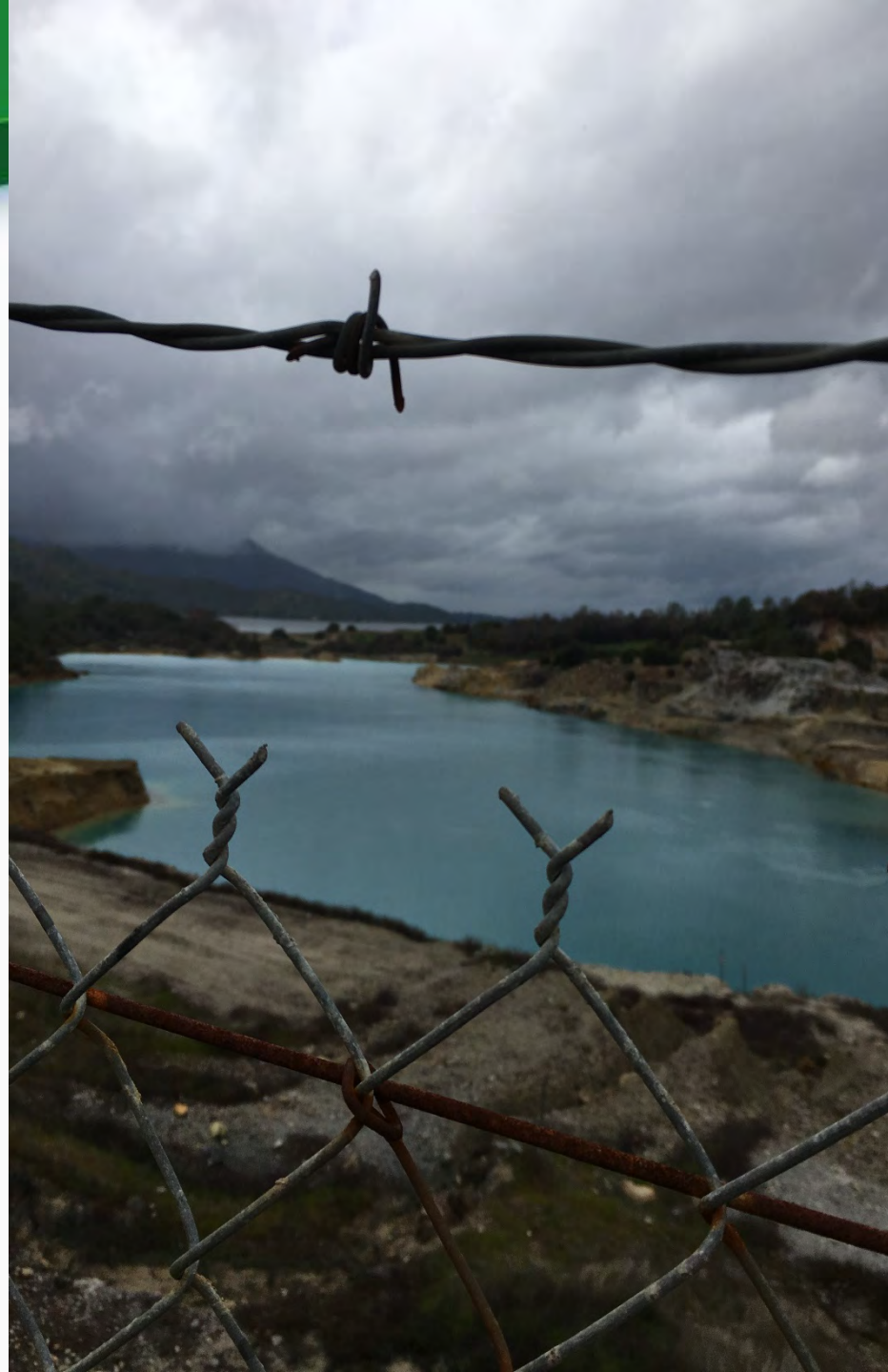
Sulphur Bank Mercury Mine Superfund Site

January 14, 2020

Presentation Overview

- Site Overview & History
- Updated Conceptual Site Model
- Ongoing Work - Mine
- Fish Consumption Advisory
  - Request for input
- Ongoing Work - Clear Lake
  - Collaboration with USGS
- Discussion



Site Overview

Sulphur Bank Mercury Mine

- Operated on and off 1865 to 1957
- Added to the Superfund list in 1990
- Mercury and arsenic in soils; mercury in sediment and fish tissue
- Fish consumption advisory for Clear Lake; impacts to Elem Tribe

Site Overview

Terrestrial Mine Site and Residential Soils

Operable Unit 1

Lake Sediments and North Wetlands

Operable Unit 2

Mine History

- Sulphur Bank Mine operated from 1856 to 1957.
  - First borax, then sulfur, then shifting to mercury in 1873
  - Shallow underground tunnels and open pit operations
  - Cinnabar ore processed on-site
  - Bradley Mining Corp identified as the responsible party

Photo credit: Lake County Historical Society

Major Mine Site Features

Source Areas

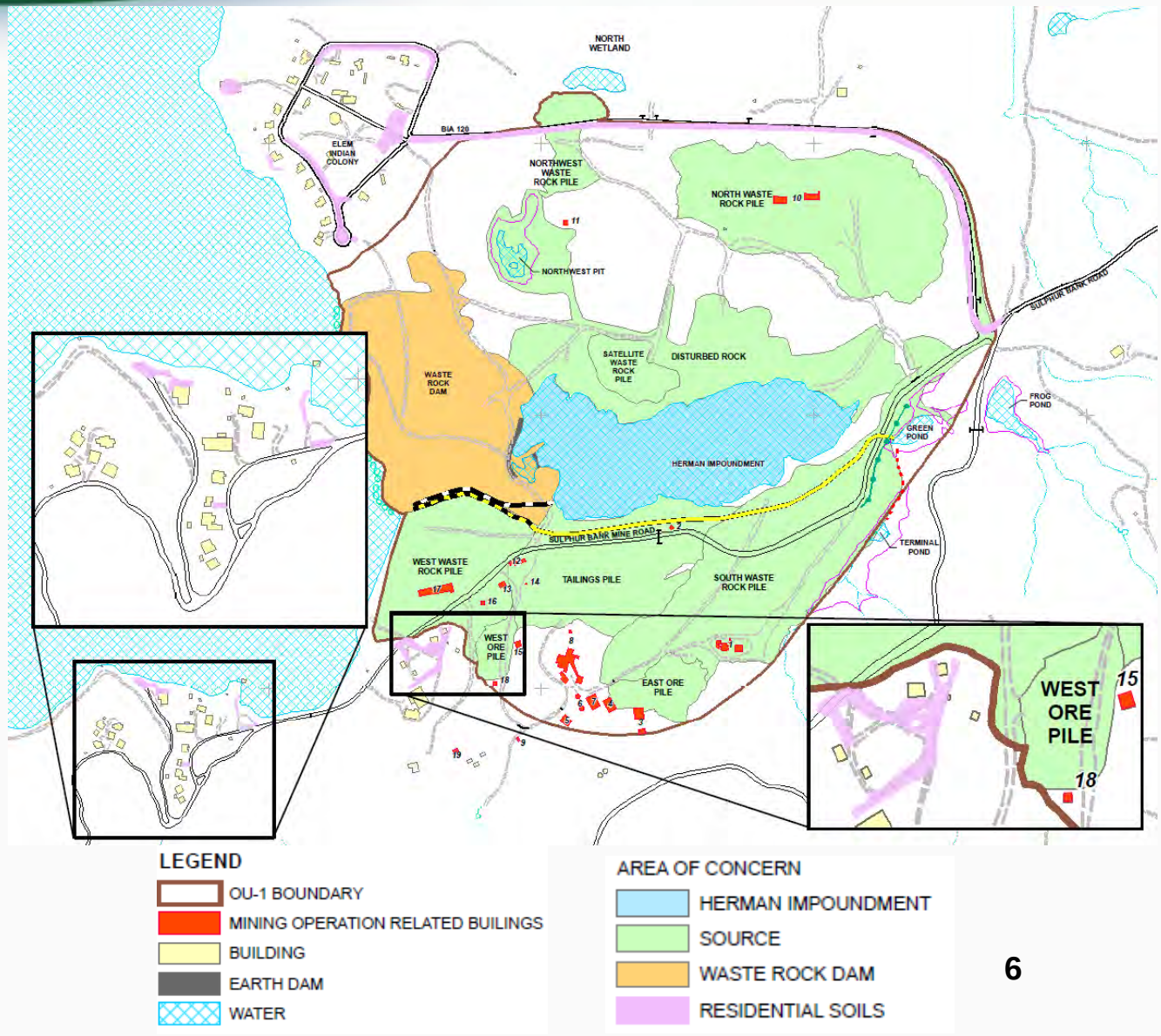
- Waste Rock Piles
- Ores Piles
- Tailings Pile
- Disturbed and Native Rock
- Northwest Pit
- Mining Facilities/Buildings

Herman Impoundment (HI)

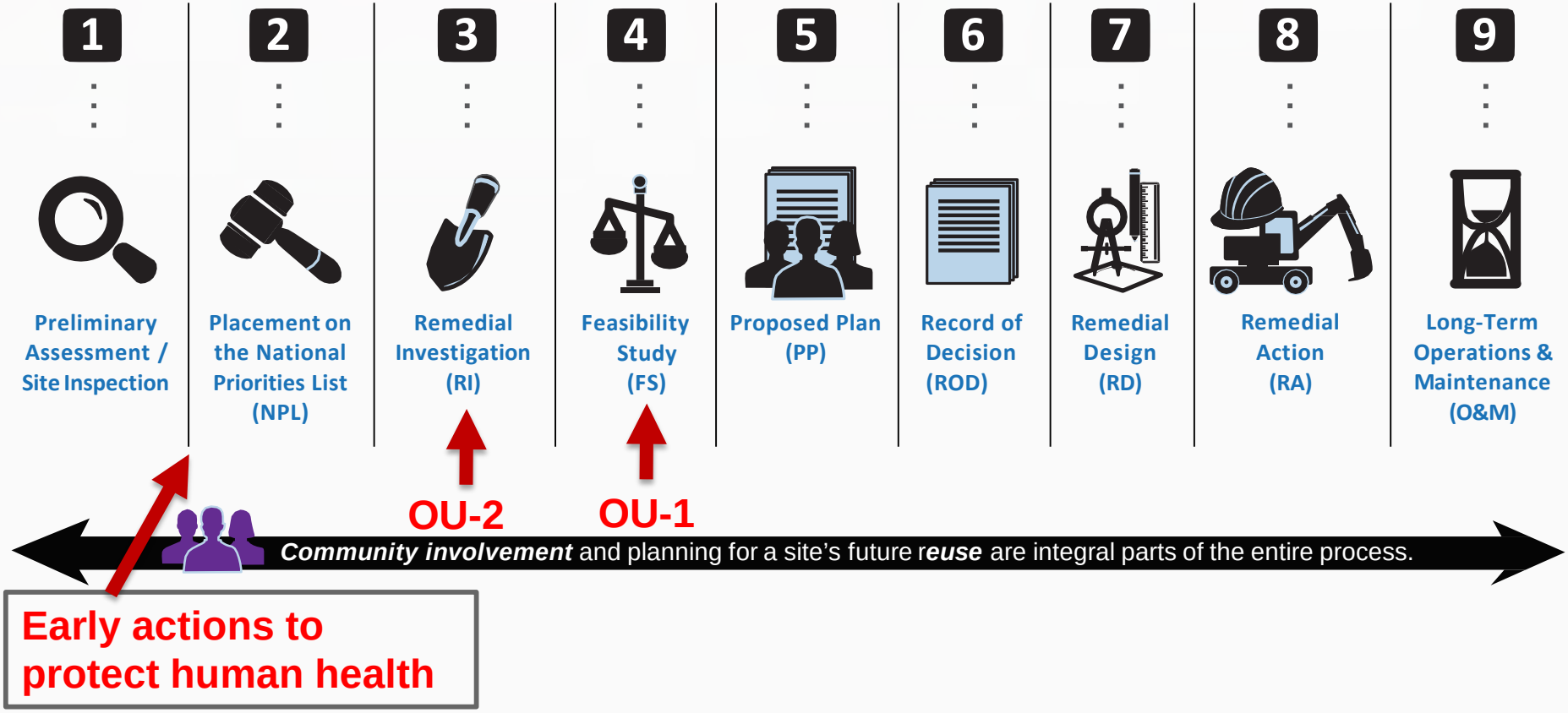
Waste Rock Dam (WRD)

Off-Site Residential Soils

- Elem Indian Colony
- Sulphur Bank Mine Road neighborhood



Superfund Remedial Process



Actions to Reduce Exposure

Human Health

- Site Controls (1990)
- Removal of soils, replacement of homes and infrastructure on Elem Indian Colony (1997,1998,2006)
- Geothermal well closures (2000-2001)
- Removal of soils from Sulphur Bank Mine Road residential area (2008)
- Pomo Road cleanup (2010)

Clear Lake

- Stabilization of Waste Rock Dam (1992)
- Stormwater Diversion/Pipeline (1999-2000)
- Sediment test caps in Clear Lake (2012-2016)

Conceptual Site Model

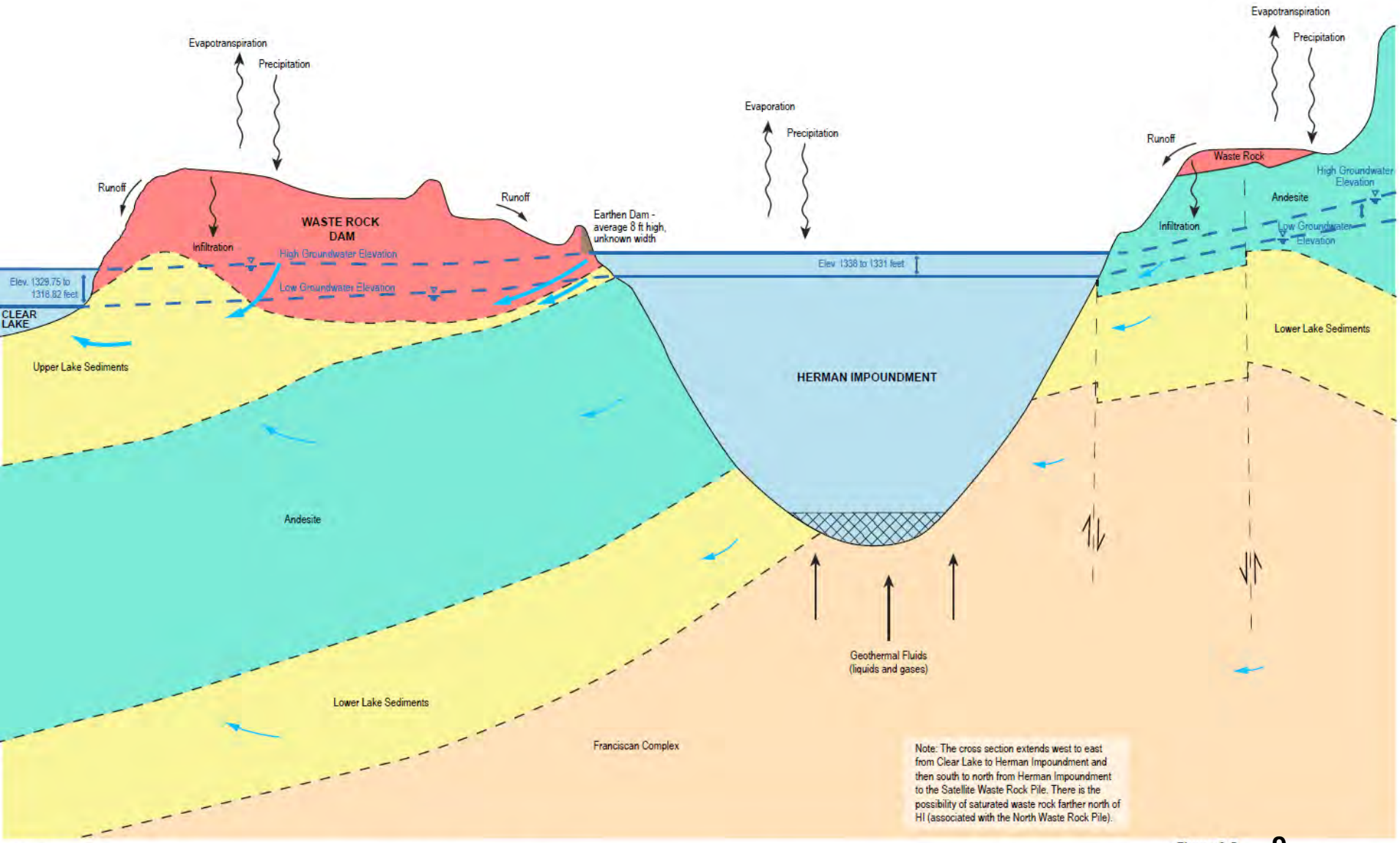


Figure 3-5
Conceptual Site Model of Water Flow between Herman Impoundment and Clear Lake
OU-1 Focused Feasibility Study
Sulphur Bank Mercury Mine

Superfund Process

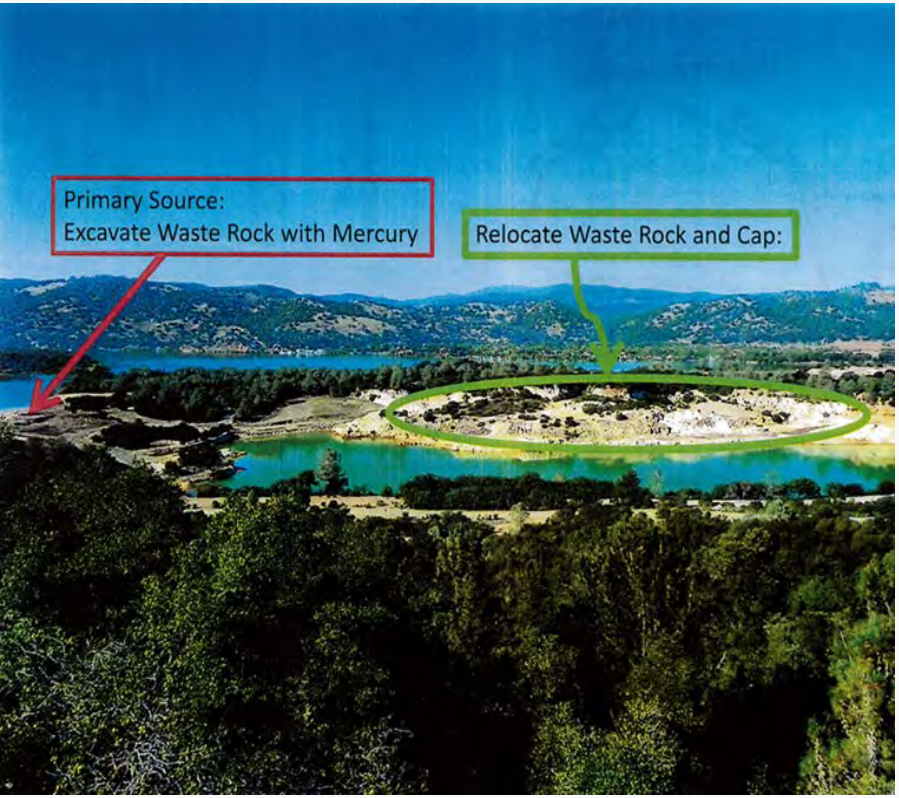
Chronology of major SBMM Site Work

- 1990 – Listed on Superfund NPL
  - 1993 – Site Stabilization, Fencing, Stormwater Controls
  - 1997, 1998 – Cleanup Actions on Elem Lands
  - 1999 – Stormwater Diversion Pipeline
- 2001 – OU1 Remedial Investigation completed
- 2006 – OU1 Feasibility Study completed
  - 2006, 2008, 2010 – Cleanup Actions on Elem Lands and Residential Neighborhood South of Mine
  - 2014-2016 Lake Sediments Capping Project
- 2017 – OU1 Focused Feasibility Study (draft final)

Remedial Approach

- 2006 Feasibility Study envisioned
  - Consolidate and cap mine wastes
  - In-perpetuity pump and treat to prevent loading through WRD
  - Significant treatment of naturally occuring consituents
- Drought of 2013-16 led to improved water quality
  - pH rose from < 3 to ~ 5; metals significantly reduced
  - Underscored role of stormwater runoff from surrounding waste

Revised Approach

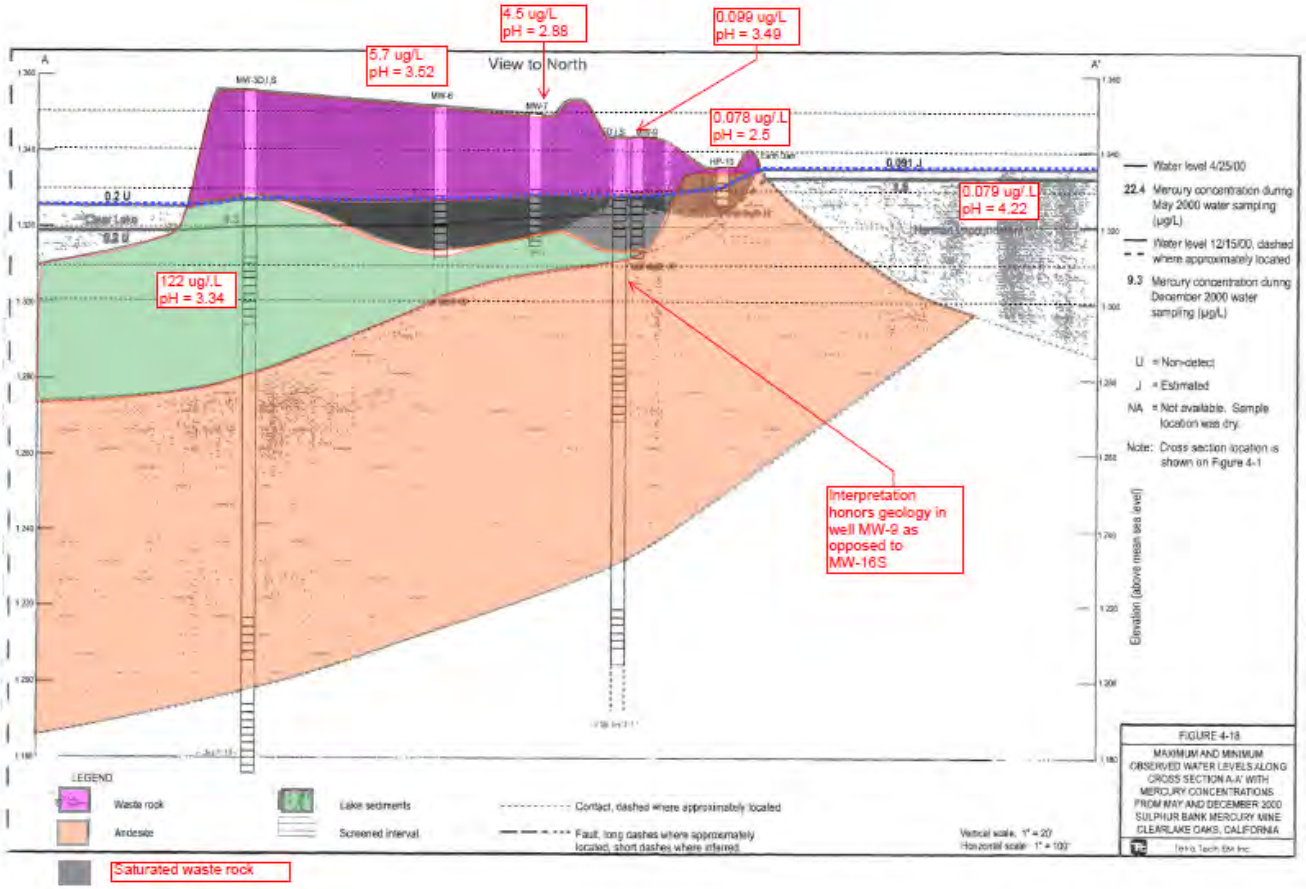


- Consolidation and capping remains the first step
- HI water modeled to move toward background groundwater
- Geothermal groundwater in HI would then discharge to Clear Lake
- Draft Focused Feasibility Study produced in 2017
  - Finalization delayed, but expected 2020

Current Work on OU-1

- Site-wide Human Health Risk Assessment
  - Particular focus on tribal risk
  - Background study
  - Likely reevaluation of surface soils clean up targets
- Engineering Evaluation/Cost Analysis for Removal of Northwest Waste Rock Pile
- Mercury Flux Investigation
  - Refine baseline estimate of ongoing loading of Hg to Clear Lake through WRD
  - Clarifying location and volume of saturated waste rock
  - Providing remedial effectiveness monitoring in long term (compliance with Clear Lake TMDL and Basin Plan)

Mercury Flux Investigation



- Past estimates uncertain
- Based upon proxies and assumptions
- New effort using revised interpretation of well logs and new wells in saturated WR

Estimator	Year Published	Method	Hg Flux, pounds per year			Citation
			Minimum	Average	Maximum	
E2	2018	Darcy Flux	17	38	59	(E2 2018)
E2	2018	Groundwater Model	-	51.5	-	(E2 2018)
UC Davis	2008	Mass Balance	710	719.5	729	(Suchanek et al. 2008)
TetraTech	2002	Water Balance	0.01	0.055	0.1	(TtEMI 2002)

Mercury in Clear Lake

- Mercury tends to bind to soil and sediment
- Clear Lake water contains low/safe levels of mercury for consumption/recreation
- Methylation of mercury makes it available for biological uptake
- Primary pathway for exposure – methylmercury in fish

CA Fish Consumption Advisory for Clear Lake

A GUIDE TO EATING FISH *from* CLEAR LAKE

(LAKE COUNTY)

Eat the Good Fish
Eating fish that are low in chemicals may provide health benefits to children and adults.

Avoid the Bad Fish
Eating fish with higher levels of chemicals like mercury or PCBs may cause health problems in children and adults.

Choose the Right Fish
Chemicals may be more harmful to unborn babies and children.

Women (18-49 Years) Children (1-17 Years)	Women (50+ Years) Men (18+ Years)
7 TOTAL SERVINGS A WEEK	7 TOTAL SERVINGS A WEEK
OR	OR
3 TOTAL SERVINGS A WEEK	7 TOTAL SERVINGS A WEEK
OR	OR
1 TOTAL SERVING A WEEK	3 TOTAL SERVINGS A WEEK
	OR
0 DO NOT EAT	1 TOTAL SERVING A WEEK


Asian Clam (Corbicula)


Winged Floater Mussel


Inland Silverside


Threadfin Shad


Blackfish


Bullhead


Catfish


Common Carp


Crappie


Crayfish


Mosquitofish


Prickly Sculpin


Sunfish Species

*Clear Lake Hitch removed from advisory. See note below.


Black Bass Species

Serving Size
A serving of fish is about the size and thickness of your hand. Give children smaller servings.

For Adults

For Children

California Office of Environmental Health Hazard Assessment
web www.oehha.ca.gov/fish
email fish@oehha.ca.gov
phone (916) 324-7572

Inland silverside photo: North American Native Fishes Association. Threadfin shad photo: Uland Thomas, Ohio Department of Natural Resources.

Eat only the skinless fillet

Eat only the meat

Some chemicals are higher in the skin, fat, and guts.

***Clear Lake Hitch:**
No take permitted per the California Endangered Species Act.

Updated 08/2018

Updated August 2018

Fish Advisory Outreach

- Limited outreach to date
  - 2018 temporary signage posted
- Tribal community concerns
- Fishing assessment?
  - CDPH
  - Lake County
- Road blocks
- Recommendations?

Remedial Investigation OU-2

- Additional Study Needed
- No firm answers on
  - Likely effectiveness of sediment capping/dredging
  - Whether Basin Plan compliance would achieve desired outcome
  - Long term trends in fish tissue concentrations
- USGS Interagency Agreement
  - Coordination with Blue Ribbon Committee sponsored work

Interagency Agreement with USGS

EPA partnership with USGS has four primary goals:

- Clarify the relationship between site contaminants and sediment mercury concentrations in Clear Lake
- Determine the proportion of site-derived Hg in fish in Clear Lake
- Examine relationships between dissolved and particulate Hg to develop monitoring approaches
- Model mercury cycling in Clear Lake to inform remedial approaches that might disrupt that cycle


Questions?