SECOND FIVE-YEAR REVIEW REPORT FOR

LAVA CAP MINE SUPERFUND SITE

NEVADA COUNTY, CALIFORNIA

PREPARED BY

U.S. Army Corps of Engineers

Seattle District

FOR

U.S. Environmental Protection Agency

Region IX

Approved by:

Date:

August 29, 2016

John Lyons, Acting Assistant Division Director
California Site Cleanup and Enforcement Branch
Superfund Division
U.S. Environmental Protection Agency, Region IX

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Executive Summary

This is the second Five-Year Review (FYR) of the Lava Cap Mine Superfund Site (Site) located in Nevada County, California. The purpose of this FYR is to review information to determine if the remedies implemented at several operable units (OUs) at this Site are and will continue to be protective of human health and the environment.

The Site is located in the historical gold-mining area in the foothills of the Sierra Nevada Mountains, approximately 5 miles southeast of Nevada City, Nevada County, California. The contaminant of concern at the Site is arsenic, which was found above health-based standards in soil, sediment, surface water, and groundwater. Arsenic is a known human carcinogen and is potentially harmful to plant and animal species.

The Site has four operable units (OUs): Lava Cap Mine Area (OU1); Groundwater (OU2); Lost Lake/Deposition Area (OU3); and Mine Area Residences (OU4). The original remedy for OU1 as provided in the 2004 Record of Decision (ROD) addressed the tailings and adit water in the mine area and four mine residences. In 2005, in order to accelerate cleanup, two of the four mine area residences were separated out of OU1 and designated as OU4. The ROD for OU1 is being implemented in phases as two distinct remedies. The first remedy (Phase 1) included excavation of tailings and tailings consolidation, vegetative covers, a tailings pile cap, a rock buttress, drainage channels, and demolition of two residences. The second remedy for OU1 (Phase 2), which is still in the remedial design phase, is treatment of adit water emanating from the mine area. The OU1 remedy also includes institutional controls (ICs) to minimize potential future exposure to remaining contaminated materials. The OU2 Interim ROD for groundwater was signed in 2008 to address the immediate risk at nearby private drinking water wells. The final OU2 remedy addressing all the groundwater is currently in the remedial investigation/feasibility investigation phase. The remedy for the Lost Lake/Deposition Area, OU3, has not been selected and EPA is conducting a remedial investigation/feasibility study for the area. The remedy for OU4 (Mine Area Residences), which consists of two residential parcels located away from the mine's historic operations that contained limited quantities of contaminated materials, consisted of excavating contaminated soil from around one residence and replacing with clean fill and revegetating; paving roads and driveways on both parcels, to cover mine waste materials that could not be removed, and installing culverts beneath the main roadway to convey surface water drainage.

The remedies in place are functioning as intended and progressing as expected toward meeting the remedial action objectives (RAOs) in the decision documents. The Phase 1 remedial action objectives for soil were achieved in 2007 except for the implementation of ICs. The OU2 interim RAO, completed in 2013, provided residents with connections to a reliable municipal water supply.

The exposure assumptions, toxicity data, risk assessment methods, exposure pathways, cleanup standards, and RAOs used at the time of the remedies selection are still valid. There have been no changes affecting

the protectiveness of the remedies selected and reviewed in this FYR. There is no other information that calls into question the protectiveness of the remedies.

The remedies at Lava Cape Mine Area (OU1), Interim Groundwater (OU2) and Mine Area Residences (OU4), are currently protective of human health and the environment in the short term. However, if maintenance of the cap continues to be deferred, then long-term protectiveness could compromised. For the OU1 remedy to be protective in the long term, the institutional controls (ICs) need to be formally implemented. Additionally, the ICs selected in the ROD do not address two areas where wastes were left in place: beneath the house on Parcel 39-60-16 (OU4), and beneath Tensy Lane where it crosses Little Clipper Creek on Parcel 39-170-66 (OU1).

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List of Abbreviations

µg/L	micrograms per liter
ARARs	applicable or relevant and appropriate requirement
CC	Clipper Creek
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSL	California screening level
DTSC	California Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ESD	Explanation of Significant Differences
FS	feasibility study
FYR	Five-Year Review
IC	institutional control
HHRA	human health risk assessment
LCC	Little Clipper Creek
LL	Lost Lake
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
NID	Nevada Irrigation District
NTU	nephelometric turbidity units
O&M	operations and maintenance
OU	operable unit
RA	remedial action
RAO	remedial action objective
ROD	Record of Decision
RSL	Regional Screening Level
Site	Lava Cap Mine Superfund Site
TBC	factor to be considered
UU/UE	unlimited use and unrestricted exposure

1 Introduction

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy that results in any hazardous substance, pollutant or contaminant remaining at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE) in order to determine if the remedy will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121(c), 42 U.S.C.§ 9621(c) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR § 300.430(f)(4)(ii) and EPA policy.

This is the second FYR for the Lava Cap Mine Superfund Site (Site) located in Nevada County, California (Figure 1). The triggering action for this statutory review was the start of construction in May 2006 for OU1[1]. This FYR addresses the remedies that have been implemented at the Site. These are the soil remedies for OU1 and for OU4 pursuant to the 2004 ROD as modified by the Explanation of Significant Differences (ESD) (EPA, 2006). It also is reviewing the Interim groundwater remedy implemented at OU2 pursuant to the 2008 Interim Record of Decision (IROD). The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

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[1] Although EPA began construction on OU4 in September 2005, which consisted of only parcels 39-160-16 and 39-160-21, the 2004 ROD, as amended by the 2006 ESD, established that these parcels allowed for unrestricted use once remediated. Therefore the OU4 start date did not trigger a FYR under the CERCLA Section 121(c) requirements. See ROD OU1 at p II-43.

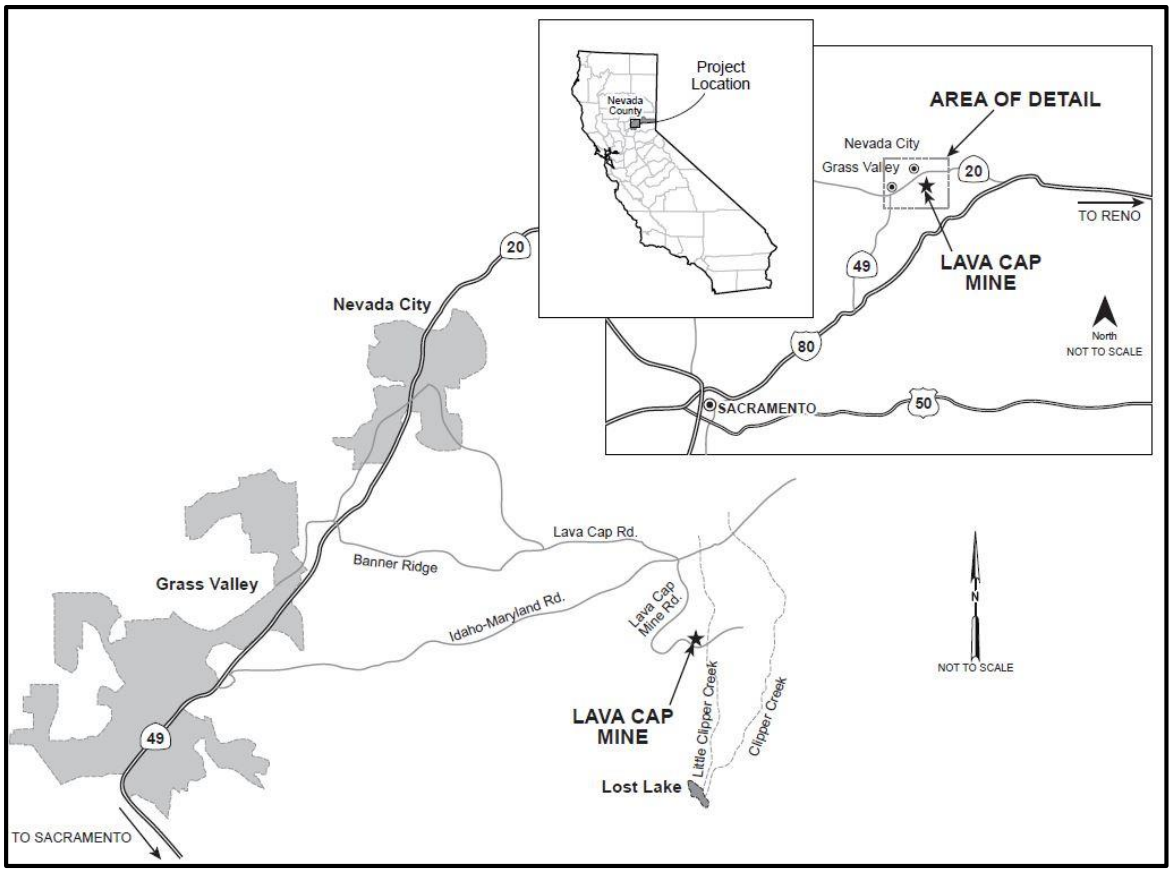

Figure 1. Site Location

The Site consists of four OUs (Figure 2) totaling as described below:

- OU1 (Mine Area) – This OU extends from the mine property to Greenhorn Road, including portions of the Site where hard rock mining operations occurred including two residences (39-160-25 and 39-160-30) that were demolished, as well as adjoining areas impacted by mine wastes. Phase 1 of the OU1 remedial action (RA) began in May 2006 and was completed in December 2007. Phase 2 of the OU1 ROD addresses remediation of the adit water and is a separate remedial action currently in the Remedial Design phase and not addressed in this FYR.

- OU2 (Groundwater) –This OU encompasses the areas of potentially impacted groundwater from OU1 in the north to OU3 in the south. The OU 2 feasibility study (FS) (CH2MHILL, 2008) was completed in July 2008 and EPA issued an Interim ROD or IROD (EPA, 2008) in September 2008.

- OU3 (Lost Lake/Deposition Area) – This OU begins where OU1 ends, comprising the Little Clipper Creek (LCC) drainage south of Greenhorn Road; the Clipper Creek (CC) drainage downstream of its confluence with LCC; Lost Lake (LL); and areas downstream of LL in Little

Greenhorn Creek. An RI data gap investigation is planned for OU3, which will lead to the development of the OU3 FS.

- OU 4 (Mine Area Residences) – The OU1 ROD originally included Parcels 39-160-16 and 39-160-21. In 2005 after the ROD was issued, these two parcels were separated from OU1 and designated as OU4 to allow for accelerated cleanup of these residential areas. The OU4 RA was started in September 2005 and completed in December 2005.

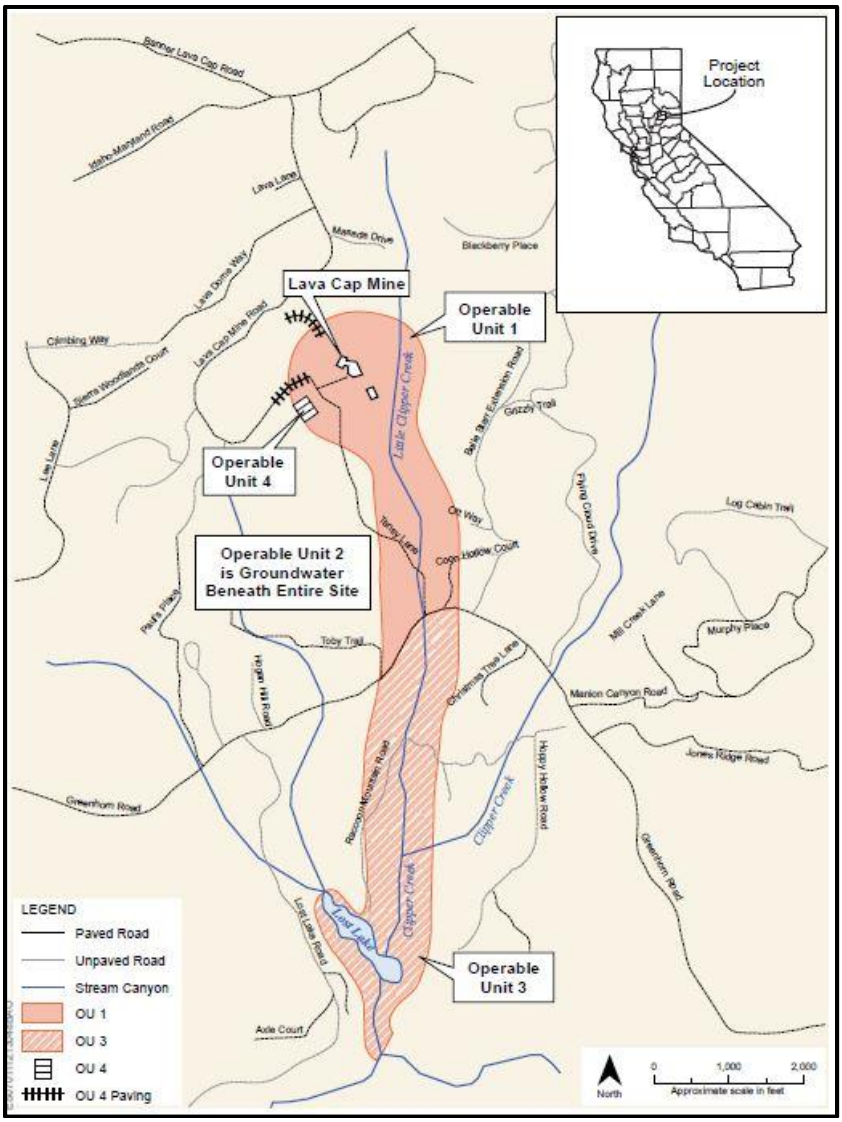

Figure 2. Site Map

Remedies that have not yet been implemented include the treatment of adit water or mine drainage at OU1, the final groundwater remedy for OU2, and soil and water remedies for OU3 (Lost Lake/Deposition Area). The adit water or mine drainage component of the OU1 remedy is in the remedial design phase,

and Lost Lake/Deposition Area (OU3) and the final groundwater (OU2) are currently in the remedial investigation/feasibility phase. These areas will not be addressed by this FYR.

The second Lava Cap Mine Superfund Site FYR was led by the following:

- Sara Goldsmith (EPA, Site Attorney)
- Cynthia Wetmore (EPA, FYR Coordinator)
- Brunilda Dávila (EPA, Remedial Project Manager [RPM])
- Alejandro Díaz (Community Involvement Coordinator [CIC])
- Cathy Martin (U.S. Army Corps of Engineers, Technical Lead)

The review began on November 13, 2015. A list of the documents evaluated for this FYR is located in Appendix A. Table 1 summarizes the FYR status of the Site.

Table 1: Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Lava Cap Mine Superfund Site		
EPA ID: CAD983618893		
Region: 9	**State:** California	**City/County:** Nevada County
SITE STATUS		
NPL Status: Final		
Multiple OUs?: Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**		
Author name (Federal or State Project Manager): Brunilda Dávila		
Author affiliation: EPA, Remedial Project Manager		
Review period: 9/14/2011 - 6/10/2016		
Date of site inspection: 10/19-20/2015		
Type of review: Statutory		
Review number: 2		
Triggering action date: 5/6/2011		
Due date *(five years after triggering action date)*: 5/6/2016		

1.1 Background

The Lava Cap Mine Superfund Site (Site) is located in the historical gold-mining area in the foothills of the Sierra Nevada Mountains, approximately 5 miles southeast of Nevada City, Nevada County, California. The Site is comprised of the Mine Area where hard rock gold- and silver-mining operations took place, and downstream areas where waste materials generated at the mine were discharged.

Various entities operated the Lava Cap Mine during two distinct periods, from 1860 to 1918, and from 1934 to 1943. During the latter period, the most intensive mining occurred, with an average of 300 to 400 tons of ore processed per day. Processing operations consisted of crushing and grinding circuits to reduce the rock to flour, followed by separation of the gold and silver in a flotation plant. The resulting concentrate was sent to smelters off site for further refining. Amalgamation processes which utilized mercury in the recovery of gold and silver were not extensively used at the Lava Cap Mine because of chemical interferences with the process. Late during the mine's period of operation, a cyanide process was installed in an attempt to recover additional gold and silver from the waste tailings, but the process proved ineffective and was discontinued.

In addition to gold and silver, the native ore contained naturally occurring arsenic and trace amounts of heavy metals such as lead. Following processing of the ore, the arsenic and heavy metals remained in the finely ground tailings. The tailings were deposited in the Little Clipper Creek (LCC) drainage on the property. During operations, two structures were built for the purpose of holding the tailings in place; a log m placed across LCC on the mine property; and a tailings impoundment constructed approximately 1.5 miles downstream of the mine on Lost Lake (LL) and referred to as Lost Lake Dam. Approximately 500,000 cubic yards of tailings are present behind Lost Lake Dam in the Lost Lake Deposition Area.

In February 1978, the lessees of the mine property at that time submitted an application for a National Pollutant Discharge Elimination System (NPDES) permit to the California Regional Water Quality Control Board (RWQCB or Board), seeking to discharge 63 million gallons of mine water to Little Clipper Creek as part of a project to de-water the mine workings. RWQCB found high concentrations of arsenic in mine discharge water and did not issue a permit. In 1979, the decomposing log dam released tailings into Little Clipper Creek and the Board issued a Cleanup and Abatement Order to the owner and lessees of the mine property. Various public and private entities conducted sampling over the next decade and continued to find high concentrations of arsenic in surface water, mine discharge, waste rock, and tailings.

The Site first came to EPA's attention through a citizen complaint. EPA identified the Site's potential for releasing hazardous substances into the environment and added it to its Comprehensive Environmental Response, Compensation and Liability Information System inventory on November 25, 1991 and first inspected the Site in April 1992. EPA documented the release of arsenic into Little Clipper Creek as well as the unfenced and publicly accessible mine waste piles containing elevated levels of arsenic, lead, and cyanide in its April 1993 Preliminary Assessment report. Based on the report, EPA decided further investigation was necessary and collected sediment and soil samples in May 1994. EPA's November 1994 Site Inspection report documented elevated concentrations of arsenic and lead in both soil and sediment. In 1995, EPA issued an Expanded Site Inspection report that documented arsenic

and lead contamination was flowing from approximately 80,000 cubic yards of waste rock and mine tailings into Little Clipper Creek.

During a major winter storm on January 1, 1997, the upper half of the onsite log dam collapsed, releasing over 10,000 cubic yards of tailings into LCC. The downstream areas received extensive deposits of tailings in LCC, downstream in CC after it merges with LCC, and in LL. Following the partial collapse of the log dam, EPA determined that the high arsenic concentrations and mobility of the tailings posed the threat of future releases and warranted a time-critical removal action to divert surface water flows upstream of the dam and stabilize mill tailings remaining in the vicinity of the dam.

From October 1997 to July 1998, EPA conducted the initial emergency response and removed 4,000 cubic yards of tailings from just upstream of the damaged log dam and stockpiled this material in a more stable location closer to the mine buildings. These tailings were placed in an interim cell, During the OU1 remedy, those stockpiled tailings were incorporated beneath the overall tailing pile cap which is comprised of a non-woven geotextile, LLDPE, and 18-inches of soil.

The project also included grading the tailings pile upstream of the log dam to reduce its slope, reinforcing the partially failed dam with large-diameter rock, diverting the water discharging continuously from the mine adit around the tailings pile, and diverting LCC around the tailings pile. EPA stabilized another smaller tailings release in 1998.

EPA listed the Site on the Superfund National Priorities List in February 1999 and began the remedial investigation in October 1999. From April 2003 through February 2004, EPA conducted another removal action to reduce risks to certain individuals living on the mine property and to others whose individual water supply wells had demonstrated elevated levels of arsenic. Actions taken included the offsite relocation of the occupants of the two residences on OU1 that were later demolished as part of the OU1 remedy (parcels 39-160-25 and 39-160-30 also referred to as the Upper and Lower Rentals respectively) and the installation of water filtration treatment units at three impacted residences.

1.2 Physical Characteristics

The Lava Cap Mine Site is in a rural residential area of the Sierra Nevada foothills. The Site includes the mine area and then continues along the LLC all the way to Lost Lake over a mile downstream. The mine is located approximately 5 miles southeast of Nevada City and 6 miles east of Grass Valley at 14501 Lava Cap Mine Road, Nevada City, California.

The combined OU1 and OU4 Mine Area cover approximately 30 acres. The two residences that remain on the mine property and which comprise OU4 include the residences on parcels (39-160-21), and (39-160-16). There are three additional residences along Tensy Lane in the lower stretches of the Mine Area.

Ten acres of downstream property include the Little Clipper Creek (LCC) drainage, the Clipper Creek (CC) drainage after it merges with LCC, and Lost Lake (LL), a private lake located approximately 1.25 miles south of the Mine Area. The entire Lava Cap Mine Site, including the Mine Area and downstream areas, is bordered on all sides by forest and low-density rural residential properties.

The area impacted by the Site include both abandoned industrial process areas and residential areas. There are seven parcels associated with the historic mine and an additional three parcels (30-160-65 & 30-160-66 & 39-160-77) not associated with the mine, but on which mine tailings have been deposited by surface water transport from the mine. All seven parcels are zoned with the Nevada County use designation RA-5 (Residential/Agricultural), and are expected to remain as such. All the residential parcels relied on individual wells for their water supplies. Well water has been replaced by water supplied by the Nevada Irrigation District (NID).

1.3 Hydrology

The Site contains five main rock types, including mine deposits (waste rock and tailings overlaying basal gravel), Tertiary volcanic breccias (Tvb unit), Cretaceous igneous intrusive rocks, Jurassic to Triassic metamorphosed volcanic rocks, and Paleozoic to Upper Jurassic metamorphic rocks (Pms unit). See Figure 3.

Groundwater occurs in primary pore spaces in the saturated overburden throughout the Site and in secondary openings (e.g., fissures, faults, and joints) of the consolidated and crystalline rocks of the Pms unit, which has a low hydraulic conductivity (10^{-5} to 10^{-6} centimeters per second). Groundwater also occurs in the more permeable Tvb unit that overlies the Pms unit north of the mine. Springs occur at the contact between the Tvb and Pms units. Groundwater flow is primarily from high topographic elevations (e.g., ridges) toward deep drainages, including LCC, CC, and Little Greenhorn Creek to the south-southeast. The regional groundwater table is a subtle expression of the land surface (Figure 4). Groundwater in the waste rock/tailings pile likely seeps beneath the Rock Buttress into the Pms unit and flows toward the LCC drainage. Groundwater flow also occurs in the basal gravel and fractured metasediment present at the contact between overburden material and bedrock throughout the Site, potentially creating a preferential flowpath along the contact. Groundwater flowing from northwest of LL likely discharges into the lake on the northwest shore of the northern lobe of the lake and seeps beneath Lost Lake Dam on the southern shore of the southern lobe of the lake. No long-term increasing or decreasing trends were observed in groundwater levels at the Site, suggesting that the system is in a state of dynamic equilibrium.

Vertical hydraulic gradients are generally downward in the waste rock/tailings pile (according to pre-OU1 RA water levels) and the Lost Lake/Deposition Area. In the Mine Area, vertical hydraulic gradients on the ridge above LCC alternate downward and upward at Well Pair 5K-S/5K-D and are consistently upward at Well Pair 5L-S/5L-D. Initial data indicate that CC seasonally alternates as a gaining or losing stream at Staff Gauge 14E. These observations and groundwater flow modeling results suggest that the groundwater table is located very near the bottom of the CC channel near Staff Gauge 14E. See Figure 4.

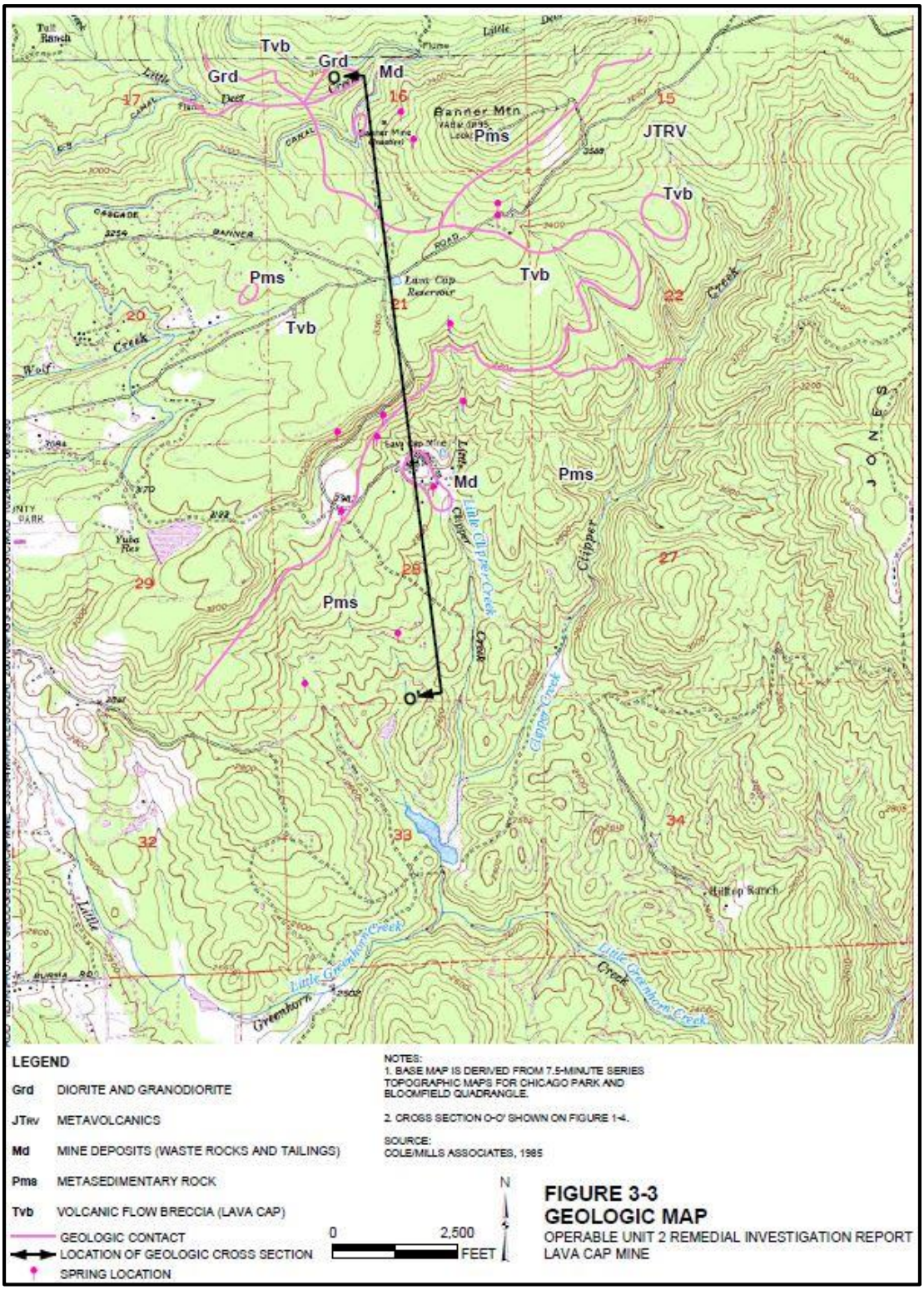

Figure 3. Geologic Map

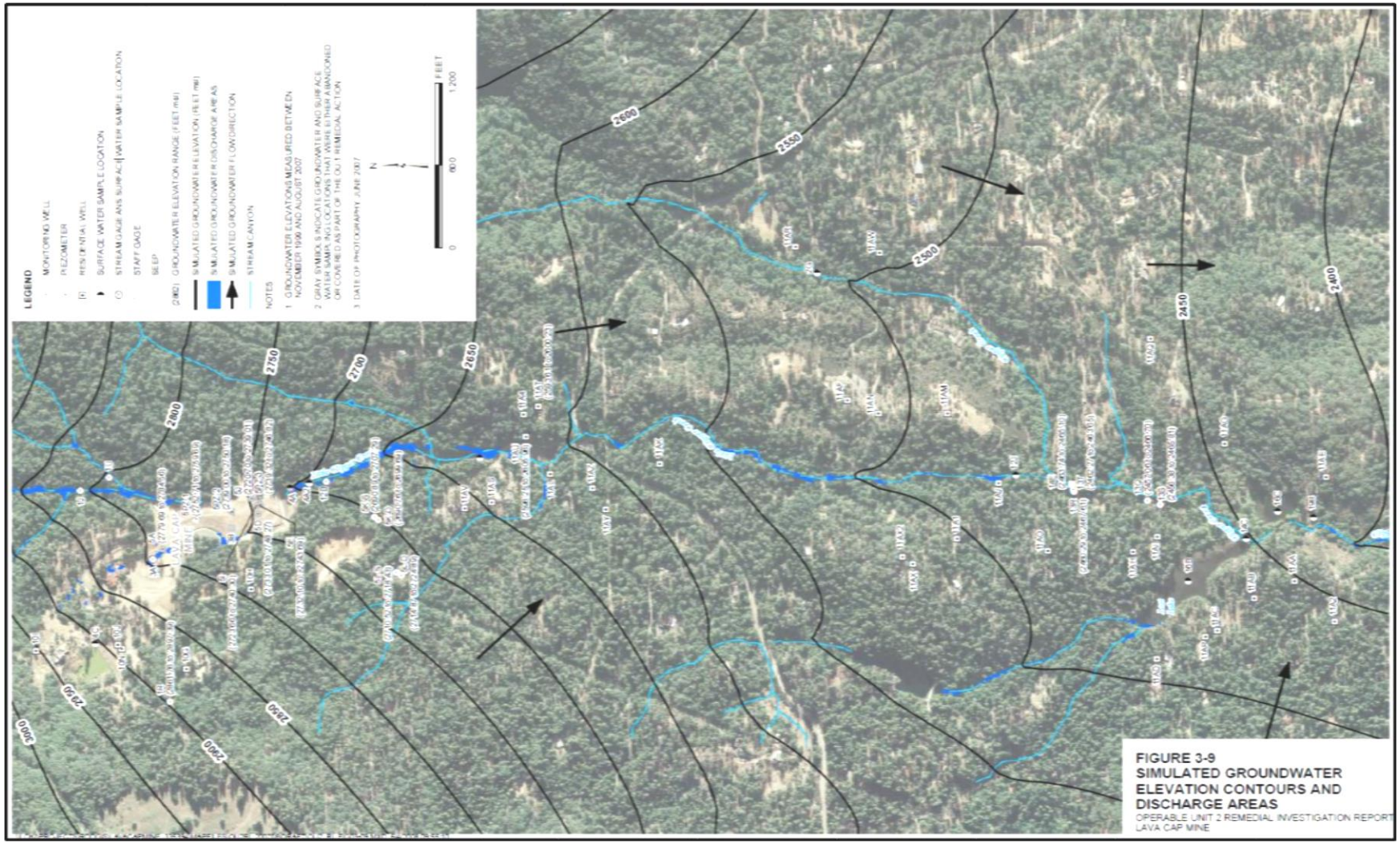

Figure 4. Groundwater Flow

2 Remedial Actions Summary

2.1 Basis for Taking Action

The contaminant of concern at the Site is arsenic, which was found above health-based standards in soil, sediment, surface water, and groundwater. Arsenic is a known human carcinogen and is potentially harmful to plant and animal species. The primary human exposure pathways included dermal contact with contaminated soil, sediment, or contaminated surface water; ingestion of contaminated soil, sediment, or contaminated water; inhalation of contaminated soil or windborne dust; and ingestion of, and dermal contact with, contaminated groundwater where residential wells contained elevated levels of arsenic.

Completed pathways for terrestrial receptors included ingestion of contaminated surface water and biota and dermal contact with contaminated water, soil, and sediment. Aquatic receptors are potentially exposed through the pathways of ingestion of contaminated surface water, sediment, and biota, and dermal contact with contaminated surface water and sediments.

2.2 Remedy Selection

EPA selected a remedy (2004 ROD) for OU1 on September 28, 2004. The ROD originally included Parcels 39-160-16 and 39-160-21, which were subsequently separated from the rest of OU1 and designated as OU4 to allow for accelerated cleanup of these residential areas during the 2005 construction season. This accelerated cleanup is documented in the *EPA Explanation of Significant Differences to the 2004 Record of Decision for the Lava Cap Mine Superfund Site, Mine Area Operable Unit (OU1), Nevada City, California. September 2006.*

In 2008 Interim ROD, EPA selected replacing well water at properties where existing wells are affected by mine-related arsenic contamination in groundwater for OU-2.

2.2.1 Remedial Action Objectives

Remedial action objectives (RAOs) selected in the decision documents are listed below.

<u>OU1 - Mine Buildings, Tailings, Waste Rock, and Mine Drainage</u>

The following are the specific RAOs for the Mine Area OU presented in the 2004 ROD:

- Protect human health against exposures to contaminants in soil, sediment, and surface water via ingestion, inhalation, or direct contact that present an unacceptable risk to human health;
- Remediate contaminants that exceed cleanup goals in soils, sediments, and surface water to the extent technically and economically feasible;
- Restore Little Clipper Creek (LCC) to its beneficial use as a potential drinking water supply
- Protect ecological receptors from exposure to contaminants in soils, sediments, and surface water that pose a significant risk;

- Minimize the potential for migration of contaminants in soil and sediment that pose a threat to the beneficial uses of groundwater and surface water;
- Minimize the potential for release of contaminated tailings during a seismic event producing 60 percent of peak ground acceleration or 0.3 g (i.e., three-tenths the force of gravity);and
- Minimize the potential for release of contaminated soils and sediments during surface water flow events up to the 100-year return frequency event.

OU2 – Groundwater/Drinking Water Component

A 2008 Interim ROD describes the following RAO for the groundwater OU:

- Protect against residential exposure to groundwater contaminated with mine-related arsenic that presents an unacceptable risk to human health.

OU4 - Mine Area Residences

The following OU1 RAOs established in the 2004 ROD (EPA, 2004) apply to the OU4 Mine Area Residences:

- Protect against exposure to contaminants in soil via ingestion, inhalation, or direct contact that present an unacceptable risk to human health;
- Remediate contaminants that exceed cleanup goals in soil to the extent technically and economically feasible;
- Protect ecological receptors from exposure to contaminants in soils, that pose a significant risk
- Minimize the potential for migration of contaminants in soil that pose a threat to the beneficial uses of groundwater and surface water; and;
- Minimize the potential for release of contaminated soils during surface water flow events up to the 100-year return frequency event.

2.2.2 Remedy Components

OU1 - Mine Buildings, Tailings, Waste Rock, and Mine Drainage

Institutional Controls

- Restrict unauthorized access by requiring deed restrictions limiting access and preventing residential, industrial, or recreational use of Parcels 39-160-25 and 39-160-28;
- Require deed restrictions to prevent intrusive activities such as construction or excavation of any type that may disturb the selected remedy on Parcels 39-160-25 and 39-160-28;
- Require deed restrictions to prevent alteration or interference with the operation of the LCC diversion structure partially located on Parcel 39-160-27; and
- Require deed restrictions to prevent alteration of the asphalt cap placed on existing gravel roadways on Parcels 39-160-25 and 39-160-30.

Mine Buildings

- Restrict unauthorized access through the installation of chain link fencing at the mine shaft and buildings;
- Achieve cleanup goals through the excavation of soil in and around the cyanide, mill, and assay buildings;
- Reduce or eliminate hazards in the cyanide, mill, and assay buildings, including removal of soil and debris associated with former process tanks, removal of cyanide vats, and removal of sumps; and
- Subject material from the cyanide, mill, and assay buildings, to chemical analysis and consolidate material on site or send off site to an appropriate disposal facility.

Tailings

- Regrade the tailings to flatted slopes;
- Achieve cleanup goals by excavating contaminated soil located around the periphery of the waste rock and tailings piles and consolidating this material under the tailings pile engineered cover system for long-term management;
- Cap the tailings with a low permeability engineered cover system.
- Remove the remnants of the log dam and, in its place, construct a rock buttress capable of withstanding a horizontal ground acceleration of 0.3 g (where g is the force of gravity);
- Install horizontal drains beneath the surface of the tailings at the upstream (or tailings) side of the buttress to dewater the tailings and collect any leachate generated by the tailings for piping to the water treatment plant to be constructed as part of the selected remedy;
- Install a channel to direct LCC along the eastern boundary of the tailings pile;
- Construct diversion channels for the western drainage that occurs adjacent to the mine buildings and for the seasonal water flow that occurs along the western boundary of the tailings pile; and
- Conduct periodic monitoring of surface water and groundwater downgradient of the tailings pile to assess compliance with cleanup goals.

Waste Rock

- Construct shallow rip-rap lined surface water diversion structures above the mine shaft and waste rock areas to reduce infiltration into the system of shafts and tunnels and thereby potentially reduce the volume of adit seepage;
- Regrade the waste rock to facilitate runoff and reduce surface water infiltration;
- Cover the re-graded waste rock with 1 foot of soil and vegetation; and
- Pave the primary access roads (which appear to have rock waste based components) on the property, including a road to the surface water treatment plant, to reduce dust emissions.

Mine Residences

Demolish two residences. (Upper Rental residence on Parcel 39-160-25 and the Lower Rental residence on Parcel 30-160-30); The 2006 ESD documented the change from excavating around the Lower Rental to demolishing the Lower Rental based on additional information obtained during the RD phase.

Mine Drainage

- Restrict unauthorized access through the installation of chain link fencing at portions of the Site including the water treatment plant, the piping, and the treatment facilities installed as part of the selected remedy;
- Pump water out of the mine workings to reduce or eliminate discharge from the adit; pipe extracted mine water to the water treatment plant that is to be constructed as part of the selected remedy;
- Construct an adit structure to measure seepage flow rates and to collect any remaining adit seepage not captured by pumping from the mine workings; subject material excavated from the adit as part of construction to chemical analysis and consolidate on site or ship off site to an appropriate disposal facility;
- Construct a water treatment plant to treat surface water collected from the mine workings and/or adit and from the mine tailings; and
- Conduct periodic monitoring of surface water in LCC upstream and downstream of the mine area to assess compliance with cleanup goals.

Little Clipper Creek

- Achieve cleanup goals by excavating arsenic-contaminated soil/sediment from the LCC channel and adjacent depositional areas;
- Subject excavated tailings to chemical analysis and consolidate material on site or ship off site to an appropriate disposal facility;
- Grade the excavated area to re-establish the LCC channel, stabilize the channel bed and banks, and revegetate in a manner similar to pre-existing conditions;
- Construct roads to provide access areas requiring excavation (to be removed following completion of construction activity); and
- Continue to conduct surface water monitoring in LCC within and downstream of the boundaries of the Mine Area OU to assess compliance with cleanup goals.

OU2 - Groundwater/Drinking Water Component

EPA selected replacing well water at properties where existing wells are affected by mine-related arsenic contamination in groundwater in the 2008 Interim ROD. The remedy consisted of constructing a public water supply line to residences with wells that were impacted by mine-related arsenic contamination and connecting these residences to NID water supply system. The selected remedy also includes

implementation of a long-term groundwater monitoring program and a land use notification process intended to minimize the potential for new wells to be installed in contaminated areas.

This was an interim remedy that focused solely on the drinking water component of the Groundwater Operable Unit. Further study is required to better understand the complexities and interactions between the fractured bedrock aquifer and surface water. After additional data are gathered and analyzed, EPA will issue a final ROD for OU2 to determine whether treatment is necessary for the remaining groundwater contamination.

OU4 - Mine Area Residences

In the vicinity of the Mine Area OU there are two residential parcels of land located away from the mine's historic operations (39-160-16 and 39-160-21). To allow for an accelerated cleanup of residential areas, EPA separated these parcels from the rest of the Mine Area OU and made it a separate Operable Unit, designated as the Mine Area Residences OU (also called "0U4").

EPA documented a change to the 2004 OU1 ROD cleanup plan for the Mine Area Residences in a September 2006 Explanation of Significant Differences ("ESD"). The ESD explained EPA's post-ROD basis and decision to demolish two, instead of one, residences located on mine tailings, and to excavate around one residence, instead of three residences, based on additional information obtained during the Remedial Design ("RD") phase of OU1.

Remediation of parcel 39-160-16 included access road and driveway paving, culvert installation, and excavation, backfilling and revegetation of a residential yard. The only required remediation activity conducted on parcel (39-160-21) was paving the access road that heading up the hill above the residence.

2.2.3 Cleanup Goals

To achieve the RAOs, EPA set numeric cleanup goals for the contaminated media; these are presented in Table 2.

Table 2: Cleanup Goals

Media	Arsenic Cleanup Goal	Basis for Goal
Surface Water, Groundwater	10 µg/L[1, 2]	Federal MCL (based on potential beneficial use of surface water as a drinking water supply)
Surface Soil	20 mg/kg[1]	Background concentration (ensures cleanup to naturally occurring levels in the surrounding environment)
Sediment	25 mg/kg[1]	Background concentration (ensures cleanup to naturally occurring levels in the surrounding environment)

Notes: µg/L = micrograms per liter; mg/kg = milligrams per kilogram; MCL = maximum contaminant level
[1] OU1 ROD (EPA, 2004)
[2] OU2 Interim ROD (EPA, 208)

2.3 Remedy Implementation

OU1 - Mine Buildings, Tailings, Waste Rock, and Mine Drainage

Mobilization for construction activities at OU1 started in late May 2006. On-site structures were removed and the highly contaminated materials was shipped off site for disposal. The waste rock area was regraded and revegetated. All tailings, contaminated soil and contaminated sediment was consolidated and capped on-site. Channels to divert Lower Clipper Creek were constructed, as well as, channels to divert clean surface water flows around the mine buildings, tailings pile, and waste rock pile. The Upper Rental residence and the Lower Rental residence (Parcels 39-160-25 and 39-160-30, respectively) were demolished. After demolition, these areas were addressed in a manner consistent with the treatment of other waste rock/tailings impacted areas, including construction of a vegetative soil cap. Construction was completed in December 2007.

The adit water or mine drainage component of the Mine Area OU1 remedy is still in the remedial design phase and has been designated as a separate RA; therefore, it is not addressed in this FYR Report. As part of the phased implementation of the Mine Area OU1 remedy, treatment of the mine drainage is planned to be the final remedy component constructed. This phasing allows time for evaluation of any changes in mine drainage characteristics resulting from implementation of the Mine Area OU1 remedy components and provides an opportunity for additional pilot testing of treatment technologies for the mine discharge.

Because mine waste and contaminated materials were capped and left in place, institutional controls (ICs) are required to minimize potential future exposure. The 2004 ROD requires implementing land use restrictions to protect the remedy from physical disturbance and prohibit residential use of land parcels where such use is inconsistent with the constructed remedy. Land use covenants have been drafted for OU1 Parcels 39-160-25, 39-160-27, 39-160-28, and 39-160-30 (Appendix C), and EPA has obtained concurrence from California Department of Toxic Substances Control (DTSC) on these draft documents. However, to date, the property owner has not agreed to record the restrictions. EPA will continue to work with the property owner to have these land use covenants recorded. A summary of planned and implemented ICs can be found in Table 3.

OU2 – Groundwater/Drinking Water Component

Construction activities at OU2 began in July 2012 and were completed in November 2013. EPA constructed an approximately 1.5 mile 8-inch distribution line and service lines to seven residences.

A monitoring program is in place to determine if other residential wells are impacted by arsenic contaminated mine waste.

To limit potential human exposure to contaminated groundwater, EPA has being working with the Nevada County Environmental Health Department (NCEHD) to develop a land use notification process for 30 to 50 parcels located within the footprint of potential groundwater flow paths emanating from Lava Cap Mine. To implement this notification process, EPA provided NCEHD parcels numbers and maps showing the parcels located in potentially impacted areas. It should be noted, however, that existing wells in most of

these areas currently produce water that is below the MCL for arsenic. Whenever a resident located on one of the potentially impacted parcels requests a well permit from NCEHD, the NCEHD should notify EPA and provide the resident with written information about the potential for arsenic contamination in the proposed well and the associated health risks.

OU4 – Mine Area Residences

Construction activities started at OU4 on-September 21, 2005 and were completed in December 2005.

Remediation of parcel 39-160-16 included access road and driveway paving, culvert installation, and excavation, backfilling and revegetation of a residential yard. The required remediation activity conducted on parcel (39-160-21) was paving the access road that heading up the hill above the residence.

Table 3: Summary of Planned and/or Implemented ICs

Media, Engineered Controls, and Areas That Do Not Support UU/UE based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Tailings, waste rock (OU1)	Yes	Yes	39-160-25 39-160-28	1) Restrict unauthorized access 2) Prevent residential, industrial, or recreational use 3) Prevent intrusive activities that may disturb the remedy or alter or interfere with the operation of the remedy	Deed Restriction
Diversion structure on LCC (OU 1)	Yes	Yes	39-160-27	Prevent alteration or interference with the operation of LCC diversion structure	Deed restriction
Asphalt cap (OU 1)	Yes	Yes	39-160-25 39-160-30	Prevent alteration of the asphalt cap placed on existing gravel roadways	Deed Restriction

Media, Engineered Controls, and Areas That Do Not Support UU/UE based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Soil (OU1)	Yes	Yes	39-16-25, 39-160-27, 39-160-28, 39-160-30	Minimize potential future exposure, protect the remedy from physical disturbance, and prohibit residential use of parcels where such use is inconsistent with the constructed remedy	Land Use Covenant
Groundwater (OU2)	Yes	Yes	OU2 parcels located within the footprint of potential flowpaths emanating from the mine	Prevent exposure to contaminated groundwater	Land Use Notification
1) Mine Area residential soil (OU4) 2) Soil (OU1)	Yes	No	1) 39-60-16 (beneath the residence) 2) 39-170-66 (beneath Tensy Lane where it crosses LCC)	Prevent disturbance of and exposure to wastes left in place	Land Use Covenant

2.4 Operation and Maintenance (O&M) for OU1 and OU4

The cap has been operational since December 2007. Until January 2011 and in accordance with the Operation and Maintenance Manual for the Mine Area (OU1) Phase 1 and Mine Residences (OU4) Remedial Actions (CH2MHILL, 2010), EPA contractors performed routine inspections and as-needed maintenance to keep the system operational. In February 2011, the DTSC took over the O&M for this remedy and issued a new O&M manual, *Operation and Maintenance Work Plan – Lava Cap Mine, Lava Cap Mine Superfund Site, Nevada City, California* (Arcadis, 2011). Since that time, O&M has consisted of inspections, irregular maintenance and repairs as discussed in the Annual Summary Reports (ARCADIS, 2012, 2013).

The CH2MHill 2010 O&M Manual does not have a high and low priority, per se, but has a recommended schedule and frequency of when inspection/maintenance activities are to be performed. Since very little O&M has been performed the past few years, there are high priority items that require immediate attention as they are hindering effective remedy performance and many of the items is negatively impacting the data collected as part of the adit sampling design efforts.

Once these items are completed/corrected, the recommended inspection and monitoring schedule presented in the Manual should be resumed. Low priority items should be addressed during normal or recommended schedule/frequency per the Manual.

DTSC O&M activities have included the following:

- Clearing debris and vegetation from the mine adit drainage channels and LCC;
- Removal of significant vegetation from storm water channels;
- Placement of straw wattles on the slope of the adit discharge weir and along the western cap slope leading to the adit discharge; and
- Removal of branches from the culvert below the rock buttress.
- All maintenance operations were performed in accordance with the work plan (ARCADIS, 2011) with the following exceptions:
    - A settlement monument survey was not performed in 2011;
    - The Site inspection scheduled to be performed per the O&M work plan in March 2012 could not be completed until June 2012 due to site access issues.

In 2013 only two Site inspections were performed due to access issues (the work plan recommends eight). Site features associated with OU1 and OU4 were found to be intact during the inspections and generally performing as-designed, and;

In 2014, no Site inspections performed due to site access issues.

According to the annual reports, there were several other observations that have not been addressed since the time the reports were filed. These include:

- Localized slope failure in the form of minor sloughing of soils on the slope just up-gradient of the mine adit; and
- Poor vegetative cover on the tailings pile final cover.

EPA has provided recommendations to DTSC for improving the management of soil, sediment and vegetation removed during maintenance activities on site. A summary of deficiencies can be found in Section 4.3. EPA recommendations to DTSC can be found in Section 6.1 of this FYR.

3 Progress Since the Last Five-Year Review

3.1 Previous Five-Year Review Protectiveness Statement and Issues

The protectiveness statement from the 2011 FYR for the Lava Cap Superfund Site stated the following:

According to the data reviewed and the site inspection, the remedy is functioning as intended by the ROD and ESD. The selected ICs (land use covenants) have not yet been recorded, but in the interim, EPA ensures compliance with the land use restrictions for these parcels through routine O&M inspections that evaluate whether the implemented remedy has been compromised.

The 2011 FYR included three issues and recommendations. Each recommendation and the current status is discussed below and summarized in Table 4.

Table 4: Status of Recommendations from the 2011 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description
1	Land use covenants	Land use covenants should be implemented per the OU1 ROD	Considered But Not Implemented	Land use covenants have been prepared and are ready to be recorded but the property owner has not agreed to record them.
4	Selected ICs do not cover waste that was left in place.	ICs should be at the rental house on Parcel 39-160-16 and Parcel 39-170-66 (beneath Tensy Lane where it crosses LCC)	Under Discussion	Not yet implemented

3.2 Work Completed at the Site during this Five Year Review Period

For OU1, DTSC O&M was performed in 2012, 2013, and 2015 as described in Section 2.4.

For OU2, on December 2, 2013 the water supply pipeline became fully functional and NID accepted the pipeline. EPA connected six residences' service lines to the NID water supply pipeline in 2014.

Three groundwater Sitewide sampling events were conducted during this FYR period – in 2012, 2014, and 2015. To limit potential human exposure to contaminated groundwater, EPA has being working with the Nevada County Environmental Health Department (NCEHD) to develop a land use notification process for 30 to 50 parcels located within the footprint of potential flow paths emanating from Lava Cap Mine. To implement this notification process, in 2011 EPA provided NCEHD parcels numbers and maps showing the parcels located in potentially impacted areas. It should be noted, however, that existing wells in most of these areas currently produce water that is below the MCL for arsenic. EPA envisions that whenever a resident located on one of the potentially impacted parcels requests a well permit from NCEHD, the NCEHD will notify USEPA and provide the resident with written information about the potential for arsenic contamination in the proposed well and the associated health risks. At the issuance of the final ROD for OU2, EPA will evaluate institutional controls for the Groundwater.

4 Five-Year Review Process

4.1 Community Notification

EPA placed a public notice in the *Grass Valley Union Newspaper* in August 2016, stating that there was a Five-Year review and inviting the public to submit any comments to the U.S. EPA. There were no comments. The results of the review and the report will be made available at the Site information repository located at the following locations:

Nevada County Library
980 Helling Way
Nevada City, CA 95959
(530) 265-7050

Grass Valley Public Library
206 Mill Street
Grass Valley, CA 95945
(530) 273-4117

Site documents are also located on EPA's web site: www.epa.gov/region09/lavacap.

4.2 Data Review

The results of samples collected from 32 groundwater and surface water locations sampled during January, 2014 are compared to historic results and presented below (CH2MHILL, 2014). The data collected is being used to support the upcoming Record of Decision for the Groundwater OU.

4.2.1 Groundwater (OU 2)

Arsenic detections above background concentrations are present within the Mine Site Area as well as select downgradient locations along Tensy Lane (Figure 5, Figure 6). Although the Tensy Lane residential wells are no longer being used as a source of drinking water, they remain in the sampling program to assist in groundwater contaminant characterization. The arsenic concentrations in residential wells within the footprint of potential flowpaths emanating from Lava Cap Mine including south of Greenhorn Road in the OU3 portion of the Site were non-detect or below the MCL when detected.

Concentrations of arsenic in groundwater are generally consistent with results from previous sampling events, with the exception of the 48,000 µg/L reported from monitoring well 13R. The elevated well 13R is attributed to high turbidity of 421 nephelometric turbidity units (NTU) in the sample. The region has experienced unusually dry conditions in the recent years, not typical of the winter season, with low seasonal rainfall totals. These unusual, drought-like conditions, coupled with the presence of sands and elevated turbidity readings in monitoring well 13R, may have been contributing factors to the remarkably high concentration of arsenic reported at 48,000 µg/L. This result is 60 times the 2012 results of 800 µg/L in 2012 when turbidity was 19.3 NTU.

Table 5. 2014 Arsenic Analytical Results

Type/Location	Sample ID	Parcel	Type	Note	Result (ug/L)
Monitoring Wells					
Mine Site Area	5KD	39-160-29	MW		**41**
	5KS	39-160-29	MW		**5.1**
	5KS	39-160-29	MW	Field Duplicate	**5.1**
	5LD	39-160-29	MW		**25**
	5LS	39-160-29	MW		**1,400**
	5MD	39-160-29	MW		**22**
	5MS	39-160-28	MW		**16**
	1R	39-160-16	MW		**17**
	1B	39-150-24	MW		**NS**
Deposition Area	13Q	39-221-69	MW		**170**
	13R	39-221-70	MW		**48,000**
	13S	39-221-69	MW		**6.8**
	13T	39-221-70	MW		**15**
Surface Water					
Deposition Area	14B	39-221-70	Surface Water		**83**
	15A	39-221-15	Surface Water		**58**
	15A	39-221-15	Surface Water	Field Duplicate	**55**
Residential Wells					
Mine Site Area	10H	39-160-30	ResWell		**NS**
	10G	39-160-16	ResWell		**29**
	10N	39-160-25	ResWell		**86**
Tensy Lane Area	11AL	39-170-77	ResWell		**26**
	11AL-TREAT1	39-170-77	ResWell	after RO unit	**1.1**
	11AL-TREAT2	39-170-77	ResWell	after RO unit	**1.7**
	11AS	39-170-66	ResWell		**16**
	11AS	39-170-66	ResWell	Field Duplicate	**17**
	11AU	39-170-66	ResWell		**2.9**
	11AV	39-170-65	ResWell		**NS**
	11AV-TREAT	39-170-65	ResWell		**NS**
Greenhorn/Deposition Area	11AA	39-230-45	ResWell		**0.25 U**
	11AB	39-230-58	ResWell		**0.86**
	11AC	39-230-51	ResWell		**0.25 U**
	11AD	39-221-22	ResWell		**NS**
	11AE	39-230-62	ResWell		**NS**
	11AF	39-221-01	ResWell		**NS**
	11AG	39-230-61	ResWell		**0.25 U**
	11AH	39-221-17	ResWell		**0.25 U**
	11AH	39-221-17	ResWell	Field Duplicate	**0.25 U**
	11AI	39-221-69	ResWell		**0.25 U**
	11AJ	39-221-13	ResWell		**0.25 U**
	11AK	39-170-74	ResWell		**NS**
	11AM	39-221-63	ResWell		**0.34 J**
	11AN	39-221-64	ResWell		**NS**
	11AO	39-221-15	ResWell		**0.25 U**
	11AP	39-221-23	ResWell		**0.54**
	11AQ	39-221-66	ResWell		**0.31 J**
	11AY	39-170-75	ResWell		**0.4 J**
	11AZ	39-170-75	ResWell		**NS**

Notes:

U = Not Detected
NS = Not Sampled
J = Estimated Value
RO Unit = Reverse Osmosis

All units are in µg/L

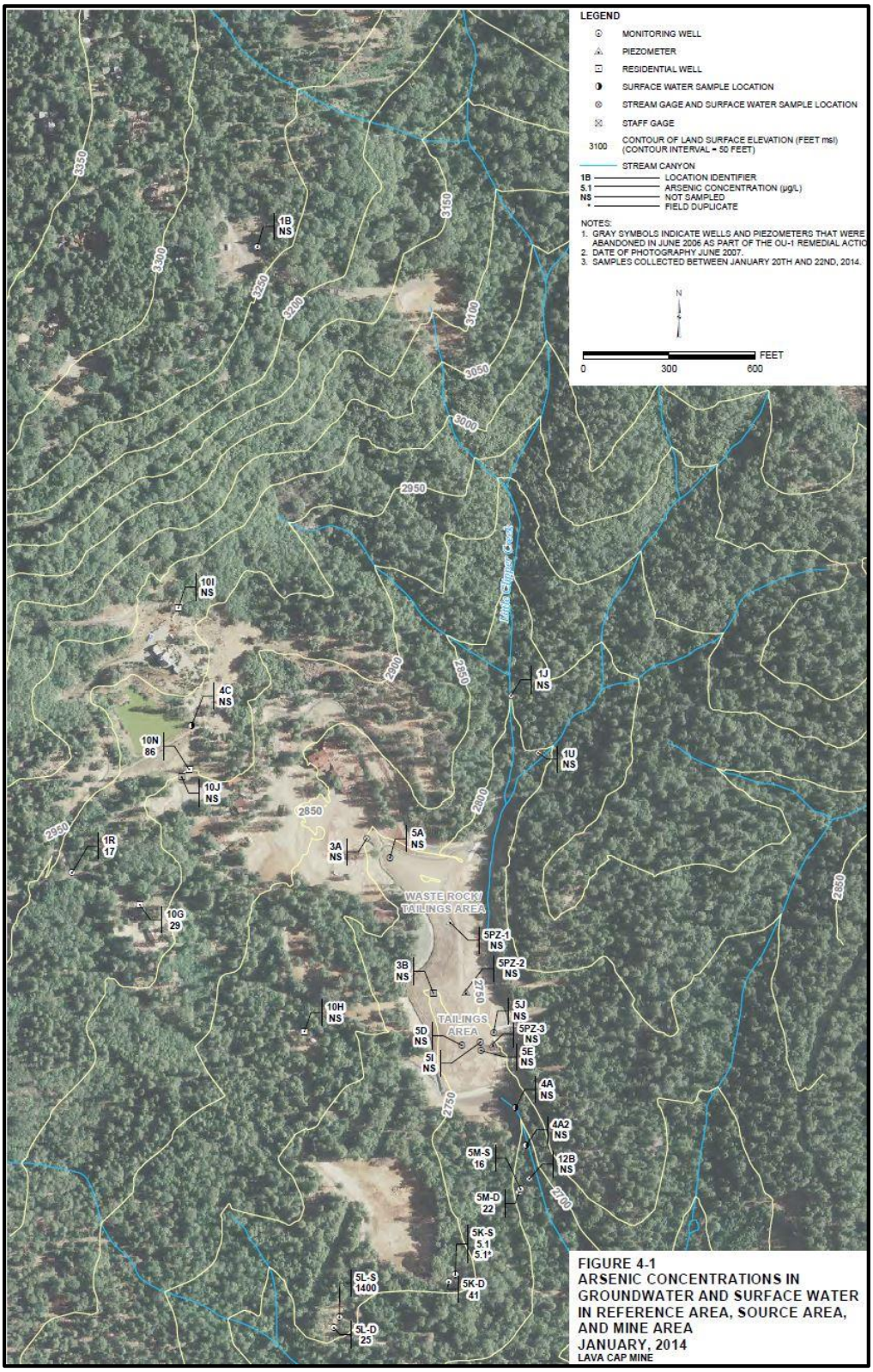

Figure 5: Arsenic Concentrations in Groundwater and Surface Water (Mine Site Area)

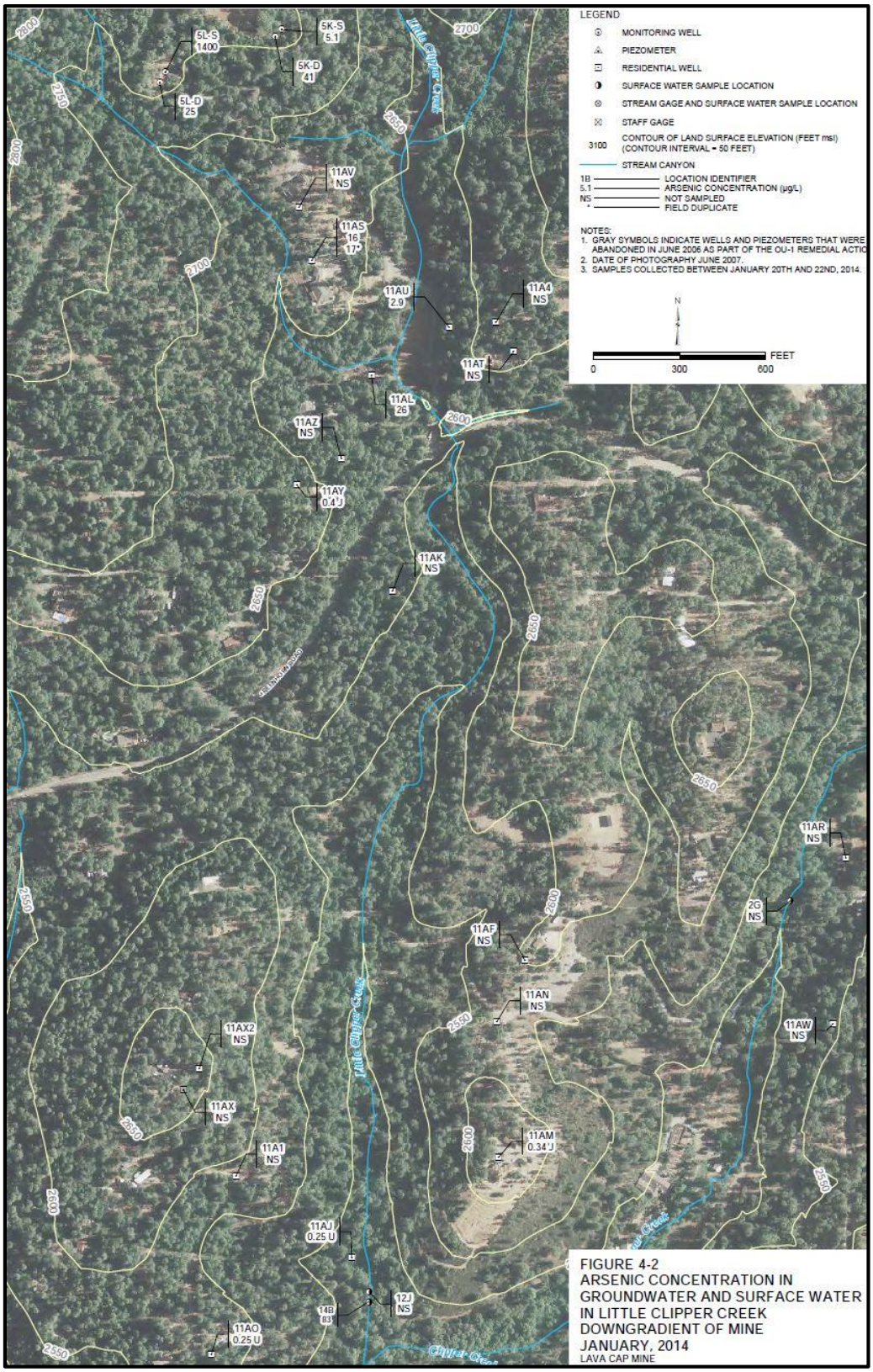

Figure 6. Arsenic Concentrations in Groundwater and Surface Water (Little Clipper Creek)

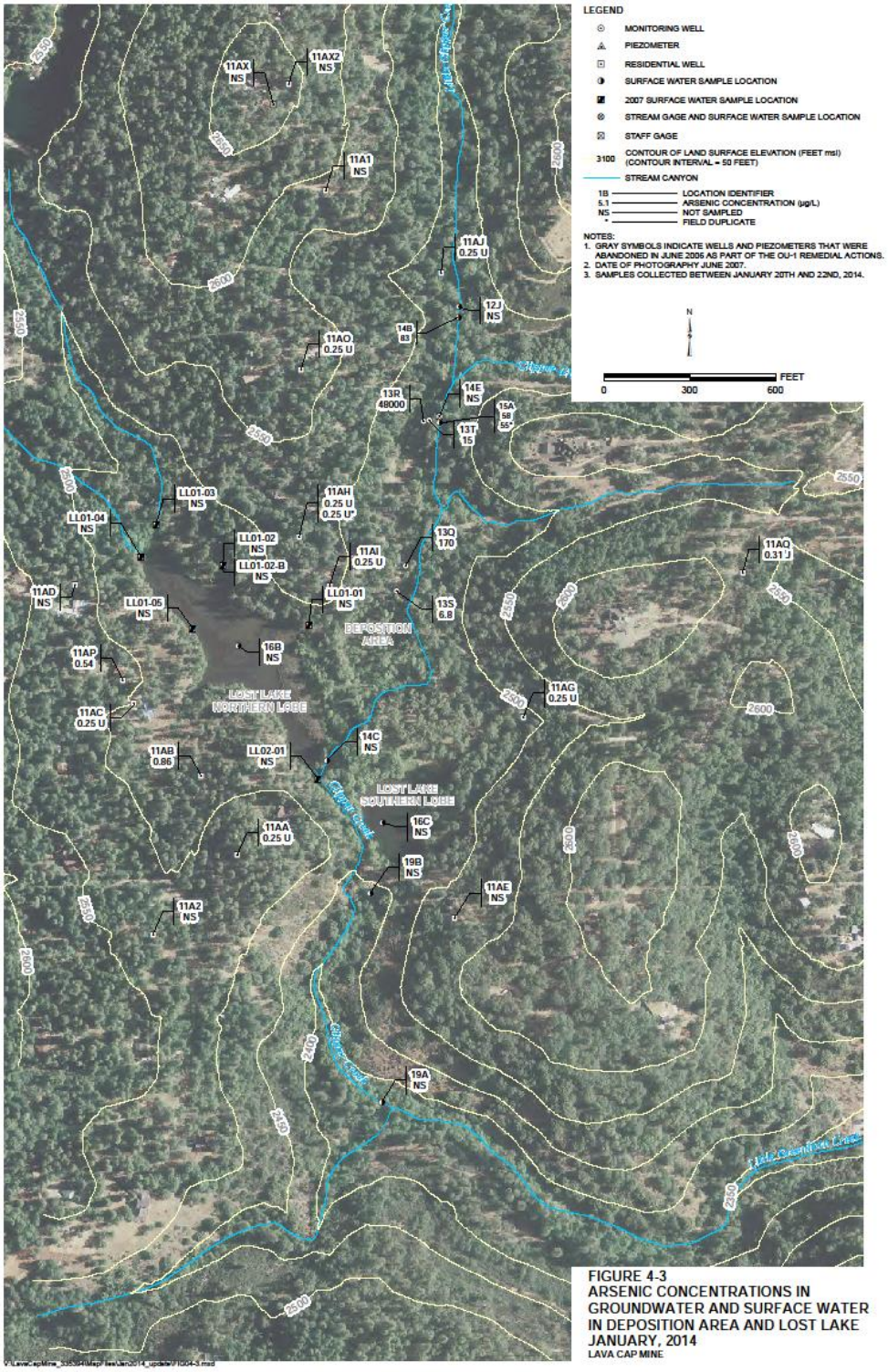

FIGURE 4-3
ARSENIC CONCENTRATIONS IN GROUNDWATER AND SURFACE WATER IN DEPOSITION AREA AND LOST LAKE
JANUARY, 2014
LAVA CAP MINE

Figure 7. Arsenic Concentrations in Groundwater and Surface Water (Deposition Area and Lost Lake)

4.3 Site Inspection

The Five Year Review inspection of the Site was conducted on October 19, 2015. In attendance were lead EPA representative Brunilda Dávila (EPA RPM), John Hartley (U.S. Army Corps of Engineers, Center of Expertise, geologist), and Jeff Taylor (U.S. Army Corps of Engineers, Sacramento District, geotechnical engineer). Jeff Taylor was present at the site on October 20, 2015, to perform an inspection on the Lost Lake Dam and to confirm some observations made by Mr. Hartley. The purpose of the inspection was to assess the protectiveness of the remedy for the Five Year Review. The Site inspection and accompanying Trip Report are provided in Appendices C1 and C2.

The focus of the inspection was the tailing pile cover, perimeter drainage ditches, and the buttress on the distal end of the tailing pile. A small covered area near the access road west of the main tailings pile at the location of the water treatment pilot plant was also inspected.

Several potential problems were identified in the northern portion of the tailings pile area due to lack of vegetation, and growth of woody vegetation and trees. The steeper areas of the tailing cover in the NW corner of the cover are also showing signs of tension cracking. Minor rilling from surface water runoff and erosion from vehicle rutting was observed. The EPA RPM indicated that the State had not performed any O&M on the cap for many months.

Perimeter channels were, for the most part, in very good condition with the exception of the G-3 channel which is choked with vegetation at the northern end of the tailing pile where silt from the steep slopes has been washed into the channel allowing wetland vegetation to thrive. The vegetation is extensive enough that it will impede flow in the channel during a large storm event, possibly to the point where water could overtop the banks and erode the toe of the cover.

The buttress and associated concrete drop structure and culverts were fully functioning and in good condition. However, continued discharge of mine impacted water from beneath the buttress indicates that water is migrating beneath the tailings, or is being originated from a source under the tailings. This discharge condition does not appear to reflect on the protectiveness of the cover. Exposure to mine impacted water is possible at two locations, neither of which have signage indicating potential exposure risk

Wells and cleanouts were in good condition with no damage to the cover penetration boots. The metal cap on the cleanout on the southwest corner of the buttress was unlocked and not fully set on the well protective casing. However, there was no apparent damage to the well.

5 Technical Assessment

5.1 Question A: Is the Remedy Functioning as Intended by the Decision Documents?

Yes. Document review and the results of the Site inspection indicate that the remedies are generally functioning as intended by the ROD, Interim ROD and ESD.

Remedial Action Performance

The engineered tailings pile cap and vegetative caps installed as part of the OU1 remedy have been performing as intended. Contaminated well water has been replaced by the NID water supply line. The performance of these remedies is protective of human health and the environment. However, since very little O&M has been performed the past few years, there are high priority items that require immediate attention as they are hindering long term effective remedy performance.

System Operations/O&M

The O&M procedures were found to be inadequate to maintain the effectiveness of the remedy. The following items require corrective action:

- Remove woody vegetation and trees growing on the cap,
- Revegetated the cap especially on steep slopes in order to prevent erosion,
- Remove vegetation from channels,
- Repair ruts in cover,
- Install surface water diversions or velocity reducing structures
- Vehicle traffic should be reduced or eliminated.
- Future Site inspection should be scheduled after major rainfall events.

Despite the need for corrective action, the capped mine wastes remain under control and the performance of the remedy is currently protective.

Implementation of Institutional Controls and Other Measures

The ROD requires land use restrictions (i.e., land use covenants) to protect the cap from physical disturbance and prohibit residential use of land parcels where such use is inconsistent with the constructed remedy. Land use covenants have been drafted, and EPA has obtained concurrence from the State (i.e., DTSC) on these draft documents. However, to date, the property owner has not agreed to record the restrictions. EPA and DTSC are working with the property owner to record these land use covenants and, in the interim, to ensure the cap is protected and there is no residential use inconsistent with the remedy occurring on these parcels (Appendix C). EPA will continue to monitor whether any of the impacted parcels are transferred to new owners and, if so, will work with the new owner to record these land use covenants.

The ICs selected in the remedy do not address two areas where wastes were left in place: beneath the house on Parcel 39-160-16 and beneath Tensy Lane where it crosses LCC on Parcel 39-170-66. It may be necessary to expand the area where ICs are implemented to include these two areas to prevent disturbance of and/or exposure to the wastes left in place. Until this time, the remedy is protective in the short term as the residents are aware of the hazards. EPA has alerted the residents that prior to conducting any foundation or work on Tensy Lane they should consult with EPA to make sure that appropriate Health and Safety and Hazardous Waste management Plans are in place.

5.2 Question B: Are the Exposure Assumptions, Toxicity Data, Cleanup Levels, and Remedial Action Objectives Used at the Time of Remedy Selection Still Valid?

Yes. The exposure assumptions, toxicity data, cleanup levels and Remedial Action Objectives remain valid.

There have been no changes in applicable or relevant and appropriate requirements (ARARs) and no new standards or factors to be considered (TBCs) affecting the protectiveness of the remedy. Details regarding ARARs can be found in Appendix B.

The toxicity factors used in human health risk assessment at the time of the remedy selection have not changed and are still valid. A detailed risk assessment review and toxicity analysis for human and ecological health is provided in Appendix D. The risk assessment methodologies that affect the protectiveness of the remedy have not changed and are still valid. The exposure assumptions have not changed and are still valid. The exposure pathway for the Mine Site Area has been eliminated through the excavation, consolidation, and capping of contaminated soil. Ingestion of groundwater from contaminated wells has also been eliminated by the installation of the NID water supply.

Bioavailability, although not strictly an exposure pathway, has an impact on the magnitude of exposure. The site-specific bioavailabilty of arsenic has been determined to be lower than it was thought at the time of the risk assessment. There is no impact from this determination on the protectiveness of the remedy since a decrease in bioavailability decreases exposure concentration and risk. Changes to site-specific bioavailability are covered in more detail in Appendix D (Attachment 1)

The RAOs have not changed and are still valid. The remedies for OU1 are progressing as expected toward meeting the RAOs. Remedy objectives for soil were achieved in 2007. The remedy selected in the 2008 Interim ROD for OU2 groundwater was replacement of contaminated well water with a reliable municipal supply. This action was completed in 2014.

5.3 Question C: Has Any Other Information Come to Light That Could Call Into Question the Protectiveness of the Remedy?

No. There is no other information that calls into question the protectiveness of the remedy.

6 Issues/Recommendations

Table 6: OU1 Issues and Recommendations Identified in the Five-Year Review

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU1	**Issue Category:** Institutional Controls			
	Issue: Land use covenants, specified by the OU1 ROD, have not yet been implemented. The land use covenants have been prepared and are ready to be recorded, but the property owner has not yet agreed to record them.			
	Recommendation: Continue negotiations with the property owner			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	9/1/2018
OU(s): **OU1**	**Issue Category**: Operations and Maintenance			
	Issue: Significant maintenance activities have not been performed over the past five years.			
	Recommendation: Perform the high priority maintenance items identified in the 2011 Arcadis O&M Workplan (DTSC) and 2010 CH2MHILL O&M report (EPA).			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	DTSC	EPA	9/1/2017
OU(s): OU1/OU4	**Issue Category:** Institutional Controls			
	Issue: The selected ICs do not address two areas where wastes were left in place: beneath the house on Parcel 39-60-16 (OU4) and beneath Tensy Lane where it crosses Little Clipper Creek on Parcel 39-170-66 (OU1) (Appendix C).			
	Recommendation: It may be necessary to expand the area where ICs are implemented to include these two areas to prevent disturbance of and/or exposure to the wastes left in place.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	9/1/2018

6.1 Other Findings

In addition, the following are recommendations that may improve performance of the remedy, but do not affect current and/or future protectiveness, were identified during the FYR:

- State's difficulty in achieving reliable access to the Site has hampered its ability to effectively perform O&M. Since CERCLA requires that the State perform O&M, it is critical for the long-term protection of the remedy that the State prioritize its efforts to establish access and consistently perform O&M.
- Remedy O&M deficiencies (remove woody vegetation and trees growing on the cap, irrigate the vegetative cover to allow it to establish, remove vegetation from channels, repair ruts, and install

surface water diversions or velocity reducing structures). Proper and timely maintenance of the cap would prevent sediment from entering channels; therefore reducing the volume of waste for characterization and disposal.

- Eliminate vehicle traffic on the cap.
- Monitor movement of tension cracks and repair cracks/holes to eliminate potential pathways for surface flows.
- The soil/sediment removed from the channels should be temporarily stockpiled on site, properly profiled, and allowed to dry. Proper stockpile best management practices should be employed (tarping, run off controls, etc.), while waiting for waste profiling results. Profiling results will allow decision makers to determine whether off-site disposal or onsite re-use is appropriate.
- Removed vegetation should also be profiled because plants can take up arsenic. If shown to be appropriate, composting the vegetation would generate material for ultimate placement back on the vegetated caps to support growth.

7 Protectiveness Statement

Table 7: Protectiveness Statement

Protectiveness Statements		
Operable Unit: OU1/OU4	***Protectiveness Determination:*** Short-term Protective	***Planned Addendum Completion Date:*** Click here to enter a date
Protectiveness Statement: The remedy at the Lava Cap Mine Area OU1 (the cap, beneath the house on Parcel 39-60-16 (OU4) and beneath Tensy Lane where it crosses Little Clipper Creek on Parcel 39-170-66 (OU1)) is currently protective of human health and the environment in the short term because contaminated soil has been consolidated and capped. However, to be protective in the long term, ICs need to be formally implemented and regular maintenance and repair activities for the cap need to be completed..		
Operable Unit: OU2	***Protectiveness Determination:*** Short-term Protective	***Planned Addendum Completion Date:*** Click here to enter a date
Protectiveness Statement: The remedy at OU2 currently protects human health and the environment in the short term because a replacement residential water supply has been provided through the NID. However, to be protective in the long term, ICs requiring a land use notification process intended to minimize the potential for installation of new wells in contaminated areas must be formally implemented.		

8 Next Review

The next FYR report for the Lava Cap Superfund Site is required 5 years from the completion date of this review.

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Appendix A: List of Documents Reviewed

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List of Documents Reviewed

ARCADIS, 2010. *Operations and Maintenance, Lava Cap Mine – Annual Report, Lava Cap Mine Superfund Site, Nevada County, California*. July.

ARCADIS. 2011. *Operation and Maintenance Work Plan - Lava Cap Mine, Lava Cap Mine Superfund Site, Nevada City, California*. Prepared for California Environmental Protection Agency, Department of Toxic Substances Control (DTSC). November.

ARCADIS. 2013. *Operations and Maintenance Annual Summary Report, Lava Cap Mine Superfund Site, Nevada County, California*. November.

ARCADIS. 2012. *Operations and Maintenance, Lava Cap Mine – Annual Report, Lava Cap Mine Superfund Site, Nevada County, California*. July.

CH2MHILL. 2008. *Final Operable Unit 2 Feasibility Study, Lava Cap Mine Superfund Site, Nevada County, California.* Prepared for U.S. Environmental Protection Agency. Region IX. July.

CH2MHILL. 2010. *Operation and Maintenance Manual for the Mine Area (OU1) Phase 1 and Mine Residences (OU4) Remedial Actions, Lava Cap Mine Superfund Site, Nevada County, California*. Prepared for U.S. Environmental Protection Agency, Region IX (EPA R9). September.

CH2MHILL. 2014. *2014 Annual Groundwater Summary Report, Lava Cap Mine Superfund Site, Nevada County, California*. Prepared for U.S. Environmental Protection Agency, Region IX. July.

EPA. 2001. *Public Release Draft, Remedial investigation Report for the Lava Cap Mine Superfund Site, Nevada County, California*. November.

EPA. 2004. *Record of Decision for the Lava Cap Mine Superfund Site, Mine Area Operable Unit (OU1), Nevada City, California*. September

EPA. 2006. *Explanation of Significant Differences to the 2004 Record of Decision for the Lava Cap Mine Superfund Site, Mine Area Operable Unit (OU1), Nevada City, California*. September.

EPA, 2007. *Remedial Action Report:* Mine Area Residences Operable Unit (OU4), *Lava Cap*

Mine Superfund Site, Nevada City, California. April. EPA, 2008. *Interim Record of Decision, the Lava Cap Mine Superfund Site, Groundwater Operable Unit (OU2), Nevada City, California*. September.

EPA, 2010. *Remedial Action Report: Mine Area Operable Unit (OU1), Lava Cap Mine Superfund Site Nevada County, California*. November.

EPA. 2011a. *First Five-Year Review Report, Lava Cap Mine Superfund Site, Nevada County, California.* Prepared by EPA Region IX. September.

EPA, 2016. *Remedial Action Report: Operable Unit 2 (Water Supply Pipeline), Lava Cap Mine Superfund Site, Nevada City, California.* May.

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Appendix B: ARARs Assessment

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ARARs Assessment

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCA), Section 121(d)(1)(A) requires that remedial actions at CERCLA sites attain (or justify the waiver of) any Federal or State environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). Federal ARARs may include requirements promulgated under any Federal environmental laws. State ARARs may only include promulgated, enforceable environmental or facility-siting laws of general application that are more stringent or broader in scope than Federal requirements and that are identified by the State in a timely manner. ARARs are identified on a site-specific basis from information about the chemicals at the site, the RAs being considered, the physical characteristics of the site, and other appropriate factors. ARARs include only substantive, not administrative, requirements and pertain only to onsite activities. There are three general categories of ARARs: chemical-specific, location-specific, and action-specific.

Chemical-specific ARARs are health- or risk-based concentration limits, numeric values, or methodologies applicable to various environmental media (i.e., groundwater, surface water, air, soil) that are established for a chemical that may be present in the media at the site, or that may be discharged to the site during remedial activities. The chemical-specific ARARs for the Lava Cap Mine Superfund Site (Site) identified in the 2004 ROD and 2008 Interim ROD are relevant to surface water and groundwater as listed in Table E-1.

Table E-1: Summary of Groundwater ARARs

Contaminants of Concern	2004 ROD ARAR (µg/L)	Current State MCL[1] (µg/L)	Current Federal MCL[2] (µg/L)	Is the cleanup goal above the current MCL?
Arsenic (inorganic)	10	10	10	No

[1]http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.shtml (September 23, 2015)

[2]http://www.epa.gov/your-drinking-water/table-regulated-drinking-water-contaminants

Note: µg/L = micrograms per liter; MCL= maximum contaminant level;

There are no chemical-specific ARARs for soil or sediment. Cleanup goals were based on site-specific background.

There are no Federal and state laws and regulations that have been promulgated or changed over the past five years that affect the protectiveness of the remedy. This analysis does not consider ARARs identified in the 2004 ROD and 2008 Interim ROD that are no longer pertinent now that the response action has transitioned from construction to long-term work in the operations, maintenance, and monitoring phase. For example, ARARs that related to remedial design and construction are not considered if they do not continue long term. There have been no revisions to laws and regulations that affect the protectiveness of the remedy.

The following ARARs have not changed since the last FYR; and therefore, do not affect protectiveness:

- Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.; 40 Code of Federal Regulations (CFR) 6.302(g))
- Fish and Game Code (California Fish and Game Code 1600 and 1603)
- Clean Water Act (CWA); Dredge or Fill Requirements (CWA Section 404;33 U.S.C. 1251-1376; 40 CFR 230)
- Protection of Floodplains (Executive Order 11988; 40 CFR 6.302(b); 40 CFR Part 6, Appendix A)
- Protection of Wetlands (Executive Order 11990; 40 CFR 6.302(a); 40 CFR Part 6, Appendix A)
- CERCLA (121(d)(3); 42 U.S.C. Section 9621(d); 40 CFR 300.440)
- Land Use Covenants Regulations (22 California Code of Regulations 67391.1)
- National Pollutant Discharge Elimination System, 40 CFR 122
- California Storm Water Permit Program (California State Water Resources Control Board, Order 97-03-DWQ; 40 CFR 122, 123, 124)
- Property Use where Hazardous Substances are Present (California Health and Safety Code, Section 25355.5)
- Property Use where Hazardous Substances are Present (California Civil Code Section 1471(c))
- Mining Closure Requirements (California Water Code Section 13172; 27 CCR 21090(a), (b) and (c); 23 CCR 21400(a) and (b)(1))

Appendix C: Institutional Controls

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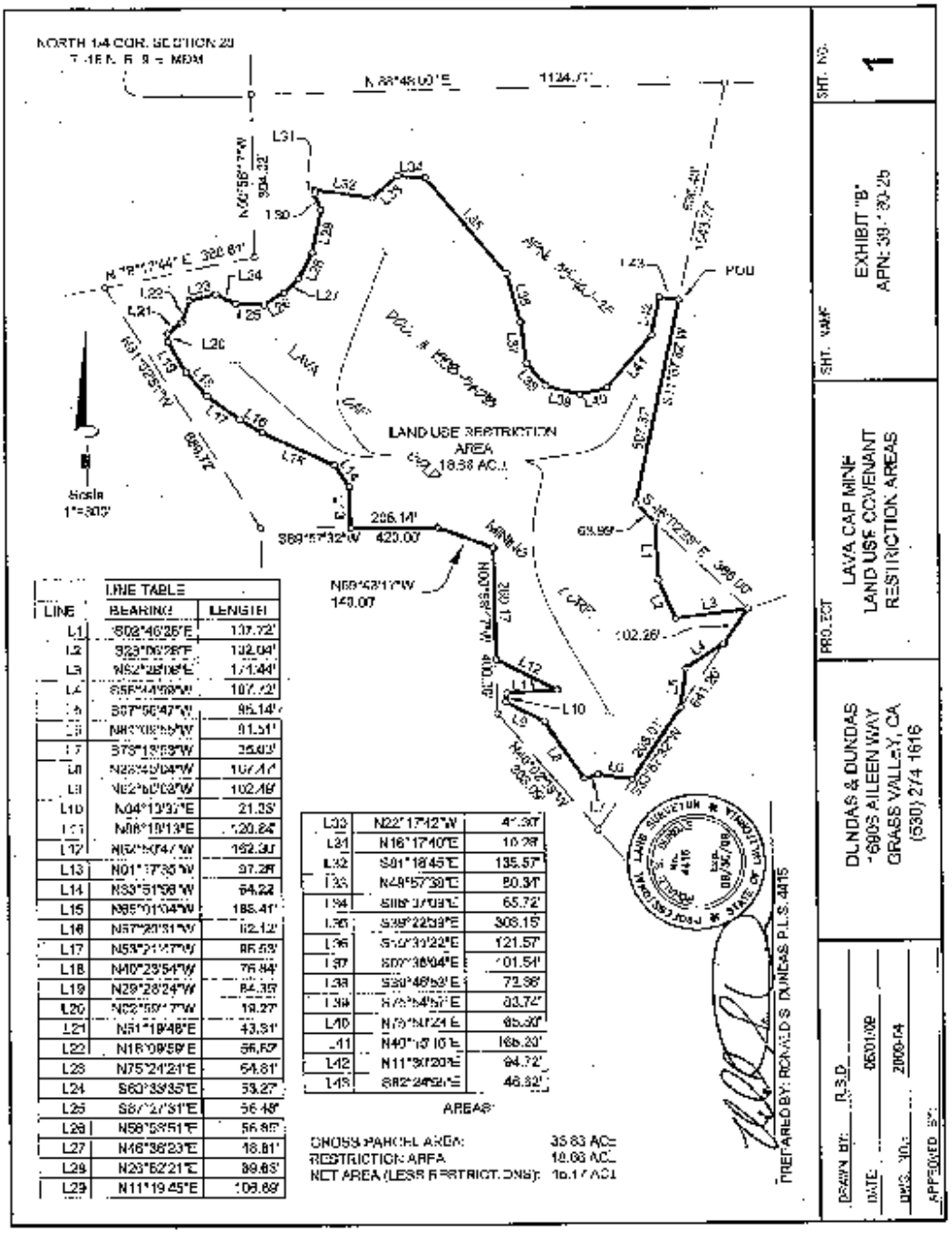
Institutional Controls



LINE TABLE		
LINE	BEARING	LENGTH
L1	S02°46'35"E	137.72'
L2	S23°06'28"E	132.04'
L3	N52°28'06"E	171.44'
L4	S56°44'58"W	107.72'
L5	S07°56'47"W	95.14'
L6	N83°08'55"W	91.51'
L7	S73°13'53"W	35.03'
L8	N23°45'04"W	107.41'
L9	N52°50'03"W	102.48'
L10	N04°12'07"E	21.35'
L11	N08°19'13"E	120.84'
L12	N54°50'47"W	192.30'
L13	N01°17'35"W	97.28'
L14	N33°51'58"W	94.22'
L15	N85°01'04"W	185.41'
L16	N57°28'31"W	82.12'
L17	N53°21'27"W	86.53'
L18	N10°23'54"W	76.84'
L19	N29°28'24"W	84.35'
L20	N02°59'17"W	19.27'
L21	N51°19'46"E	43.31'
L22	N16°09'59"E	56.57'
L23	N75°24'21"E	64.81'
L24	S60°33'35"E	53.27'
L25	S87°27'31"E	56.48'
L26	N58°58'51"E	56.85'
L27	N46°36'23"E	18.81'
L28	N23°52'21"E	89.83'
L29	N11°19'45"E	109.69'
L30	N22°17'42"W	41.30'
L31	N16°17'40"E	10.28'
L32	S01°18'45"E	135.57'
L33	N28°57'39"E	80.31'
L34	S18°37'09"E	65.72'
L35	S39°22'59"E	308.15'
L36	S12°30'22"E	121.57'
L37	S07°38'04"E	101.54'
L38	S30°48'53"E	72.36'
L39	S76°54'57"E	83.72'
L40	N79°57'21"E	85.30'
L41	N40°13'10"E	186.20'
L42	N11°30'20"E	84.72'
L43	S82°24'59"E	46.32'

AREAS

GROSS PARCEL AREA:	35.83 AC±
RESTRICTION AREA	18.58 AC±
NET AREA (LESS RESTRICT. ONLY):	16.17 AC±

Figure 1. Parcel (APN 39-160-25)

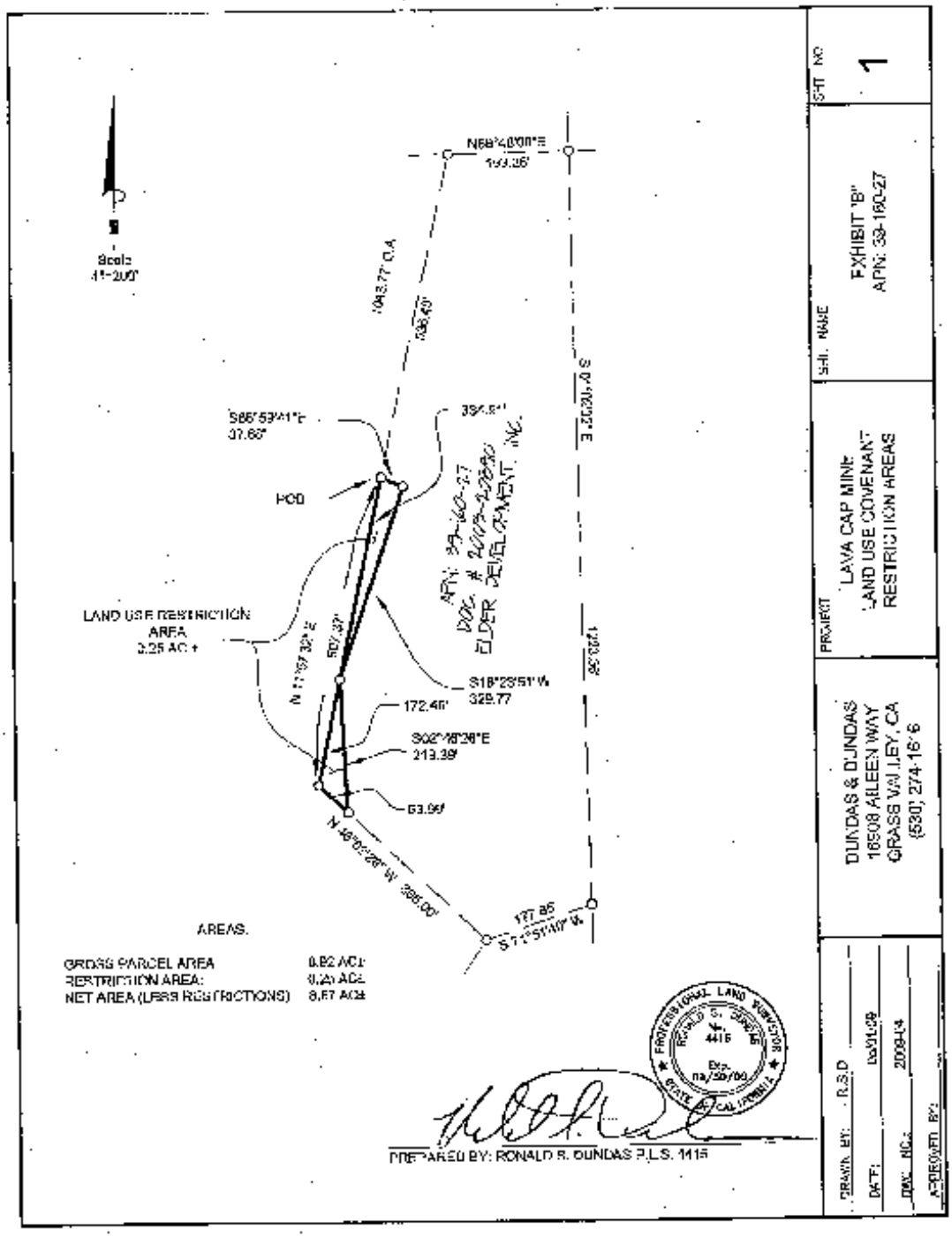


Figure 2. Parcel (APN 39-160-27)

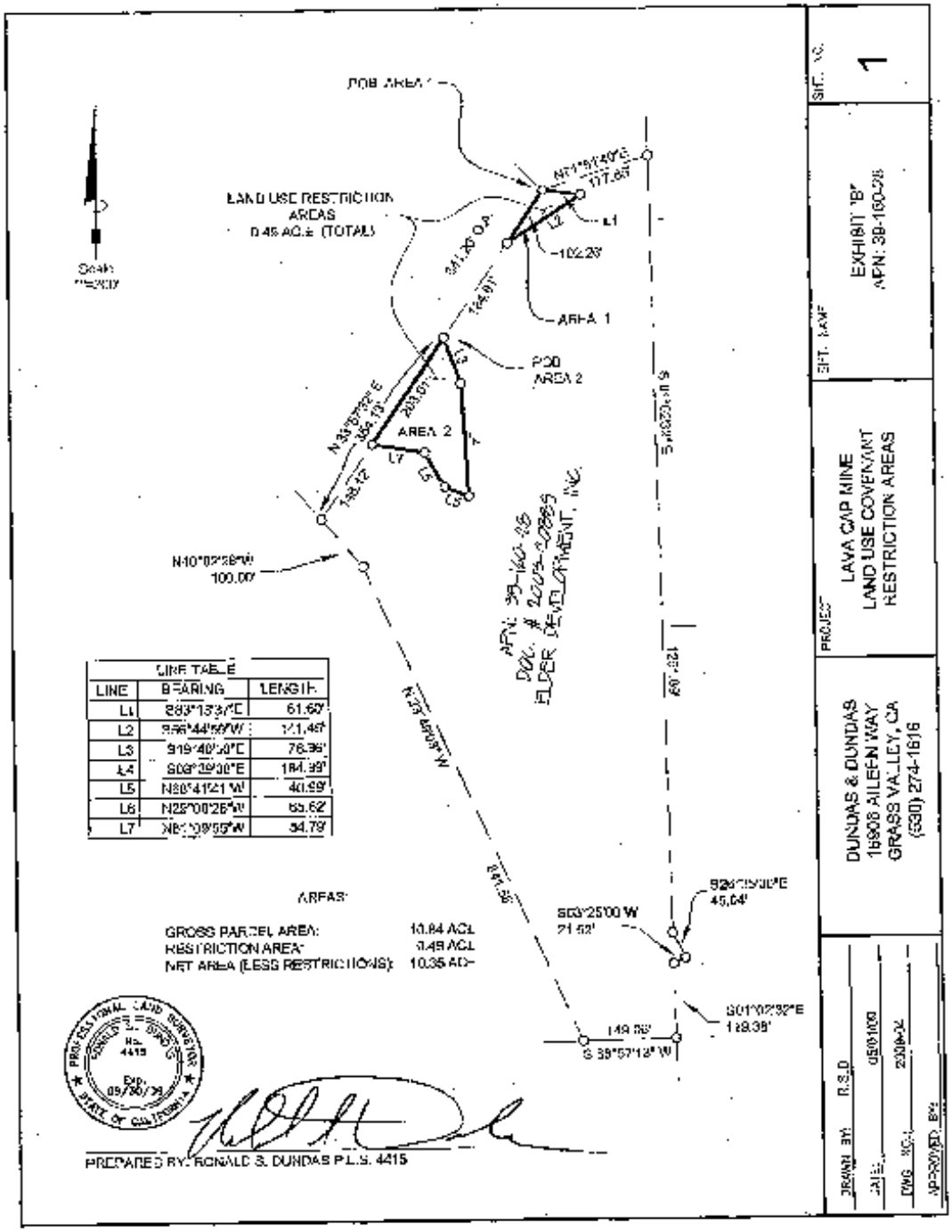


Figure 3. Parcel (APN 39-160-28)

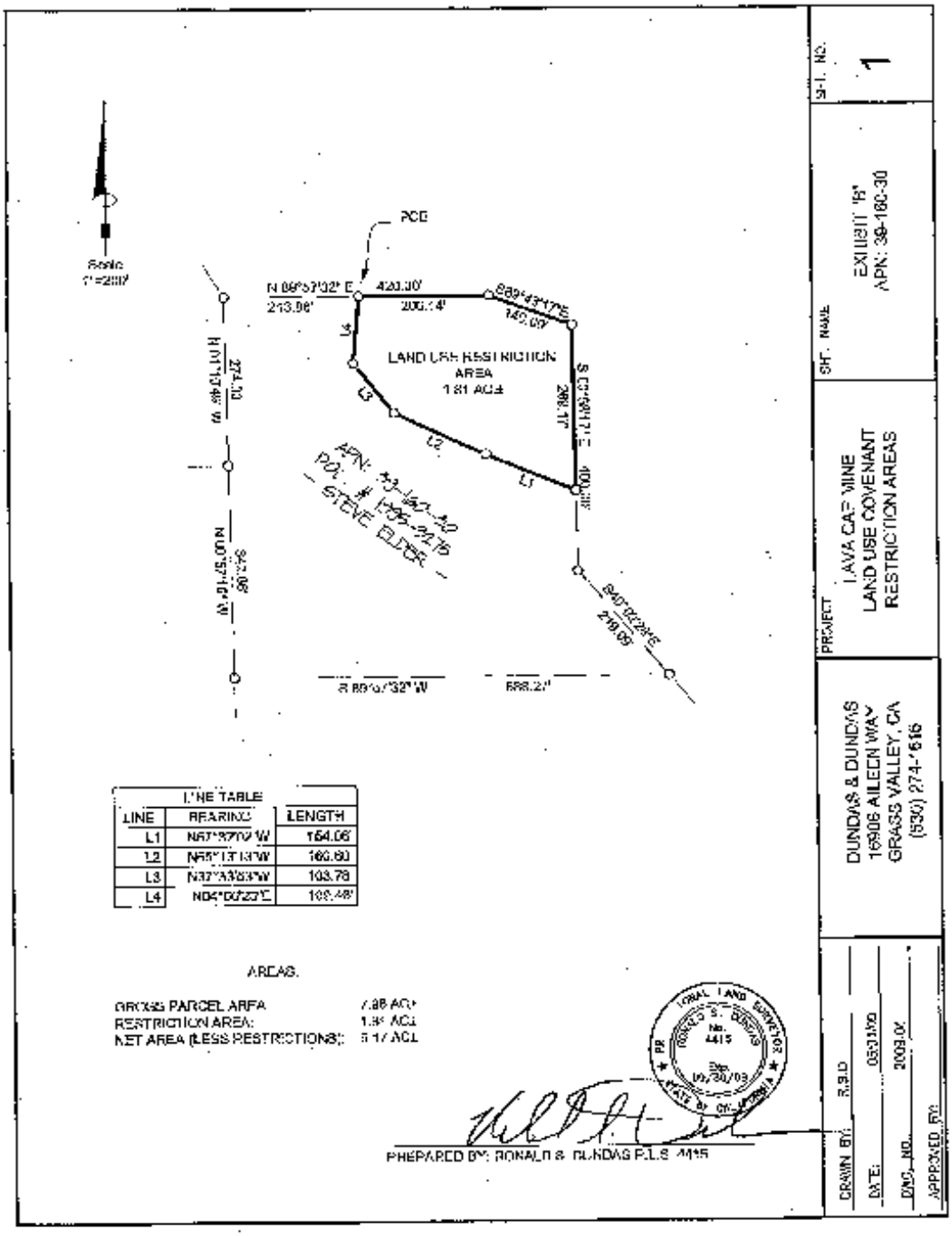


Figure 4. Parcel (APN 39-160-30)

Appendix D. Risk Assessment Review and Toxicity Analysis

Risk Assessment Review and Toxicity Analysis (Operable Units 1 and 4)

A human health risk assessment (HHRA) and ecological risk assessment (ERA) were completed for the Lava Cap Mine Superfund Site (Site) in November 2001 (CH2M Hill, 2001) and were reviewed to identify any changes in receptors, site conditions, exposure pathways, and toxicity values that could impact protectiveness.

E-1. Human Health Risk Exposure and Site Conditions

The human health receptors and exposure pathways evaluated in the 2001 HHRA include the following:

- Outdoor workers exposed to surface soil and sediment in the waste rock and tailings disposal areas, and in and around the mine buildings through incidental ingestion, dermal contact, and inhalation of particulates.
- Residents exposed to surface soil in areas adjacent to, but not in, the mine buildings and the waste rock and tailings disposal areas. Exposure pathways include ingestion of soil, dermal contact with soil and inhalation of suspended particulates. Another exposure pathway is ingestion of groundwater from private wells and dermal contact with well water through showering.
- Residents and recreational users along Little Clipper Creek (LCC) downstream of the mine would be exposed by ingestion of soil or sediment, inhalation of suspended particulates, and dermal contact with and incidental ingestion of surface water while wading.

The most significant routes of exposure were through the incidental ingestion of arsenic in soil, sediment, surface water, and airborne dust.

Residents are no longer exposed to risk from ingestion of elevated levels of arsenic in contaminated groundwater used as domestic water supply. The domestic water supply has been replaced by a delivery system managed by the Nevada Irrigation District. Construction of a cap on the mine area has also eliminated the exposure pathways to soil via dermal contact, incidental ingestion, and inhalation.

Currently, there is surface water drainage from the mine adit containing elevated levels of arsenic. The drainage water flows via engineered channels along the tailings pile into LCC below the rock buttress. Residential or recreational receptors wading in LCC currently continue to be affected by elevated arsenic concentrations contributed to LCC by the mine drainage. Therefore, risks to these receptors from exposure to arsenic may still be present. However, implementation of the full OU1 remedy, which includes treatment of the mine drainage, will reduce arsenic levels below cleanup goals and is

expected to be protective of residents or recreational users exposed to LCC. In the phased implementation of the Mine Area OU remedy, treatment of the mine drainage is planned to be the final remedy component

Institutional controls (ICs) including land use restrictions to protect the remedy from physical disturbance and prohibit residential use are planned for implementation for the capped and vegetated Site areas. After they are in place, these ICs will be protective of human health.

E-2. Changes in Toxicity Values

To evaluate the protectiveness of the cleanup levels for this FYR, the Record of Decision (ROD) standards were compared to California Department of Toxic Substances Control (DTSC) modified screening levels (screening levels) which use the most recent exposure and toxicity values. The California screening levels (CSLs) are chemical-specific concentrations for individual contaminants that correspond to an excess cancer risk level of $1x10^{-6}$ (or a Hazard Quotient of 1 for non-carcinogens), and they have been developed for a variety of exposure scenarios (e.g., residential, commercial/industrial). These screening levels are not de facto cleanup standards for a Superfund site, but they do provide a good indication of whether actions may be needed to address potential human health exposures. The EPA acceptable risk range is between $1x10^{-6}$ and $1x10^{-4}$. Screening levels values that fall within this range were determined to be acceptable from a risk stand point.

The 2004 ROD cleanup levels for soil and sediment are greater than the non-cancer screening levels and outside of the cancer risk range. The 2004 ROD cleanup levels for arsenic are based on natural background levels for soil and sediment. Therefore, the 2004 ROD values are still considered protective. The cancer risk range based on the California modified screening level for groundwater and surface water is below the ROD cleanup level. Since the 2004 ROD cleanup level is based on the Federal maximum contaminant level (MCL), the ROD cleanup level is considered by EPA to be protective of human health. The groundwater and surface water non-cancer RSL is above the ROD cleanup level; therefore this ROD cleanup level is also still protective. Table F-1. Below, presents this comparison.

Table F-1: Comparison of ROD Cleanup Standards to Current Toxicity Information

Contaminant of Concern (Media)	CSL for cancer risk[1]	Protective Cancer Risk Range	CSL for Non-Cancer Hazard[1]	ROD Cleanup Level
Arsenic, inorganic (soil)	0.067 mg/kg	0.067 – 6.7 mg/kg	0.25 mg/kg	20 mg/kg (background)*
Arsenic, inorganic (sediment)				25 mg/kg (background)*
Arsenic (groundwater/surface water)	0.0082 mg/L	0.0082-0.082 mg/L	70	10 mg/L**
CSL Tables. https://www.dtsc.ca.gov/assessingrisk/humanrisk2.cfm *2004 ROD **2008 Interim ROD Note: mg/kg = milligrams per kilogram; mg/L = milligrams per liter				

E-3. Ecological Risk

The ERA for the Site was performed in accordance with U.S. Environmental Protection Agency (EPA) and DTSC guidance. The results were presented in Appendix F of the remedial investigation report (EPA, 2001). The ERA evaluated potential risks from Site-related contamination in surface water, sediment, and soil in four areas at the Lava Cap Mine. Potential risks to fish, sediment biota (benthic invertebrates), amphibians (e.g., the red-legged frog), terrestrial plants, soil invertebrates (e.g., earthworms), soil microbial processes, as well as birds and mammals (e.g., American dipper, red-tailed hawk, green heron, California quail, mink, ornate shrew, California vole, and long-tailed weasel) were evaluated in the ERA.

The results of risk characterization for the Mine Area are summarized in the 2004 ROD. The ecological risk assessment concluded that various species are expected to be adversely affected by arsenic, cyanide, and metals in contaminated media at the Site.

The Mine Area OU remedy has eliminated or significantly limited exposure pathways to key source areas. Although areas of the Site that were excavated to weathered bedrock have arsenic concentrations that may pose a risk to ecological receptors, these levels are consistent with those that naturally occur in other areas of exposed bedrock in the Site vicinity. Therefore, exposure pathways to site-related contamination have been eliminated by the remedy.

Surface water exposure pathways to fish, amphibians, sediment biota, and aquatic birds and mammals continue to be affected by elevated arsenic concentrations contributed to LCC by the mine drainage. Therefore, risk to these receptors from exposure to arsenic may be present. However, the final remedy for the mine drainage will reduce arsenic concentrations below cleanup goals and is expected to be protective of ecological receptors using LCC.

E-4 Exposure Characterization

In exposure characterization, the nature and magnitude of the interaction between contaminants in environmental media and ecological receptors are described and quantified. To establish parameters for the exposure model, various assumptions are necessary. One of these assumptions is the absorption efficiency or bioavailabilty of a chemical. At the time the ecological and human health risk assessment was performed, guidance assumed that 60 percent of arsenic was available (could be absorbed) through oral ingestion. This value was developed from mammalian data for human health and the assumption was generalized to include ecological receptors as well.

In more recent studies based on animal bioassays, the bioavailability of arsenic was reassessed. The current recommendation for bioavailabilty uses a value of 27 percent in risk assessment (Attachments

1-3 EPA, 2015). This recommendation is consistent with EPA's guidance on developing protective assumptions, is not overly protective, and represents established science.

Lowering the bioavailability value for arsenic leads to the conclusion that the cleanup standards established for both human and ecological receptors at the Site would be more protective than previously assumed. Decisions regarding the adoption of the revised bioavailability of arsenic for Lava Cap Mine will be postponed until the next FYR.

References

CH2MHILL. 2001 *Human Health Risk Assessment for Lava Cap Mine Superfund Site, Nevada County, California*. November, 2001.

CH2MHILL. 2001. *Proposed Cleanup Concentrations for Ecological Risk Assessment at Lava Cap Mine Superfund Site, Nevada County, California. Technical Memorandum*. Prepared for the United States Environmental Protection Agency. October 6, 2003.

EPA. 2015. Memorandum from Sophia M. Serda, Ph.D., EPA Region IX Toxicologist, Operations and Scientific Support Section; to Brunilda Davila, RPM. SUBJECT: Arsenic Contamination – Site-specific Bioavailability, Lava Cap Mine Site in Nevada City, California. August 30, 2015.

Attachment 1, Memo: Arsenic Contamination – Site-specific Bioavailability, Lava Cap Mine

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IX

75 Hawthorne St.

San Francisco, CA 94105

MEMORANDUM

SUBJECT: Arsenic Contamination - Site Specific Bioavailability

Lava Cap Mine Site, in Nevada City, California

FROM: Sophia M Serda, PhD Toxicologist, Operations and Scientific Support Section

TO: Brunilda Davila, RPM

DATE: August 30, 2015

Introduction

The purpose of this technical memorandum is to document the basis on which I have proposed a site-specific arsenic bioavailability for the risk assessment and cleanup of arsenic contamination at the Lava Cap Mine Superfund Site in Nevada City, California. Based on site-specific information including soil characterization, Arsenic *in vivo* relative bioavailability (RBA) assays and Arsenic *in vitro* bioaccessibility (IVBA) assays of samples from soils at the Site.

I have recommended that the Region adopt a site-specific arsenic bioavailability of 27%. This level is not overly protective, represents established science and is consistent with the EPA's relevant guidance for such risks.

Analysis of Bioavailability of Arsenic in Samples from the Lava Cap Mine Site

In a December 2012 guidance, "Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil" US Environmental Protection Agency Office of Solid Waste and Emergency Response: Washington, DC. OSWER 9200.1-113, (available at: http://www.epa.gov/superfund/bioavailability/pdfs/Arsenic%20Bioavailability%20POLICY%20Memorandum%2012-20-12.pdf) ("December 2012 Arsenic Bioavailability Guidance"), EPA recommended, in the absence of a site-specific study of the bioavailability of arsenic, that EPA

assume that 60% of arsenic found in sampling was bioavailable. This recommendation was based at studies of a number of Superfund Sites.

Difficulties inherent in measuring site-specific soil arsenic bioavailability in humans have prompted development of in vivo animal bioassays to determine arsenic RBA in soil. Although mice and humans differ in metabolism and disposition of arsenicals, similarities are sufficient to permit the use of mouse data to create physiologically based pharmacokinetic models that can be scaled for humans. For these assays the bioavailability of soil arsenic is expressed relative to the bioavailability of a completely water soluble form of arsenic (sodium arsenate).

In addition to RBA bioassays, IVBA assays have been developed to measure the extent of arsenic solubilization in simulated gastrointestinal fluids. Arsenic IVBA was determined using the SBRC *in vitro* method at pH 1.5.

EPA recently conducted site specific *in vivo* RBA and *in vitro* IVBA for 6 soil/tailings samples collected from the Lava Cap Mine Site.

Soil Characterization Results. Total arsenic in test soils ranged from 197 to 884 mg/kg. The soil pH ranged from 5.2 to 6.6. The Arsenic speciation was categorized into 3 coordination environments, As (V) –oxygen bonding (arsenate sorbed to oxides), As(III)-oxygen bonding (arsenite sorbed to oxides), and As-sulfide bonding (realgar) . The soils were predominately sorbed Arsenic (V) and realgar.

Arsenic RBA and IVBA Assays Results. Arsenic RBA values observed in the mouse assay ranged from 11.1 to 28.7 %. Further calculations demonstrated that 27% was a percentage that was not exceeded in 95% of the samples.

Conclusion

Based on soil characterization, Arsenic RBA assays, and Arsenic IVBA,assays I recommend that EPA use a value of 27% arsenic bioavailability in its risk assessment. This recommendation is consistent with EPA's guidance on developing protective assumptions, which may be found in the December 2012 Arsenic Bioavailability Guidance, cited above. The proposed arsenic bioavailability factor of 27% is not overly protective, represents established science and is consistent with the EPA's relevant guidance for such risks.

Attachments
Lava Cap IVBA and RBA summary Data,
Speciation data for soils

Appendix D – Attachment 2 (Site-Specific Bioavailability Sample Collection)

Report prepared by Karen Bradham for Sophia Serda, Toxicologist for EPA Region 9

Lava Cap Soil Samples

US EPA's Region 9 shipped six Lava Cap soil samples to USEPA's Office of Research and Development (ORD) for bioavailability testing, which was conducted by Karen Bradham (ORD, Research Triangle Park, NC). After collecting weights for the soil containers and contents, the soils were blended and spread out in drying trays. The trays containing the soil were placed in an air-drying oven and dried for ~ 5 days at < 40 ºC and sample weights were collected subsequent to air-drying. The soil was then added to a vibrating 2 mm stainless steel sieve screen to remove any large chunks of aggregated soil. Material remaining on the screen was disaggregated using a gloved hand and rescreened. The soil was sieved to < 250 µm to maximize the quantity of soil for bioavailability studies. The soil was passed through a riffler five times and aliquots were collected in pre-cleaned 250 mL high-density polyethylene bottles. The soil samples were extracted according to EPA Method 9200.2-86 *Standard Operating Procedure for an In Vitro Bioaccessibility Assay for Lead in Soil* dated April 2012 with the following exceptions: duplicate extractions of each soil sample were conducted (duplicate samples are only required once per batch according to EPA Method 9200.2-86).

Dr. Bradham provided samples (via chain of custody) to:

- Dr. David Thomas (USEPA, ORD) for in vivo mouse assays (Bradham et al 2011) and total arsenic analysis by Instrumental Neutron Activation Analysis (INAA) at North Carolina State University's Nuclear Reactor Program;
- Dr. Kirk Scheckel (USEPA, ORD) for arsenic speciation, which was examined using the Materials Research Collaborative Access Team's (MRCAT) beamline 10-ID, Sector 10 at the Advanced Photon Source (APS), Argonne National Laboratory (ANL), Argonne, IL.

Appendix D– Attachment 3 (Site-Specific Bioavailability Calculations)

Site-specific

Resident Equation Inputs for Soil

1

Variable	Value
TR (target cancer risk) unitless	1.0E-6
THQ (target hazard quotient) unitless	1
LT (lifetime - resident) year	70
ET__ (exposure time) hour/day	24
ET__ (child exposure time) hour/day	24
ET__ (adult exposure time) hour/day	24
ED__ (exposure duration) year	26
ED__ (exposure duration - child) year	6
ED__ (exposure duration - adult) year	20
ED (mutagenic exposure duration) year	2
ED (mutagenic exposure duration) year	4
ED (mutagenic exposure duration) year	10
ED (mutagenic exposure duration) year	10
BW (body weight - child) kg	15
BW (body weight - adult) kg	80
BW (mutagenic body weight) kg	15
BW (mutagenic body weight) kg	15
BW (mutagenic body weight) kg	80
BW (mutagenic body weight) kg	80
SA (skin surface area - child) cm ²/day	2373
SA (skin surface area - adult) cm ²/day	6032
SA (mutagenic skin surface area) cm ²/day	2373
SA (mutagenic skin surface area) cm ²/day	2373
SA (mutagenic skin surface area) cm ²/day	6032
SA (mutagenic skin surface area) cm ²/day	6032
EF__ (exposure frequency) day/year	350
EF (exposure frequency - child) day/year	350
EF (exposure frequency - adult) day/year	350
EF (mutagenic exposure frequency) day/year	350
EF (mutagenic exposure frequency) day/year	350
EF (mutagenic exposure frequency) day/year	350
EF (mutagenic exposure frequency) day/year	350
IFS (age-adjusted soil ingestion factor) mg/kg	36750

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Site-specific

Resident Equation Inputs for Soil

2

Variable	Value
IFSM$_{adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.33
IRS$_{c}$ (soil intake rate - child) mg/day	200
IRS$_{a}$ (soil intake rate - adult) mg/day	100
IRS$_{0-2}$ (mutagenic soil intake rate) mg/day	200
IRS$_{2-6}$ (mutagenic soil intake rate) mg/day	200
IRS$_{6-16}$ (mutagenic soil intake rate) mg/day	100
IRS$_{16-26}$ (mutagenic soil intake rate) mg/day	100
AF$_{a}$ (skin adherence factor - adult) mg/cm^2	0.07
AF$_{c}$ (skin adherence factor - child) mg/cm^2	0.2
AF$_{0-2}$ (mutagenic skin adherence factor) mg/cm^2	0.2
AF$_{2-6}$ (mutagenic skin adherence factor) mg/cm^2	0.2
AF$_{6-16}$ (mutagenic skin adherence factor) mg/cm^2	0.07
AF$_{16-26}$ (mutagenic skin adherence factor) mg/cm^2	0.07
DFS$_{adj}$ (age-adjusted soil dermal factor) mg/kg	103390
DFSM$_{adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260
City (Climate Zone) PEF Selection	Default
A$_s$ (acres)	.5
Q/C$_{wp}$ (g/m^2-s per kg/m^3)	93.77
PEF (particulate emission factor) m^3/kg	1359344438
A (PEF Dispersion Constant)	16.2302
B (PEF Dispersion Constant)	18.7762
C (PEF Dispersion Constant)	216.108
V (fraction of vegetative cover) unitless	0.5
U$_m$ (mean annual wind speed) m/s	4.69
U$_t$ (equivalent threshold value)	11.32
F(x) (function dependant on U$_m$/U$_t$) unitless	0.194
City (Climate Zone) VF Selection	Default
A$_s$ (acres)	.5
Q/C$_{vol}$ (g/m^2-s per kg/m^3)	68.18
foc (fraction organic carbon in soil) g/g	0.006
ρ$_b$ (dry soil bulk density) g/cm^3	1.5
ρ$_s$ (soil particle density) g/cm^3	2.65

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Site-specific

Resident Equation Inputs for Soil

3

Variable	Value
n (total soil porosity) L $_{pore}$/L$_{soil}$	0.43396
θ$_a$ (air-filled soil porosity) L $_{air}$/L$_{soil}$	0.28396
θ$_w$ (water-filled soil porosity) L $_{water}$/L$_{soil}$	0.15
T (exposure interval) s	819936000
A (VF Dispersion Constant)	11.911
B (VF Dispersion Constant)	18.4385
C (VF Dispersion Constant)	209.7845
City (Climate Zone) VF $_{air}$ Selection	Default
VF$_s$ (volitization factor) m ^{3}/kg	.
Q/C$_{vol}$ (g/m^2-s per kg/m^3)	68.18365
A$_s$ (acres)	.5
T (exposure interval) yr	26
d$_s$ (depth of source) m	.
ρ$_b$ (dry soil bulk density) g/cm ^{3}	1.5
A (VF Dispersion Constant - Mass Limit)	11.911
B (VF Dispersion Constant - Mass Limit)	18.4385
C (VF Dispersion Constant - Mass Limit)	209.7845

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Site-specific

4

Resident Screening Levels (RSL) for Soil

ca=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
ca** (Where nc SL < 10 x ca SL), max=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat,
Smax=Soil SL exceeds ceiling limit and has been substituted with the max value (see User's Guide),
Ssat=Soil inhalation SL exceeds csat and has been substituted with the csat

Chemical	CAS Number	Mutagen?	VOC?	Ingestion SF $(mg/kg\text{-}day)^{-1}$	SFO Ref	Inhalation Unit Risk $(ug/m^3)^{-1}$	IUR Ref	Chronic RfD (mg/kg-day)	Chronic RfD Ref	Chronic RfC (mg/m^3)	Chronic RfC Ref	GIABS
Arsenic, Inorganic	7440-38-2	No	No	1.50E+00	U	4.30E-03	U	3.00E-04	U	1.50E-05	U	1

Chemical	ABS	RBA	Volatilization Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	Particulate Emission Factor (m^3/kg)	Ingestion SL TR=1.0E-6 (mg/kg)	Dermal SL TR=1.0E-6 (mg/kg)	Inhalation SL TR=1.0E-6 (mg/kg)	Carcinogenic SL TR=1.0E-6 (mg/kg)	Ingestion SL Child THQ=1 (mg/kg)
Arsenic, Inorganic	0.03	0.27	-	-	1.36E+09	1.72E+00	5.49E+00	8.88E+02	1.31E+00	8.69E+01

Chemical	Dermal SL Child THQ=1 (mg/kg)	Inhalation SL Child THQ=1 (mg/kg)	Noncarcinogenic SL Child THI=1 (mg/kg)	Ingestion SL Adult THQ=1 (mg/kg)	Dermal SL Adult THQ=1 (mg/kg)	Inhalation SL Adult THQ=1 (mg/kg)	Noncarcinogenic SL Adult THI=1 (mg/kg)	Screening Level (mg/kg)
Arsenic, Inorganic	3.30E+02	2.13E+04	6.86E+01	9.27E+02	1.98E+03	2.13E+04	6.13E+02	1.31E+00 ca*

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Appendix E: Press Notice

THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA) BEGAN SECOND FIVE-YEAR REVIEW OF CLEANUP AT THE LAVA CAP SUPERFUND SITE

The EPA has been cleaning up historic waste from mining operations at the Lava Cap Mine, a Superfund site since 1999. After the US EPA conducted emergency cleanup actions in 1998, the agency decided to permanently address site contamination through further cleanup actions and declared it a Superfund site. As cleanup continues, US EPA is required by law to review the constructed remedies, and to measure progress toward meeting cleanup objectives that the EPA established to protect human health and the environment. In 2016, a second Five-Year Review report will be completed and available at the information repositories and website below.

SITE LOCATION AND HISTORY

In 1861, gold and silver mining activities began six miles east of Grass Valley, California, in the Sierra Nevada foothills. The Lava Cap Mine operated until 1918. In the 1940s, a brief operation to recover cyanide was attempted. It failed. Waste rock, slurry and other mine waste remained on the site. Much of the slurry was dumped into a ravine where a 60-foot log dam protected it until a major winter storm in 1997. In January, 1997, the top of the dam broke and released 10,000 cubic yards of slurry into Lost Lake and Clipper Creek.

CLEANUP ACTIONS

In 1998, US EPA took immediate emergency action to remove and consolidate 4,000 cubic yards of tailing from the damaged dam area and stockpiled it with existing waste rock north of the mine. Then the area was capped with a clay liner. The site was separated into four operable units (OU). In 2004, the agency signed decisions to clean up the mine area and historic mine residences (OU 1 and 4), and the groundwater (OU2).

Cleanup included excavation and consolidation of tailings, vegetative covers, a tailings pile cap, a rock buttress and drainage channels. Mine residences were demolished and contaminated debris and soils were removed (completed in 2005). In response to arsenic groundwater contamination, US EPA also built a water distribution line and service lines to connect local residents to municipal drinking water. Treatment of water from the mine passage is in the design phase.

FOR MORE INFORMATION

To view the report, the administrative record or for further information, please contact:

US EPA Superfund website: **http://www.epa.gov/superfund/lavacap**.

Information Repositories:

Grass Valley Public Library

207 Mill Street

Grass Valley, California 95945

Telephone: (530) 273-4117

Nevada County Library

980 Helling Way

Nevada City, California 95959

Telephone: (530) 265-7050

US EPA Project Manager:

Ms. Brunilda Dávila

75 Hawthorne Street, SFD 7-2

San Francisco, California 94105

Telephone: (415) 972-3162

Davila.brunilda@epa.gov

Appendix F: Site Inspection Checklist and Trip Report

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Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Lava Cap Mine Superfund Site, CA	**Date of inspection:** 19 Oct, 2015
Location: 5 Mi SE of Nevada City CA	**EPA ID:** CAD983618893
Agency, office, or company leading the five-year review: USACE Seattle District.	**Weather/temperature** Clear and sunny,mid-upper 70's

Remedy Includes: (Check all that apply)

- ■ Tailing pile cover/containment
- ■ Access controls
- ■ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ■ Other: *e.g. Groundwater monitoring*

  surface water channels, rock buttress, mine building fencing, mine adit discharge diversion, access road paving, backfill and restoration
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ☐ Inspection-team roster attached ☐ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** _____ _____ _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency USEPA
Contact Brunilda Davila | Remedial Project Manager | _____ | _____
Name | Title | Date | Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ | _____ | _____ | _____
Name | Title | Date | Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ | _____ | _____ | _____
Name | Title | Date | Phone no.
Problems; suggestions; ☐ Report attached _____

Agency _____
Contact _____ | _____ | _____ | _____
Name | Title | Date | Phone no.
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ☐ Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**

☐ O&M manual	☐ Readily available	☐ Up to date	☐ N/A
☐ As-built drawings	☐ Readily available	☐ Up to date	☐ N/A
☐ Maintenance logs	☐ Readily available	☐ Up to date	☐ N/A

Remarks No O&M manager on site and could not physically confirm the presence of documentation on site.

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☐ N/A
☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☐ N/A

Remarks No O&M manager on site and could not physically confirm the presence of documentation on site.

3.	**O&M and OSHA Training Records**	■ Readily available	☐ Up to date	☐ N/A
	Remarks No O&M manager on site and could not physically confirm the presence of documentation on site.			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☐ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	■ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits_____	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	☐ N/A
	Remarks No O&M manager on site and could not physically confirm the presence of documentation on site.			
7.	**Groundwater Monitoring Records**	☐ Readily available	☐ Up to date	☐ N/A
	Remarks No O&M manager on site and could not physically confirm the presence of documentation on site.			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	☐ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	☐ Air	■ Readily available	☐ Up to date	☐ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	☐ N/A
	Remarks No O&M manager on site and could not physically confirm the presence of documentation on site.			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	■ N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**

☒ State in-house ☒ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other O&M costs were not reviewed as part of the inspection

2. **O&M Cost Records**

☐ Readily available ☐ Up to date ☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From_____ To_____ _____ ☐Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost
From_____ To_____ _____ ☐ Breakdown attached
Date Date Total cost

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons:

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ☐Gates secured ☐ N/A

Remarks There is an initial entry gate to the main site road. The gate was in good condition and locked. Fencing around the mine buildings was locked and appeared to be in good condition. No fencing is present around the tailings. The cap reflected rutting damage from vehicle traffic. Additional vehicle access restriction to the cap should be provided to minimize vehicle traffic.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks One sign mentioning the hazards of the tailing was noted near a road accessing the tailings landfill buttress area. Given there area several ways to enter the tailing area placing the at the road, or adding additional signs near the mine, would better communicate risks at the site. In particular risks from exposure to the adit flow and sub-buttress flow should be posted.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☐ No ☒ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ☐ No ☒ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ☒ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☒ No ☐ N/A
Violations have been reported ☐ Yes ☒ No ☐ N/A
Other problems or suggestions: ☐ Report attached

The 2011 5 yr review indicated that IC covenants had not been recorded. The USEPA RPM for the project has stated that the status of the IC has not changed. In that report it was stated that USEPA intends to monitor any land transfers to ensure protectiveness of the remedy conveyed by the covenants is maintained pending recording of those documents.

2. **Adequacy** ☐ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks No vandalism was apparent however vehicle traffic on the cover is causing incipient rutting near the center line of the cover on the southern end of the cover which would likely be a focal point for surface water erosion in a large storm event. Vehicle traffic also has significant impacts on the already sparse vegetation. It is not known if this traffic impact is the result of periodic sampling teams or trespassers. Additional vehicle access restriction is recommended.

2. **Land use changes on site** ☒ N/A

Remarks

3. **Land use changes off site** ☒ N/A

Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☐ Roads adequate ☐ N/A

Remarks While not a defined road there appears to be a commonly used traffic path across the cover from the entrance to the area near the buttress. Traffic on this pathway is causing incipient rutting on the steeper slope leading across the cover towards the adit. This rutting will likely be be a focal point for surface water erosion in a large storm event and should be repaired. If the access road is required consideration should be given to reinforcing the subgrade with a geofabric and adding rock to make a more durable road across the cover. Otherwise vehicle traffic should be more restricted by adding a locking gate at the access near the buttress with sampling contractors made responsible for immediately repairing their own damage or reporting damage noted upon arrival at the site. Mechanisms to slow runoff down the existing slope (wattles,benches) may be helpful though unlikely to withstand vehicle traffic unless made part of an engineered road.

B. Other Site Conditions

Remarks

Covered tailings area in the location of the pilot water treatment plant showed no signs of erosion. One area was over excavated during demobilization of the site and could provide a preferential storm water flow path in a large rain event.

VII. LANDFILL COVERS ☐ Applicable ☐ N/A

A. Tailing Pile Cover Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
   Areal extent_____ Depth_____
   Remarks

2. **Cracks** ☐ Location shown on site map ☐ Cracking not evident
   Lengths 1-10 ft Widths 1/16-1/4 inch Depths measured to ~18 inches
   Remarks Cracks were noted and were almost always associated with holes noted in the cover. Some cracks were obviously continuous but others were either partially occluded at the surface by washing sediment or were developed below the surface and were evident as longer continuous cracks only when soil between holes was kicked away. Most cracks ran parallel with slope contours.

3. **Erosion** ☐ Location shown on site map ☐ Erosion not evident
   Areal extent northern, steeper part of fill Depth <1 in
   Remarks minor rilling <1/4 in deep was noted throughout the non-vegetated areas, especially in the steeper, northern portions of the cover. A few of the rills were more significant reaching depths of 1 inch. Deeper erosion also was noted associated with the vehicle rutting in the apparent road which runs across the longitudinal midpoint of the cover. There was also apparent removal of approximately 1-1.5 in of sediment from beneath the pad of a survey marker which indicates a more uniform removal of material from the cover. Similar erosion was noted around some vegetation clumps where roots maintained the original surface. Minor scour erosion was also noted on the down slope side of Wattles

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
   Areal extent pervasive, northern half of cover Depth ~18
   Remarks The depth of the holes was measured with a probe to a depth of ~8 inches. It is likely that the holes extend to the drainage layer but they are not straight so full penetration to that level was not attained. holes range from 1/2 in diameter to maybe 1.25 in and they are often elongate reflecting fracture development associated with the hole.

5. **Vegetative Cover** ☒ Grass ☐ Cover properly established
   ☐ No signs of stress ☒ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks The vegetative cover is sparse in places, especially on the 4h:1v slopes on the north east side of the cover where it appears that a combination of shade and excessive slopes limiting moisture retention limit vegetation taking hold. Vegetation was more established on the flatter southern portions of the cover though there were still bare areas and evidence of vehicle damage to vegetation. Evergreen trees and other woody bushes were noted on the cover, especially in the northern portion. The evergreens appeared to be limited to 18-24 in tall after which size they died. Possible moisture limitations once the evergreens reach that side limits their grown. Large woody plants should be removed from the cover.

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
   Remarks

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
   Areal extent 100 + ft Height_____
   Remarks Bulges were not evident even though the cracks on the cover are thought to most likely be tension cracks. The tension cracks are most developed on the west side of the cover on the side of the flowing adit channel. It is possible that removal of fines by that flow minimizes the appearance of bulging. The cracks are also of limited width so sufficient movement to cause bulging may not have occurred.

8. **Wet Areas/Water Damage** ☒ Wet areas/water damage not evident

☐ Wet areas ☐ Location shown on site map Areal extent 100-125 linear ft

☐ Ponding ☐ Location shown on site map Areal extent_____

☒ Seeps ☐ Location shown on site map Areal extent_____

☐ Soft subgrade ☐ Location shown on site map Areal extent_____

Remarks There is a likely seep area near the low water crossing on the east side of the fill area as evidenced by iron staining of the channel rip rap in that area. there is also seepage discharge at the base of the buttress.

9. **Slope Instability** ☐ Slides ☐ Location shown on site map ☐ No evidence of slope instability

Areal extent northern, steeper portions of cover, es

Remarks The cracks developing in the cover appear to be tension cracks developing in the ML material comprising the cover.

B. Benches ☒ N/A ☐ Applicable

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐ Location shown on site map ☐ N/A or okay

Remarks

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay

Remarks

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay

Remarks

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☒ No evidence of settlement

Areal extent_____ Depth_____

Remarks

2. **Material Degradation** ☐ Location shown on site map ☒ No evidence of degradation

Material type_____ Areal extent_____

Remarks

3. **Erosion** ☐ Location shown on site map ☒ No evidence of erosion

Areal extent_____ Depth_____

Remarks

4. **Undercutting** ☐ Location shown on site map ☒ No evidence of undercutting
Areal extent_____ Depth_____
Remarks

5. **Obstructions** Type_____ ☒ No obstructions ☐ Location shown on site map
Areal extent_____ Size_____
Remarks

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Gas Vents** ☒ N/A ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning
☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration
Remarks

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks

3. **Monitoring Wells** (within surface area of landfill)
☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks With the exception of one well near the SW corner of the buttress, which was found unlocked with the cover partially on, monitoring wells all appeared to be in good condition with no apparent problems with the booted penetrations. Wells include 1 piezometer, 1 chimney drain monitoring well and 2 chimney drain cleanouts.

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A
Remarks

5. **Settlement Monuments** ☒ Located ☐ Routinely surveyed ☐ N/A
Remarks One settlement marker/survey monument was noted at the north end of the cover. Removal of ~1-1.5 inches of cover material has been eroded from beneath the concrete pad put around this marker. The marker did not appear to have been displaced by erosion.

E. Gas Collection and Treatment		☐ Applicable	■ N/A
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks		
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks		
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks		
F. Cover Drainage Layer		■ Applicable	☐ N/A
1.	**Outlet Pipes Inspected** Remarks	■ Functioning	☐ N/A
2.	**Outlet Rock Inspected** Remarks Rock at the bottom of the buttress associated with the seep, at the bottom of the drop structure adjacent to the buttress, and rock at the adit out fall showed no sign of displacement.	■ Functioning	☐ N/A
G. Detention/Sedimentation Ponds		☐ Applicable	■ N/A
1.	**Siltation** ☐ N/A ☐ Siltation not evident Areal extent_____ Depth_____ Remarks		
2.	**Erosion** Areal extent_____ Depth_____ ☐ Erosion not evident Remarks		
3.	**Outlet Works** ☐ Functioning ☐ N/A Remarks		
4.	**Dam** ☐ Functioning ☐ N/A Remarks		

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____
Remarks

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
Areal extent 100 + ft Depth unknown
Remarks the G3 adit flow channel immediately down gradient from the adit outfall is vegetated with wetland plants that are most likely rooted in slope wash material derived from the steeper NW corner of the cover.

2. **Vegetative Growth** ☐ Location shown on site map ☒ N/A
☐ Vegetation does not impede flow
Areal extent 100-125 linear ft Type wetland plants
Remarks the adit flow channel immediately down gradient from the outfall is vegetated with wetland plants. There are some restrictions in flow over the entire vegetated length and one area approximately 15-20 ft long near the end of the vegetated section the growth is dense and flow restrictions area likely very significant. If channel overbank flow occurs during high flow events significant cover damage is likely. Plants should be removed ASAP for both flow management reasons and to ensure that the vegetation does not get counted as regulated wetland. Vegetation was also noted in the first 5 yr review with no apparent removal of the initial growth.

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent_____ Depth_____
Remarks Minor settlement was noted in the drainage channel on the north east side of the cover immediately up stream of where the cover perimeter channel joins up with clipper creek channel. The settling was evident by a low spot in the riprap. The settling does not appear to have any functional impact to the channel.

4. **Discharge Structure** ☐ Functioning ☐ N/A
Remarks low water crossing and concrete drop structure show no sign of damage or settlement. Rock at the discharge of the drop structure is in place. Culvert in G3 channel at buttress functioning as intended.

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent_____ Depth_____
Remarks

2. **Performance Monitoring** Type of monitoring_____
☐ Performance not monitored ☐ Evidence of breaching
Frequency_____ Head differential_____
Remarks

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ☒ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ☒ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
Remarks

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

B. Surface Water Collection Structures, Pumps, and Pipelines ☒ Applicable ☐ N/A

1. **Collection Structures, Pumps, and Electrical**
☒ Good condition ☐ Needs Maintenance
Remarks Flume at the adit outfall was in good condition. Rock at outfall basin showed no sign of displacement.

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
☐ Good condition ☐ Needs Maintenance
Remarks

3. **Spare Parts and Equipment**
☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
Remarks

C. Treatment System ☐ Applicable ☒ N/A

1. **Treatment Train** (Check components that apply)
☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
☐ Air stripping ☐ Carbon adsorbers
☐ Filters_____
☐ Additive (*e.g.*, chelation agent, flocculent)_____
☐ Others_____
☐ Good condition ☐ Needs Maintenance
☐ Sampling ports properly marked and functional
☐ Sampling/maintenance log displayed and up to date
☐ Equipment properly identified
☐ Quantity of groundwater treated annually_____
☐ Quantity of surface water treated annually_____
Remarks

2. **Electrical Enclosures and Panels** (properly rated and functional)
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks

3. **Tanks, Vaults, Storage Vessels**
☐ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance
Remarks

4. **Discharge Structure and Appurtenances**
☐ N/A ☐ Good condition ☐ Needs Maintenance
Remarks

5. **Treatment Building(s)**
☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
☐ Chemicals and equipment properly stored
Remarks

6. **Monitoring Wells** (pump and treatment remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks

D. Monitoring Data

1. Monitoring Data
☐ Is routinely submitted on time ☐ Is of acceptable quality

2. Monitoring data suggests:
☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The remedy is intended to isolate tailings from human and biota exposure pathways and to minimize infiltration of rainfall and surface water into the tailings. The remedy is functioning as intended. Continued discharge of mine impacted water from beneath the buttress indicates water is migrating beneath the tailings, or is being originated from a source under the tailings but this does not appear to reflect on the effectiveness of the cover. Exposure to mine impacted water is possible at two locations, neither of which have signage indicating the potential exposure risk.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M deficiencies in establishing and maintaining adequate vegetation on slopes and for removal of woody vegetation and trees from the cover were evident. Erosion associated with vehicle rutting needs to be repair and surface water flow diversions or velocity reducing structures added to eliminate the risk of significant erosion in El Nino related high rainfall events

C. Early Indicators of Potential Remedy Problems

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.

- Inability to maintain vegetative cover in ML material on the steeper slopes in the northern half of the cover may lead to erosion problems in high rainfall events. Monitoring the cover condition after each significant rain event, and immediate repair of noted damage, is recommended.
- the presence of rutting in the vehicle path may lead to significant erosion from concentration runoff during high rainfall events.
- The presence of minor tension cracks in the steeper portion of the slope suggests likely downslope movement of cover material. This movement should be monitored and cracks/holes repaired to eliminate potential piping pathways for surface water flows.
-The restriction of the adit channel flow from vegetation could lead to flow leaving the channel which could have significant erosional impact to the ML cover adjacent to the channel. Removal of material from the toe of the cover slope could lead to downslope movement of remaining cover material and to headcutting gulling up slope from toe erosion.

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

Utilizing recently installed potable water line to provide irrigation water to the cover to aid in establishment of vegetative cover would help to eliminate surface water induced rilling, would enhance root binding of the slope and potentially reduce or eliminate downslope movement of the cover material.

Trip Report

1. INTRODUCTION

a. Date of Visit: 19 Oct, 2015

b. Location: 5 Miles SE of Nevada City CA

c. Purpose: A site visit was conducted to visually inspect and document the conditions of the remedy, the site, and the surrounding area for inclusion into the Five-Year Review Report.

d. Participants:

John Hartley	CEHNC-EMG	402-697-2654 Geologist
Jeff Taylor	CESPKL-ED-GS-A	916-557-7035 Geotechnical Engineer
Brunilda Davila	USEPA	415-972-3162 Project Manager

2. SUMMARY

The focus of the inspection was the tailing pile cover, perimeter drainage ditches and the buttress on the distal end of the tailing pile (Figure 1). A small covered area near the access road west of the main tailings pile at the location of the former water treatment pilot plant was also inspected. Primary inspection was performed by John Hartley accompanied by Bruni Davila. Jeff Taylor was present at the site on 20 Oct 2015 to perform an inspection on the Lost Lake Dam and was asked to confirm some observations made by Mr Hartley.

3. DISCUSSION

The initial inspection was performed between approximately 1300 and 1700 on 19 Oct, 2015. The day was clear, sunny and warm. Most of the time was spent in the northern portion of the tailings pile area due to the prevalence of potential problems in that area resulting from lack of vegetation and steeper slopes. Bruni, the EPA Remedial Project Manager indicated that the state had not performed any O&M for many months due to access issues with the land owner that they were trying to work out. While there is some minor rill development on the slopes that would require maintenance if it progresses, there is also evidence that vehicle traffic is responsible for the most significant damage to the cover. The steeper areas of the tailing cover in the NW corner of the cover are showing signs of tension cracking. This cracking is most likely due to a combination of the steeper slopes, the lack of cohesion in the silt (ML) used to construct the cover which is exacerbated by the lack of sufficient vegetation to provide root structure to bind the cover material together. Perimeter channels are for the most part in very good condition. The G-3 channel is choked with vegetation at the northern end of the tailing pile where silt from the steeper slopes has been washed into the channel and allowed wetland vegetation to thrive. Water from the adit discharge is maintaining fairly lush vegetation in the channel. This vegetation was also noted in the First Five-Year Review. The vegetation is extensive

enough that it will impede flow in the channel during a large storm event, possibly to the point where water could overtop the banks and erode the toe of the cover. The buttress and associated concrete drop structure and culverts were fully functioning and in good condition. Wells and clean outs were in good condition with no damage to the cover penetration boots. The metal cap on the cleanout on the south west corner of the buttress was unlocked and not fully set on the well protective casing. There was no apparent damage to the well.

The initial inspection was performed between approximately 1300 and 1700 on 19 Oct, 2015. The day was clear, sunny and warm. Most of the time was spent in the northern portion of the tailings pile area due to the prevalence of potential problems in that area resulting from lack of vegetation and steeper slopes (Appendix G, photo 1). Bruni Davila, the EPA Remedial Project Manager indicated that the state had not performed any O&M for many months due to access issues with the property owner that they were trying to work out. While there is some rill development (Appendix G, photo 4, 5, 7, & 9) on the slopes that would require maintenance if it progresses, there is also evidence that vehicle traffic is responsible for the most significant damage to the cover (Appendix G, photo 8, 9, &10). The steeper areas of the tailing cover in the NW corner of the cover are showing signs of tension cracking (Appendix G photo 3). This cracking is most likely due to a combination of the steeper slopes, the lack of cohesion in the silt (ML) used to construct the cover which is exacerbated by the lack of sufficient vegetation to provide root structure to bind the cover material together. Perimeter channels are for the most part in very good condition. The G-3 channel is choked with vegetation at the northern end of the tailing pile (Appendix G, photo 6) where silt from the steeper slopes has been washed into the channel and allowed wetland vegetation to thrive. Water from the adit discharge is maintaining fairly lush vegetation in the channel. This vegetation was also noted in the First Five-Year review. The vegetation is extensive enough that it will impede flow in the channel during a large storm event, possibly to the point where water could overtop the banks and erode the toe of the cover. The buttress and associated concrete drop structure and culverts were fully functioning and in good condition. Wells and clean outs were in good condition with no damage to the cover penetration boots. The metal cap on the cleanout on the south west corner of the buttress was unlocked and not fully set on the well protective casing (Appendix, G photo 11). There was no apparent damage to the well.

4. ACTIONS

The USACE will incorporate information obtained from the site visit into the Five -Year Review report.

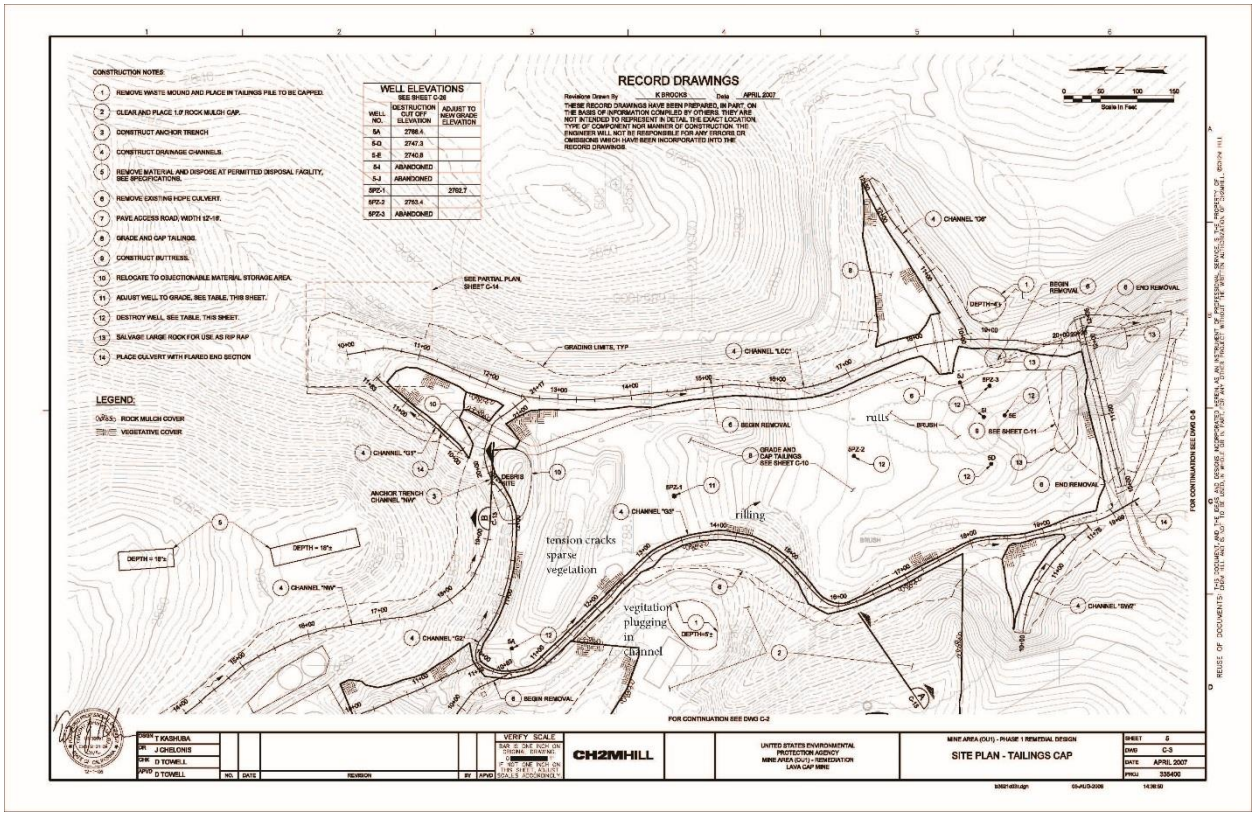

Figure 1. Cap Tailing pile and cover site plan showing general locations of tension cracking and sparse vegetation, rill development on slopes and rutting associated with vehicle traffic

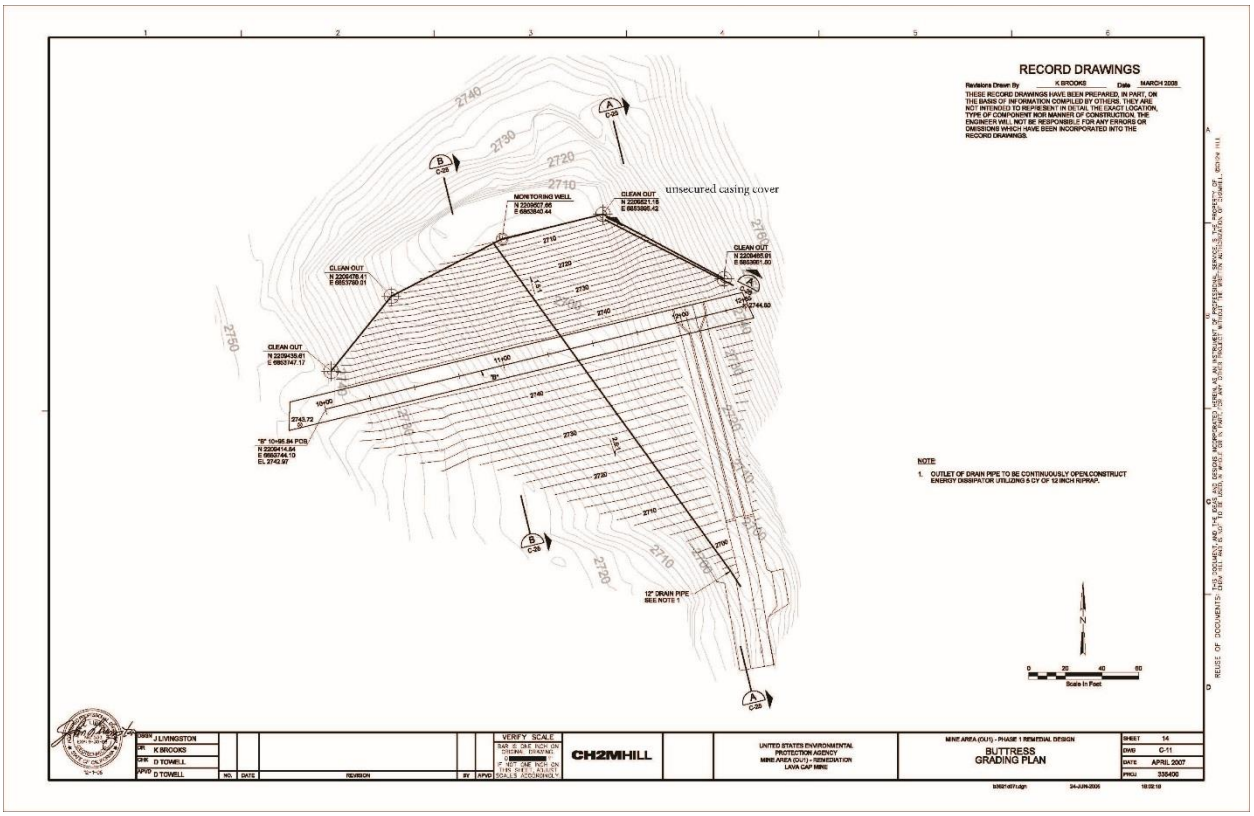

Figure 2. Buttress Grading Plan

Appendix G: Photographs from Site Inspection

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Photo 1 Northwest corner of tailings cover showing essentially no vegetation and relatively steep slopes

Photo 2 Survey monument in the poorly vegetated north western area of cover. Note removal of soil from below the monument pad

Photo 3 Holes in cover surface. Note the linearity of the trace. Removal of surface soils shows the holes for the most part to be connected to form cracks. Probes went to 18 in bgs. Holes/cracks likely to be deeper but sidewall variation prevented full depth measurement with probe.

Photo 4 Small pine trees and woody vegetation on cover. Pine trees do not appear to get bigger than the one shown in the picture, possibly due to moisture limitations. Note rill formation in front of the bush

Photo 5 Rill development upslope of G3 channel

Photo 6 Vegetation choking G3 channel

Photo 7 Erosion across access road at south east corner of buttress. Rock surfacing has not been maintained. Figure 8 of the removal action report showed a survey marker in this corner but it is not evident in this picture.

Photo 8 Rutting in vehicle path across the cover looking to the north from the SE corner of the cover

Photo 9 Rill formation in vehicle path near center of cover area looking north. Note relative lack of vegetation

Photo 10 Damage to vegetation from vehicle traffic looking east near buttress

Photo 11 Buttress end of tailing pile showing location of well with unsecured protective casing cap

Photo 12 Area in smaller tailing cover site showing where poor grading with bobcat during demob of pilot treatment plant has created a low spot and a potential preferential surface water flow path which could lead to erosion concerns.