## Strategies to Control Mercury Pollution in the Cache Creek Basin, Northern California Melissa Riley, Amibeth Sheridan, Bethany Taylor, Kristiana Teige, Toshiyuki Yamasaki, Nick Zigler Client: U.S. Department of the Interior, Bureau of Land Management– California State Office - Faculty Adviser: Arturo A. Keller, Ph.D.

### Background

The Cache Creek Basin, located in Northern California, is one of the major contributors of mercury to the Sacramento- San Joaquin Delta and San Francisco Bay. Sources of mercury to the Cache Creek Basin include geothermal springs, atmospheric deposition, erosion of natural mercury-enriched soils, erosion of waste rock and tailings from historical mines, and the mobilization of legacy mercury that has been deposited in streams from historical mining activity. Mercury, particularly the bioavailable form, methylmercury, is a potent neurotoxin and can have detrimental health effects on both humans and wildlife. Our client, the Bureau of Land Management (BLM), is one of the primary responsible parties that must reduce mercury pollution to meet water quality standards in the Basin.



### Objectives

- Identify ways to conduct mercury remediation and restoration in the Cache Creek Basin
- Develop a method to determine best remediation and restoration options for different site locations
- Evaluate management options through watershed modeling
- Assess legal constraints on management options

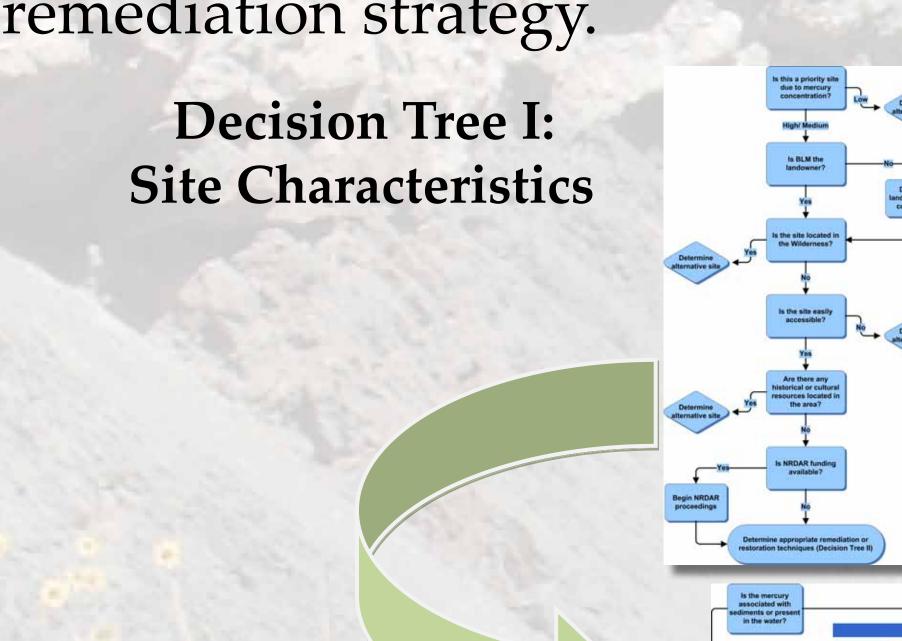
### **Additional Information**

For more information on our project, please visit our website to view our full report: http://fiesta.bren.ucsb.edu/~cachecreek/

### Methods

### **Decision Trees**

We created the following three decision trees to assist in determining which remediation actions would be most applicable at each type of contaminated site. The different actions can then be compared using a ranking system that balances cost and effectiveness to determine the optimal remediation strategy.



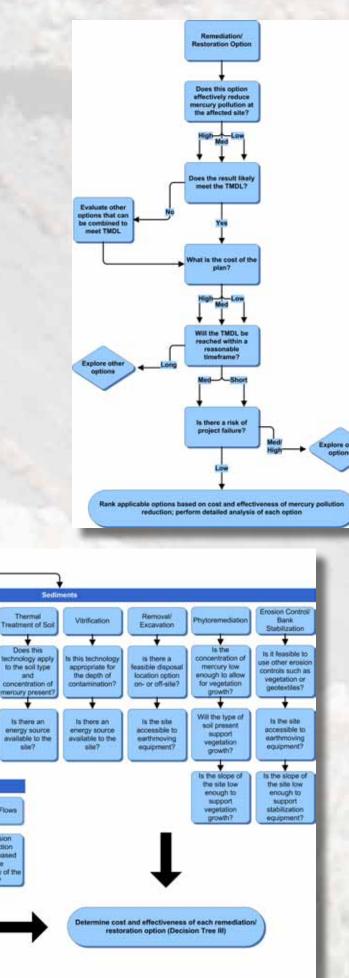
**Decision Tree II:** 

 Before Remediati After Remediatio

# Cache Creek Settling Basin

### Watershed Model

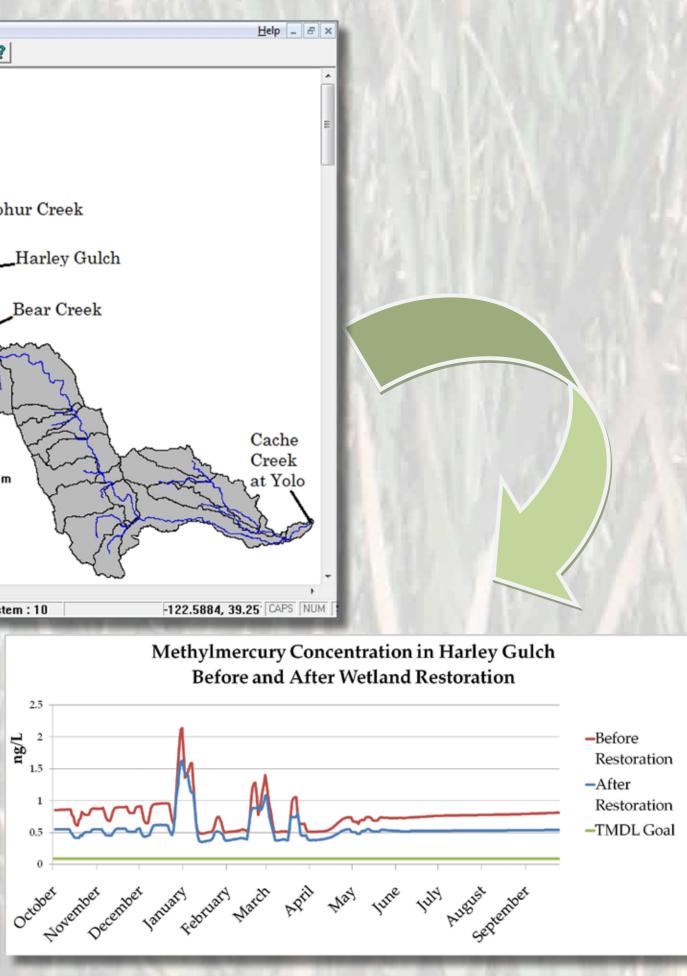
Another contribution of this project was to model the Cache Creek Basin Additional data collection: More water quality samples to underusing WARMF (Watershed Analysis Risk Management Framework). Our stand mercury sources, water quality monitoring before and after remodel allowed us to analyze the daily flow and sediment and mercury mediation and restoration actions; loads for each stream reach in the Basin. By removing the abandoned Further research: More sponsorship of applied research into methylamines from the model to simulate that they had been cleaned up, it was tion processes, mercury sources and concentrations, and remediation possible to analyze the benefits of these remedial actions. and restoration options, including emerging technologies;



**Decision Tree III: Evaluation of Cost**, Effectiveness and Timeframe

The decision trees and the watershed model provide a structured approach to analyzing remediation actions and their benefits in order to determine if water quality objectives in the Basin will be met. Cleanup of all mines would significantly reduce mercury and methylmercury concentrations in downstream waters. However, there are large natural sources of mercury that may prevent water quality objectives from being met, even if concentrations are reduced to natural levels.

**Restoration/ Remediation Options** 



Actions to take: Remediation and restoration actions, best management practices in the region;

Partnerships: Collaborations that the BLM can encourage with other agencies and entities to help reduce mercury pollution within the Basin and downstream.

Jim Weigand, BLM; BLM California State Office Staff BLM Ukiah Field Office Staff; Arturo A. Keller, Bren School Christina Tague, Bren School; Robert Wilkinson, Bren School Martina Nöthiger; UCD McLaughlin Reserve; The Environ Foundation

### Conclusion



### Recommendations

### Acknowledgements