SEMS-RM DOCID # 100031865

U. S. Environmental Protection Agency • Pacific Southwest Region • Region 9 • December 2022

This Proposed Plan Covers

What is a Proposed Plan?

The goal of a proposed plan is:

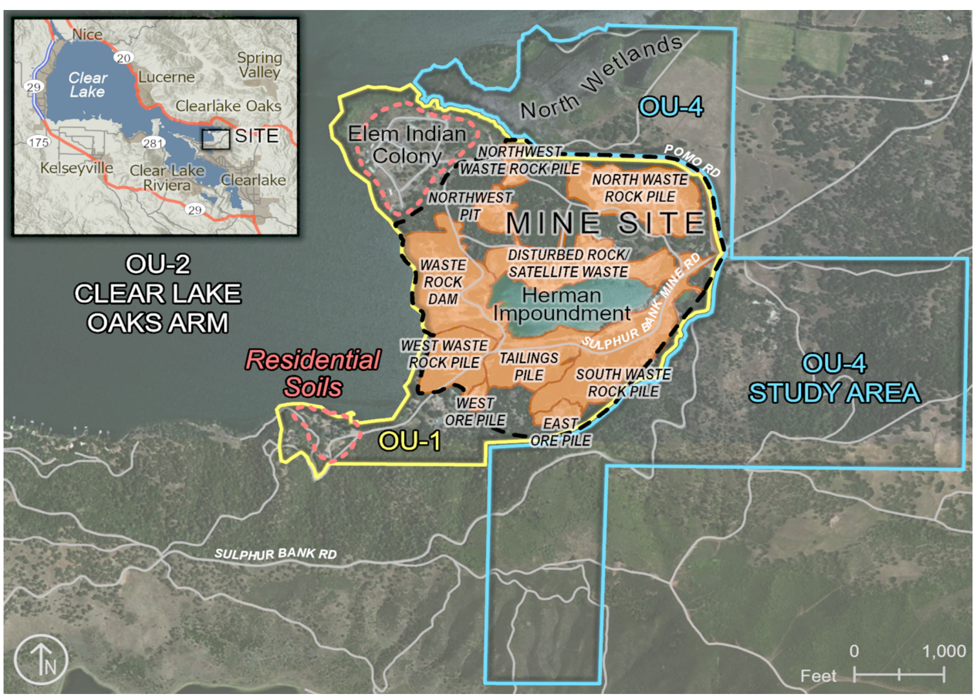
1. Describe EPA's preferred cleanup option for the site
2. Explain how EPA chose that cleanup approach
3. Give the public a chance to review and comment

Overview

This Proposed Plan summarizes how the U.S. Environmental Protection Agency (EPA) proposes to protect human health and the environment by performing a cleanup at the Sulphur Bank Mercury Mine Superfund Site (SBMM or the site) Operable Unit 1 (OU-1).

EPA has divided the site into three parts that will each require unique cleanup approaches. These parts are called operable units (OUs). The site's Operable Units (as shown above) are:

- OU-1: the mine itself, **Herman Impoundment** (the flooded mine pit in the center of the site) and the impacted residential soil areas on the Elem Indian Colony and to the south of the site.;
- OU-2: Clear Lake and its sediments;
- OU-4: the North Wetlands and study area.



Site map showing the different parts of the site.

EPA evaluated different cleanup options for OU-1. The recommended cleanup plan described in this Proposed Plan selects the best elements of several options in order to take advantage of specific strengths and to avoid identified weaknesses.

EPA continues to study Clear Lake (OU-2) to understand how it might best address the mercury contamination in the lake. EPA anticipates the Proposed Plan for the lake and sediment cleanup is several years away.

OU-4 was created in 2021. EPA is still evaluating the contamination in this area and anticipates a cleanup plan for this area in several years.

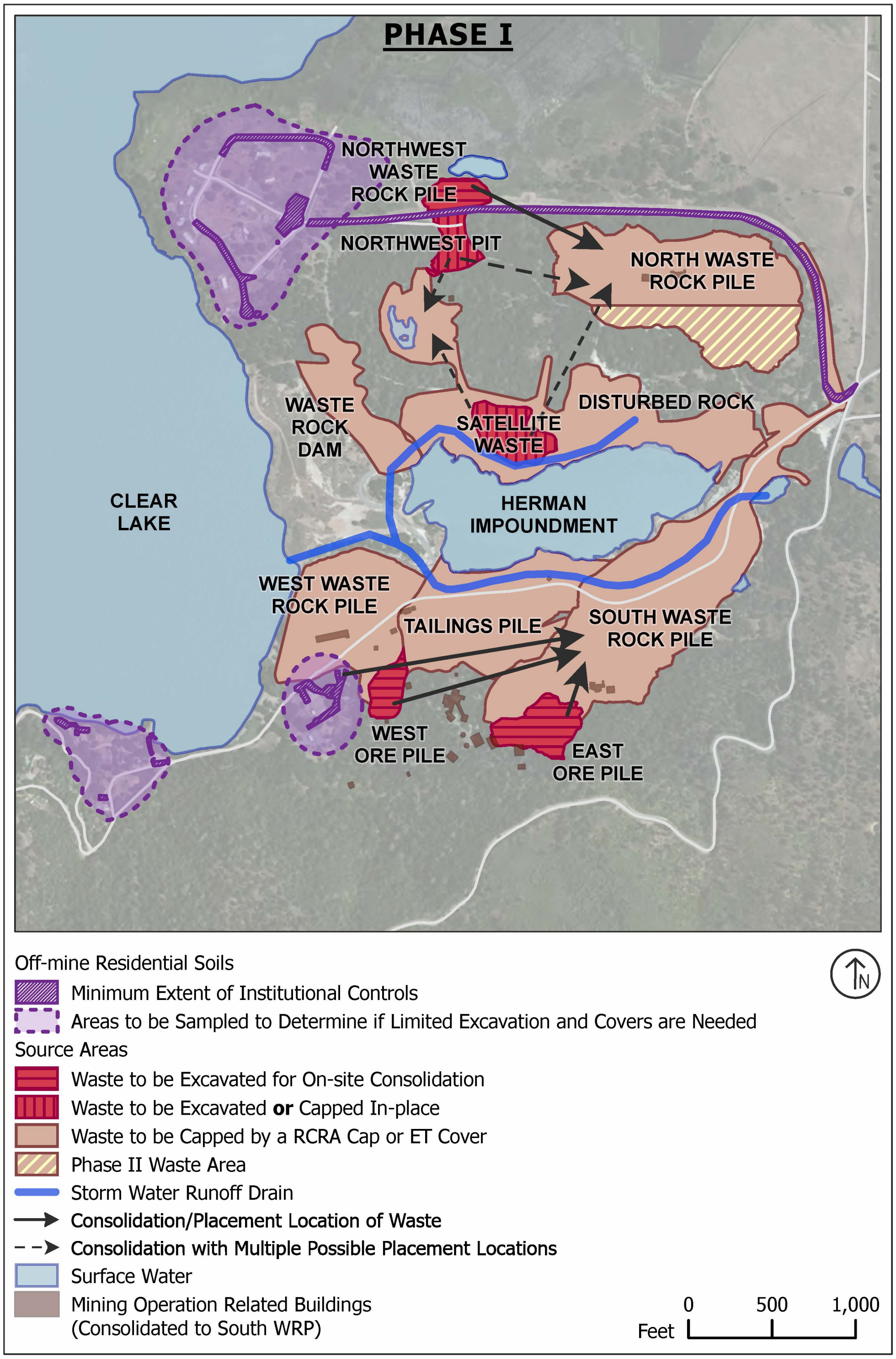
A more complete discussion of the contamination at Sulphur Bank Mine, including the full Remedial Investigation report and Feasibility Studies for OU1 can be found in the administrative record for the site, available online at https://www.epa.gov/superfund/sulphurbankmercury

glossary terms and explains that bolded terms' definitions can be found in the glossary.

PART 1: Summary of EPA's Cleanup Plan

Phase 1 Cleanup

EPA's recommended cleanup (preferred remedial alternatives) for the mine portion of the site are summarized below by Area of Concern. The actions of Phase 1 *(shown in the map below)* are as follows:



OFF-MINE RESIDENTIAL SOILS *(shown in purple)*: The off-mine contaminated soils in residential and agricultural areas will be excavated and placed on-site with the source area materials before capping, and the excavated areas will be appropriately covered with clean soil and institutional controls applied. This is Residential Soils Alternative 2 of the Focused Feasibility Study (FFS).

SOURCE AREAS: The mine waste, ore piles, tailings piles, and waste rock piles will be consolidated (piled together) *(shown with black arrows below)* and capped in place, remaining on-site. The type of cap to be used for each area will be determined based on factors such as the chemistry of the material to be capped and may be either a RCRA-type (landfill-type) cap or an evapotranspiration (ET) cover. These two cap designs are Source Area Alternatives 2 and 3. The waste rock pile located off the mine site and partially on the Elem Indian Colony will be relocated and consolidated to an area on- site. Clean stormwater will be diverted away from Herman Impoundment and into Clear Lake (shown with dark blue lines). The Northwest Pit will be backfilled for use as a waste rock repository or capped to ensure protection of future users of the site, based upon the findings of pre-design and design studies.

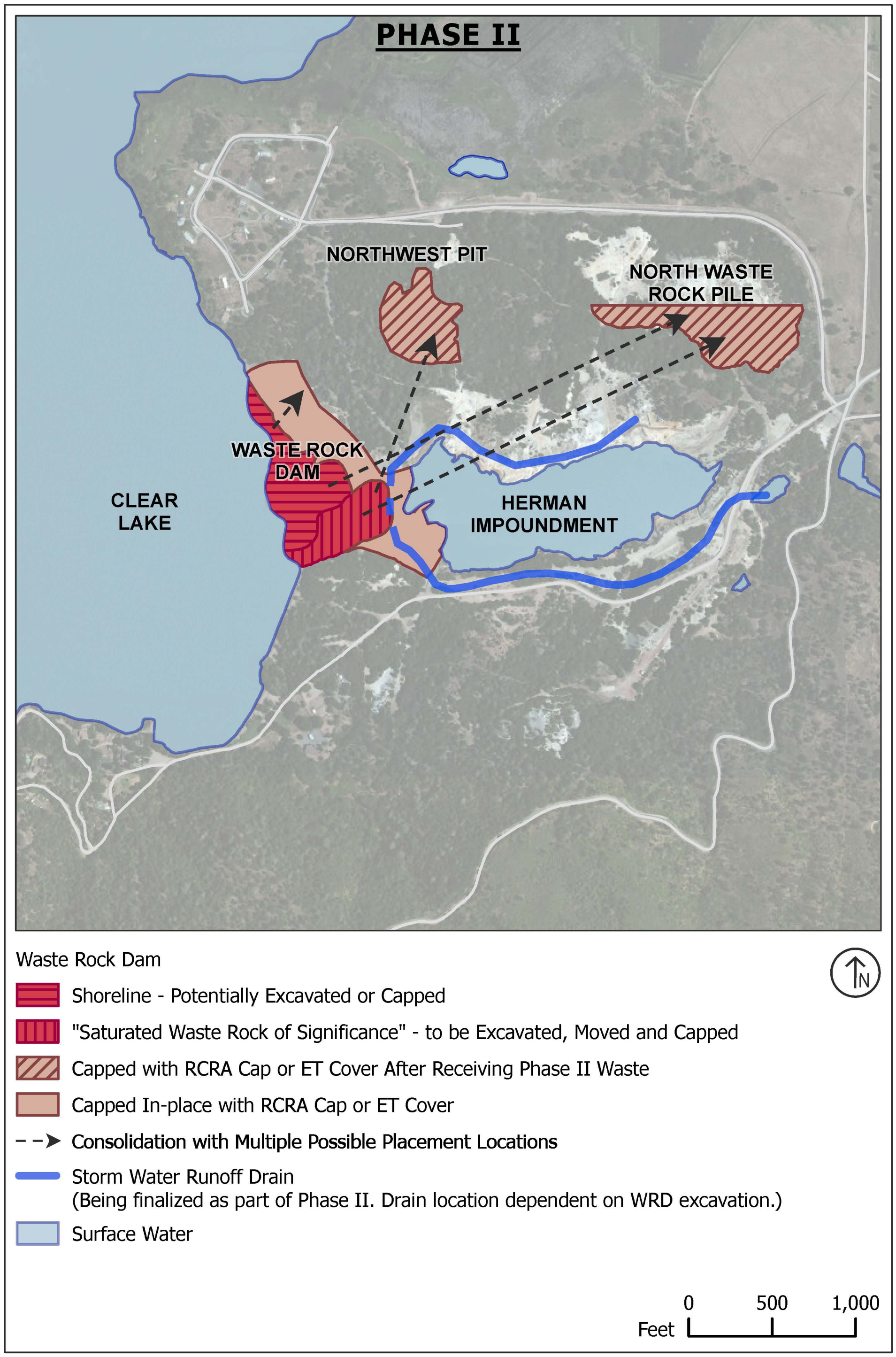
PART 1: Summary of EPA's Cleanup Plan

Phase 2 Cleanup

Phase 1 is expected to lower the water level in Herman Impoundment (the flooded mine pit in the center of the site), improve water quality in the impoundment and reduce contamination flowing into Clear Lake.

Following a period of monitoring these changes, Phase 2 will include:

WASTE ROCK DAM: Excavation of saturated waste rock within the Waste Rock Dam. This saturated rock is the source of mercury and other contaminants that enter the groundwater flowing into Clear Lake. Monitoring of groundwater wells in the Waste Rock Dam will inform the amount of this rock that needs to be removed and placed on top of one of the existing waste piles (where space will be reserved for it during phase 1). Clean rock and earth will be placed into the excavated area for safety, slope stability and access. The remainder of the Waste Rock Dam will be capped with either RCRA-type cap or ET cover to prevent infiltration of rainwater. This approach is a combination of Waste Rock Dam Alternatives 2 and 3, with the final volume of waste rock to be excavated determined during the pre-design investigation.



HERMAN IMPOUNDMENT: A remedial action for Herman Impoundment (HI) is not being selected because the water within HI is improving and may not require cleanup. Water chemistry will be monitored and if needed a cleanup plan will be selected in a future decision document.

For more information on which capping technology will be used in what area, please refer to Part 5 of this Proposed Plan.

Best ways to protect yourself from the contamination at Sulphur Bank Mine

1 Stay off the mine site. Direct contact with the waste piles can be harmful to your health. Stay out of fenced areas.

2 Eat no more than recommended amounts of fish from Clear Lake. Fish in Clear Lake have high levels of mercury. A State fish consumption advisory recommends limiting the amounts of certain types of fish you eat.

3 Wash hands after working in the soil near the site. Soil near the site has both naturally occuring and site-related arsenic in it.

4 Do not eat acorns from trees growing on the mine site. These have been found to contain high levels of arsenic.

For more information on site risks go to the Risk Management section on page 13.

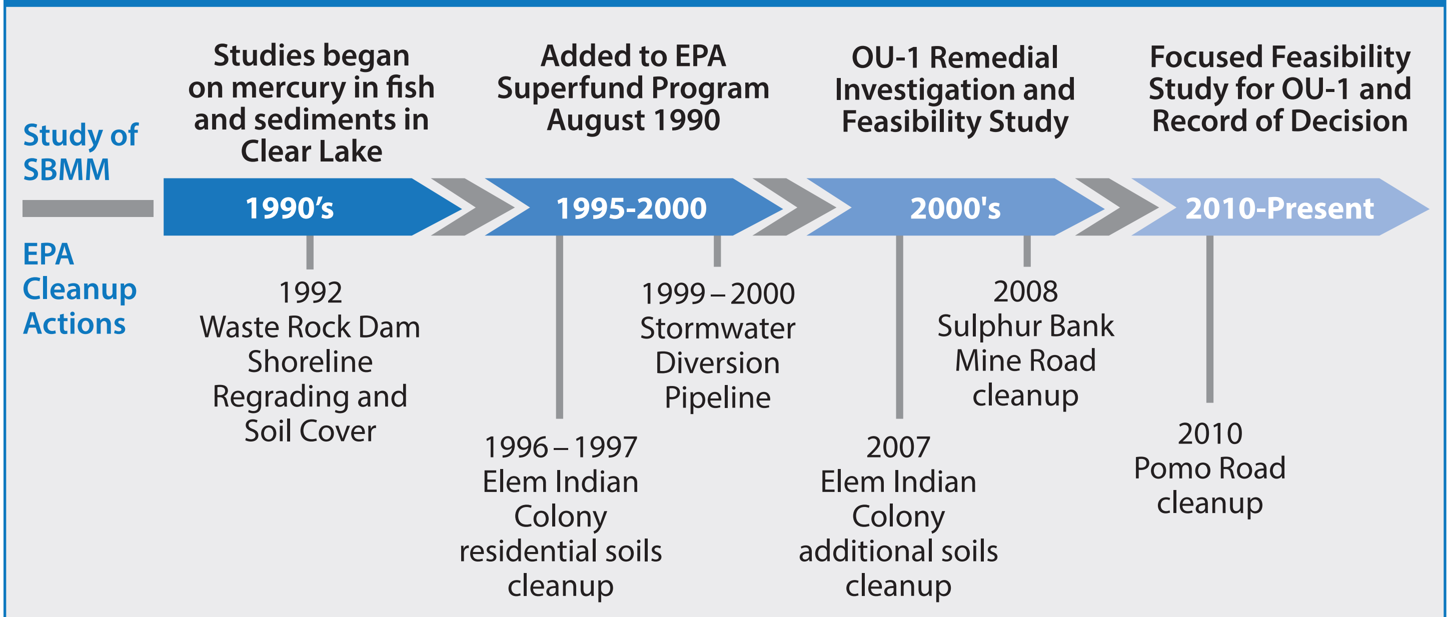
Safe Activities on Clear Lake

The following activities do not pose significant risks caused by the Sulphur Bank Mine:

- **Boating**
- **Catch and release fishing**
- **Bird/Wildlife watching**
- **Swimming**

Clear Lake experiences toxic algae blooms unrelated to Sulphur Bank Mine. Follow all guidelines/warnings related to algae blooms.

Timeline of Major Studies and Cleanups at Sulphur Bank Mine



Detailed Table of Contents

PART 2: How to learn more and comment?

The following document describes:

- the history of the Sulphur Bank Mine Site;
- EPA's understanding of the **contamination** caused by the site;
- the risks that contamination poses to the public,
- the various cleanup options (Remedial Alternatives) that EPA has considered; and
- what EPA has identified as its recommended cleanup option (Preferred Alternative).

The Plan also explains how the public can provide comments, where to find more information, and who to contact with any questions or concerns.

Public Meeting Information

Two formal public hearings are scheduled to solicit input on EPA's Proposed Plan:

A tribal-focused hearing on **February 28, 2023** from 6:00p-8:00p at Konocti Vista Casino and Resort, 2755 Mission Rancheria Road, Lakeport, CA 95453

A hearing with focus for the full community on **March 1, 2023** from 6:00p-8:00p at the Highlands Senior Center 3245 Bowers Ave, Clearlake, CA 95422

EPA will give a presentation on the cleanup options described in this fact sheet (including EPA's preferred alternative) and invite formal public comments from the community. EPA will create a full transcript of the hearings which will be shared on our website along with responses to all formal comments lodged once the final cleanup action is selected in the Record of Decision.

If you have any questions or concerns about how to participate in these meetings or provide comments, please see the site webpage or contact Gavin Pauley.

Public Comment Period

To make sure that the community has sufficient time to comment on the Proposed Plan, the Public Comment Period has been extended from 30 days to 90 calendar days. This period begins on January 11th, 2023 and closes April 10th, 2023

Ways to Comment

EPA and other government agencies want to hear your opinion on this cleanup plan!

- Verbally at public meeting
- Written – you can deliver them at the public meeting or submit them to EPA via mail/email

How do I learn more?

For more information on EPA's Proposed Plan, public meetings and the full "Administrative Record," which includes all documents and information used to develop and evaluate the cleanup options, please visit the site webpage at:
https://www.epa.gov/superfund/sulphurbankmercury

The full Administrative Record is available on EPA's website. Compact disks of the Administrative Record and hard copies of key site documents are available for review at the site Information Repositories:

Lake Port Main Library
1425 N. High Street
Lakeport, CA 95453

Lake County Library Redbud Branch
14785 Burns Valley Road,
Clearlake, CA 95422

EPA Records Center
75 Hawthorne Street
San Francisco, CA 94105

Who to Contact?

Gavin Pauley
Community Involvement Coordinator
75 Hawthorne Street (Mail Code: OPA-2)
San Francisco, CA, 94102
(415) 535 – 3725 | *pauley.gavin@epa.gov*

Carter Jessop
Remedial Project Manager
(628) 223 – 3524 | *jessop.carter@epa.gov*

PART 3: Site Overview, History and Description

Site Overview and History

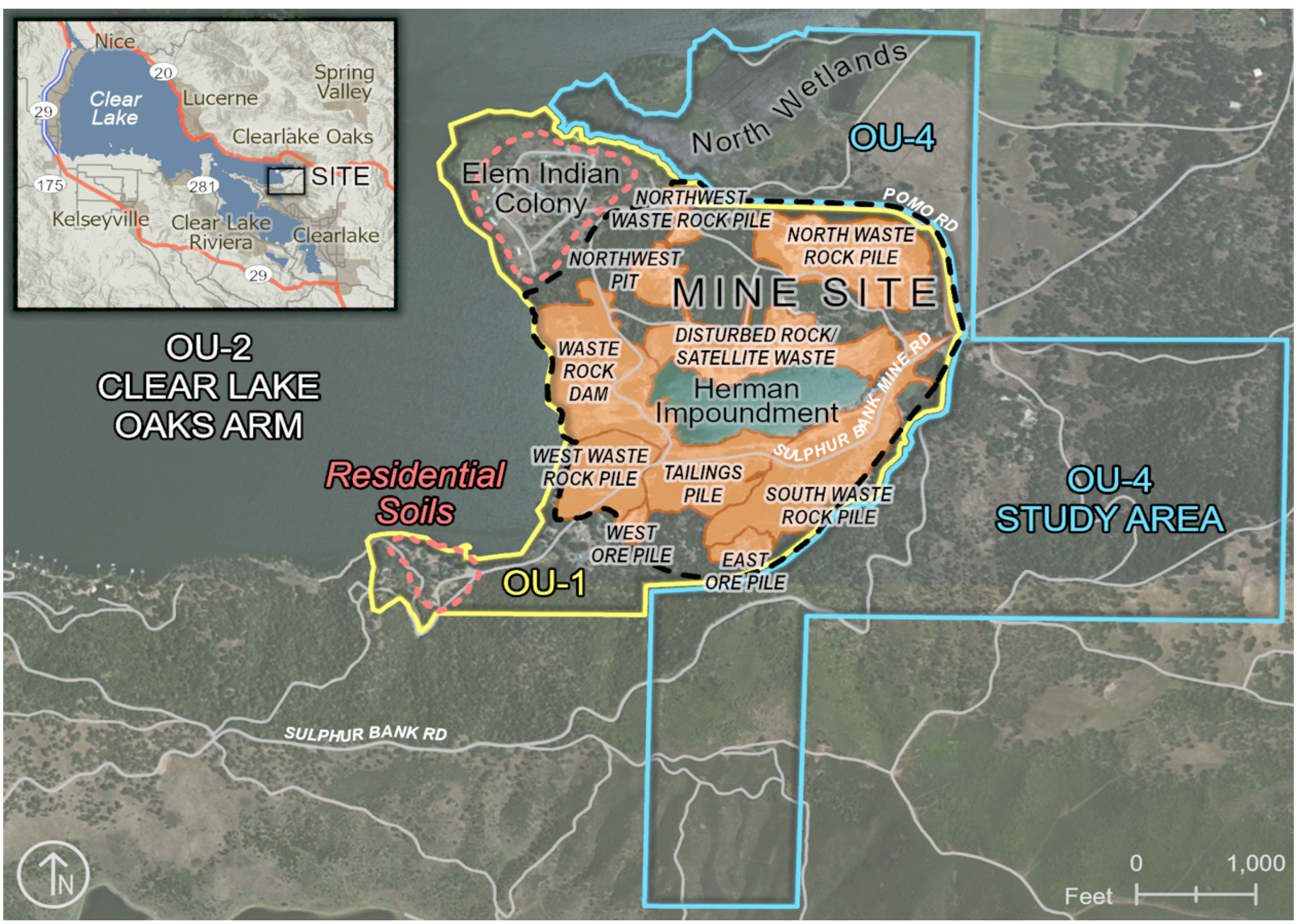
The 160 acre mine site is located on the eastern shore of the Oaks Arm of Clear Lake, approximately 70 miles northwest of Sacramento. The mine operated intermittently from 1865 to 1957, during which both underground and open pit mining technologies were employed. Waste rock and low-grade ore distributed across the site contain high levels of mercury and arsenic and form an acidic solution when contacted by rainwater. The site was placed on the Superfund National Priorities List (NPL) in August 1990 due to the impact of site contamination on the residents near the mine and the people and wildlife who use the resources of Clear Lake. EPA has split the site into three "operable units" (OUs) to allow development of specific cleanup plans for unique parts of the site.

(1) OU-1 (the mine portion of the site) is approximately 160 acres and includes:

- 2.25 million tons of mine waste distributed across 9 waste rock, tailings, and ore piles
- Residential areas and roadways where mine waste was historically used for construction, including the Elem Indian Colony (EIC), BIA Road 120, and the neighborhood along Sulphur Bank Mine Road.
- The flooded open pit mine (Herman Impoundment) was once designated as "OU-3", but has since been incorporated into Operable Unit 1.

(2) OU-2 (Clear Lake and its sediments) includes the waste rock and contaminated sediment below the surface of Clear Lake, primarily in the Oaks Arm.

Figure 1: *Site map showing the different parts of the site, key features and where the site is located on Clear Lake.*

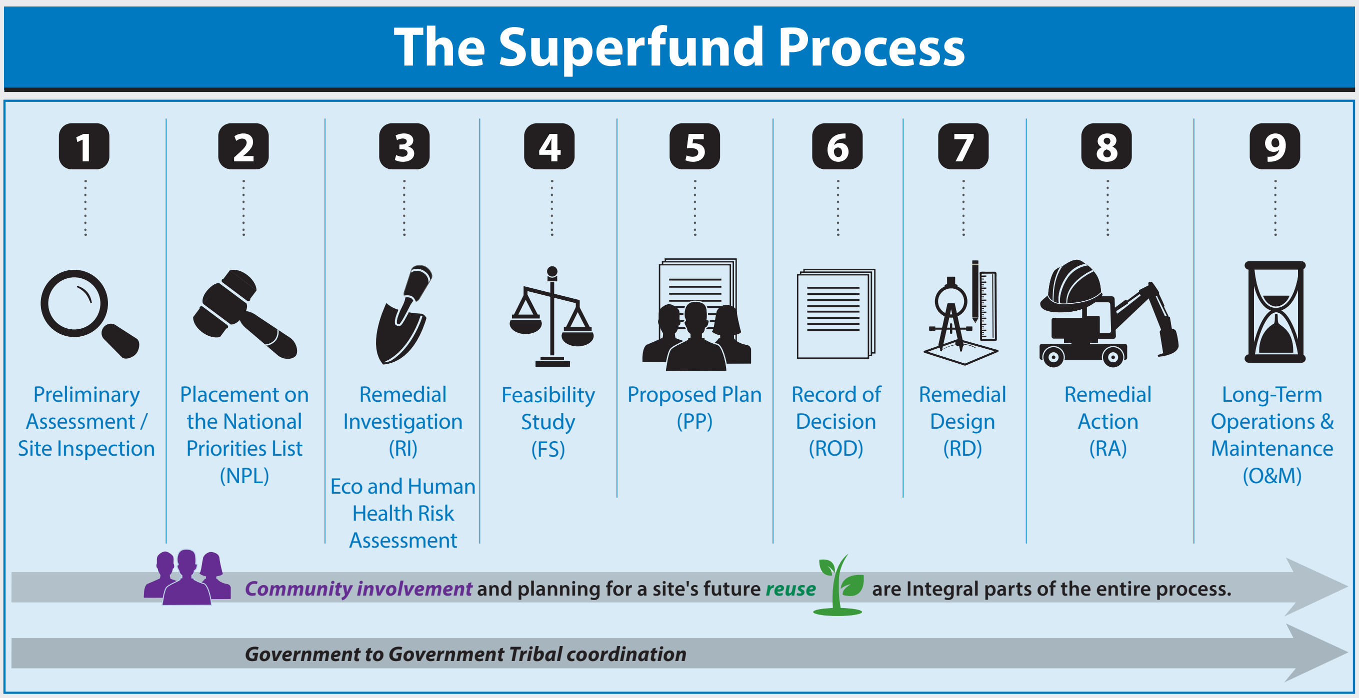


(3) OU-4 (the North Wetlands and nearby lands) includes the wetland area north of the mine site where the former mine operator placed mine waste and discharged mine-influenced water. OU-4 also includes study of the land east of the mine, believed to have only small amounts of site contamination.

What caused the contamination at Sulphur Bank Mine?

The Sulphur Bank Mercury Mine site has a long history of mining activity which led to mine waste being distributed across the site and into Clear Lake. Highlights of the site's mining history include:

- In 1865, the California Borax Company began sulfur mining at the site, which continued through 1871.
- In 1873, the mine reopened for mercury production. Over the subsequent 30 years a total of 6 major underground mine shafts were constructed. The "Herman Shaft" was the deepest of these, reaching 450 feet below the surface. Underground mining was ultimately abandoned in 1906.
- In 1927, the Bradley Mining Company began open pit mining operations using power shovels and updated blasting techniques. By 1943 the open pit, named Herman Pit, had been mined to a depth of approximately 100 feet, 60 to 70 feet below the water surface in Clear Lake. Water pumped from Herman Pit to keep the mining operations dry was discharged either directly to Clear Lake or into the Northwest Pit, where it then overflowed to the North Wetland area.



EPA is cleaning up the Site through the Superfund process, which is based on a law called the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). CERCLA gives EPA the ability to respond to hazardous sites that threaten public health and the environment.

At the Sulphur Bank Mercury Mine Site, EPA is both funding and leading the cleanup (as the lead agency). EPA's work at the site has been closely coordinated with a Multi-Agency Team that includes:

- the California **Department of Toxic Substances Control (DTSC)**;
- the Central Valley **Regional Water Quality Control Board (RWQCB)**; and
- the Elem Indian Colony (EIC) Environmental Protection Agency.

The team is deeply committed to working with the broader local community to ensure its planned clean up best meets the needs of everyone affected by the Site.

- In 1957 all operations were ceased and the pit began filling with groundwater and stormwater, forming what is now referred to as Herman Impoundment

History of site investigations and cleanups

Study and Cleanup Work Before Superfund

The majority of studies and cleanup actions performed before the site was added to the Superfund Program were led by the California Central Valley Regional Water Quality Control Board (RWQCB). The first of these dates back to the 1950's when the RWQCB began routine inspections and collected monitoring data to determine compliance with discharge limitations. The Bradley Mining Company completed several actions in response to requests and orders from the RWQCB, including construction in 1979 of an earth and rock dam at the west end of Herman Impoundment in an effort to reduce the discharge of water from Herman Impoundment into Clear Lake. Unfortunately, these control measures were not sufficient to adequately protect human or environmental health from the risks posed by site contamination.

In 1983 the Clear Lake Mercury Task Force was created in response to the identification of elevated levels of mercury in the fish in Clear Lake. This task force included representatives from California Department of Fish and Game, the RWQCB, California Department of Health Services (DHS), the EIC, several local and county agencies, and interested members of the public. In 1986, DHS issued a public health advisory recommending limits on human consumption of Clear Lake fish, the first such advisory for the State of California.

When the Site was placed on the NPL in August 1990, EPA became the lead regulatory agency.

EPA Site Investigations

After adding the site to the Superfund list, EPA pursued emergency clean up measures (detailed in Part 4), while it evaluated the types of contamination, their location, movement, and significance (the "nature and extent of site contamination").

EPA has published its findings regarding the contamination at the mine site in a number of key reports shown in the timeline (shown below). The Remedial Investigation Report completed in 2002 delineated the nature and extent of contamination found across the mine site. Further study since then has refined those findings to that shown in Figure 3 below.

Details of EPA's study of site risks and cleanup options are presented in Sections 4 and 5.

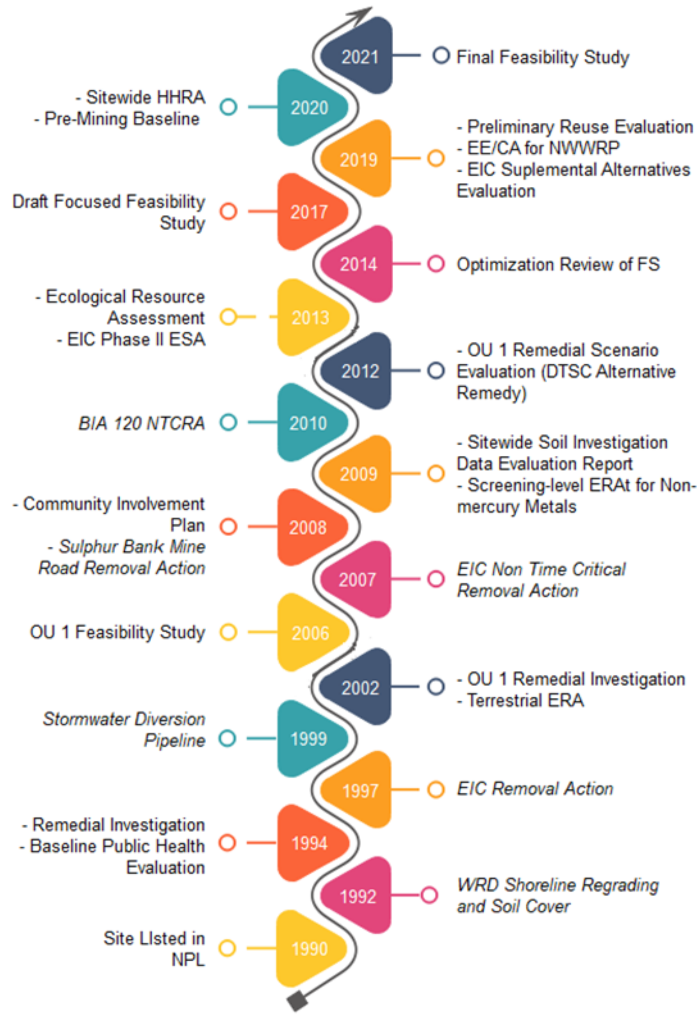


Figure 2: *Timeline of EPA actions and major investigation work.*

Superfund Enforcement History

CERCLA, the Superfund law, imposes liability on parties responsible for causing or contributing to contamination at a Superfund site. In April 2012, the Federal government and Elem Indian Colony (EIC) entered into a Consent Decree with the Bradley Mining Company. This legal settlement included direct payments by the Bradley Mining Company to USEPA and the EIC, payments by the Bureau of Indian Affairs to address mine waste used by the Bureau in construction on and around EIC lands, and the establishment of the Sulphur Bank Redevelopment Trust to take ownership of 11 parcels of land in the area, including the mine site itself. Of these 11 parcels, 5 are intended for eventual transfer to the EIC in partial compensation for the impact the mine has had on the natural resources essential to their traditional tribal lifeways. Direct payments by the Bradley Mining Company totaled only a fraction of the total anticipated cost of cleaning up the SBMM site due to the company's limited financial assets.

What are the contaminants and where are they located?

Contaminants of Concern

Arsenic and mercury are the site contaminants that pose the greatest risk to human health and the environment, for this reason they are the primary **contaminants of concern (COCs)** at the site. The mine site contains approximately 2.25 million tons of mine waste containing arsenic and mercury. Mine waste includes soil, ore, waste rock, tailings, and other materials processed during mining operations. This material is concentrated in several large waste piles on the mine property; including the Waste Rock Dam and the other waste rock piles.

Areas of Concern within OU-1

Parts of the site where contaminants of concern are found.

Source Areas: The Source Areas include mining waste in waste rock piles, ore piles, mine tailings, disturbed rock (where mining activities were taking place), the Northwest Pit (a small open mining pit), and the historic mine processing buildings.

Waste Rock Dam: The Waste Rock Dam consists of a large pile of mine waste that was placed on the shore of Clear Lake between the Herman Impoundment and the lake. The Waste Rock Dam is not a conventional dam and does not prevent Herman Impoundment water from flowing through it as groundwater into Clear Lake.

Though the surface of the waste rock dam has been covered with clean material, its interior contains areas with high levels of mercury and areas that produce strong acid when contacted by water. A hydrothermal spring also exists under the northeastern portion of the WRD that might contribute to the release of mercury from this area.

Off-Mine Residential Soil: Mine waste was used as a construction material in the 1940s and 1970s, resulting in contamination in residential areas of the Elem Indian Colony and the neighborhood south of the mine along Sulphur Bank Mine Road. Waste was also used in the construction of BIA Road 120. EPA has removed or capped the majority of the mine waste from these areas, however small amounts remain.

Herman Impoundment: The Herman Impoundment is the open pit from which the mercury-containing rock (ore) was mined. It is over 90 feet deep and now is filled with a mixture of stormwater, shallow groundwater and deep hydrothermal groundwater from an underground spring.

Source Material

With the exception of Herman Impoundment, all of the areas of concern with OU-1 are considered "source material," which includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water, air, or acts as a source for direct exposure. Source material is characterized as either principal threat waste or low-level threat waste. Principal threat waste is material considered to be highly toxic or highly mobile and, in general, cannot be reliably contained and/or would present a significant risk to human health or the environment should exposure occur. Low level threat wastes are those source materials that can be reliably contained and that present a low risk in the event of release.

All OU-1 source materials are principal threat waste, and none are low level threat waste. The source materials all include surface soil contamination, which is mobilized as a result of surface runoff, wind, and groundwater flows (particularly as it flows through Waste Rock Dam toward Clear Lake). The source materials are also highly toxic due to the presence of arsenic and mercury at levels exceeding potential risk thresholds.

How does contamination from the site move in the environment?

Historically, the mine operators dumped mercury-containing waste directly into Clear Lake or placed it where it could erode into the lake. EPA and State actions at the site have largely stopped mercury from entering the lake in these ways. Today, it is primarily the movement of stormwater and groundwater that transports contamination from Sulphur Bank Mine into Clear Lake or elsewhere off the site.

Acid Mine Drainage (AMD) is created when rainwater or groundwater mix with mine waste material. The acidic water that is formed pulls the mercury, arsenic, and other COCs out of the mine waste and carries them with it. In this way, when groundwater flows from Herman Impoundment to Clear Lake by traveling through the Waste Rock Dam, it becomes contaminated with mercury, which is then deposited in Clear Lake. Once the mercury is in the lake, it builds up in the food chain, making certain fish unhealthy to eat. The levels of mercury in the fish in Clear Lake led the state to issue an advisory recommending the public limit how much fish is eaten from the lake.

Figure 3 shows how water and contaminants move through the environment at Sulphur Bank Mine.

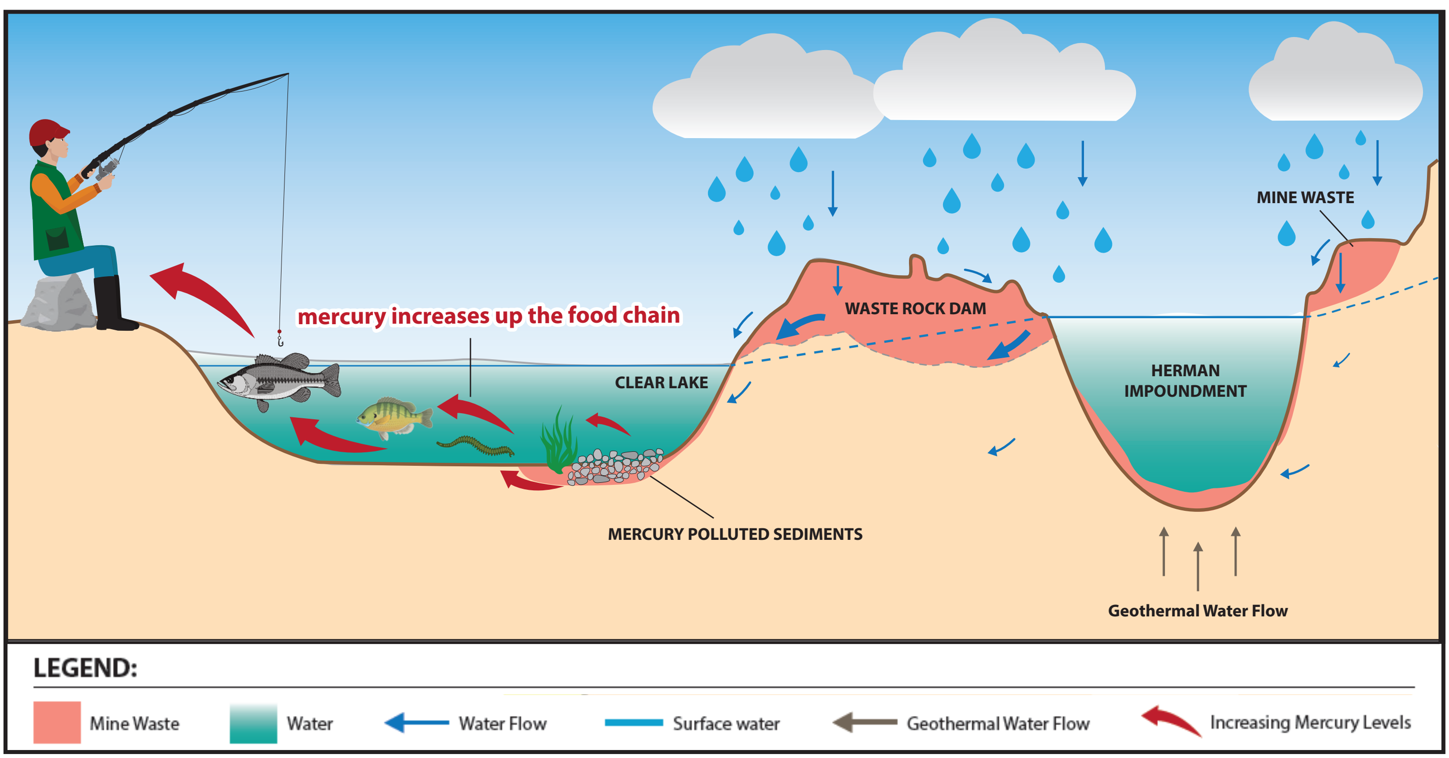
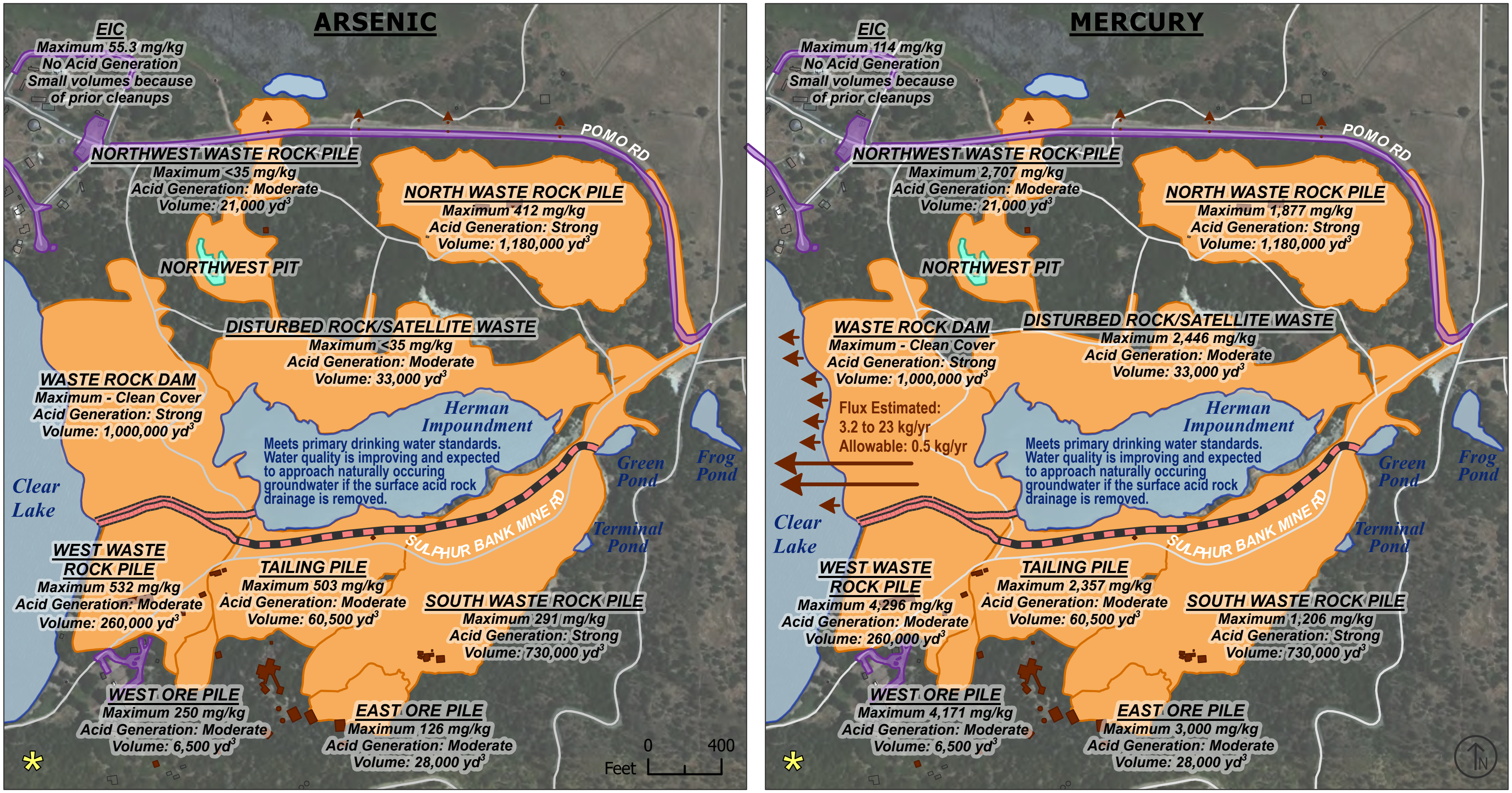


Figure 3: *Sulphur Bank Mine Site Model - how mercury and other contaminants move in the environment.*

Nature and Extent of Contamination within OU-1



Summary of Current Conditions for Arsenic Contamination

Groundwater flowing into Clear Lake does not exceed drinking water standards for arsenic.

Direct contact with arsenic in the source area soils can cause health risks to the public and ecological system.

Windblown dust from the source areas can cause arsenic contamination to move off the mine site.

Arsenic is more toxic in soils than mercury, and cleanup of arsenic would need to be to background concentrations.

*
There are areas south of these maps with contaminated soils and which are included in the proposed plan. The total estimated volume of contaminated soils on EIC and south residential areas is around 2,000 cubic yards.

- Source Area
- Surface Water (Non-contaminated)
- Surface Water (Contaminated)
- Mining Operation Related Buildings
- Off-mine Residential Soils
- Groundwater Exiting the Site
- Potential Groundwater Exiting the Site

Overflow Diversion System

- Above Ground
- Below Ground

Summary of Current Conditions for Mercury Contamination

Mercury flows into Clear Lake along the Waste Rock Dam, above the amount allowed by the Regional Water Board. The groundwater flowing below Waste Rock Dam picks up mercury and takes it to Clear Lake.

The water in Herman Impoundment is below drinking water standards for mercury, and has improved in the past decade. Concentrations of aluminum have dropped and the water is more neutral.

The acid on the site is Acid Rock Drainage from the source areas. Acid Rock Drainage is created when water contacts mine waste material.

The groundwater beneath the site is not suitable for a drinking water source because of naturally occurring geothermal spring water.

The groundwater in the North Wetlands has not been found to be contaminated and monitoring continues in that area.

Direct contact with mercury in the source area soils can cause health risks to the public and ecological system.

Windblown dust from the source areas can cause mercury contamination to move off the mine site.

Wildlife still accesses the site and if harvested could contain elevated mercury or other contaminants. This could lead to impacts to the Elem's health or restrict their ability to practice their traditional hunting and foraging.

Figure 4: *Summary of contamination for Operable Unit 1.*

PART 4: Risk Management

Prior EPA actions to reduce risk

Figure 5: *Excavation of mine waste during, residential soils cleanup work on the Elem Indian Colony (1997 – 1998, 2007).*

EPA prioritizes those actions that will address the most serious risks to human health and the environment. Therefore, while studies were taking place, EPA reduced the risk posed by the Site to the public and Clear Lake by taking six major early cleanup actions, including:

- **1992 Waste Rock Dam Shoreline Regrading and Soil Cover**: The Waste Rock Dam was eroding directly into Clear Lake, so EPA performed an emergency action under Superfund removal authorities to armor the shoreline with large boulders, regrade (reduce the slope of) the waste pile, and cap this highly contaminated material with clean soil.
- **1996 – 1997 Elem Indian Colony residential soils cleanup:** Mine waste had been used as a construction material on the Elem Indian Colony, so under emergency authority, EPA removed the most highly contaminated soil and placed clean soil on top.
- **1999 – 2000 Stormwater Diversion Pipeline:** Stormwater flowing into Herman Impoundment was causing it to overflow directly into Clear Lake. Under a time-critical removal action, EPA installed stormwater diversions and a conveyance pipeline to carry stormwater around the mine on its way to Clear Lake.
- **2007 Elem Indian Colony additional soils cleanup:** Additional contamination was found on the EIC, including in some homes. Under non-time-critical removal authority, EPA excavated more soil, placed more clean soil to cap contaminated areas, and renovated or replaced any homes where indoor contaminant levels were unsafe.
- **2008 Sulphur Bank Mine Road cleanup:** Contamination was found near homes south of the mine as well, so EPA performed a further non-time-critical removal to excavate contaminated areas and cap them with clean soil.
- **2010 BIA 120 cleanup:** The road into the EIC was built with mine waste, so EPA repaired the road under a non-time-critical removal action and permanently sealed the site-related contaminants under new pavement.

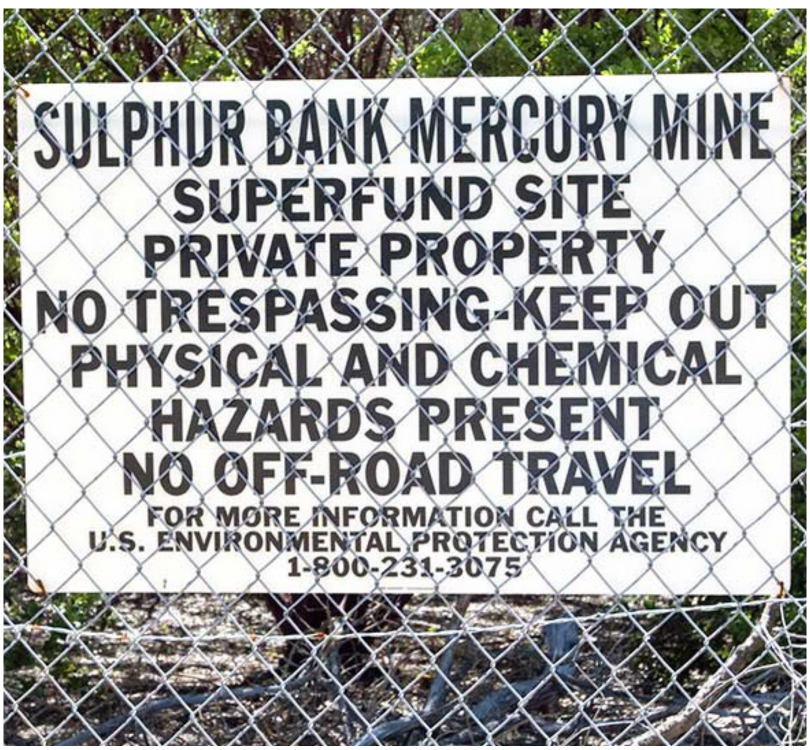
These actions were completed in a manner intended to be consistent with the eventual final cleanup (remedy) for the Site, however the cleanup levels used for mercury and arsenic (80 mg/kg and 50 mg/kg, respectively) were less stringent than the cleanup levels (PRGs) now being proposed. EPA's preferred cleanup approach will ensure these actions were sufficiently protective, expand them where needed, and maintain the remedies implemented in these emergency actions.

Risks Posed by the Site

Human Health Risk Assessment (HHRA)

The Sulphur Bank Mercury Mine Site impacts the health of the Clear Lake community and the surrounding environment whenever the public or ecosystems are exposed to high levels of mercury, arsenic, or other contaminants from the site. EPA evaluated the risk the site poses to humans in a study called a Human Health Risk Assessment (HHRA) (2020), while risks to mammals, birds, plants, and the ecosystem was studied in an Ecological Risk Assessment (ERA) (2002). The HHRA was performed to evaluate the potential human health effects associated with chemicals at the Site.

Although EPA's Proposed Plan is for OU-1, the risk assessment looked holistically at all sources of risk across the site. Those risks associated with Clear Lake and the North Wetlands do not directly affect EPA's cleanup decision for OU-1, but are included in this summary for completeness.



Signs at Operable Unit One cautioning against trespass.

What/where did EPA study in the Human Health Risk Assessment?

- Mine waste materials and soils on the site.
- Residential soils on the Elem Indian Colony (EIC)and the residential areas south of the mine (residents included exposure to soil in their yards and road).
- Sediments in Clear Lake (OU-2) and the North Wetlands (OU-4) near the mine site.
- Surface water samples onsite and from nearby waters, including Clear Lake and the wetlands.
- Drinking water in homes near the mine that draw water from Clear Lake for consumption.
- Fish tissue (crappie, bluegill, catfish, largemouth bass, and 6 other species) from different parts of Clear Lake.
- Wild plants (including acorns, tules, and cattails) from the North Wetlands, mine site and the EIC.

Who was considered for the Human Health Risk Assessment?

- Traditional tribal users of the land and lake.
- Clear Lake residents.
- Recreational users, including fishermen (with both a low and a high fish consumption rate) and swimmers/waders (exposed to sediment and surface water), and
- Unauthorized users/trespassers onto the mine site (exposed to on-mine soil, exposure to surface water while swimming in Herman Impoundment, and inhalation of harmful vapors).

What tribal exposures were considered?

Traditional practices for a member of the Elem Indian Colony, including:

- Eating fish, waterfowl and local plants (acorns, tules, cattails) at traditional consumption rates assuming 100 percent of calories come from areas affected by the site;
- Drinking water from Clear Lake (as the sole source of drinking water);
- Exposure to soil in yards

In summary, the **Human Health Risk Assessment** found that:

- Eating more fish from Clear Lake than recommended by State fish advisories poses a significant risk to both tribal and recreational fisher-people.
- Exposure of the public to mine waste and contaminated soils on the site presents significant risk that warrants EPA action to clean up the waste piles on the mine site.
- Residential soils south of the mine require further cleanup to address excess risk to residents.
- Acorns harvested from oaks growing in mine waste are a risk to tribal members due to arsenic accumulation.

How was human health risk calculated?

Specific risk calculations are performed for both cancer-related and noncancer-related risks. For chemicals with cancer-causing properties, risk is calculated based on the estimated total excess lifetime cancer risk posed by the exposure. Under the Superfund program, EPA generally considers action to be necessary when the total cancer risk caused by a given exposure would cause more than 1 additional cancer case for every 10,000 people exposed throughout their lifetime. This level of cancer risk is presented as 1x10-4 or 1E-04. EPA does not generally consider action necessary where risk is less than 1 cancer case per million people exposed (1E-06). Between these two values of 1E-06 and 1E-04, the need for action is judged on a case-by-case basis.

Noncancer risk is calculated where chemicals cause harm to human health in ways other than an increased incidence of cancer. These risks are presented via their **hazard index**. The hazard index is simply the calculated exposure compared against a defined maximum acceptable dose. A hazard index that is greater than 1 means that the exposure exceeds the maximum acceptable dose and therefore is generally considered to warrant cleanup action.

The HHRA results summarized below are based on total risk calculated for each affected group. They represent the sum of all risks the site poses for each scenario presented. These risk estimates are calculated based on conservative assumptions, meaning that they represent the highest amount of exposure to site contamination that can be reasonably expected for each scenario. This approach is intended to prevent site impacts to human health from being under-estimated.

Results of Human Health Risk for Each Affected Group

The results of the sitewide HHRA for each effected group are as follows:

Recreational User of Clear Lake (includes recreational fishing): The total lifetime cancer risk is within the EPA's risk management range of 1E-06 to 1E-04, and the site risk (1E-5) is similar to background risk (8E-6). The primary exposure pathway contributing to cancer risk is exposure to sediment when wading near the mine site, and the primary contributor is arsenic. The non-cancer hazard index in excess of background was calculated to be 13, which exceeds the EPA's threshold of 1. The primary exposure pathway is consumption of recreational caught fish, and the primary chemical contributor is methylmercury. Methylmercury causes neurological damage, particularly to the developing brain of unborn babies during pregnancy and young children.

Lakeside Resident: The total lifetime cancer risk exceeds the EPA's risk management range (1E-06 to 1E-04); however, the risk posed by the Sulphur Bank Mine site (7E-4) is similar to the background risk resulting from cancer-causing substances unrelated to the site (5E-4). The primary exposure pathways contributing to the cancer risk are drinking untreated water directly from the lake and incidental soil ingestion in the residential area, and the primary contributor is arsenic. The noncancer hazard index in excess of background for an adult was calculated to be 7 and for a child 24. The primary exposure pathways contributing to the noncancer hazard index are drinking lake water and incidental soil ingestion and the primary contributors are arsenic, antimony, and thallium.

Unauthorized Users (of the mine site): The total lifetime cancer risk (3E-5) is within EPA's risk management range. The primary exposure pathway contributing to the cancer risk is incidental ingestion of contaminated soil on the mine site, and the primary contributor is arsenic. The noncancer hazard index in excess of background was calculated to be 5. The primary exposure pathway is incidental ingestion of on-mine soil, and the primary chemical contributor is arsenic.

Traditional Tribal Receptor : The total lifetime cancer risk exceeds the EPA's risk management range (1E-06 to 1E-04); however, the site risk (2E-3) is similar to background risk (2E-3). The primary exposure pathways contributing to the cancer risk are drinking of untreated water directly from the lake and incidental ingestion of soil, and the primary contributor is arsenic. The noncancer hazard index in excess of background was calculated to be 20 for an adult and 23 for a child. The primary contributors to the noncancer hazard index in excess of background are consumption of fish, waterfowl and plants at subsistence levels. The primary chemical is methyl mercury.

Collecting Tule Roots for the Human Health Risk Assessment.

Ecological Risk Assessment (ERA)

EPA evaluated the risk for plants, birds and mammals in a study called an Ecological Risk Assessment (ERA) (2002). The ERA evaluates the likelihood of adverse ecological effects from the interaction of site contaminants with the environment. The ERA found that soils containing aluminum, antimony, and lead, in addition to arsenic and mercury, pose probable risk to plants, birds and mammals in areas affected by the mine site. In the evaluation of cleanup options for the SBMM site (OU-1), EPA found that the cleanup actions required to protect human health and meet environmental regulations will also address the ecological risks for this portion of the site.

It is the lead agency's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

PART 5: Evaluation of Cleanup Options

Current and Future Land Uses

Current Land Use

There are two residential areas near the mine, the residents of which are at greatest risk of contact with site related contaminants. The EIC immediately north and adjacent to the mine site and the residents to the south and southwest of the mine.

The former open pit mine at SBMM is inactive. Current land use includes undeveloped open space and unauthorized entry/use by members of the EIC. EIC leadership has indicated that members enter the site to collect wood, plants and for subsistence hunting, as well as for recreation among adolescents. A number of parcels surrounding the mine site are currently held by the Sulphur Bank Redevelopment Trust.

While there are portions of the mine property north of Herman Impoundment that do not contain mine waste and could potentially be sold by the Redevelopment Trust with few restrictions following remediation, much of the property will have engineered covers vulnerable to damage. In these areas, permanent institutional controls, including access restrictions, will be required to ensure the long-term integrity of the remedy.

Reasonable Anticipated Future Land Use

The Reasonably Anticipated Future Land Use (RAFLU) for the Site is therefore primarily undeveloped open space with traditional tribal use where post-remediation conditions will allow. This future land use was determined by EPA in collaboration with the Multi-Agency Site Team, based on the need to balance the requirements of the remedy with the requests of the EIC, who have indicated their desire to purchase and/or access the land after the cleanup in order to practice traditional tribal activities. Wildlife would not be restricted by conventional fencing and therefore the tribal practice of harvesting local game could involve wildlife and game that pass through or live on portions of the site that have been remediated. EPA anticipates evaluating possible design elements such as pedestrian corridors to enable safe transit across the site.

It is assumed that the residential areas included in OU-1 on the EIC lands and south of the mine site will continue to be used as residential land.

View of Herman Impoundment looking South.

What are EPA's objectives and goals for the cleanup?

Cleanup (Remedial Action) Objectives (RAOs)

RAOs are overarching goals to be met by the cleanup plan that inform the contaminants of concern, exposure routes and affected groups (receptors), and the acceptable chemical level for each exposure route.

They are based on considerations such as:

- protecting human health and the environment;
- where site contamination occurs;
- how it moves;
- how the community and environment come into contact with it; and
- what the future use of the site is expected – the RAFLU.

Based on the current and anticipated future land use, the following Remedial Action Objectives for the SBMM site were developed with input from the Elem Indian Colony, the California Regional Water Quality Control Board and the California Department of Toxic Substances Control.

In evaluating future use of the Sulphur Bank Mine property, the Elem Indian Colony expressed its desire to use the site for traditional tribal purposes following site remediation. Although future property ownership is uncertain, this future use is reasonably anticipated and therefore informs the Remedial Action Objectives described below. In addition, in order maximize land available for *unrestricted* tribal use, an informal remedial action objective of maximizing consolidation of waste away from the Elem Indian Colony will be incorporated into EPA's design of the selected remedy.

Remedial Action Objectives

1. Reduce risk posed by contact with mining wastes/on mine soils to acceptable levels for reasonably anticipated future land uses.
2. Control off-site transport of Contaminants of Concern in surface water and dust, at concentrations that would result in unacceptable degradation of surface and groundwater resources or at levels not in compliance with applicable or relevant and appropriate requirements.
3. Prevent exposure to contaminated soil that contributes to excess risk for residential users in the residential areas and associated roads.
4. Prevent Acid Mine Drainage generation by surface water infiltration through mining waste where this AMD would cause or substantially contribute to exceedance of water quality standards.
5. Limit transport of Contaminants of Concern in accordance with the Clear Lake Mercury TMDL

Preliminary Cleanup (Remediation) Goals

Preliminary Remediation Goals (PRGs) are the numeric level to which site contaminants will be cleaned up to under this Proposed Plan. There are different PRGs for different portions of the site based on:

- the risk posed to the public;
- the regulations that apply to the area and
- the **background** concentration of each contaminant (since arsenic, mercury, and other pollutants at the site occur naturally in the environment).

EPA cannot cleanup to levels below those that would occur at the site had the mine not been constructed (referred to as "background" levels). For this reason (except if the environmental regulations dictate otherwise), the cleanup levels listed in Table 1 below:

- were decided based on what will be fully protective of human health and
- are based on the Human Health Risk Assessment or are the natural background levels (whichever is higher.)

Table 1: Preliminary Remediation Goals

Media	Preliminary Remediation Goals	Basis for the Remediation Goal
On-mine Soil	Mercury = 245 mg/kg Arsenic = 22 mg/kg Antimony = 622 mg/kg	Addresses RAOs 1, 2, and 4. Mercury and antimony goals are based on the risk-based safe exposure limit from the HHRA. Arsenic goal is based on the estimated background concentration for the soils over Andesite formation rock.
Off-mine Residential Soil	Mercury = 35 mg/kg Arsenic = 18 mg/kg Antimony = 15 mg/kg	Addresses RAO 3. Off-mine residential soil goals will be based on estimated background concentrations for mercury and arsenic. Each residential lot will be evaluated and cleaned up based on comparison against background. Numeric goals shown are "not to exceed" levels. The antimony goal is a risk-based value.
Groundwater	Mercury - Annual Load to Clear Lake = 0.5 kg/year	Addresses RAOs 2 & 4. Total mercury load target via the groundwater pathway is based on the RWQCB's Basin Plan Mercury TMDL for Clear Lake. This target was determined by the State to enable long term recovery of mercury levels in Clear Lake.
Surface Water	Mercury = 0.050 μg/L Arsenic = 0.01 mg/L	Addresses RAOs 2 & 4. Surface water goals are based on the EPA California Toxic Rule Water Quality Standards and the State of California Maximum Contaminant Levels/ California Primary Drinking Water Standards.

How did EPA evaluate possible cleanup options?

EPA has evaluated a wide range of cleanup options (Remedial Alternatives) to reduce the risks the site poses to human health and environment. These evaluations considered:

- 9 General Response Actions (cleanup methods, such as capping, treatment or offsite disposal),
- 25 Remedial Technologies (such as different types of caps or water treatment processes), and
- 54 Process Options (different ways of using the cleanup technologies in each area of concern).

EPA's evaluations of cleanup options for OU-1 are documented in two Feasibility Studies (FS).

1. the first was completed in 2006 and
2. the second was a **Focused Feasibility Study (Focused FS or FFS)** completed in 2021.

The tables below summarize the remedial alternatives evaluated in these studies and the timeline shows how EPA's early actions at the site, changes in site conditions over time, and input from EPA's partners on the Multi-Agency Site Team led to the updated alternatives from which the Preferred Alternative is being selected.

Table 2: 2006 OU-1 Feasibility Study
COMPONENTS OF ALTERNATIVES CONSIDERED

2006 REMEDIAL ALTERNATIVE COMPONENTS	ALT 1	ALT 2	ALT 3	ALT 4	ALT 5	ALT 6
Hydraulic Barrier Wall	X			X		X
Water Treatment Facility		X	X		X	
Re-Grade and Cap Waste Rock Dam	X	X	X	X	X	
Re-Grade and Cap North Waste Rock Pile			X	X	X	
Re-Grade and Soil Cover All Remaining Waste Areas				X	X	
Reclaim with Topsoil and Revegetate All Disturbed Area						X
Excavate and Relocate Ore Piles	X	X	X	X	X	
Excavate and Relocate North West Waste Rock Pile	X	X	X	X	X	
Excavate and Relocate Mine Waste Along Shoreline				X		
Backfill Northwest Pit						X
Removal and Off-Site Transport All Mine Wastes						X
Create a Shallow Cover in the Absence of WRD						X
Repository Located on the South Waste Rock Pile	X	X	X	X	X	
Intercept and Pump Shallow Groundwater Flowing from North to Herman Impoundment	X	X				

Site Activities that Influenced EPA's Development of the Second Evaluation of Cleanup Options in the Focused Feasibility Study

Year	Activity	Impact on Developing Alternatives in Focused FS
2004 – 2006	OU-1 Feasibility Study	Cleanup alternatives were developed for OU-1 after considering a wide range of general response actions, technologies, and process options.
2007	EIC additional soils removal	Additional soils were removed from the EIC to further reduce risk.
2007 – 2009	Sitewide Soil Investigation covering areas outside OU-1	Soils were found to be contaminated in small quantities in residential areas. This led to including residential soils in the FFS.
2010	BIA 120 Removal Action and road improvement	The removal action relocated contaminated soils along the BIA 120 road to OU-1. The northern portion of the NW WRP was left in place and is included in the FFS.
2012	CA DTSC proposed a new strategy	DTSC proposed a strategy based on removing the mercury waste beneath the Waste Rock Dam that was contacting groundwater, and more aggressive consolidation and capping to reduce acid generation and exposure to contaminated soils.
2013 – 2021	Herman Impoundment pH has become more neutral and aluminum concentrations dropped substantially	The 2006 FS included pumping the Herman Impoundment so acidic water containing aluminum would not reach Clear Lake. Aluminum could create a floc in Clear Lake, making mercury more mobile. Herman Impoundment water improving indicates it is can return to pre-mining conditions, so pumping Herman Impoundment was not included in the FFS.
2016	Geochemical modeling of future conditions	A geochemical model indicated Herman Impoundment would improve to natural conditions if the source areas were capped and acid generation was reduced. This led to the Herman Impoundment alternatives focusing on monitoring, stormwater control, and assuring groundwater leaving Herman Impoundment would not encounter waste rock.
2018 – 2020	Updated Human Health Risk Assessment	New data, more stringent toxicity values, and traditional EIC tribal practices were included in a sitewide HHRA. The HHRA influenced the soils cleanup levels and confirmed that Herman Impoundment did not pose a human health risk from contamination.
2018	EIC Supplemental Alternatives	The EIC proposed three new alternatives. The alternatives were evaluated and significant implementation issues, including disposal of treated water, were insurmountable. The process led to an understanding that removing wastes nearest the EIC was preferred by the tribe. The FFS consolidation alternatives allows for removing waste piles nearest the EIC.
2019 – 2020	Determination of pre-mining background concentrations in surface soils	The pre-mining baseline study, along with the HHRA, provided the preliminary remediation goals (PRGs) for the soils in the FFS.
2019 – 2020	Strategic Planning Process – Facilitated by EPA with the Multi-agency Team	It was agreed that the OU-1 remedy could be selected with the current understanding of the site and cleanup options, as described in the FFS. The idea of dividing the action into two phases was proposed and agreed to have merit.

EPA Cleanups Led to Changing Conditions, Changing Understanding

Stormwater monitoring and geochemical modeling indicate that surface water runoff into **Herman Impoundment** has historically contributed a significant amount of acid to the Impoundment water. EPA's efforts to reduce contaminated runoff from the mine, in conjunction with dry weather conditions during the 2012-2016 drought, caused **Herman Impoundment's** water to become less acidic, less polluted, and more like the natural volcanic groundwater that once flowed from a spring at the site in the days before the mine was built.

The implication of this change was that Herman Impoundment's water was not a source of pollution itself and so did not require direct treatment. Further EPA study found that Herman Impoundment's water quality could be expected to continue to improve, moving even closer to the natural (**background**) groundwater quality once the rest of EPA's cleanup was implemented.

Informed by this, the state of California recommended an alternative approach for cleaning up the site, leading to the development of the **Focused Feasibility Study (FFS)**.

A Second Evaluation of Cleanup Options in a Focused Feasibility Study

Based on the changing conditions and understanding of the Site following the completion of the 2006 Feasibility Study, the following cleanup strategy was recognized:

1 Stop acid mine drainage from being formed by the Source Areas and flowing into Herman Impoundment.

2 Without AMD entering the Impoundment, the water in the Impoundment would be a mix of rainwater, (clean) stormwater, and natural groundwater.

3 Prevent the groundwater exiting Herman Impoundment from contacting the waste rock in the Waste Rock Dam and the site would no longer release contamination into the environment.

Through a series of technical workshops, the Multi-Agency Team developed a new set of cleanup alternatives better matching the current site conditions and with the new cleanup strategy in mind. The new cleanup alternatives are presented in the **Focused Feasibility Study (FFS)** and are described in the table below. Included in all alternatives is a pre-design investigation to provide further detail to support final design of the preferred alternative.

The Focused FS evaluated alternatives from the 2006 FS that were still relevant under the changed site conditions as well as new alternatives. The following table summarizes the components for each potential remedial alternative by area of concern. Alternative 1 is always the No Action alternative, so it is not shown in the summary table.

The following table summarizes the components for each potential remedial alternative by each of the site areas of concern. ***Each alternative is explained in further detail after the table.***

The table is organized in the following way:

- The first column indicates the various cleanup actions included in all of the options (alternatives).
- The next three columns indicate the different parts of the site (Source Areas, Waste Rock Dam, Herman Impoundment, Residential Soils).
- The Source Area column has three cleanup options (SA-2, SA-3, SA-4).
- The Waste Rock Dam column has two cleanup options (WRD-2, WRD-3).
- The Herman Impoundment column has two cleanup options (HI-2, HI-3).
- The Residential Soils column has one option (RS-2).
- The X's indicate which cleanup action is included in each alternative.

Table 2 Continued: 2021 OU-1 Focused Feasibility Study Components of Remedial Alternatives

REMEDIAL ALTERNATIVE COMPONENTS **Indicates the alternative component was carried forward from 2006 Feasibility Study**	Source Areas			Waste Rock Dam		Herman Impoundment		Residential Soils
	SA-2	SA-3	SA-4	WRD-2	WRD-3	HI-2	HI-3	RS-2
Excavate and Relocate Ore Piles	X	X						
Excavate and Backfill Waste Rock Dam Saturated Waste Rock of Significance				X				
Excavate and Backfill Waste Rock Dam Shoreline and Saturated Waste Rock of Significance					X			
Cap Consolidated Source Areas with RCRA Type Cover	X							
Cap Consolidated Source Areas with Evapotranspirative Cove		X						
Consolidate and Cap Remaining Portion of Waste Rock Dam				X	X			
Consolidate Northwest Waste Rock Pile to North Waste Rock Pile	X	X						
Monitor and Maintain						X		
Hydraulic Barrier Wall							X	
Excavate or Cover Residential Soils								X
Removal and Off-Site Transport of All Mine Waste			X					
Stormwater Management	Stormwater management is applicable to all alternatives.							
Contingency Shallow Groundwater Trench on North: Included in the Source Area alternatives.	A groundwater collection trench was evaluated as a contingency in the Focused Feasibility Study, however, currently, the groundwater north of the mine site (in the North Wetlands) is being evaluated as part of the CERCLA process for OU-4. This groundwater is not a source for domestic or municipal use because of very high total dissolved solids that appear to be naturally occuring. Any further corrective action needed to address contamination in the OU-4 will be subject of a subsequent decision document.							
Contingency Groundwater Control within Waste Rock Dam: Included in the Waste Rock Dam alternatives.	As above, though the FFS included a contingency for installation of a groundwater extraction system to remove water from the Waste Rock Dam, this contingency is not being included as part of the preferred alternative for this Proposed Plan. The efficacy and need for such a system is too uncertain at this time. Any further corrective action needed to address migration of contaminants to OU-2 will be subject of a subsequent decision document.							

Applicable or Relevant and Appropriate Requirements (ARARs)

In addition to the provisions and requirements of CERCLA, the need for action and extent of action described in these alternatives is most significantly influenced by the following State regulations. The State of California has asked EPA to comply with these requirements and evaluate whether they fit CERCLA's definition as applicable or relevant and appropriate requirements (ARARs):

1 California Code of Regulations Title 27, Division 2 - Consolidated Regulations for Treatment, Storage, Processing or Disposal of Solid Waste

Provides for classification of mining waste and identifies mining waste repository siting, design and monitoring requirements, including requirements for the type of cap used (based on the characteristics of the waste being managed). About 2.5 million tons of waste will be managed in accordance with these requirements.

Northwest Pit – shown here flooded after heavy rains - will either be filled with mine waste and capped or capped as is. See site map on page 2 for location.

2 California Water Code Section 13240-13243, Amendment to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Mercury in Clear Lake

This amendment to the Sacramento River and San Joaquin River Basins Plan established the Clear Lake Mercury Total Maximum Daily Load (TMDL) as an amendment to the Regional Basin Plan and included the addition of a beneficial use designation of Commercial and/or Sport Fishing, site-specific water quality objectives for methylmercury in fish tissue, an implementation plan for controlling mercury loads, and a surveillance and monitoring program.

Source Area (SA) Alternatives

Remedial Alternatives for Source Areas include the following elements. The summary tables in the following section provide the comparative analysis for the alternative to the National Contingency Plan (NCP) criteria.

- **SA Alternative 1, No Action:** The Superfund law requires EPA to consider a "no action (leave waste in place)" option for every site; which is Alternative 1. (The option establishes a baseline or reference point to compare the other clean-up options.) EPA studied Alternative 1 and found it would not protect human health and the environment and therefore it is not shown in the summary table.
- **SA Alternative 2, On-site Consolidation and Capping with RCRA-type Cap:** This alternative would include:
  - (i) excavation of east and west ore piles and consolidation of the excavated material into south waste rock pile,
  - (ii) excavation of the northern portion of the Northwest Waste Rock Pile and consolidate the excavation material into the Northwest Pit or North Waste Rock Pile,
  - (iii) consolidation of as much as practical to minimize the amount of capping.

The excavated areas will be graded and revegetated to control stormwater. All the polluted material (source area material) will be capped (including the Northwest Pit), which would include the placement of an impermeable liner in the cap. Two options are considered, with the basic difference being the liner.
The two options are:

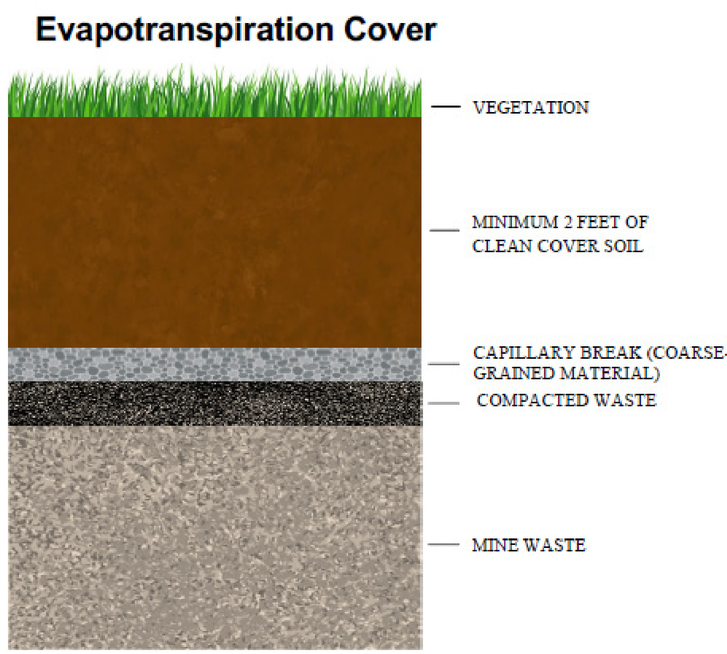
A A **geosynthetic clay liner** (GCL) or

B A **high-density polyethylene** (HDPE) liner.

This alternative also includes:

- cleanup of the former mine operations buildings and the soils around them (clearing debris, demolishing concrete pads within the excavation or capping, hauling debris to landfill, demolishing and consolidating the mining operations retaining wall, and/or excavating soils) and
- a contingency action of a groundwater collection trench along the north side of the mine was evaluated with this alternative, but is not being carried forward with the Preferred Alternative.
- institutional controls to ensure that capped areas areas remain undisturbed after capping, such as barriers to prevent vehicle access and deed restrictions to prohibit ground penetrating activities where caps have been placed.

- **SA Alternative 3, On-site Consolidation and Capping with Evapotranspirative-type Cap:** This alternative would include all of the components described in SA Alternative 2 above, with the exception of the capping technology to be used. This option utilizes an evapotranspiration (ET) cap that includes the placement of three feet of locally-sourced soil blends (based on the ET cap requirements that have been at other sites). Then the soil will be planted with suitable perennial plants, shrubs, and trees.



- **SA Alternative 4, Complete Excavation and Off-site Disposal:** This alternative entails the complete removal of the contaminated soil from source area, which poses unacceptable risk to future users. The excavated soil would be transported to an offsite licensed waste management unit and characterized before an appropriate landfill facility is identified. This alternative would result in the permanent removal of the source area risks at the Site, but would include substantial impacts to infrastructure and public welfare associated with waste hauling.

Waste Rock Dam (WRD) Alternatives

The remedial alternatives for Waste Rock Dam include the following:

- **WRD Alternative 1, No Action:** The no-action alternative is included to provide a basis for comparison to the other alternatives. In this alternative, the site will be fenced and monitored, but not actively maintained.
- **WRD Alternative 2, Excavation of Saturated Waste Rock of Significance and Capping:** This alternative entails:
    - excavation of the portion of the Waste Rock Dam that is saturated by groundwater and has a groundwater flow towards Clear Lake (the amount or extent of material to be excavated was determined by the California Department of Toxic Substances Control and will be refined);
    - the excavated area will be either backfilled with clean fill or a combination of limestone gravel and clean fill;
    - the excavated material will be consolidated and capped in the North Waste Rock Pile or placed in the Northwest Pit and then capped and
    - a contingency action of groundwater extraction wells was evaluated in case pockets of elevated mercury caused by the spring beneath the WRD is not mitigated by capping and continues to exceed water quality standards. This contingency is not being carried forward into the Preferred Alternative;
    - remaining portions of the WRD would be capped using either RCRA-type of ET capping technologies;
    - where waste is capped, institutional controls would be applied to prevent disturbance of capped areas in the long term.
- **WRD Alternative 3, Excavation to Pre-Mining Shoreline and Capping (Includes Saturated Waste Rock of Significance):** This alternative entails excavation of the portion of the Waste Rock Dam that is in contact with Clear Lake along the shoreline and the portion that is saturated by groundwater that is flowing towards Clear Lake (WRD Alternative 2). Removing additional shoreline will lead to a smaller area of the Waste Rock Dam that requires a cap because the excavated material will be placed in the North Waste Rock Pile or the Northwest Pit. The same backfilling and institutional control requirements as WRD Alternative 2 apply. The necessity of excavating the shoreline will be based on compliance with the mercury flux limits of 0.5 kg/year established by the Clear Lake TMDL. If the results of the flux monitoring network, pre-RD investigation, and monitoring during the implementation of the remedy indicate the waste rock along the shoreline would cause an exceedance of the allowable mercury flux, then the shoreline would need to be excavated to reduce the flux to acceptable levels. The shoreline excavation would be accomplished by placing sheet piling in Clear Lake outside the shoreline to be excavated, then dewatering and excavating the waste rock. The WRD would be sloped back and the face protected with the appropriate capping. The modified shoreline would be protected with boulders and riprap.

West slope of the Waste Rock Dam after the 1992 cleanup.

Herman Impoundment (HI) Alternatives

The remedial alternatives for Herman Impoundment include the following:

- **HI Alternative 1, No Action:** The no-action alternative is included to provide a basis for comparison to the other alternatives. In this alternative, no action will be taken to address the surface water at Herman Impoundment.

- **HI Alternative 2, Actively Maintain and Monitor:** This alternative would entail:

  - annual monitoring of the water and sediments within Herman Impoundment and maintaining the site security and outfalls (monitoring will include water quality, the water levels, and the condition of the site security and storm water controls);

  - the current stormwater diversion and overflow pipelines will be maintained and

  - a contingency plan for storm water overflows would be put in place to minimize the instances of overflows and prevent negative impacts to Clear Lake that may result from overflow caused by heavy storms.

- **HI Alternative 3, Construct Hydraulic Barrier Cutoff(s):** This alternative entails the construction of two slurry cutoff walls (or similar) to isolate the saturated portion of Waste Rock Dam from Clear Lake and from groundwater flow. These cutoff walls would penetrate about 20 feet below the ground on either side of the Waste Rock Dam. The wall between the Waste Rock Dam and Herman Impoundment would be about 1000 feet in length to inhibit the flow of groundwater from Herman Impoundment (or other areas within OU-1), into the Waste Rock Dam. The second would be about 2500 feet long and aimed at preventing Clear Lake water from the entering the Waste Rock Dam. This alternative would also require the long term institutional controls (site security) noted above for Alternative HI 2.

Herman Impoundment and surrounding mine waste.

Off-Mine Residential Soils (RS) Alternatives

The remedial alternatives for Residential Soils include the following:

- **RS Alternative 1, No Action:** In this alternative, no action will be taken to address the contaminated soils in the off-mine residential areas. The soils would be left in place without implementing any land use controls, containment, removal, treatment, or other mitigating actions.
- **RS Alternative 2, Excavation, Soil Cover, and/or Institutional Controls (ICs):** This alternative includes:
  - either excavation, placement of soil cover, and/or Institutional Controls to continue to protect residents from relatively small amounts of contaminated soil that remain at depth;
  - soil will be excavated from areas where concentrations of **Contaminants of Concern** are found above cleanup levels at less than two feet below ground surface;
  - the excavated soil will be consolidated under the nearest capped source area within the mine site (OU-1);
  - excavated areas will be backfilled with clean topsoil to prevent future human contact with remaining contaminated material;
  - areas that are not appropriate to excavate (potentially due to their location relative to a building, will be covered with a soil cover);
  - ICs in areas where excavation is not possible to prevent future actions that may expose mining waste below clean soil; and
  - ICs will also be put into place on BIA 120 and the paved roads in Elem Indian Colony (where there is known mining waste below a paved road or its soil shoulder).
  - EPA's ICs will restrict future excavation of these areas so that the mining waste remains beneath the clean topsoil and pavement such that there is no exposure pathway to residents. Pavement will be well maintained to ensure that the exposure pathway of soil to residents remains cut off.

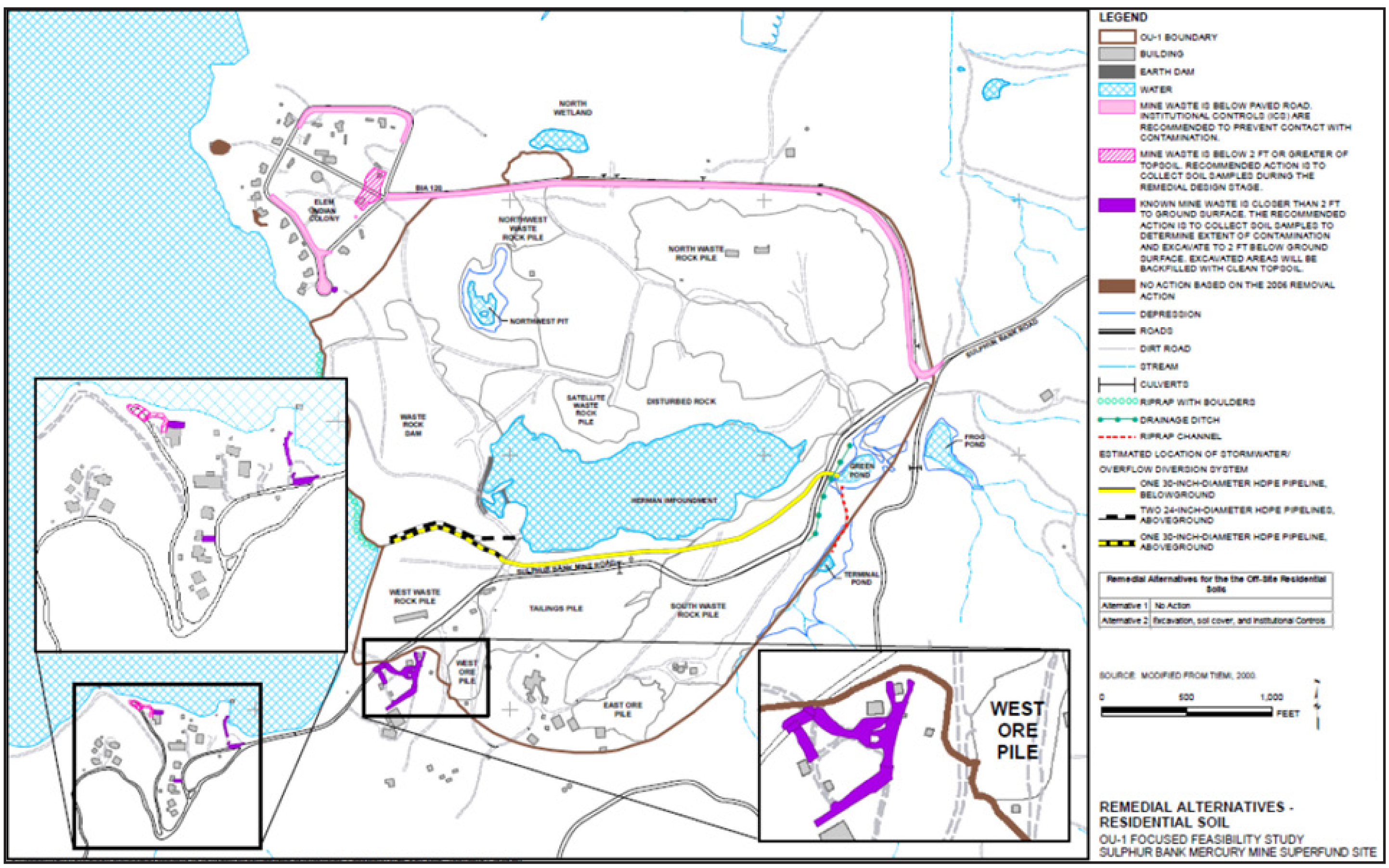


Figure 7: *Location of residential soils impacted by the mine. Areas indicated by pink and purple were previously removed and/or capped by EPA, but may require followup action to ensure long-term protection.*

EPA's Questions to Evaluate Cleanup Options (CERCLA's 9 Criteria)

EPA develops different options to manage contamination. We use nine questions to compare the options and choose which one is best.

The most important are question 1 about protecting human health and the environment and question 2 about meeting local environmental requirements. Questions 3 to 7 help us identify major pros and cons among the options. Questions 8 and 9 are fully considered after we get public comments back from this Proposed Plan.

1 Does it protect human health and the environment?

Answers if the cleanup option protects human health and the environment.

Sometimes the options can treat or remove contamination. Other times we use "controls" to prevent exposure, such as:

- an engineered control, like a barrier cap or a fence; or
- an institutional control, like a land use restriction or a health advisory

2 Does it meet local environmental requirements?

Answers if the cleanup option meets federal, state, tribal, and local environmental requirements.

While compliance with these environmental requirements, known in the Superfund law as Applicable or Relevant and Appropriate Requirements, is generally required, in rare cases one or more such requirement might be waived if it is proven that compliance cannot be achieved.

3 Will it be effective in the long-term

Examines how the cleanup option will continue to protect human health and the environment when completed.

This includes understanding how engineered controls (like a barrier cap or fence) or institutional controls (like a land use restriction or a health advisory) can be successful through time.

4 How will it reduce contamination?

Examines how the cleanup option reduces the levels, harmful effects, or movement of the contamination.

5 What are the short-term trade-offs?

Examines:

- how quickly the cleanup option can be put into effect,
- health risks the public may face during the time it takes to do the cleanup option, and
- the safety concerns to workers who do the work.

6 Is it easy or difficult to put into place/implement?

Examines the ease or difficulty of doing the cleanup option, including how easy it is to get materials and services needed.

7 How much will it cost?

Examines the costs for the cleanup option, including planning and construction costs, as well as operation and maintenance costs through time.

8 What does the state or tribe think?

Considers if the state or tribal government is in favor of the preferred cleanup option and if they meet state or tribal government environmental regulations.

9 What does the community think?

Considers if the community is in favor of the preferred cleanup option.

This looks at the community's comments on the Proposed Plan. After we review comments, we will respond to the community's concerns.

PART 6: Evaluation and Selection of Alternatives

Alternative Comparison Tables

The comparison of the Residential Soils Alternatives (Alternative RS-1-No Action and Alternative RS-2-Excavation or Cover of Soils) is not presented in detail because there is only one viable alternative that would meet the threshold requirement of protecting human health from site-related contamination. Alternative RS-2 meets the evaluation criteria and is protective and cost effective. The costs for Alternative RS-2 are: capital cost $145K, O&M $16.5K per year, and net present value $538.8K. ***Note that all costs shown account for inflation since finalization of the Focused Feasibility Study based on a simple Consumer Price Index adjustment***

Table 3. SOURCE AREAS REMEDIAL ALTERNATIVES COMPARISON

EVALUATION CRITERIA	SA ALTERNATIVE 1	SA ALTERNATIVE 2		SA ALTERNATIVE 3	SA ALTERNATIVE 4	PREFERRED REMEDY
	No Action	2A - On-site consolidation and capping–RCRA cap with GCL	2B - On-site consolidation & capping – RCRA cap with HDPE	On-site consolidation and capping – ET cap	Complete excavation and off-site disposal	Combination of Alternatives 2 and 3
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes	Yes	Yes
Compliance with ARARs	Not Applicable	Yes	Yes	Yes	Yes	Yes
Long-Term Effectiveness and Permanence	Not Included	High	High	High	High	High
Reduction in Toxicity, Mobility, and Volume through Treatment	Not Included	Low	Low	Low	Low	Low
Short-Term Effectiveness	Not Included	Medium	Medium	Medium	Medium	Medium
Implementability	Not Included	Medium	Medium	Low – due to the large volume of clean soil that would need to be trucked to the site. If on-site sources of soils are found, this ranking would be Medium.	Medium	Medium, although ET cap is rated Low unless on-site soils are used, the partial use of ET caps will include cost considerations.
Capital Cost Annual O&M Cost Net Present Value	$0	$55.3M $335K $63.6M	$55.6M $333.8K $63.8M	$66.3M $301.3k $74.9M	$808.1M $0 $808.4M	$61.3M $318.75k $69.3M
Time to construct and implement to meet RAOs	none	Completion of RD and RA estimated to be 6 years from ROD signature	Completion of RD and RA estimated to be 6 years from ROD signature	Completion of RD and RA estimated to be 6 years from ROD signature	Completion of RD and RA estimated to be 7 years from ROD signature	Completion of RD and RA estimated to be 6 years from ROD signature

EVALUATION CRITERIA	Table 4. WASTE ROCK DAM REMEDIAL ALTERNATIVES COMPARISON			
	WRD ALTERNATIVE 1	WRD ALTERNATIVE 2	WRD ALTERNATIVE 3	Preferred Remedy
	No Action	Excavation of saturated waste rock of significance and capping	Excavation to pre-mining shoreline, including the saturated waste rock of significance (Alt 2) and capping	Combination of WRD Alternatives 2 and 3
Overall Protection of Human Health and the Environment	No	Yes	Yes	Yes
Compliance with ARARs	Not Applicable	Possibly. There is unavoidable uncertainty regarding the effect of Phase 1 on TMDL compliance. The portion of the waste rock dam that needs to be removed to meet clean-up levels will be determined between Phase 1 and 2.	Possibly. There is unavoidable uncertainty regarding the effect of Phase 1 on TMDL compliance. The portion of the waste rock dam that needs to be removed to meet clean-up levels will be determined between Phase 1 and 2.	Yes. The extent of excavation would be determined between Phase 1 and Phase with the purpose of removing enough waste rock to comply with the TMDL.
Long-Term Effectiveness and Permanence	Not Included	Medium	High – based on assumption that future conditions, such as climate change, could result in unanticipated releases from the shoreline waste material if left in place.	High
Reduction in Toxicity, Mobility, and Volume through Treatment	Not Included	Medium	Medium	Medium
Short-Term Effectiveness	Not Included	Medium	Medium	Medium
Implementability	Not Included	Medium	Medium	Medium
Capital Cost **Annual O&M Cost** **Net Present Value**	$0 $0 $0	$20.5M to $26.1M $21.8k to $21.9k $21M to $26.6M	$17M to $29.8M $21.8k to $21.9k $17.5M to $30.3M	$17M to $29.8M $21.8k to $21.9k $17.5M to $30.3M
		Reducing the footprint of the WRD through consolidation reduces costs due to the high cost of commercially available topsoil for capping. Local sources of clean topsoil will be investigated prior to Remedial Design, potentially affecting the cost comparison between Alternatives 2 & 3. The range of costs is driven by the smaller cap area of Alternative 3 on the low end, and the potential large volume of shoreline protection on the high end.		
Time to construct and implement to meet RAOs	none	Completion of RD and RA estimated to take 3 years, beginning after Source Areas remedy is completed.	Completion of RD and RA estimated to take 3 years, beginning after Source Areas remedy is completed.	Completion of RD and RA estimated to take 3 years, beginning after Source Areas remedy is completed.

EPA's Preferred Alternative

EPA analyzed a range of cleanup options for each of the major parts of the site or the OU-1 site components (Off-mine Residential Soils, Source Areas, Waste Rock Dam, Herman Impoundment). The recommended cleanup plan described below selects the best elements of each alternative in order to take advantage of the strengths of several alternatives, while avoiding identified weaknesses.

EPA's recommended option (Preferred Alternatives) is:

- intended to be the final remedy for all of OU-1 (except Herman Impoundment, which may not require any active cleanup);
- is not intended to address the risk associated with the Clear Lake and the North Wetlands (this means that there will be another cleanup plan developed to account for these portions site) and
- is split into two phases to enable EPA to move forward with the site cleanup despite unavoidable uncertainties regarding how the first phase of work will affect site conditions.

*EPA's recommended cleanup (preferred remedial alternatives) for the mine portion of the site is summarized below by **Area of Concern** in the same manner as the FFS alternatives.*

The State of California, as represented by the Department of Toxic Substances Control and the Central Valley Waterboard has expressed their general concurrence with this preferred alternative, while the Elem Indian Colony have expressed concern/objections.

Phase 1

OFF-MINE RESIDENTIAL SOILS:

- The off-mine contaminated soils in residential areas will be excavated and placed on- site with the source area materials before capping
- Then, the excavated areas will be appropriately covered with clean soil and institutional controls applied.

(This is Residential Soils Alternative 2 of the FFS, which is explained in detail on page 28.)

SOURCE AREAS:

- The mine waste, ore piles, tailings piles, and waste rock piles will be consolidated (piled together) and capped in place, remaining on-site.
- The type of cap may be either a RCRA-type cap or an evapotranspiration (ET) cover and will be determined for each area based on:
  - The completion of the pre-remedial design investigation in accordance with Title 27 requirements, which will designate the waste in each area as Group A or Group B.Control and will be refined);
  - Group A wastes will be required to have a RCRA cap.

- Group B wastes can have either a RCRA cap or an ET cover, and that choice will be determined by the final costs for soils to support the cap's vegetation. The ET cover requires more soil, and if the cost for soil is lower, then an ET cover would be more cost effective.

(These two cap designs are Source Area Alternatives 2 and 3., which are explained in detail on page 24-25.)

- The waste rock pile located off the mine site and partially on the Elem Indian Colony will be relocated and consolidated to an area on-site.
- Clean stormwater will be diverted away from Herman Impoundment and into Clear Lake.
- The Northwest Pit will be backfilled as needed to enable stormwater to drain from it. It's use as a waste repository as well will be evaluated during the detailed design of the remedy.

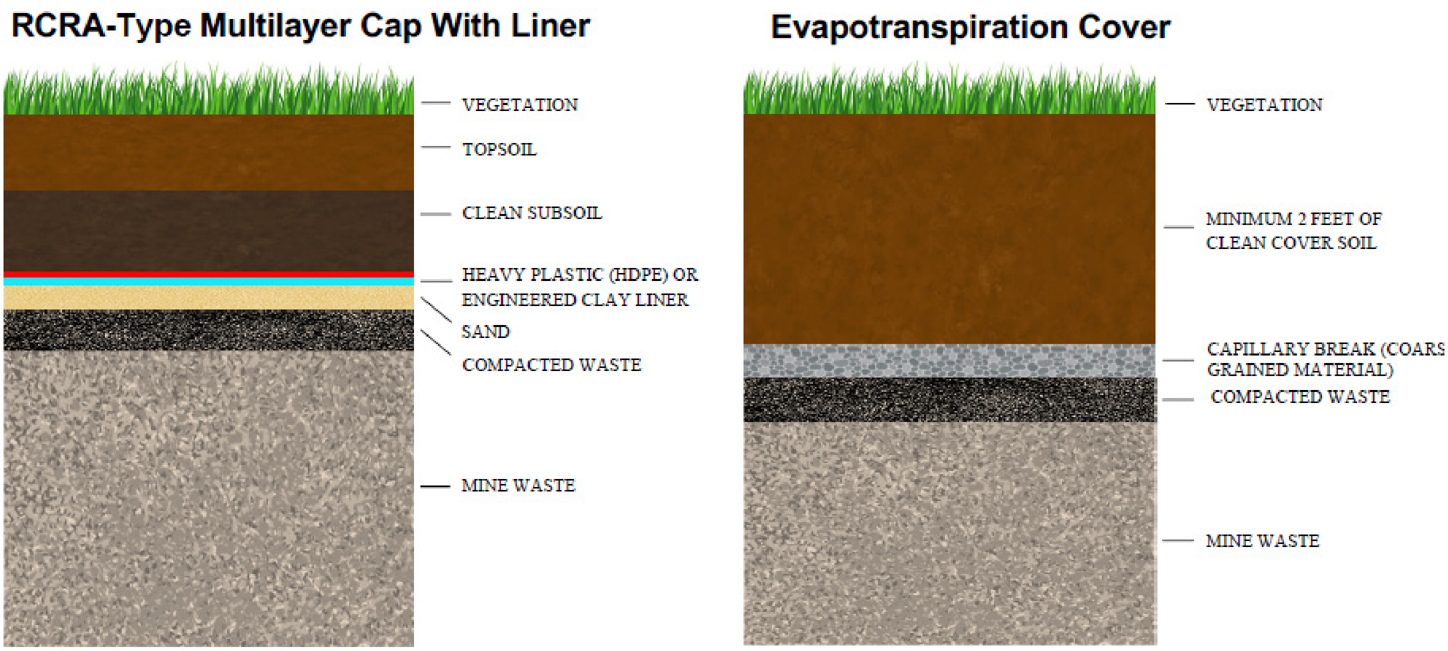


Figure 8: *RCRA-type Cap vs. ET Cover.*

Phase 2

Phase 2 will address the mercury contamination entering Clear Lake through groundwater.

The caps and stormwater controls installed in phase 1 will limit rainfall infiltrating to groundwater and runoff entering Herman Impoundment. This will significantly change the movement of groundwater through the WRD. Initiation of phase 2 will occur once the post-Phase 1 groundwater has been monitored during both normal and high flow conditions or until sufficient data has been gathered that such conditions can be accurately predicted. From these data, the volume of WRD excavation necessary to protect Clear Lake (based on the mercury flux limits of 0.5kg/year, set by the TMDL) will be determined. Mercury flux through the WRD will be calculated using the high resolution groundwater modeling developed as part of the pre-design flux monitoring effort currently underway.

WASTE ROCK DAM

- The final volume of waste rock to be excavated will be determined during post-Phase 1 monitoring.
- Clean rock and earth will be placed into the excavated area for safety, slope stability and access.
- The remainder of the Waste Rock Dam will remain in place and be capped with either RCRA-type cap or ET cover (following the cap selection criteria for the Source Areas) to prevent infiltration of water into the waste rock.

(This approach is a combination of Waste Rock Dam Alternatives 2 and 3, but is modified to ensure full protectiveness and ARARs compliance. These alternatives are explained in detail on page 26.)

HERMAN IMPOUNDMENT

A remedial action for Herman Impoundment is not being selected at this time as the water within the Impoundment is improving and does not pose chemical risks that exceed background.

- The water chemistry will be monitored as part of operation of the source area remedy.
- If an action is needed for Herman Impoundment in the future, it will be selected in a future decision document.

(Left) *Face of Waste Rock Dam during installation of stormwater control features and* ***(Right)*** *Stormwater Diversion Pipeline.*

Basis for Selection of the Preferred Alternative

Based on information currently available, EPA (the lead agency) believes this Preferred Alternative meets the threshold criteria specificed by the law (CERCLA). The recommended option (alternative) provides the best balance of tradeoffs among the other alternatives and takes into consideration the balancing/modifying criteria.

EPA expects the Preferred Alternative to satisfy the following legal and statutory requirements of CERCLA §121(b):

1. it is fully protective of human health and the environment (for the areas included in the cleanup;
2. it fully complies with ARARs;
3. is the most cost-effective available option;
4. it utilizes permanent solutions (to the maximum extent practicable)

EPA's Preferred Alternative

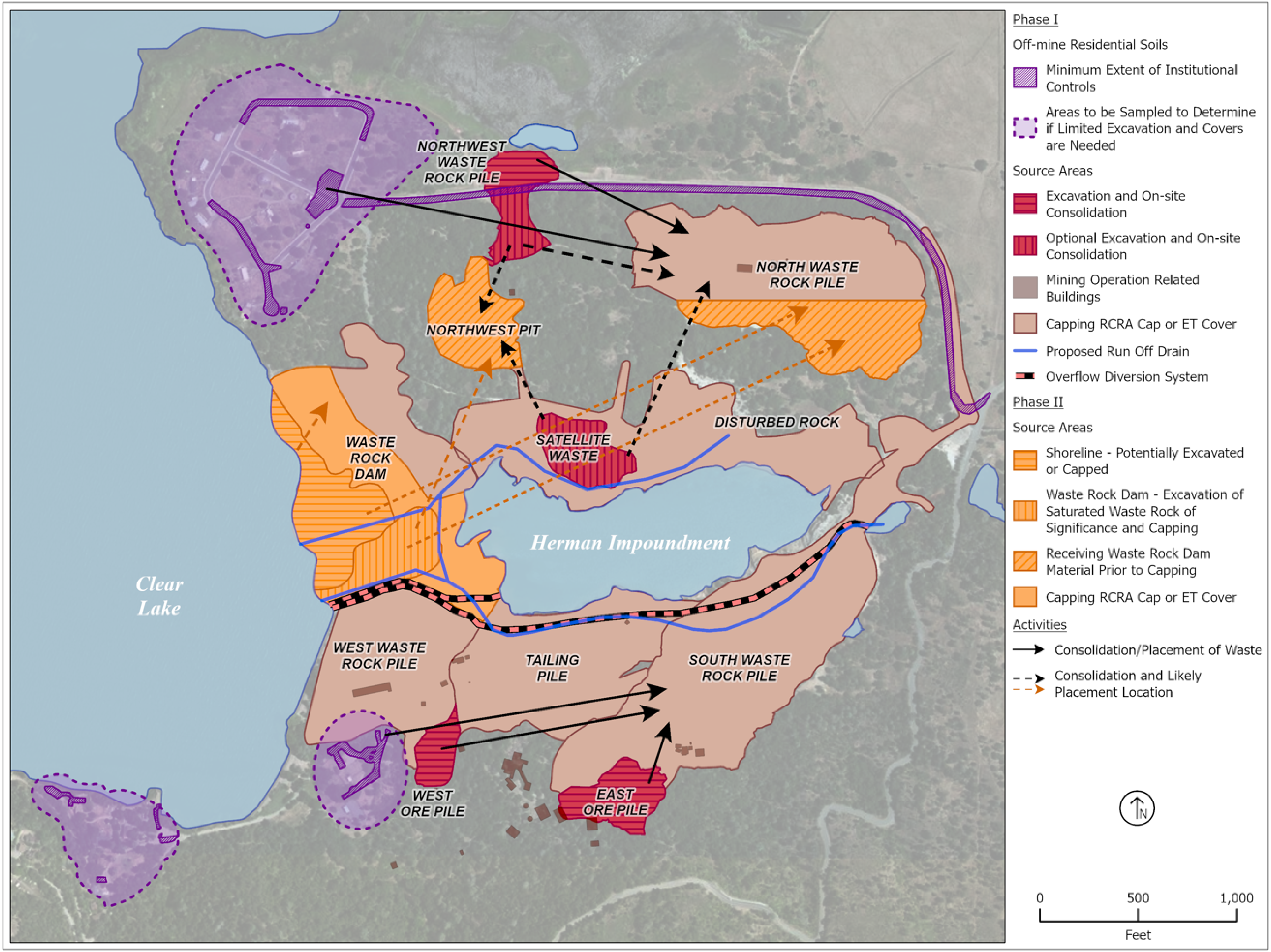


Figure 9: *Phases 1 and 2 of the proposed cleanup plan.*

Preferred Alternative Cost Evaluation

The **Focused Feasibility Study** included the calculation of estimated costs for each alternative and its component parts. Total estimated costs for the preferred remedy displayed on table below have then been adjusted for inflation.

Phase	Source Areas	Residential	Herman Impoundment	Waste Rock Dam	Total
Capital Cost					
Phase 1	$55,587,473	$144,886	$41,250	$6,644,425	$62,418,035
Phase 2				$14,119,402	$14,119,402
Total	$55,587,473	$144,886	$41,250	$20,763,827	$76,537,437
Annual Operation and Maintenance Cost					
	$344,661	$16,418	$51,878	$21,460	$434,420
Discount Rate	**Total Net Present Value**				
1.5 Percent	$63,864,653	$539,196	$ $1,287,127	$ $21,279,205	$86,970,182
7 Percent	$59,864,381	$348,630	$685,008	$21,030,128	$81,928,148

The capital cost for **consolidation and capping** of the source areas covered a range from $55,271,218 to $67,328,557 based on the capping technology selected. It is expected that the remedy will likely include portions of the source areas being capped with each of the three options evaluated (RCRA-style cap that integrates a High Density Poly Ethylene (HDPE) liner, evapotranspirative (ET) cap, and the RCRA-style cap with a geosynthetic clay liner). This enables flexibility to accommodate the needs of each area and provide the best combination of effectiveness; cost efficiency and support for future use of the site (it is assumed that ET cap would provide the greatest benefit for traditional tribal practices, as it would support a greater range of native vegetation).

The largest cost drivers for capping are the purchase and importation of clean soils and installation of irrigation systems to support establishment of vegetation. Local sources of clean topsoil will be investigated prior to Remedial Design, potentially affecting the cost comparison between the three capping technologies. Remedial design will also seek to optimize of the amount of waste excavation and consolidation. The cost analysis shows that it is less expensive to consolidate thinner areas of waste than it would be to cap these areas. The cost estimates are based on reasonable assumptions about how much consolidation can be achieved, but significant cost savings may be possible with detailed evaluation during design.

The **residential soils** excavation and cover will be a relatively small cost compared to other elements of the remedy in large part because the majority of the residential soils requiring remediation have been addressed by prior EPA work at the site. The cost is relatively small because it's a small volume and the soil that is removed will be placed on the source areas before they are capped, which saves money compared to shipping it to an off-site disposal.

The **Waste Rock Dam** remedy ranges in capital cost from $17,003,685 to $29,766,548.

- The high end of this range corresponds to Alternative 2, which removes just the "saturated waste rock of significance" known to be the primary contributor of site-related contaminants to the groundwater flowing from the site into Clear Lake.
- The lower cost alternative is Alternative 3, which removes both the saturated waste rock of significance and all of the waste rock outside the natural shoreline that was buried by the Waste Rock Dam. Alternative 3 is less costly while requiring excavation of more waste rock because it results in a much smaller footprint requiring capping.

Detailed investigation and monitoring of the movement of mercury-rich groundwater through the waste rock dam is ongoing and will determine the exact amount of waste that needs to be removed to meet applicable regulatory requirements. Remedial design will then optimize the balance between excavation and capping according to the required effectiveness and cost. Evaluation of alternative sources of capping soil will also affect the relative costs of alternatives 2 and 3.

The **Herman Impoundment** is not subject to this remedy decision. Costs indicated reflect ongoing monitoring needed to assess changes in chemistry and water level. If a remedy is required for Herman Impoundment, it will be subject to a subsequent decision document.

Tentative Cleanup Timeline

The time between remedy selection and completion of all cleanup activities is shown below. The duration indicated is how long each activity is expected to take following the completion of the preceding step:

- Record of Decision (ROD) (Remedy selection): 6 months to 1 year following Proposed Plan publication
- Pre-design investigation: completion within 1 year of remedy selection
- Phased Remedy design: 1-2 years following completion of pre-design investigation, with a second 1-2 year design stage prior to implementation of phase 2 of the remedy
- Phase 1 Remedy Implementation: minimum 3 years active construction and 1-2 years monitoring
- Phase 2 Remedy Implementation: minimum 2 years active construction once triggered

Phase 2 activities will follow after a period of time spent monitoring the effects of the Phase 1 activities. The length of this monitoring period is tentatively defined as the time period necessary for the Phase 1-modified groundwater flow conditions within the WRD to be observed under normal and high flow conditions or until sufficient data has been gathered that such conditions can be accurately predicted. Such observations are necessary for accurate evaluation of mercury releases from the site to Clear Lake.

Acronym

AMD	Acid Mine Drainage
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
BIA	Bureau of Indian Affairs
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COC	Contaminants of Concern
CSM	Conceptual Site Model
DTSC	California Department of Toxic Substances Control
EIC	Elem Indian Colony
EPA	US Environmental Protection Agency
ERA	Ecological Risk Assessment
ET	evapotranspiration
FS	Feasibility Study
FFS	Focused Feasibility Study
GCL	Geosynthetic Clay Liners
HDPE	High-density polyethylene
HHRA	Human Health Risk Assessment
HI	Hazard Index
HI	Herman Impoundment
HQ	Hazard Quotient
NCP	National Contingency Plan
NPL	National Priorities List
NPV	Net Present Value
OU	Operable Unit
O&M	Operations and Maintenance
PP	Proposed Plan
PRG	Preliminary Remedial Action Goal
RA	Remedial Action
RAFLU	Reasonably Anticipated Future Land
RAO	Use Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RG	Remedial Action Goal
RI	Remedial Investigation
ROD	Record of Decision
RS	Residential Soils
RWQCB	Regional Water Quality Control Board
SBMM	Sulphur Bank Mercury Mine
WRD	Waste Rock Dam

Glossary of Terms

Administrative Record: the complete body of documents that forms the basis for selecting a CERCLA response action (i.e., documents considered or relied upon in selecting a remedy)

Acid Mine Drainage: The formation and movement of highly acidic water rich in heavy metals. This acidic water forms through the chemical reaction of water with rocks that contain sulfur-bearing minerals, resulting in sulfuric acid.

Applicable or Relevant and Appropriate Requirements (ARARs): Any state, federal or local statute or regulation that pertains to the protection of human health and the environment in addressing specific conditions (chemical, action, and location) or use of a particular cleanup technology at a Superfund site.

Areas of Concern (AOCs): Environmentally sensitive areas that have been affected by contamination.

Background: Constituents or locations that are not influenced by contaminants from a site. Usually described as naturally occurring or anthropogenic.

Baseline Risk Assessment: The first step of the Remedial Investigation/Feasibility Study. The baseline risk assessment is an analysis of the potential adverse health effects (current or future) caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA): The Federal law that addresses problems resulting from releases of hazardous substances to the environment.

Consent Decree: Judicial agreement between the federal government and the potentially responsible parties (PRPs) fully or partially settling a claim under CERCLA.

Consolidating and Capping: the process of combining waste piles together then putting soil, earth, plastic, or an engineered combination over top of them.

Contaminants of Concern (COC): A chemical that significantly contributes unacceptable human health risk at a site.

Ecological Risk Assessment (ERA): A study that estimates the possible effects of contamination on plants and animals in the absence of any remedial action.

Evapotranspiration (ET) Cap: A type of cap placed over contaminated material, such as landfill waste or mining tailings, to prevent water from reaching it that uses plants and soil to store water from rainfall and snowmelt until drier or warmer weather evaporates the water, or until the water is taken in by plant roots and released to the air as water vapor through the leaves and stems.

Feasibility Study (FS): A process under CERCLA to develop, screen, and evaluate various remedial alternatives being considered for selection of a remedial action.

Focused Feasibility Study (FFS): An evaluation of cleanup options targeted at a specific subset of the problems at a site.

Geosynthetic Clay Liners (GCL): a water-proof capping material that uses sodium bentonite clay to forms a hydraulic barrier.

Hazard Index: The sum of hazards for toxins that affect the same target organ or organ system. A hazard index of 1 or lower means toxins are unlikely to cause adverse non-cancer health effects over a lifetime of exposure.

Herman Impoundment: The open pit mine on the site. Open pit mining is a technique in which a hole is dug to take out minerals that are close to the surface.

High-density Polyethylene Liner (HDPE): A widely used high strength plastic polymer.

Human Health Risk Assessment: A study that provides an evaluation of the potential threat to human health in the absence of any remedial action.

Institutional Controls: Institutional Controls are non-engineered instruments, such as administrative and/or legal controls, that help minimize the potential for human exposure to contamination and/or protect the integrity of a remedy by limiting land or resource use. Examples include fishing restrictions, deed restrictions, and the posting of warning signs outside of a contaminated site.

Mine Waste/Mining Waste: Includes waste generated during the extraction, beneficiation, and processing of ores and minerals, including overburden, waste rock, and solid residues resulting from ore processing.

Operable Unit (OU): A portion of a CERCLA site designated based on the geographic area, specific site problems, or the areas where a specific action is required.

Preferred Alternative: The cleanup approach recommended by EPA and presented in the Proposed Plan.

Preliminary Remediation Goal (PRG): Numeric contaminant concentration levels needed to be achieved to meet remedial action objectives by the cleanup alternatives.

Principal Threat Waste: Source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur.

Reasonably Anticipated Land Use (RAFLU): the type and frequency of activities expected on a CERCLA site after its remediation based on interest expressed by the local community and/or the site's redevelopment potential.

Remedial Investigation (RI): A process under CERCLA to determine the nature and extent of the problem presented by a contaminant release.

Resource Conservation and Recovery Act (RCRA): The public law that creates the framework for the proper management of hazardous and non-hazardous solid wastes.

Remedial Action Objective: Objectives that specify the level, area, and time required for site cleanup.

Remedial Alternative: An action considered in the Feasibility Study intended to reduce or eliminate unacceptable risks to human health and the environment at a site. The Feasibility Study considers a range of remedial alternatives.

Residential Soils: Soils located on private properties with homes and residential use. Residential soil may present a direct exposure pathway to persons working, playing, or conducting other recreational activities on a property.

Risk: the probability of harm to people, plants, or animals from exposure to contaminants.

Sediment: Soils, sand, organic matter or minerals that accumulate on the bottom of a water body or an at some point in time are submerged.

Source Material: Material that includes or contains hazardous substances, pollutants, or contaminants that acts as a reservoir for migration of contamination to groundwater, surface water, sediment, or air.

Stakeholders: One who has stake in an enterprise or who is involved in or affected by a course of action.

Waste Rock Dam: A pile of contaminated waste rock that was unofficially constructed as a dam to prevent water flow from Herman Impoundment into Clear Lake.