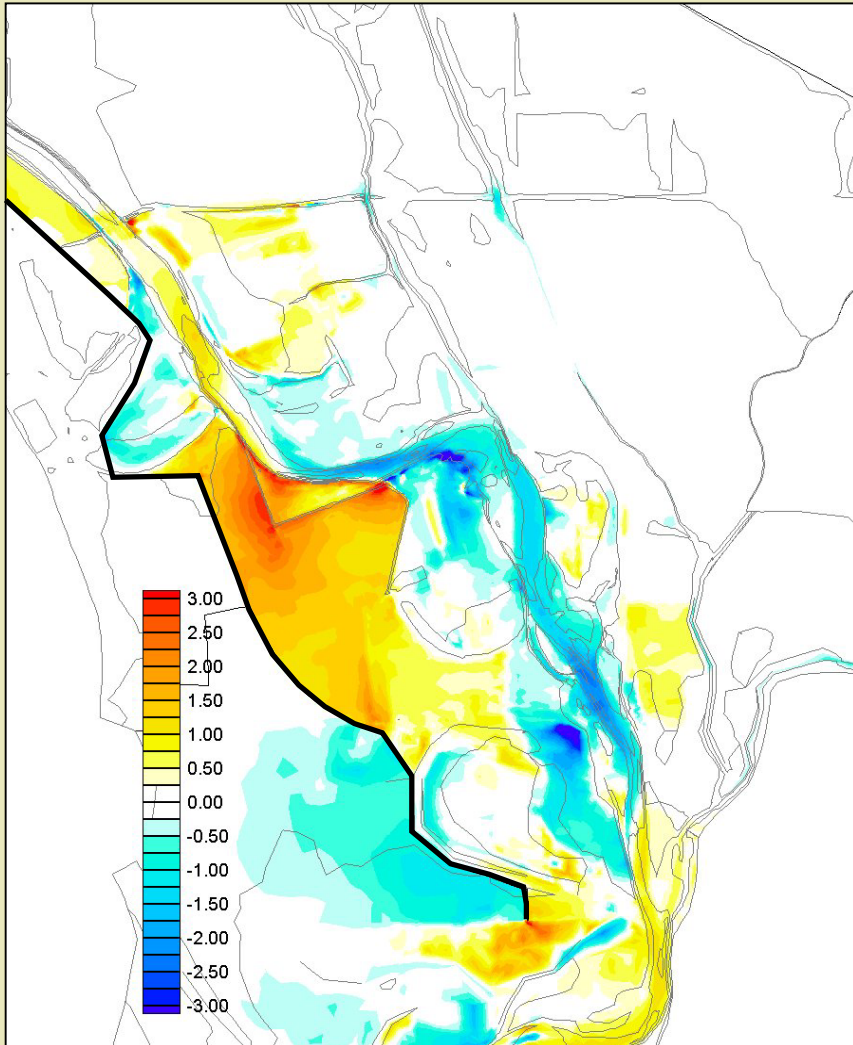


# Alignment of the Setback Levee

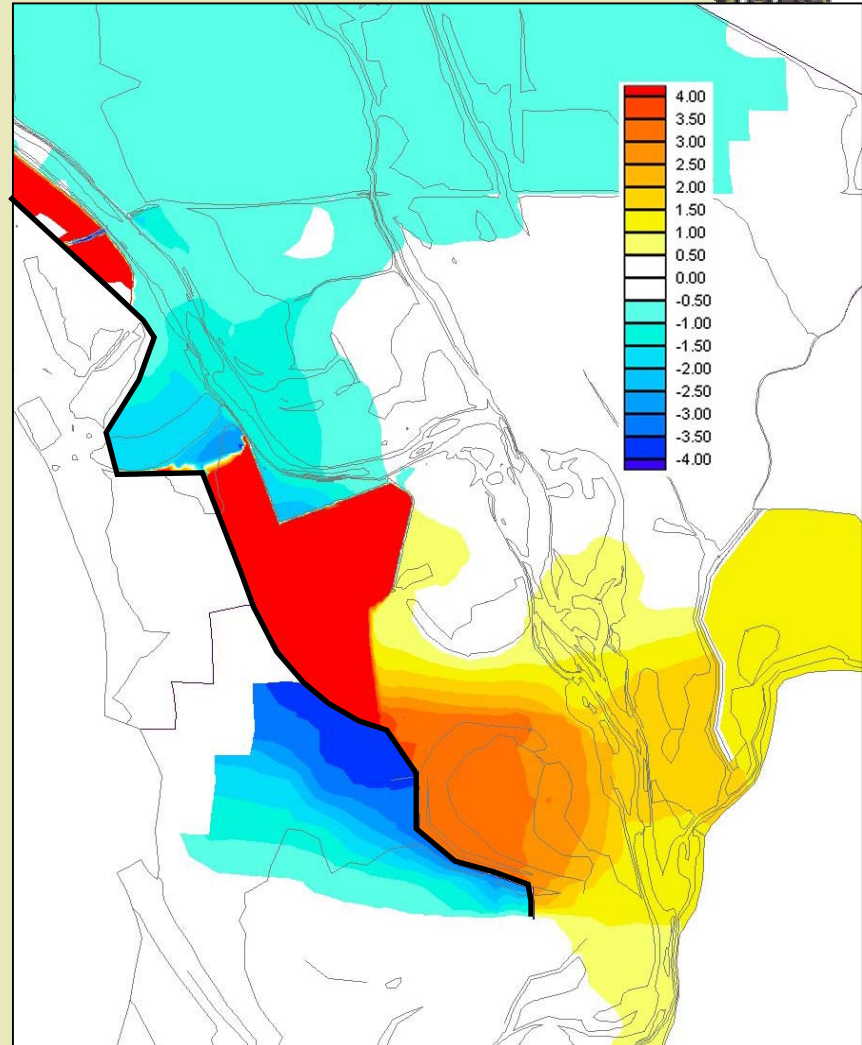




# Resulting Changes in Hydraulics



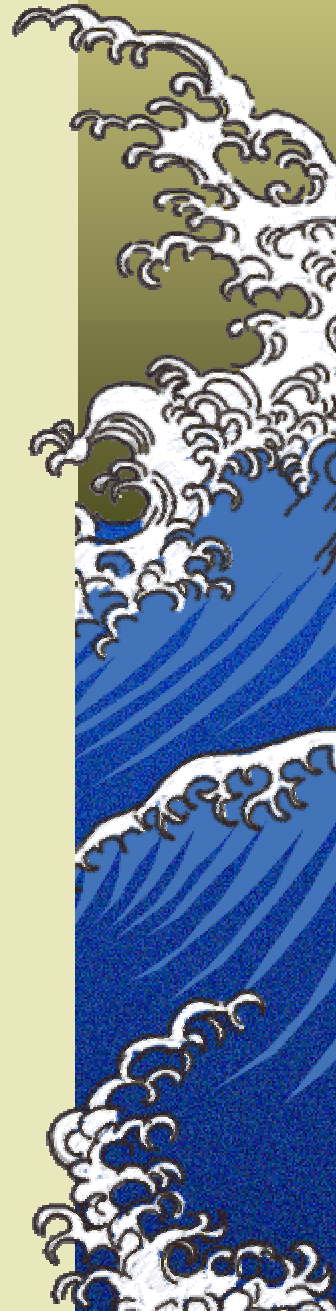
Change In Velocity, fps



Change In Water Surface, ft

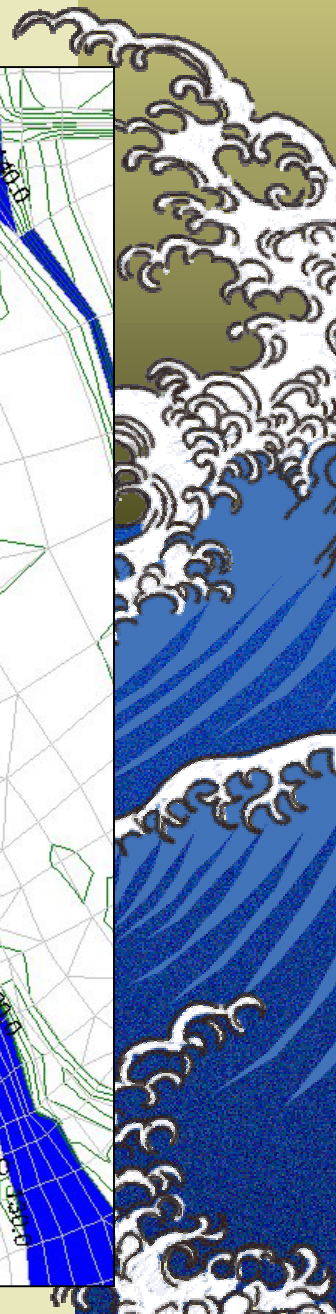
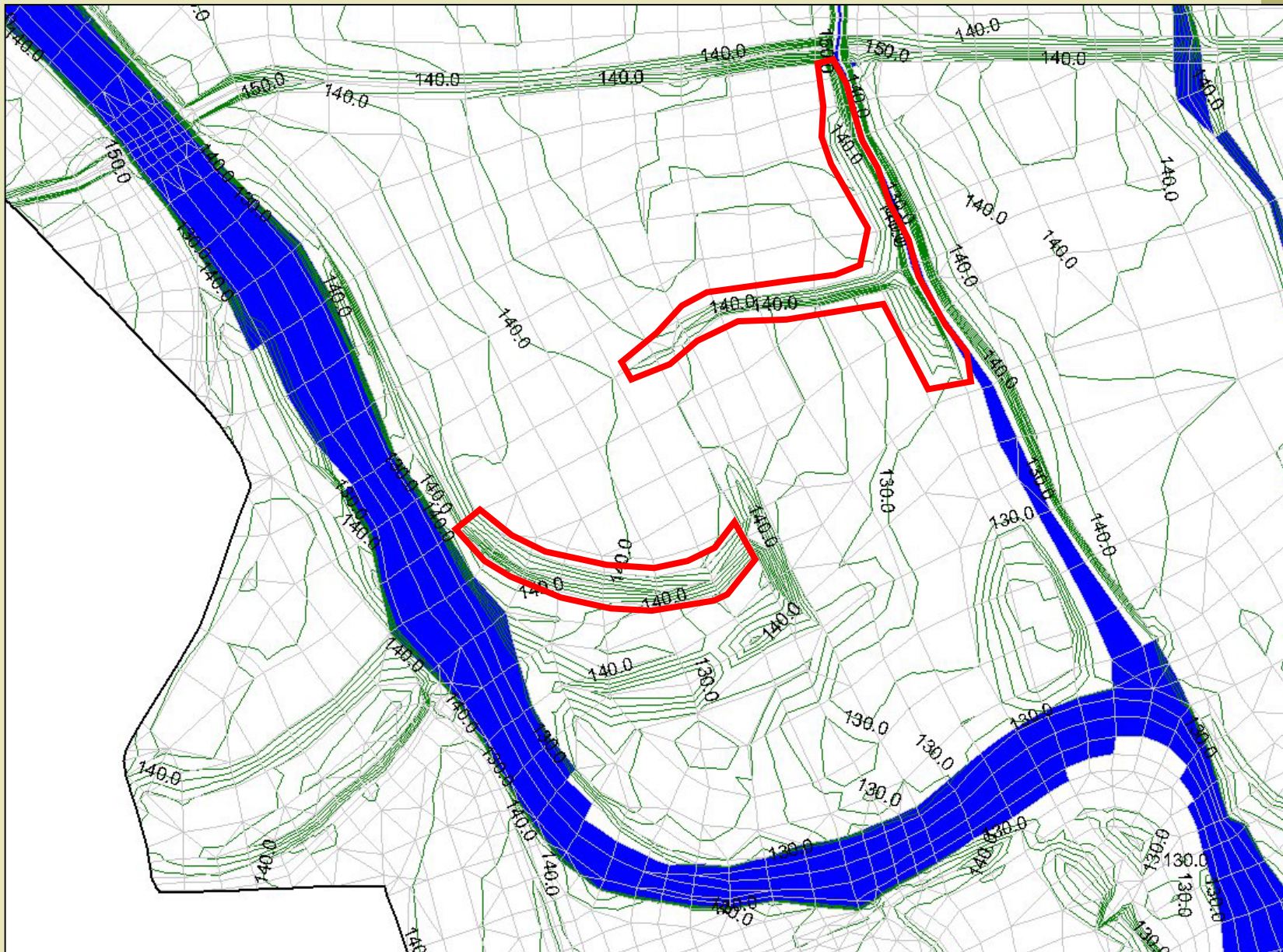
# Model Representing Levee Removal

- ✦ *Incorporated land use changes*
- ✦ *Incorporated setback levee*
- ✦ *Removed of private levees, east of Dunning Slough reach between RM 198 and 199*



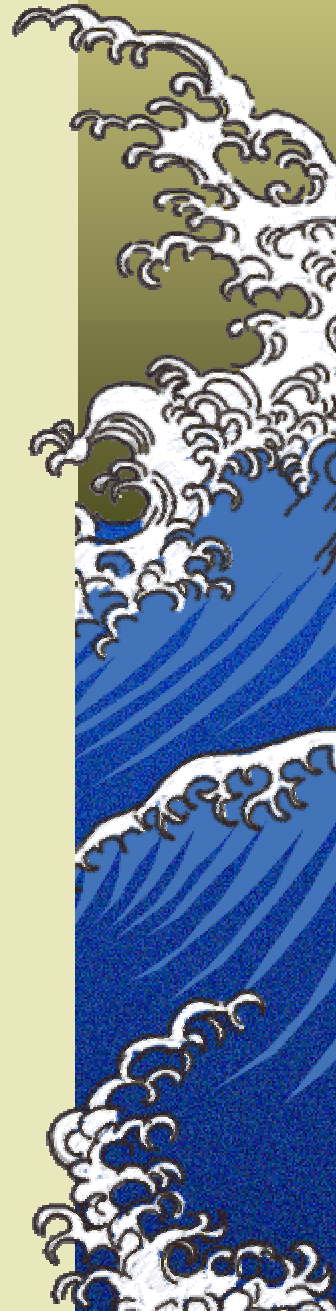


# East Levee Removal

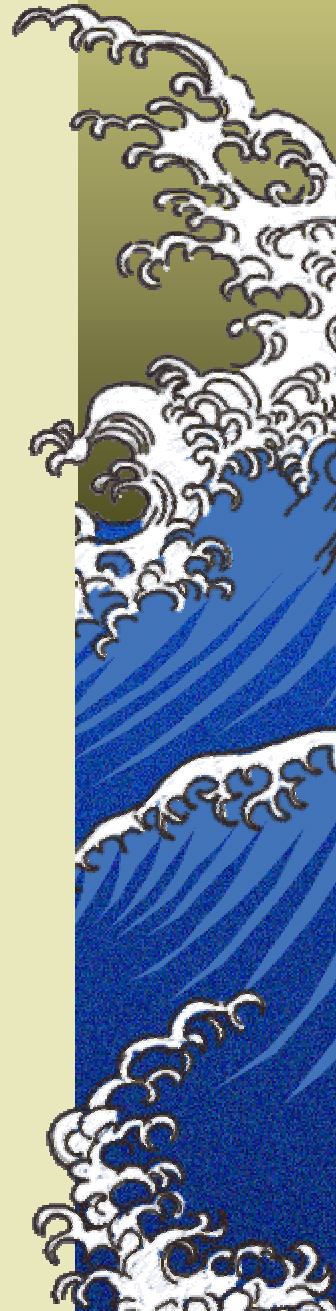
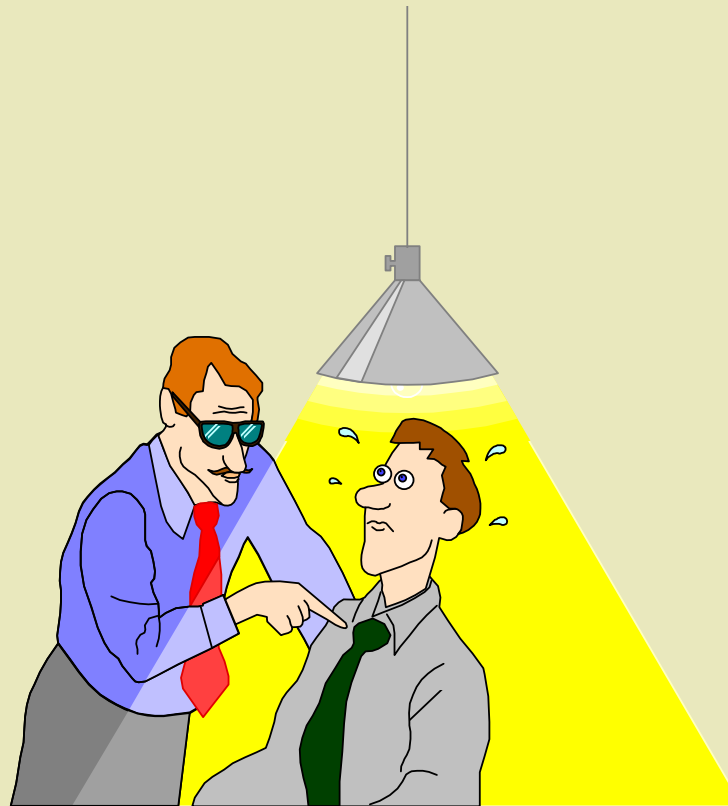


# Resulting Changes in Hydraulics

- ▶ *Negligible change in velocity distribution and magnitude*
- ▶ *Approximately  $-0.5$  ft decrease in water surface upstream of Highway 32*
- ▶ *Loss of high ground where levees were located*



# Questions?





# Thank You

**AYRES**  
ASSOCIATES

