FIVE-YEAR REVIEW REPORT

FIRST FIVE-YEAR REVIEW REPORT

for

LAVA CAP MINE SUPERFUND SITE
NEVADA COUNTY, CALIFORNIA

Prepared by:

United States Environmental Protection Agency Region 9
San Francisco, California

SEPTEMBER 2011

If you have any questions on this First Five-Year Review Report,
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for

Lava Cap Mine Superfund Site

Nevada County, California

September 2011

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Region 9

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Date: 9/14/11

Five-Year Review Report

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List of Acronyms

µg/L	micrograms per liter
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DTSC	California Department of Toxic Substances Control
EPA	United States Environmental Protection Agency
ERA	ecological risk assessment
ESD	Explanation of Significant Differences
FYR	five-year review
HPDE	high density polyethylene
IC	Institutional Control
LCC	Little Clipper Creek
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
NCP	National Contingency Plan
NID	Nevada Irrigation District
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NSAQMD	Northern Sierra Air Quality Management District
O&M	Operation and Maintenance
OU	Operable Unit
RA	Remedial Action
RAO	Remedial Action Objective
RI	Remedial Investigation
ROD	Record of Decision
RPM	Remedial Project Manager
RWQCB	Regional Water Quality Control Board
SWRCB	State Water Resources Control Board
TBC	To Be Considered
µg/L	micrograms per liter

Executive Summary

The United States Environmental Protection Agency (EPA) Region 9 has conducted the first five-year review (FYR) of the Lava Cap Superfund Site (the Site) in Nevada County, California. The purpose of this FYR is to determine whether the remedial actions implemented at the Site are protective of human health and the environment. This FYR is required because hazardous substances remain on-site, thereby preventing unrestricted use. The methods, findings, and conclusions of the review are documented in this report. In addition, this report summarizes issues identified during the review and includes follow-up actions to address them.

This site has four operable units (OUs) and two signed Records of Decision (RODs). The OU1 ROD includes the tailings and adit water in the mine area and the mine residences, which was later separated into OU1 and OU4. The OU2 Interim ROD for groundwater was signed in 2008.

The ROD for OU1 (the Lava Cap Mine Area) is being implemented as two distinct remedies. The first remedy included excavation of tailings and tailings consolidation, vegetative covers, a tailings pile cap, a rock buttress, and drainage channels. The second remedy for OU1, which is still in the remedial design phase, is treatment of adit water emanating from the mine area. The remedy also includes institutional controls to minimize potential future exposure to remaining contaminated materials. The remedy for OU4 (mine residences) consisted of demolition of mine residences followed by removal of contaminated debris and soils.

The trigger for this five-year review was the actual start of construction in May 2006 for OU1. The Groundwater (OU2) is in the remedial design phase and the Lost Lake OU (OU3) is currently in the remedial investigation/feasibility phase. This five-year review addresses the remedies that have been implemented at the Site, which are the soil remedies for OU1 and OU4.

The assessment of this five-year review found that the remedies for OU1 and OU4 were implemented in accordance with the requirements of the September 2004 Record of Decision (ROD). The remedies are functioning as designed. The remedies are protective of human health and the environment in the short term, but are not protective in the long term, because 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. In addition, the planned institutional controls (ICs) do not address two areas where wastes were left in place: beneath the rental house on Parcel 39-60-16 and beneath Tensy Lane where it crosses Little Clipper Creek on Parcel 39-170-66 (Appendix E). 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. Follow-up actions include developing strategies for addressing these issues related to filing land use covenants.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name : Lava Cap Mine		
EPA ID: CAD983618893		
Region: 9	**State:** California	**City/County:** Nevada

SITE STATUS	
NPL status: X Final ☐ ☐Deleted ☐ Other (specify) _____	
Remediation status (choose all that apply): X Operating ☐Complete	
Multiple OUs? X YES NO	**Construction completion date:** October 8, 2010
Has site been put into reuse? ☐ YES X NO	

REVIEW STATUS	
Reviewing agency: X EPA ☐ State ☐ Tribe ☐ Other Federal Agency _____	
Author name: Brunilda Dávila	
Author title: Remedial Project Manager	**Author affiliation:** EPA Region 9
Review period: September 2010 – September 2011	
Date(s) of site inspection: October 27, 2010	
Type of review: X Statutory ☐ Policy ☐ Post-SARA ☐ Pre-SARA ☐ NPL-Removal only ☐ Non-NPL Remedial Action Site ☐ NPL State/Tribe-lead ☐ Regional Discretion)	
Review Number: X 1 (first) ☐ 2 (second) ☐ 3 (third) ☐ Other (specify)	
Triggering action:	
X Actual RA Onsite Construction	☐ Actual RA
☐ Construction Completion	☐ Previous Five-year Review Reports
Other (specify):	
Triggering action date: May 2006	
Due date (five years after triggering action date): September 2011	

Five-Year Review Summary Form, cont'd.

Issues:

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. In addition, the planned ICs do not address two areas where wastes were left in place: beneath the rental house on Parcel 39-60-16 and beneath Tensy Lane where it crosses Little Clipper Creek on Parcel 39-170-66 (Appendix E). 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.

Follow-up Actions:

EPA will develop strategies for implementing the ICs required by the OU1 ROD. These strategies will be affected by ongoing litigation, as well as the possibility that the property will transfer to new owners.

EPA will also develop an approach for ensuring long-term protectiveness in the two areas where wastes were left in place, but ICs were not required by the OU1 ROD.

Protectiveness Statement:

The remedy at the Lava Cap Mine Area OU1 and Mine Area Residences OU4 is currently protective of human health and the environment in the short term. However, to be protective in the long term, issues related to implementation of ICs need to be resolved.

I Introduction

The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and make recommendations to address them.

The Agency is preparing this five-year review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.

The agency interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

U.S. Environmental Protection Agency (EPA) Region 9 has conducted a five-year review of the remedies at the Lava Cap Mine Superfund Site in Nevada County, California. This review was conducted from September 2010 through September 2011 by the Remedial Project Manager (RPM) and the EPA Region 9 Technical Support Program. EPA contractors, including the RA Contractor, CH2M HILL, provided analysis in support of the five-year review. EPA and CH2M HILL conducted the site inspection on October 27, 2010. This report documents the results of the review.

This is the first five-year review for the Lava Cap Superfund Site. The triggering action for this statutory review is the date of actual OU1 RA onsite construction (May 2006). The five-year review is required because the remedy resulted in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure.

To facilitate implementation of the overall cleanup of the Lava Cap Mine Site, EPA divided the Site into four Operable Units (OUs). OU1 extends from the mine property to Greenhorn Road (Figure 1). OU1 includes the portion of the Site where hard rock mining operations occurred, as well as adjoining areas impacted by mine wastes (see Figure 2). OU1 is primarily disturbed land of an abandoned industrial character.

On the mine property, there are two parcels of land (parcel numbers 39-160-16 and 39-160-21) located away from the mine's historic operations and disposal areas that are primarily residential in character (each contains a single residence). These two parcels, which contain limited quantities of contaminated materials that appear to have been associated with construction fill and road building activities, were originally included as part of OU1. To allow for accelerated cleanup of these

residential areas during the 2005 construction season, EPA separated the two parcels from the rest of OU1 and designated them as the Mine Area Residences OU4.

This five-year review addresses the remedies that have been implemented at the Lava Cap Superfund Site. These are the soil remedies for OU1 and OU4. Remedies that have not yet been implemented include the treatment of adit water or mine drainage at OU1, the groundwater remedy for the Groundwater OU (OU2), and soil and water remedies for the Lost Lake (OU3). The adit water or mine drainage component of the OU1 remedy and the groundwater OU2 remedy are still in the remedial design phase, and OU3 is currently in the remedial investigation/feasibility phase. The primary RAO for OU2, as described in the 2008 Interim ROD for OU2, is to protect against residential exposure to groundwater contaminated with mine-related arsenic that presents an unacceptable risk to human health. The selected Interim Remedy for OU2 includes the following components:

- Nevada Irrigation District (NID) Water Supply: Installation of a new NID water supply pipeline, with direct connections provided to homes where residential wells are impacted by mine-related arsenic contamination.
- Land Use Notification: Development of a process that notifies property owners of the potential presence of arsenic contamination if they are planning to install residential wells within the footprint of potential mine-impacted groundwater migration pathways.
- Groundwater Monitoring: Implementation of an expanded groundwater monitoring network and sampling program to further define the current extent of mine-impacted groundwater contamination and to monitor for future migration.

The Interim Remedy for OU2 has not yet been implemented.

II Site Chronology

TABLE 1
Chronology of Site Events for OU1 and OU4

Date	Event
February 1999	Lava Cap Mine site added to NPL
October 1999	Remedial investigation (RI) starts
February 2004	The Feasibility Study for the mine area was released for public comment as was the Proposed Plan for cleanup of the Mine Area OU (OU1)
February 26, 2004	Public meeting to present the Proposed Plan
September 28, 2004	Record of Decision (ROD) signed defining the selected remedy for the Mine Area OU. In 2005, this OU was divided into 2 distinct OUs, OU1 Mine Area and OU4 Mine Residences.
January 2005	OU4 Engineering design starts.
May 2005	OU1 Engineering design starts.
July 2005	EPA completes the remedial design for OU4.
September 2005	OU4 construction activities, including excavation of contaminated soil start.
December 29, 2005	Construction activities completed for OU4
March 2006	EPA approves the remedial design for OU1; EPA and the State conduct final inspection of the completed OU4 remedy
May 2006	OU1 construction activities start.
September 29, 2006	Explanation of Significant Differences (ESD) document issued, clarifying the OU4 remedy for cleanup of the Mine Residences.
April 2007	Remedial Action Report completed for OU4.
June–August 2007	Mine Area OU1 construction for soils remedy completed.
2008 to Present	Routine operations and maintenance (O&M) of OU1 soils remedy.
February 2010	EPA and the State conduct final inspection of the OU1 soils remedy.
October 2010	Remedial Action Report completed for the soils component of OU1

III Background

Physical Characteristics

The Lava Cap Mine Superfund 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 (see Figure 1). The Site comprises 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. The Mine Area comprises the portion of the Site where active mining occurred, plus portions of several adjacent land parcels. The Mine Area covers approximately 20 acres. Two residences remain on the mine property in close proximity to the Mine Area; one houses the current property owner and the second houses a tenant. There are three additional residences along Tensy Lane in the lower stretches of the Mine Area.

The downstream areas of the Lava Cap Mine site include the Little Clipper Creek (LCC) drainage, the Clipper Creek drainage after it merges with LCC, and Lost Lake, a private lake located approximately 1¼ miles downstream of the mine property. 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.

Land and Resource Use

OU1 and OU4 include both abandoned industrial process areas and residential areas. The Operable Units include seven parcels associated with the historic mine and an additional two parcels not associated with the mine but on which mine tailings have been deposited by surface water transport from the mine.

The historic mine property is divided into seven land parcels (39-160-16, 39-160-21, 39-160-25, 39-160-27, 39-160-28, 39-160-29, and 39-160-30). All seven parcels are zoned with the Nevada County use designation RA-5 (Residential/Agricultural), and are expected to remain as such. These are low-density, rural residential properties; parcel sizes range from 5 to 15 acres. All of the homes located on these parcels rely on individual residential wells for their water supply. There are currently no other options (i.e., municipal water supply) besides individual groundwater wells to supply the residential properties.

History of Contamination

Contamination was first detected at the Site in February 1978, when lessees of the mine property submitted an application for a National Pollutant Discharge Elimination System (NPDES) permit to the California Regional Water Quality Control Board (RWQCB), seeking to discharge 63 million gallons of mine water to LCC as part of a project to dewater the mine workings. RWQCB found high concentrations of arsenic in mine discharge water and did not issue a permit.

In 1979, a decomposing log dam on the property released tailings into LCC. 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.

In May 1994, EPA detected high concentrations of arsenic and lead in soil, sediment, waste rock, and mine tailings.

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 Clipper Creek (after it merges with LCC) and Lost Lake.

Initial Response

Following the partial collapse of the log dam and release of tailings into LCC, in October 1997, the EPA Region 9 Superfund Emergency Response Office determined that the high arsenic concentrations and the mobility of the extremely fine-grained tailings warranted a time-critical removal action under Superfund authority. During October and November 1997, EPA 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 on an under-liner of high density polyethylene (HDPE) and covered with an over-liner of HDPE, a clay cap, and waste rock. 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 listed the Site on the Superfund National Priorities List in February 1999 and began the Remedial Investigation (RI) in October 1999. The RI report was released for public comment in November 2001. The Feasibility Study for the Mine Area Operable Unit was released for public comment in February 2004. From April 2003 through February 2004, EPA conducted a second 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 OU4 and the installation of water filtration treatment units at three residences on OU1.

Basis for Taking Action

Arsenic was found above state and federal drinking water standards in surface water and groundwater. High arsenic concentrations and mobility of the extremely fine-grained tailings (crushed rock) posed a threat of future releases. Arsenic is a known human carcinogen and is potentially harmful to plant and animal species. The primary route of potential exposure for the public was through domestic use of untreated groundwater and direct contact with the arsenic contaminated tailings, soil, and sediment. Complete exposure pathways included dermal contact with contaminated soil or sediment; dermal contact with contaminated surface water; ingestion of contaminated soil or sediment; ingestion of contaminated surface water; and inhalation of contaminated soil/windborne dust. Additionally, ingestion of, and dermal contact with, contaminated groundwater was also possible in cases where residential wells contained elevated levels of arsenic.

There were also mechanisms in place through which terrestrial and aquatic ecological receptors could be subjected to unacceptable risks. Terrestrial receptors faced such completed pathways as ingestion of contaminated surface water and biota and dermal contact with contaminated water, soil, and sediment. Aquatic receptors faced such completed pathways as ingestion of contaminated surface water, sediment, and biota and dermal contact with contaminated surface water and sediments.

Tailings-impacted areas contained higher levels of arsenic than surrounding areas. For comparison, arsenic levels in nearby natural soils unaffected by the mine tailings were about 20 milligrams per kilogram (mg/kg) and about 25 mg/kg in nearby sediments. The highest levels of arsenic at the Site were detected in sediments at the adit (up to 34,000 mg/kg) and in and around the cyanide and mill buildings (up to 31,200 mg/kg in soil and 14,300 mg/kg in ponded water).

Arsenic levels in the waste rock and tailings pile were highest at the surface, averaging 1,340 mg/kg, and decreasing with depth to 223 mg/kg in the deepest sample. The estimated volume of tailings and waste rock in the Mine Area was 210,000 cubic yards; including about 50,000 cubic yards of tailings.

Soils around the two residences closest to the tailings pile also contained high levels of arsenic (1,750 mg/kg and 1,230 mg/kg). These two residences: the Upper Rental residence (Parcel 39-160-25) and the Lower Rental residence (Parcel 39-160-30), were removed as part of the Mine Area OU1 remedy, and are different from the OU4 residences on Parcels 39-160-16 and 39-160-21.

Surface water from the collapsed adit and from seeps in the tailings pile and at the log dam all showed arsenic concentrations above the EPA's drinking water maximum contaminant level (MCL) of 10 micrograms per liter (µg/L), which is the surface water cleanup standard at the Site. The highest level, 910 µg/L, was detected at the adit during the low-flow period of late summer and early fall. Groundwater collected from monitoring wells completed beneath the waste rock/tailings in the Mine Area also contained elevated levels of arsenic, with concentrations ranging generally between 100 and 500 µg/L. Residential wells on the mine property and immediately downgradient typically contained arsenic at concentrations between 10 and 60 µg/L.

IV Remedial Actions

Remedy Selection

The ROD for the Lava Cap Mine Area OU1 was signed 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.

As stated in the ROD, specific Remedial Action Objectives (RAOs) for the Mine Area OU are the following:

- 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 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)
- Minimize the potential for release of contaminated soils and sediments during surface water flow events up to the 100-year return frequency event

The major components of the remedy for the Mine Area Operable Unit are as follows:

- **Mine Buildings, Tailings, Waste Rock, and Mine Drainage:** Consolidate, regrade, and cap the tailings with a low-permeability engineered cover system; contour, cover, and revegetate the waste rock disposal area to promote runoff and reduce surface infiltration; replace the failed log dam with a rock buttress; divert clean surface water flows around the tailings and waste rock disposal areas; collect and treat contaminated water emanating from the mine (i.e., the mine drainage) and from the tailings pile (i.e., the seeps) to meet the remedial action objective of restoring LCC to its beneficial use as a potential drinking water supply; remove tanks, vats, sumps, and contaminated soil from mine buildings, consolidating this material with the mine tailings or shipping it offsite for disposal; and implement land use restrictions to protect the remedy from physical disturbance and prohibit the property from being used as a residence (including any mobile home), a hospital, a public or private school, or a day care center, where such use is inconsistent with the remedy. (Such land use restrictions shall be implemented as land use covenants under California civil code, Section 1471 (c).)
- **Mine Area Residences:** Demolish the residence (Upper Rental residence) on Parcel 39-160-25 that was constructed over the waste rock and adjacent to the tailings disposal areas; remove

arsenic-contaminated soil from around three other residences and replace it with clean soil; move excavated material to the tailings disposal area for long-term management.

An Explanation of Significant Differences was prepared in 2006 to memorialize changes in the remedy required at the Lower Rental residence and surrounding area on Parcel 39-160-30. The ROD called for excavating contaminated soils from around the Lower Rental residence, consolidating the contaminated materials under the tailings pile cap, and returning the parcel to residential use. A soil-sampling program was conducted around the Lower Rental residence as part of the remedial design process. The sampling indicated that the lateral and vertical extent of arsenic contamination was much larger than had been anticipated. The depth and areal extent of the contaminated soil surrounding the Lower Rental residence made it technically impracticable to remove the contaminated materials and maintain the property in residential use. Instead, USEPA determined that the Lower Rental residence should be demolished and the entire area covered with a vegetated soil cover similar to the other waste rock/tailings impacted areas.

- **LCC to Greenhorn Road:** Excavate the tailings and arsenic-contaminated sediment that has accumulated along LCC adjacent to Tensy Lane as far south as Greenhorn Road and haul excavated material to the tailings disposal area for long-term management.

Remedy Implementation

Mobilization for construction activities at OU1 started in late May 2006; construction was completed by in December 2007. Construction activities started at OU4 in mid-September 2005 and completed in December 2005.

EPA completed the following elements of the remedy:

- **Mine Buildings and Surrounding Area:** Removed tanks, vats, sumps, and contaminated soil from in and around the main mine buildings (Mill, Assay, and Cyanide Buildings) and shipped the highly contaminated materials offsite for disposal; restricted unauthorized access to the buildings through the installation of fencing; covered areas around the mine storage buildings with a vegetative cap.
- **Waste Rock:** Contoured, covered, and re-vegetated the entire waste rock disposal area to promote runoff and reduce surface infiltration.
- **Mine Tailings and Rock Buttress:** Consolidated all tailings and adjacent contaminated soil from around the Site and from LCC in the Tensy Lane area into the tailings pile; re-graded and capped the tailings with a low-permeability engineered cover system, including a vegetative layer; replaced the failed log dam with a rock buttress at the downstream end of the tailings pile.
- **LCC and Smaller Mine Area Drainage Channels:** Constructed engineered channels to divert LCC and all other clean surface water flows around the mine buildings, tailings pile, and waste rock pile.
- **Mine Area Residences:** Demolished the Upper Rental residence and the Lower Rental residence (Parcels 39-160-25 and 39-160-30, respectively). After demolition, these areas were addressed consistent with other waste rock/tailings impacted areas including construction of a vegetative soil cap. Remediation of two other residential areas at the mine (on Parcels 39-160-16 and 39-160-21) was addressed as part of OU4.
- **LCC from the Mine to Greenhorn Road:** Excavated the tailings and arsenic-contaminated sediment that accumulated along the LCC drainage and surrounding floodplain as far south as

Greenhorn Road; consolidated these materials under the tailings pile cap on the mine property; and re-graded the excavated areas.

EPA is currently implementing the following remedy components:

- **Institutional Controls:** Because mine waste and contaminated materials were to be capped and left in place, institutional controls are required to minimize potential future exposure. The 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, 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 expects to have these land use covenants recorded within the next five years.
- 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 remedial action; 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.

Operation and Maintenance

O&M requirements for the implemented portion of the OU1 remedy are fairly minimal. To date, O&M has consisted of regular inspections of the OU1 and OU4 areas and minor maintenance and repairs. Routine maintenance activities have included addressing minor erosion problems (typically by hand), clearing debris and vegetation from drainage channels, and performing access road maintenance. Repairs were performed to address the buttress spillway concrete cracks and chips in November 2008.

The cap has been operational for approximately 46 months. Over this time, EPA's contractors have performed routine inspections and as-needed maintenance to keep the system operational. In February 2011, the Department of Toxic Substances Control (DTSC) took over the O&M for this remedy.

O&M activities have been performed in accordance with the final *Operation and Maintenance (O&M) Manual for the Lava Cap Mine Superfund Site, Mine Area (OU1) Phase 1 and Mine Residences (OU4) Remedies*, which defines the general requirements for the monitoring, inspection, and maintenance of the Mine Area remedy to ensure the long-term effectiveness and integrity of the remedial action.

<u>Annual O&M Costs</u>

The original estimated annual O&M cost was $38,000 (in 2004 dollars). This included approximately $15,500 in labor costs, approximately $7,500 in typical repairs/maintenance, and approximately $15,000 in non-typical repairs. The estimate was adjusted to $42,000 in 2006 dollars, based on a 5% annual inflation rate. The actual annual O&M cost from October 2008 to October 2010 was approximately $49,000. This is slightly higher than the original estimates, primarily due to an increased inspection frequency and the additional effort required to repair minor erosion impacts and to remove vegetation and downed trees.

V Progress Since the Last Review

This is the first five-year review for the Site.

VI Five-Year Review Process

Administrative Components

The Lava Cap Mine Area OU1 Five-Year Review team was led by Bruni Dávila of EPA, RPM for the Lava Cap Mine Site, and Cynthia Wetmore of the Regional Technical Support Program with expertise in engineering and risk assessment. EPA RAC Contractor CH2M HILL provided additional technical support.

The report was reviewed by DTSC.

Community Involvement

On October 18, 2010, EPA placed a public notice in the Grass Valley Union Newspaper, providing notice of this Five-Year review. In addition, on November 6, 2010, EPA mailed out to Lava Cap Site mailing list the fact sheet entitled "The United States Environmental Protection Agency Begins First Five-Year Review of Cleanup at the Lava Cap Mine Superfund Site." Copies of the public notice and fact sheet are provided in Appendix A.

Document Review

This five-year review consisted of a review of relevant documents, including decision documents and remedial action reports. The list of documents reviewed is included as Appendix B.

Data Review

A detailed discussion of the data review analysis can be found in Appendix C. The key findings from the review of the OU1 and OU4 remedies are presented below.

OU1

Overall, the engineered tailings pile cap and vegetative caps installed as part of the Mine Area (OU1) remedy have been performing as intended. There have not been any breaches of the caps or excessive erosion or settlement observed in the capped areas. The mine wastes remain under control.

The primary performance standards for OU1 are as follows:

- Construct the physical components of the remedy (e.g., waste rock and tailings pile caps, LCC and other drainage channels, rock buttress) in accordance with the approved design.
- Confirm that the rock buttress meets seismic stability requirements.
- Record deed restrictions that prevent inappropriate uses of the property and prevent intrusive activities that interfere with the constructed remedy.
- Conduct waste characterization analyses on the highly contaminated materials removed from in and around the mine buildings and in selected excavation areas. Transport any materials that exceed hazardous waste characteristic criteria (i.e., California soluble threshold limit concentrations or EPA toxicity characteristic leaching procedure limits) offsite to an appropriate disposal facility.

- Compare post-excavation confirmation sample results with background data sets to ensure that cleanup has been achieved.

The remedy was constructed as designed, as documented in the Remedial Action Report (CH2M HILL, 2010). The modified rock buttress meets the seismic stability criteria specified in the ROD, as confirmed by supplemental calculations included as Appendix B to the Remedial Action Report. EPA is still in the process of working with the California Environmental Protection Agency, DTSC, and the property owner to make sure that the appropriate deed restrictions are recorded on the OU1 parcels. The highly contaminated soil/waste material from the mine buildings was stockpiled, characterized, transported, and disposed of offsite at an appropriate facility.

Post-excavation confirmation samples were collected in three primary areas: the slopes adjacent to the drainage channels surrounding the waste rock and tailings piles, the excavation areas along the ridge above the mine buildings, and the LCC drainage in the Tensy Lane area (Figures 3 and 4). Sampling results for OU1 are shown in Table 2 and Figures 3 and 4. The performance criteria described in the ROD was to remove contaminated soil or sediment that exceeded EPA's cleanup targets of 20 mg/kg (soil) or 25 mg/kg (sediment). These cleanup goals represent sitewide background conditions developed during the remedial investigation/feasibility study. The background evaluations were based on samples of loose, organic surficial forest soils and of sediments accumulated in unimpacted drainage channels. However, in all three areas of the Mine Area OU remedy where post-excavation confirmation samples were collected, all surficial materials had been removed leaving only weathered bedrock at the ground surface. As was demonstrated during evaluation of parcel 39-160-21 (located immediately adjacent to and uphill from the Mine Area OU remedy areas), as part of the OU4 remedial design, the weathered bedrock in the mine area that has not been impacted by mining activities contains higher naturally occurring arsenic concentration than the surface soils that were sampled as part of the background soil investigation. A technical memorandum (CH2M HILL, 2005) summarizes these findings for mine area parcel 39-160-21, where the arsenic concentrations detected in the naturally-occurring weathered bedrock ranged from 9.2 to 127 mg/kg.

In areas where all surface soils had been removed, confirmation samples were collected from the native weathered bedrock present at the ground surface. These bedrock confirmation samples typically contained arsenic above EPA's target cleanup goals. Most of the confirmation sample arsenic results fall in the same concentration range (9.2 to 127 mg/kg) as detected in the unimpacted, weathered bedrock on Mine Area parcel 39-160-21, as shown in Table 2. Because of the higher, naturally occurring arsenic concentrations present in the native bedrock, the bedrock essentially represents a background condition separate and distinct from that evaluated in selecting the sitewide background value of 20 mg/kg for surface soil. EPA believes it is consistent with the Selected Remedy to apply a localized background level when scientific data support such an approach, as documented in the ESD (USEPA, 2006). The concentrations are generally much lower than the contaminated materials that had been present in the various areas prior to construction.

TABLE 2
OU1 Confirmation Soil Sampling Results

Sample ID	Location	Final Arsenic Concentration (mg/kg)
Slopes Adjacent to the Mine Area Drainage Ditches Around the Waste Rock and Tailings Piles		
LCC-001	Slope east of LCC—near Station 17+50	29
LCC-002	Slope east of LCC—near Station 16+75	33

TABLE 2
OU1 Confirmation Soil Sampling Results

Sample ID	Location	Final Arsenic Concentration (mg/kg)
LCC-003	Slope east of LCC—near Station 16+00	85
LCC-005	Slope east of LCC—near Station 14+50	32
LCC-006	Slope east of LCC—near Station 13+75	19
LCC-007	Slope east of LCC—near Station 13+00	62
LCC-008	Slope east of LCC—near Station 12+00	66
LCC-009	Slope east of LCC—near Station 15+25	23
G1C-001	Slope west of G1 channel—near Station 10+75	170
G1C-002	Slope west of G1 channel—near Station 11+25	110
NWC-001	Slope east of NW channel—near Station 19+25	140
NWC-002	Slope east of NW channel—near Station 18+25	18
NWC-003	Slope east of NW channel—near Station 16+00	13
G6C-001	Slope south of G6 channel—near Station 11+75	68
G6C-002	Slope south of G6 channel—near Station 10+75	48
Excavation Areas on the Ridge Above and East of the Mine Buildings		
Upper-001	Upper excavation area	18
Upper-002	Upper excavation area	33
Lower-003	Floor of lower excavation area	58
Lower-004	West side of bedrock berm around lower area	500
Lower-004a	Deeper into bedrock at Lower-004 location	68
Lower-005	East side of bedrock berm around lower area	64
Lower-006	West side of bedrock berm around lower area	570
Lower-007	West side of bedrock berm around lower area	88
Lower-008	West side of bedrock berm around lower area	270
LCC Drainage in the Tensy Lane Area		
TNSW-06	North of Tensy Lane, east slope about 80 feet north of culvert	130
TNSW-07	North of Tensy Lane, east slope about 180 feet north of culvert	37
TNSW-08	North of Tensy Lane, east slope about 280 feet north of culvert	15
TNSW-09	North of Tensy Lane, east slope about 108 feet north of culvert	140
TNSW-10	North of Tensy Lane, east slope about 196 feet north of culvert	390
TNSW-11	North of Tensy Lane, west slope about 162 feet north of culvert	71
TNSW-12	North of Tensy Lane, west slope about 80 feet north of culvert	24
TNSW-13	North of Tensy Lane, west slope near mine property fence	15

TABLE 2
OU1 Confirmation Soil Sampling Results

Sample ID	Location	Final Arsenic Concentration (mg/kg)
TNSW-14	North of Tensy Lane, east slope near mine property fence	72
TNSW-15	North of Tensy Lane, west slope about 375 feet north of culvert	78
TNSW-16	North of Tensy Lane, east slope about 425 feet north of culvert	120
TNSW-17	North of Tensy Lane, west slope about 340 feet north of culvert	76
TNSW-18	North of Tensy Lane, east slope about 300 feet north of culvert	49
TNSW-19	North of Tensy Lane, west slope about 280 feet north of culvert	86
TLS-14	South of Tensy Lane, floor of excavation	55
TLS-15	South of Tensy Lane, floor of excavation	56
TLS-16	South of Tensy Lane, east slope at southeast corner	63
TLS-17	South of Tensy Lane, west slope downstream of pond	65
TLS-18	South of Tensy Lane, west slope about 125 feet south of culvert	100

OU4

The primary performance standard for the Mine Area Residences OU4 was to remove contaminated materials that exceeded EPA's cleanup standard of 20 mg/kg, except in roadways, where contaminated materials were capped with asphalt. Confirmation of performance for the roads was based on visual assessment of the paving activities to ensure that the entire road was covered. To ensure that all contaminated materials were removed from the excavations, confirmation samples were collected from the floor and walls of the excavation in each separate excavation area (Figure 5). Preconstruction sample results of the contaminated materials ranged generally from 100 mg/kg to 2,200 mg/kg.

Results of the confirmation soil sampling in the excavation areas are presented in Figure 5 and in Table 3. Some of the initial confirmation samples were still well above the cleanup standards, but additional soil removal was performed and follow-up confirmation samples were collected. All of these follow-up samples were below the cleanup goal except at one location that still had an elevated arsenic concentration. This was a sidewall sample collected near the edge of the deck in an area where additional material could not be safely excavated without jeopardizing the integrity of the house and adjoining deck. There is a narrow sliver of soil, typically less than 12 inches wide, surrounding a portion of the house and deck footings, that could not be removed and likely contains elevated arsenic concentrations. Some of the soil beneath the house may also contain contaminated materials.

As indicated in Figure 5 and in Table 3, some of the individual confirmation samples slightly exceed the cleanup goal of 20 mg/kg, with the maximum concentration being 32.2 mg/kg. However, the mean concentration in each excavation area is below the cleanup target of 20 mg/kg, and overall, the confirmation data set is consistent with the background data set.

TABLE 3
Parcel 39-160-16 OU4 Confirmation Soil Sampling Results

Sample ID	Area	Location	Final Arsenic Concentration (mg/kg)
10UPRES01	Behind garage		8.9
10UPRES02	Behind garage		6.8
10UPRES03	Behind garage		4
10UPRES04	Behind garage		6.2
10UPRES05	Behind garage		8.5
10UPRES06	Behind garage		8.7
10UPRES07	Behind garage		ND
10UPRES08	Behind garage		ND
10UPRESBP-01	Behind garage	Burn pit at base of excavation	7.6
10UPRES09	W. and S. of house	Floor—near back steps	ND
10UPRES10	W. and S. of house		7.6
10UPRES11	W. and S. of house		15
10UPRES12	W. and S. of house		19.8
10UPRES13	W. and S. of house	Former pond area	7.6
10UPRES14	W. and S. of house		5.7
10UPRES15	W. and S. of house	Shallow excavation in yard	15.9
10UPRES16	W. and S. of house	Sidewall near flower bed	27.8
10UPRES17	W. and S. of house	Shallow excavation in yard	15.6
10UPRES26	W. and S. of house	Floor—near shed	27.5
10UPRES27	W. and S. of house	Floor—end of driveway	27.7
10UPRES28	W. and S. of house		13.2
10UPRES29	W. and S. of house	Floor—SE corner of excavation	32.2
10UPRES30	W. and S. of house	Sidewall near deck	189[a]
10UPRES31	W. and S. of house		7.6
10UPRES18	NE. of house	Sidewall at driveway	4.5
10UPRES19	NE. of house		18.9
10UPRES20	NE. of house		10.6
10UPRES21	NE. of house		13.4
10UPRES22	NE. of house	Excavation floor	6.3
10UPRES23	NE. of house		9.4
10UPRES24	NE. of house		19.3
10UPRES25	NE. of house	Excavation floor	17.3

TABLE 3
Parcel 39-160-16 OU4 Confirmation Soil Sampling Results

Sample ID	Area	Location	Final Arsenic Concentration (mg/kg)

[a] Additional excavation could not be performed without compromising the structural integrity of the house/deck.

Site Inspection

The site inspection was conducted on October 27, 2010, by the EPA Project Manager and CH2M HILL. The purpose of the inspection was to assess and confirm the integrity of the remedy. A copy of the site inspection checklist and photographs are provided in Appendix D.

The remedy, which is intended to consolidate and contain mine tailings, cover contaminated materials to minimize exposure and erosion, and divert clean surface water runoff around the mine waste areas, was found to be effective and functioning as designed. There are no major issues impacting remedy performance. The O&M procedures were found to be adequate to maintain the effectiveness of the remedy, as long as repairs (primarily of minor erosion) are made on a regular basis. It was noted that site inspections should occur soon after major rainfall events, and that additional effort should be expended to enhance growth of vegetation on the various vegetative covers and portions of the tailings pile cap.

Interviews

Site interviews were conducted October 13–25, 2010, with the following persons:

- David Towell, CH2M HILL Former Project Manager
- Jeff Huggins, Water Resources Control engineer, Regional Water Quality Control Board
- Wesley Nicks, Director of Environmental Health, Nevada County Director of Environmental Health
- Steve Ross, Hazardous Substances Engineer, State of California Department of Toxic Substances Control (DTSC)
- Jerry Grant and Corinne Gelfan, residents
- Doug Haussler, resident
- Robert Shoemaker, resident
- Craig and Joann Thurber, residents
- Frans and Andrea Velthuijsen, residents

Interview reports are provided in Appendix E. The overall impression of the project by interviewees was positive and the general consensus was that the remedy is functioning as expected. Some of the residents indicated concerns about the costs associated with the remedy.

VII Technical Assessment

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

The document review and the results of the site inspection indicate that the remedy is generally functioning as intended by the ROD and ESD.

The engineered tailings pile cap and vegetative caps installed as part of the OU1 remedy have been performing as intended. Although there have been several instances of erosion observed on the vegetative caps covering different waste rock areas and on the upper vegetative layer of the tailings pile cap, these have been readily repaired, and the erosion did not compromise the integrity of the caps. There have not been any breaches of the caps or settlement observed in the capped areas. The mine wastes remain under control.

Confirmation soil sampling results indicate that, with the exception of a limited amount of soil that could not be safely removed at OU4, contaminated material was removed from OU1 and OU4 to achieve the intended cleanup goals. Although several of the confirmation soil samples collected from native, weathered bedrock in OU1 exceeded cleanup goals, the concentrations are still much lower than the contaminated materials that had been present in the various areas prior to construction, and it is likely that these results are representative of the range of arsenic concentrations present in the naturally occurring bedrock in the Mine Area OU. There is no visual evidence of residual mine waste contamination in any of the areas following the remedial action.

The O&M procedures were found to be adequate to maintain the effectiveness of the remedy, as long as repairs (primarily of minor erosion) are made on a regular basis. Annual O&M costs are in line with original estimates. It was noted that site inspections should occur soon after major rainfall events, and that additional effort should be expended to enhance growth of vegetation on the various vegetative covers and portions of the tailings pile cap.

The ROD required 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 (Appendix F). Land use covenants have been drafted, and EPA has obtained concurrence from the State (i.e., DTSC) on these draft documents, but 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 to ensure that in the interim none of the proscribed activities occurs on these parcels. 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. Currently, EPA ensures that the cap keeps its integrity without ICs, through routine O&M inspections that evaluate whether the implemented remedy has been compromised.

The planned ICs do not address two areas where wastes were left in place: beneath the rental house on Parcel 39-160-16 and beneath Tensy Lane where it crosses LCC on Parcel 39-170-66 (Appendix F). 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.

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

The evaluation of the validity of exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of remedy selection is presented below.

Changes in Standards and To Be Considered

The RAOs used at the time of remedy selection are still valid. There have been no significant changes in the Applicable or Relevant and Appropriate Requirements (ARARs) and no new standards or To Be Considered Criteria (TBCs) affecting the protectiveness of the remedy (Appendix G). Therefore, the existing ARARs remain applicable or relevant and appropriate for the protection of human health and the environment with the following notes:

- The 2004 ROD identified SWRCB Order 97-03-DWQ, general permit for discharge of stormwater associated with construction activities, as an applicable ARAR. General permit 97-03-DWQ was replaced by general permit 2009-00090-DWQ effective July 1, 2010. There have been no significant changes affecting the ARAR status; however, construction activities at the Lava Cap Mine must comply with the substantive requirements in construction stormwater general permit 2009-00090-DWQ.
- The 2004 ROD identified Northern Sierra Air Quality Management District (NSAQMD) Rule 225 as an applicable ARAR that requires activities be designed to take all reasonable precautions to prevent particulate matter from becoming airborne, including use of water or chemicals as dust suppressants, covering of trucks, and prompt removal and handling of excavated material. It appears that the original citation in the 2004 ROD of Rule 225 (Compliance Testing) as an ARAR should have been Rule 226 (Dust Control) as an applicable ARAR. Therefore, NSAQMD Rule 226 is an applicable ARAR for the Lava Cap Mine.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics

The exposure and toxicity factors used in the human health risk assessment at the time of remedy selection have not changed. Although there is a proposed change for the arsenic cancer slope factor that would increase the toxicity 20-fold, this change would not affect the remedy because the target cleanup goal is based on background levels. A detailed risk assessment and toxicology analysis review for human health is provided in Appendix H.

The exposure assumptions used for the ecological risk assessment (ERA) at the time of remedy selection have not changed. Toxicity benchmarks for several inorganic-receptor combinations have been updated since the completion of the 2001 ERA. Some of these benchmarks are currently lower than those used in the ERA and may result in an increase in estimated ecological risks. However, toxicity thresholds for arsenic (the primary contaminant of concern) have either not changed or have only slightly increased (for plants and mammals only), indicating that selected cleanup goals remain protective. A detailed ecological risk assessment discussion is provided in Appendix I.

Question C: Has Any Other Information Come to Light that Could Call into Question the Protectiveness of the Remedy?

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

Technical Assessment Summary

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.

There have been no changes in the site conditions, no significant changes in the ARARs, and no new standards or TBCs that would affect the protectiveness of the remedy. There have been no significant changes in the toxicity factors for the contaminants of concern that were used in the risk assessments or the standardized risk assessment methodology that could affect the protectiveness of the remedy.

The planned ICs do not address two areas where wastes were left in place: beneath the rental house on Parcel 39-160-16 and beneath Tensy Lane where it crosses LCC. These two areas should be considered for inclusion in the ICs. There is no other information that calls into question the protectiveness of the remedy.

VIII Issues

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.

In addition, the planned ICs do not address two areas where wastes were left in place: beneath the rental house on Parcel 39-60-16- and beneath Tensy Lane where it crosses Little Clipper Creek on Parcel 39-170-66 (Appendix E). 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.

IX Follow-up Actions

By September 2016, EPA will develop strategies for implementing the ICs required by the OU1 ROD. These strategies will be affected by ongoing litigation, as well as the possibility that the property will transfer to new owners. EPA will also develop an approach for ensuring long-term protectiveness in the two areas where wastes were left in place, but ICs were not required by the OU1 ROD.

The planned institutional controls necessary for the Site do not currently impact protectiveness and are expected to be resolved within the next five years.

X Protectiveness Statement

The remedy at the Lava Cap Mine Area OU1 and Mine Area Residences OU4 is currently protective of human health and the environment in the short term. However, to be protective in the long term, issues related to implementation of ICs need to be resolved.

XI Next Review

The next five-year review for the Lava Cap Mine Area Superfund Site is required by September 2016, five years from the date of this review.

Figures

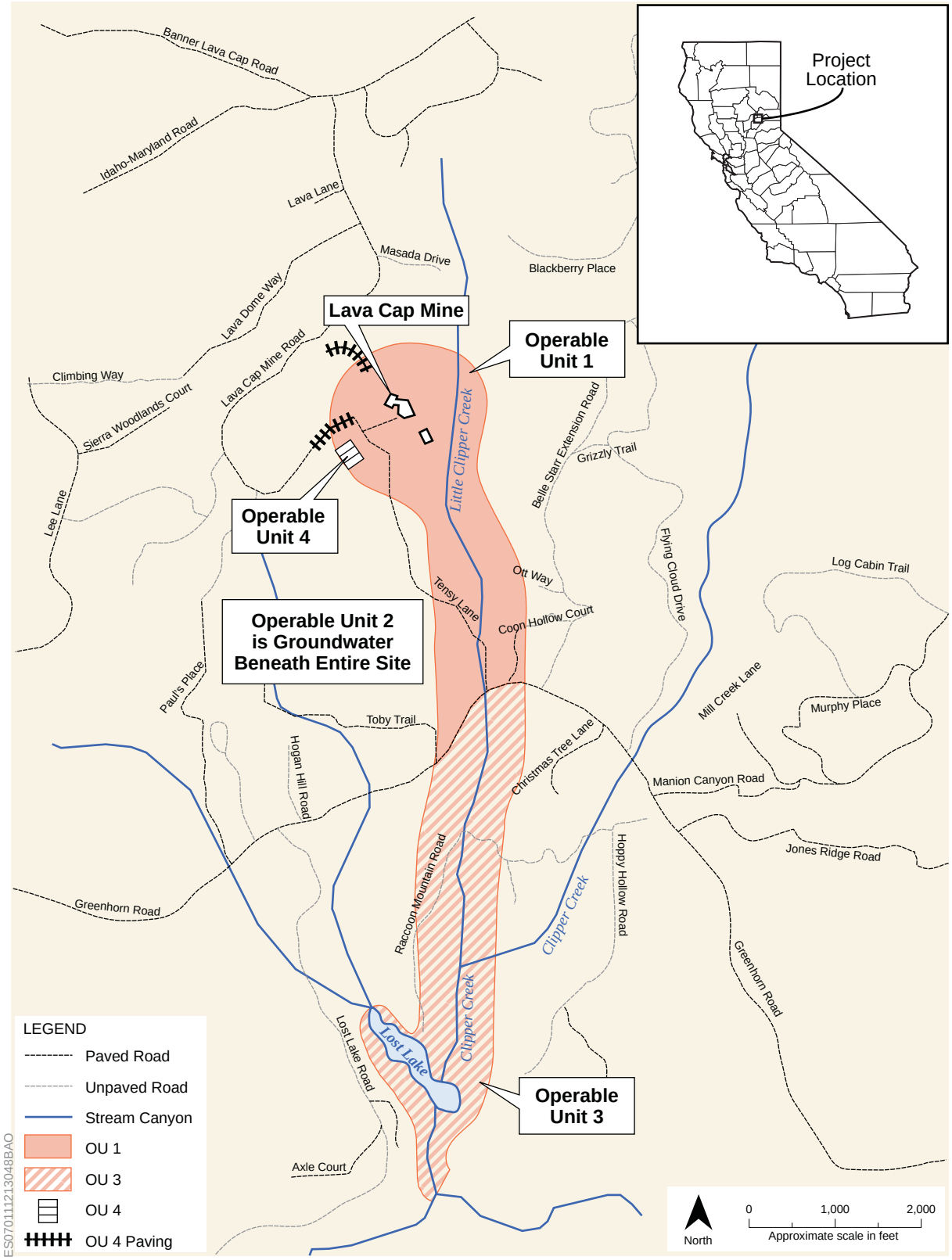
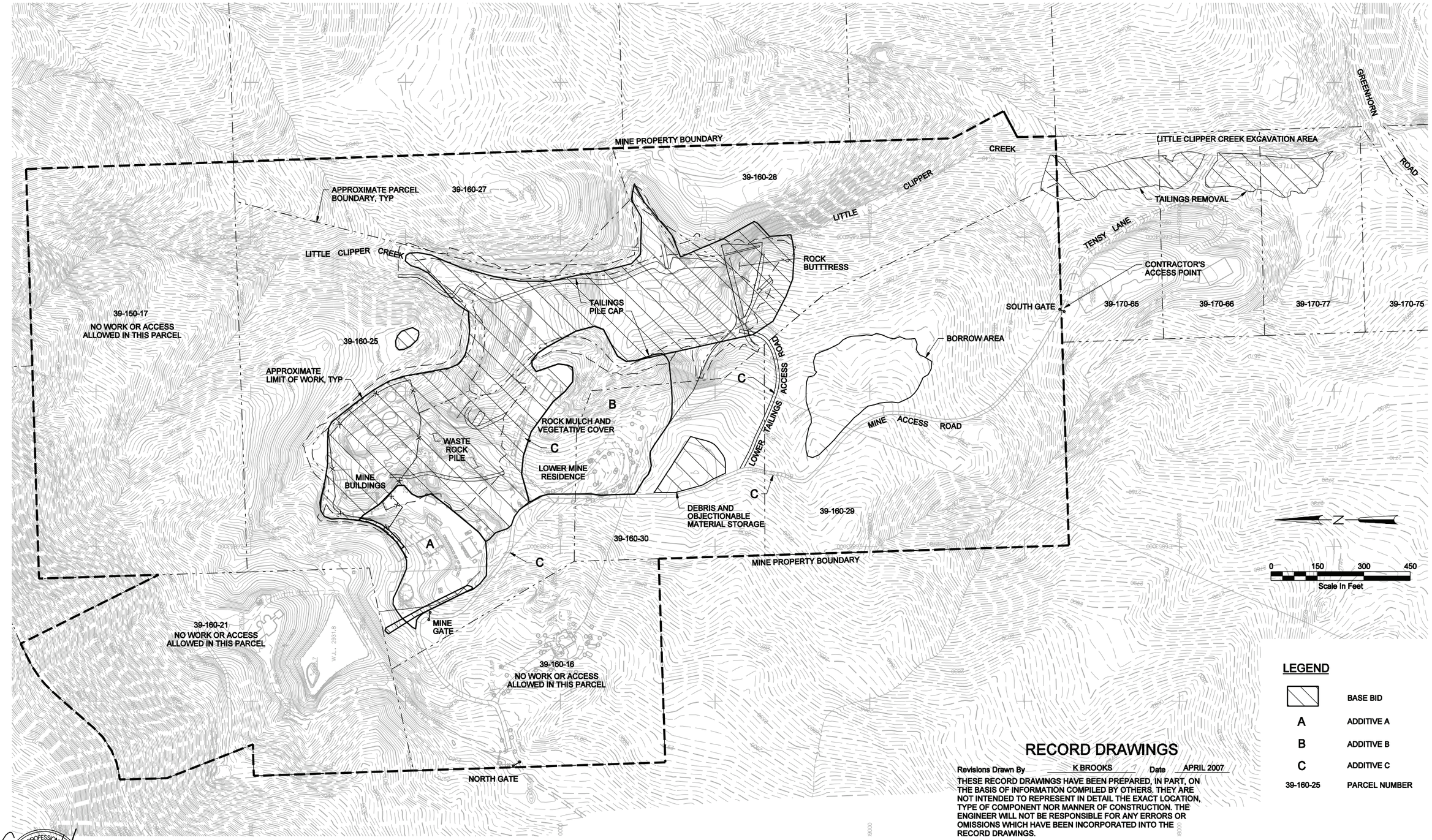


FIGURE 1
Lava Cap Mine Operable Units



LEGEND

	BASE BID
A	ADDITIVE A
B	ADDITIVE B
C	ADDITIVE C
39-160-25	PARCEL NUMBER

RECORD DRAWINGS

Revisions Drawn By K BROOKS Date APRIL 2007

THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED BY OTHERS. THEY ARE NOT INTENDED TO REPRESENT IN DETAIL THE EXACT LOCATION, TYPE OF COMPONENT NOR MANNER OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.

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DR	J CHELONIS
CHK	D TOWELL
APVD	D TOWELL

NO.	DATE	REVISION	BY	APVD

VERIFY SCALE
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0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

MINE AREA (OU1) - PHASE 1 REMEDIAL DESIGN

Figure 2

PROJECT WORK AREAS

SHEET	3
DWG	C-1a
DATE	APRIL 2007
PROJ	335400

b3621c32r.dgn 05-AUG-2008 15:32:12

CONSTRUCTION NOTES:

1. REMOVE WASTE MOUND AND PLACE IN TAILINGS PILE TO BE CAPPED.
2. CLEAR AND PLACE 1.0' ROCK MULCH CAP.
3. CONSTRUCT ANCHOR TRENCH
4. CONSTRUCT DRAINAGE CHANNELS.
5. REMOVE MATERIAL AND DISPOSE AT PERMITTED DISPOSAL FACILITY, SEE SPECIFICATIONS.
6. REMOVE EXISTING HDPE CULVERT.
7. PAVE ACCESS ROAD, WIDTH 12'-16'.
8. GRADE AND CAP TAILINGS.
9. CONSTRUCT BUTTRESS.
10. RELOCATE TO OBJECTIONABLE MATERIAL STORAGE AREA.
11. ADJUST WELL TO GRADE, SEE TABLE, THIS SHEET.
12. DESTROY WELL, SEE TABLE, THIS SHEET.
13. SALVAGE LARGE ROCK FOR USE AS RIP RAP
14. PLACE CULVERT WITH FLARED END SECTION

WELL ELEVATIONS
SEE SHEET C-28

WELL NO.	DESTRUCTION CUT OFF ELEVATION	ADJUST TO NEW GRADE ELEVATION
5A	2788.4	
5-D	2747.3	
5-E	2740.8	
5-I	ABANDONED	
5-J	ABANDONED	
5PZ-1		2792.7
5PZ-2	2753.4	
5PZ-3	ABANDONED	

LEGEND:

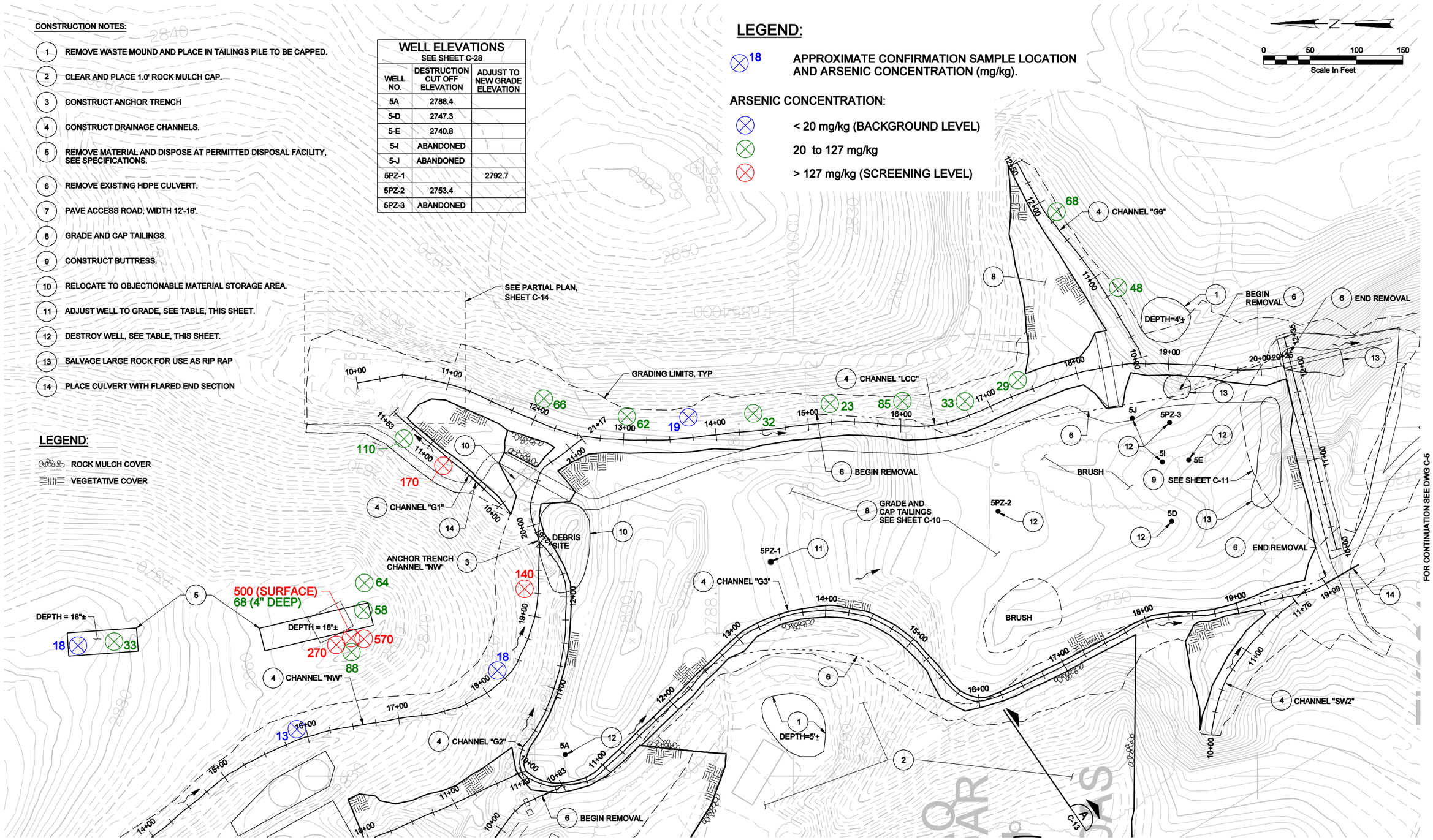
18 APPROXIMATE CONFIRMATION SAMPLE LOCATION AND ARSENIC CONCENTRATION (mg/kg).

ARSENIC CONCENTRATION:

- < 20 mg/kg (BACKGROUND LEVEL)
- 20 to 127 mg/kg
- > 127 mg/kg (SCREENING LEVEL)

LEGEND:

- ROCK MULCH COVER
- VEGETATIVE COVER



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DR	J CHELONIS
CHK	D TOWELL
APVD	D TOWELL

NO.	DATE	REVISION	BY	APVD

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

FIGURE 3
ARSENIC CONCENTRATIONS IN MINE AREA CONFIRMATION SAMPLES
LAVA CAP MINE OU1

SHEET
DWG
DATE
PROJ

13:49:48
sample-b3621c03r.dgn 17-FEB-2011

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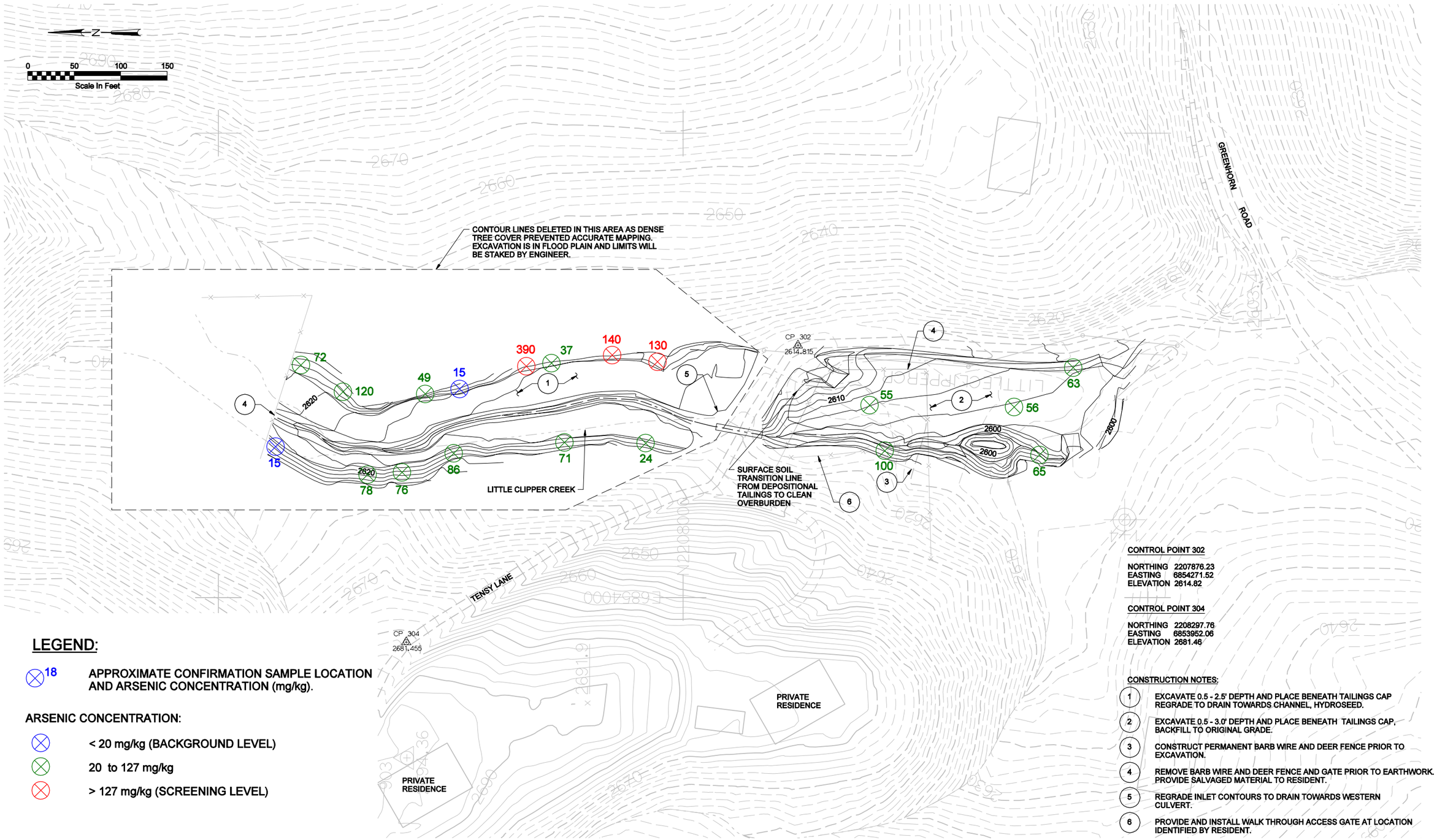

LEGEND:

⊗18 APPROXIMATE CONFIRMATION SAMPLE LOCATION AND ARSENIC CONCENTRATION (mg/kg).

ARSENIC CONCENTRATION:

- ⊗ < 20 mg/kg (BACKGROUND LEVEL)
- ⊗ 20 to 127 mg/kg
- ⊗ > 127 mg/kg (SCREENING LEVEL)

CONTROL POINT 302

NORTHING 2207876.23
EASTING 6854271.52
ELEVATION 2614.82

CONTROL POINT 304

NORTHING 2208297.76
EASTING 6853952.06
ELEVATION 2681.46

CONSTRUCTION NOTES:

1. EXCAVATE 0.5 - 2.5' DEPTH AND PLACE BENEATH TAILINGS CAP REGRADE TO DRAIN TOWARDS CHANNEL, HYDROSEED.
2. EXCAVATE 0.5 - 3.0' DEPTH AND PLACE BENEATH TAILINGS CAP, BACKFILL TO ORIGINAL GRADE.
3. CONSTRUCT PERMANENT BARB WIRE AND DEER FENCE PRIOR TO EXCAVATION.
4. REMOVE BARB WIRE AND DEER FENCE AND GATE PRIOR TO EARTHWORK. PROVIDE SALVAGED MATERIAL TO RESIDENT.
5. REGRADE INLET CONTOURS TO DRAIN TOWARDS WESTERN CULVERT.
6. PROVIDE AND INSTALL WALK THROUGH ACCESS GATE AT LOCATION IDENTIFIED BY RESIDENT.

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DR J CHELONIS						
CHK D TOWELL				DSJ	TK	
APVD D TOWELL	NO.	DATE	REVISION	BY	APVD	

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

FIGURE 4
ARSENIC CONCENTRATIONS IN TENSY LANE AREA CONFIRMATION SAMPLES
LAVA CAP MINE OU1

SHEET
DWG
DATE
PROJ

sample-b3621c06r.dgn 17-FEB-2011 13:47:36

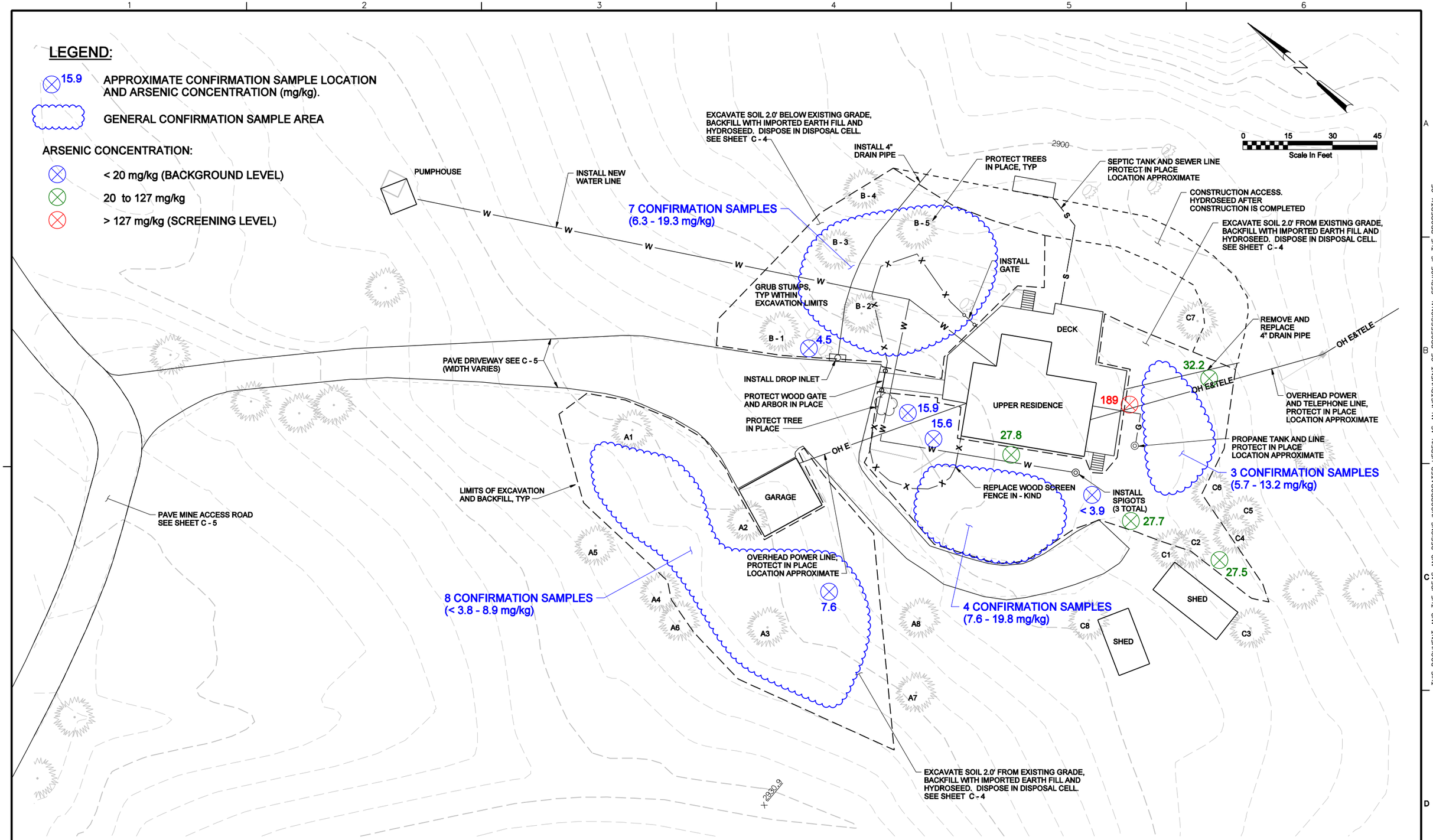
LEGEND:

15.9 APPROXIMATE CONFIRMATION SAMPLE LOCATION AND ARSENIC CONCENTRATION (mg/kg).

GENERAL CONFIRMATION SAMPLE AREA

ARSENIC CONCENTRATION:

- < 20 mg/kg (BACKGROUND LEVEL)
- 20 to 127 mg/kg
- > 127 mg/kg (SCREENING LEVEL)



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DR M BISHOP						BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.	
CHK J SPITZLEY							
APVD D TOWELL	NO.	DATE	REVISION	BY	APVD		

CH2MHILL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA RESIDENCES (OU4) - CONTAMINATED SOIL REMEDIATION
LAVA CAP MINE

FIGURE 5
ARSENIC CONCENTRATIONS IN CONFIRMATION SAMPLES
LAVA CAP MINE OU4

SHEET
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Appendix A
Public Notice and Fact Sheet Announcing Five-Year Review

DAVID

The Union
10/18/10

PUBLIC NOTICE
THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
BEGINS FIRST FIVE-YEAR REVIEW OF CLEANUP AT THE
LAVA CAP MINE SUPERFUND SITE

The United States Environmental Protection Agency (EPA) has begun the first five-year review of cleanup actions undertaken at the Lava Cap Mine Superfund Site, in Nevada County, California. The review will evaluate whether the cleanup actions for the site remain protective of human health and the environment.

Specifically, EPA will look at the movement and/or breakdown of the site's remaining contaminants, the integrity of the multi-layered vegetated cap over the mine tailings, changes in scientific knowledge about site contaminants and exposure pathways, and changes in regulatory standards.

When completed, a copy of the final report will be placed in the information repository listed below.

COMMUNITY INVOLVEMENT

EPA is always interested in hearing from the public. If you have any issues or concerns about the Lava Cap Mine Site cleanup, and particularly if you have direct knowledge regarding the operation or implementation of the as-built remedy, EPA would like to talk with you. Please contact Brunilda Dávila, EPA Project Manager (see below). To receive future fact sheets, please contact David Cooper (see below).

FOR MORE INFORMATION

Please visit the Lava Cap Mine website at: www.epa.gov/region09/lavacap

Or visit the information repositories listed below or contact the EPA contacts listed below.

INFORMATION REPOSITORY:

Nevada County Library
950 Helling Way
Nevada City, CA 95959
Telephone: 530-265-7050

Grass Valley Public Library
206 Mill Street
Grass Valley, CA 95945
Telephone: 530-273-4117

Superfund Records Center
95 Hawthorne Street
San Francisco, CA 94105
Telephone: 415-820-4700

CONTACT INFORMATION:

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75 Hawthorne St. (SFD 7-2)
San Francisco, CA 94105
(415) 972-3162
Davila.brunilda@epa.gov

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Community Involvement Coordinator
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(800) 231-3075 msg line or (415) 972-3245
Cooper.david@epa.gov

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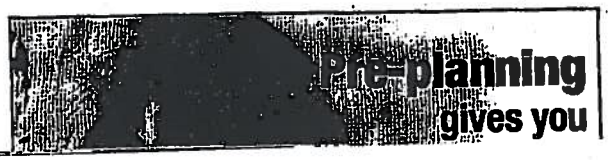


■ READERS' CORNER

Time for Santa Paws

The folks at AnimalSave are inviting everyone to their tenth annual Santa Paws Silent Auction and Wine Tasting.

Executive Director Carolyn Niehaus wants readers to know:

"The event features wine tasting from six local wineries, a silent auction, hors d'oeuvres and desserts, a no-host bar and live music. Proceeds from this event support AnimalSave's many important programs that transform the lives of dogs and cats.

"We appreciate the support we have received from our auction sponsors. Our 'Grand Paws' sponsors include The Union and Dr. Mimi Vishoot and Steve Nicholson of Pleasant Valley Veterinary Center."

It's from 6 p.m. to 10 p.m. Saturday, Nov. 13, with winetasting from 6 to 7:30 p.m., at Miners Foundry Cultural Center, 325 Spring St., Nevada City.

Auction Items include a family pass to Disneyland; restaurant and hotel packages; whale-watching trips; fabulous local shopping sprees; spa, beauty and health services; nights at bed-and-breakfast inns; casino packages; golf passes; art and jewelry.

For pets, items will include animal supplies, feed, veterinary

■ PET OF THE WEEK

Min Pin is a black and tan dog looking for a home.

He is neutered and around 3 years old.

Min Pin is available at the Grass Valley Animal Shelter on Freeman Lane, (530) 477-4630.

For more pet adoptions, contact:

• Sammie's Friends Animal Shelter, 14647 McCourtney Road, Grass Valley, (530) 471-

Lava Cap Superfund Site

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • November 2010

The United States Environmental Protection Agency Begins First Five-Year Review of Cleanup at the Lava Cap Mine Superfund Site

The United States Environmental Protection Agency (EPA) has begun the first five-year review of its cleanup actions at the Mine Area portion of the Lava Cap Mine Superfund Site located in Nevada County, California (the Site). The review will evaluate whether the cleanup actions in the Mine Area, also known as Operable Unit 1 (OU-1), remain protective of human health and the environment.

The Review Process

When EPA's cleanup leaves waste in place, the Superfund law requires it to evaluate the protectiveness of that remedy every five years. The remedy at Lava Cap includes leaving mine wastes on site beneath a protective cover.

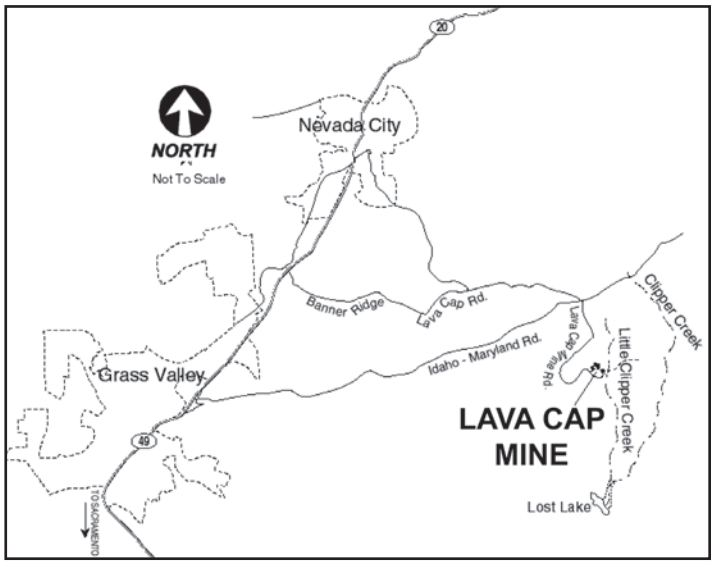
The purpose of the five-year review is to understand how the constructed remedy is operating and to measure the progress towards achieving the site's cleanup objectives. This first five-year review will evaluate the Mine Area OU-1 remedy's short- and long-term protectiveness of human health and the environment.

EPA's remedy for OU-1 soils included consolidating and capping the mine tailings onsite; covering and revegetating the waste rock area; replacing the failed log dam with a rock buttress; diverting surface water flows around the tailings and waste rock disposal areas; removing contaminated soil from around some mine area residences and demolishing other residences; excavating the tailings and arsenic-contaminated sediment that has accumulated along Little Clipper Creek.

The OU1 groundwater remedy has not yet been implemented, and will address contaminated groundwater that surfaces at the mine adit or seeps into surface waters at downstream locations. The groundwater component of the OU1 remedy will be addressed in future five year reviews.

Specifically, EPA will look at the movement and/or breakdown of the Site's remaining contaminants, the integrity of the multi-layered vegetated cap over the mine tailings, changes in scientific knowledge about Site contaminants and exposure pathways, and changes in regulatory standards.

In preparing the review, the EPA remedial project manager will talk with state and local regulatory authorities, EPA's scientific experts, and interested members of the public. Upon completion of the review, a copy of the final report will be placed in the local information repository (see Page 3) and a notice will appear in the local paper announcing the completion of the Five-Year Review Report. Thereafter, EPA will continue to monitor OU-1 and conduct additional five-year reviews to ensure the cleanup remains protective.



Lava Cap Mine Superfund Site

Site History

The Mine Area OU-1, which is approximately 30-acres and located in the northern foothills of the Sierra Nevada Mountains, comprises the portion of the Site where gold and silver operations took place intermittently from 1861 until 1943. The mine operations produced finely ground tailings containing naturally occurring arsenic and other trace metals.

The tailings were disposed in the Little Clipper Creek drainage adjacent to the mine's ore processing buildings. Some of the tailings were held in place by a log dam constructed across Little Clipper Creek. During a major storm in January 1997, the log dam partially collapsed and the flood waters spread arsenic-laden tailings downstream.

EPA determined that the high arsenic concentrations and the mobility of the extremely fine-grained tailings warranted a time-critical removal action, as these hazardous substances posed a risk to human health and the environment. In January 1999, EPA placed the Lava Cap Mine Site on its National Priorities List, or NPL (commonly called the Superfund List), and has been working to cleanup the Site ever since.

Cleanup Objectives

The cleanup goals established for OU-1 are to:

- protect 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
- collect and treat contaminated water from the mine drainage and seeps, and restore Little Clipper Creek 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
- minimize the potential for release of contaminated soils and sediments during surface water flow resulting from a 100-year storm event

To achieve these cleanup goals, the OU-1 cleanup requirements include:

- **Mine Buildings and Surrounding Area** – Remove tanks, vats, sumps, and contaminated soil from in and around the main mine buildings (Mill, Assay and Cyanide Buildings), and ship the highly-contaminated materials off-site for disposal; restrict unauthorized access to the buildings through the installation of fencing; cover areas around the mine storage buildings with a vegetative cap.
- **Waste Rock** – Contour, cover and revegetate the entire waste rock disposal area to promote runoff and reduce surface infiltration.
- **Mine Tailings and Rock Buttress –** Consolidate all tailings and adjacent contaminated soil from around the site and from Little Clipper Creek in the Tensy Lane area into the tailings pile; regrade and cap the tailings with a low-permeability engineered cover system, including a vegetative layer; replace the failed log dam with a rock buttress at the downstream end of the tailings pile.
- **Little Clipper Creek (LCC) and Smaller Mine Area Drainage Channels –** Construct engineered channels to divert LCC and all other clean surface water flows around the mine buildings, tailings pile and waste rock pile.
- **Mine Area Residences** – Demolish one residence that was located on the waste rock pile. After demolition, this area was contoured and a vegetative cover was installed. Later a second residence was also demolished.

- **Institutional Controls –** Implement land use restrictions to protect the remedy from physical disturbance and prohibit residential use of land parcels.

- **LCC from the Mine to Greenhorn Road** – Excavate the tailings and arsenic-contaminated sediment that have accumulated along the LCC drainage and surrounding floodplain as far south as Greenhorn Road. Consolidate these materials under the tailings pile cap on the mine property, and regrade the excavated areas.

Community Involvement

EPA is always interested in hearing from the public. If you have any issues or concerns about the Lava Cap Mine Site cleanup, and particularly if you have direct knowledge regarding the operation or implementation of the as-built remedy, EPA would like to hear from you. Please contact Brunilda Dávila or David Cooper at the numbers below.

If you would like to be included on EPA's mailing list for this Site and receive future fact sheets, fill out the form below and mail to David Cooper (see Contact Information at right).

For More Information

If you would like to learn more about the Lava Cap Mine Site, EPA has several resources. You may visit the information repositories listed below or contact EPA's site team members listed below.

You can also view Site documents at EPA's Lava Cap website at: **www.epa.gov/region09/lavacap**

Information Repository:

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

Superfund Records Center
95 Hawthorne Street
San Francisco, CA 94105
(415) 536-2000

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

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(415) 972-3245
cooper.david@epa.gov

Mailing List Coupon

If you are not already on the Lava Cap Superfund Site mailing list and would like to be, please fill out the coupon below and return it to: David Cooper, Community Involvement Coordinator, U.S. EPA, 75 Hawthorne St. (SFD-6-3), San Francisco, CA 94105 or e-mail the information to: *cooper.david@epa.gov*

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Lava Cap Superfund Site

The United States Environmental Protection Agency Begins First Five-Year Review of Cleanup at the Lava Cap Mine Superfund Site

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Appendix B
Documents Reviewed

Appendix B
Documents Reviewed

CH2M HILL. 2001. *Lava Cap Mine Superfund Site Baseline Human Health Risk Assessment. Nevada City, California*. November.

CH2M HILL. 2003. *Proposed Cleanup Concentrations for Ecological Risks at Lava Cap Mine, Nevada County, California.* Technical Memorandum prepared for United States Environmental Protection Agency. October 6.

CH2M HILL. 2005. *Main Residence Parcel – Evaluation of Arsenic in Soil, Lava Cap Mine Superfund Site*. September 16.

CH2M HILL. 2007. *Remedial Action Report for Mine Area Residences Operable Unit (OU4). Lava Cap Mine Superfund Site.* Prepared for U.S. Environmental Protection Agency Region 9. April.

CH2M HILL. 2010. *Remedial Action Report, Mine Area Operable Unit (OU1), Lava Cap Mine Superfund Site, Nevada County, California*. Prepared for U.S. Environmental Protection Agency Region 9. October.

United States Environmental Protection Agency (USEPA). 2001. *Public Release Draft Remedial Investigation Report Lava Cap Mine Superfund Site, Nevada Count, California*. U.S. Environmental Protection Agency Contract No. 68-W-98-225. November.

United States Environmental Protection Agency (USEPA). 2004a. *Record of Decision, Lava Cap Mine Superfund Site Mine Area Operable Unit (OU1), Nevada County, California*. September.

United States Environmental Protection Agency (USEPA). 2004b. *Mine Area Feasibility Study for the Lava Cap Mine Superfund Site, Nevada County, California, Public Release Draft*. February.

United States Environmental Protection Agency (USEPA). 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.

Appendix C
Data Review Memorandum

Data Review Memorandum
Five-Year Review of Operable Units 1 and 4, Lava Cap Superfund Site, Nevada City, California

PREPARED FOR: United States Environmental Protection Agency, Region 9

PREPARED BY: CH2M HILL

DATE: February 18, 2011

1.0 Introduction

This technical memorandum presents the findings of a data review associated with the remedy implemented at the Mine Area Operable Unit (OU1) and Mine Area Residences Operable Unit (OU4) at the Lava Cap Mine Superfund Site located approximately 5 miles southeast of Nevada City, California.

Descriptions of the background and the remedy for OU1 and OU4 are presented in this technical memorandum.

2.0 Background

The site comprises the Mine Area, where hardrock gold and silver mining operations occurred, and the downstream areas, where waste materials generated at the mine were discharged. The Mine Area comprises the portion of the site where active mining occurred plus portions of several adjacent land parcels. The Mine Area covers approximately 20 acres. There are two residences remaining on the mine property in proximity to the Mine Area: one houses the current property owner and the second houses a tenant. There are three additional residences along Tensy Lane in the lower stretches of the Mine Area.

The downstream areas of the Lava Cap Mine site include (1) the Little Clipper Creek (LCC) drainage, (2) the Clipper Creek drainage after it merges with LCC, and (3) Lost Lake, a private lake (and former tailings impoundment for the mine) located approximately 1.25 miles downstream of the mine property. 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.

To facilitate implementation of the overall cleanup of the Lava Cap Mine Site, the United States Environmental Protection Agency (USEPA) divided the site into four Operable Units. OU1 (also called the Mine Area OU) extends from the mine property down to Greenhorn Road (Figure 1). OU1 includes the portion of the site where hardrock mining operations occurred and adjoining areas impacted by mine wastes (see Figure 2). OU1 is primarily disturbed land of an abandoned industrial character.

Specific features of OU1, prior to the remedial action, included:

- The mine's process buildings (the mill building, assay building, cyanide building, and other smaller collocated structures) (Figure 3).
- The mine's disposal areas, which include waste rock and tailings, sometimes interspersed.
- The central mine shaft.
- The adit, from which contaminated mine drainage emanates as surface water flow.
- Stretches of LCC that contain contaminated sediment (subsequently removed as part of the OU1 remedy) and carry contaminated surface water flows.
- The failed log dam placed across LCC (the log dam was removed and replaced with the rock buttress as part of the OU1 remedy).
- Two rental residences constructed on mine wastes or mine-impacted materials (these were demolished as part of the OU1 remedy).

On the mine property, there are two parcels of land (parcel numbers 39-160-16 and 39-160-21) located away from the mine's historic operations and disposal areas that are primarily residential in character (each contains a single residence). These two parcels, which contain limited quantities of contaminated materials that appear to have been associated with construction fill and road building activities, were originally included as part of the Mine Area OU. To allow for accelerated cleanup of these residential areas during the 2005 construction season, USEPA separated the two parcels from the rest of the Mine Area OU and designated them as the Mine Area Residences OU (also called OU4).

Parcel 39-160-21 contains the private single-family residence of the owner of the mine property. It appears that this parcel historically has been limited to residential use; however, based on visual evidence and environmental sampling, it also appears that road-building activities resulted in the placement of relatively small quantities of mine wastes on this parcel.

Parcel 39-160-16 contains one single-family residence that is currently occupied as a rental unit. It appears that this parcel historically has been limited to residential use; however, based on visual evidence and environmental sampling, it also appears that construction fill to facilitate residential construction and road-building activities have resulted in the placement of relatively small quantities of mine wastes on this parcel.

Outside of waste rock used on roads and mine wastes used to create a building pad, there are no visual indications of mine waste disposal on these OU4 parcels. Sampling was conducted around the two residences, to determine if arsenic levels were elevated compared to the sitewide background values developed by USEPA (20 mg/kg for surface soil as presented in the Mine Area FS [USEPA, 2004]). In general, remediation is required in areas where arsenic concentrations exceed background. Extensive sampling was conducted during the remedial design phase to confirm the extent of impacted soil and to identify the specific areas requiring remediation.

On parcel 39-160-21, the weathered bedrock exposed at the ground surface has not been impacted by mining activities. However, this native bedrock contains higher naturally-occurring arsenic concentrations than the surface soils that were sampled as part of the sitewide background soil investigation. A technical memorandum (TM) titled *Main Residence Parcel – Evaluation of Arsenic in Soil, Lava Cap Mine Superfund Site* summarizes these findings (CH2M HILL, 2005). As described in the TM, the naturally-occurring arsenic concentrations detected in the native weathered bedrock (which ranged from 9.2 to 127 mg/kg) essentially represent a separate and distinct background condition than that evaluated in selecting the sitewide background value of 20 mg/kg for surface soil.

3.0 Remedial Action Objectives

3.1 Operable Unit 1

The Record of Decision (ROD) for OU1 was signed by the USEPA in September 2004. As listed in the ROD, the USEPA's remedial action objectives (RAOs) for OU1 include:

- 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 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).
- Minimize the potential for release of contaminated soils and sediments during surface water flow resulting from a 100-year storm event.

For OU1, the arsenic cleanup goals determined by USEPA to be protective of human health and the environment and to meet regulatory requirements are 10 micrograms per liter (µg/L) for surface water, 25 milligrams per kilogram (mg/kg) in sediment, and 20 mg/kg in soil. The selected cleanup goals ensure that the remedial action will reduce human health and ecological risks from the site to acceptable levels. The 10 µg/L limit for surface water is the drinking water maximum contaminant level, while the soil and sediment goals represent the background concentrations estimated for the surface soil in the forested areas upgradient of the site and for sediment in local streams not impacted by mine tailings. As noted above, it was subsequently determined that much of the weathered bedrock exposed at the surface in OU1 has higher naturally-occurring arsenic concentrations than the 20 mg/kg surface soil background value.

3.2 Operable Unit 4

The USEPA's RAOs for OU4 are the same as the RAOs for OU1 described above. To achieve these objectives, USEPA set a numeric cleanup goal for the contaminated soil at the site of 20 mg/kg. This concentration is the background concentration estimated for the surface soil in the forested areas upgradient of the site.

4.0 Remedy Summary

4.1 Operable Unit 1

The remedy selected in the 2004 Mine Area OU ROD is summarized in this section. The Mine Area OU ROD requirements included the following components:

- **Mine Buildings and Surrounding Area.** Remove tanks, vats, sumps, and contaminated soil from in and around the main mine buildings (Mill, Assay, and Cyanide Buildings) and ship the highly contaminated materials offsite for disposal. Restrict unauthorized access to the main mine buildings through the installation of fencing. Cover areas around the mine storage buildings with a vegetated soil cap.
- **Waste Rock.** Contour, cover, and revegetate the entire waste rock disposal area to promote runoff and reduce surface infiltration.
- **Mine Tailings and Rock Buttress.** Consolidate all tailings and adjacent contaminated soil from around the site and from LCC in the Tensy Lane area into the tailings pile; regrade and cap the tailings with a low-permeability engineered cover system, including a vegetative layer; and replace the failed log dam with a rock buttress at the downstream end of the tailings pile.
- **LCC and Smaller Mine Area Drainage Channels.** Construct engineered channels to divert LCC and all other clean surface water flows around the mine buildings, tailings pile, and waste rock pile.
- **Mine Discharge.** Pump water out of the mine workings to reduce or eliminate discharge from the adit; construct an adit structure to measure seepage flow rates and to collect any remaining adit seepage not captured by pumping from the mine workings; and construct a water treatment plant to treat surface water collected from the mine working and/or adit and from the mine tailings, with treatment consisting of a ferric chloride coagulation/filtration process or an alternative innovative technology). Adit discharge flow rates are in the 50-75 gallons per minute (gpm) range during much of the year, but increase into the 200-300 gpm range during the wetter winter and early spring period.
- **Mine Area Residences.** The ROD called for one residence (referred to as the Upper Rental residence) to be demolished because it was constructed immediately on or adjacent to the waste rock pile. After demolition, this area was to be addressed as part of the waste rock area with contouring and installation of a vegetative cover. After the ROD was signed, it was determined that a second residence would also need to be demolished. This second residence is referred to as the Lower Rental residence, and the remedy requirements for this area are summarized below. Two other residential areas at

the mine were addressed as part of the Mine Area Residences OU and are discussed in the background section for OU4.

- **Institutional Controls.** Because mine waste and contaminated materials were to be capped and left in place, institutional controls are required to minimize potential future exposure. The 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 restrictions were to be implemented as land use covenants under California civil code, Section 1471(c).
- **LCC from the Mine to Greenhorn Road.** Excavate the tailings and arsenic-contaminated sediment that have accumulated along the LCC drainage and surrounding floodplain as far south as Greenhorn Road, consolidate these materials under the tailings pile cap on the mine property, and regrade the excavated areas. Following remedy implementation, this downstream area would not require land use restrictions and would be available for any future use.

An Explanation of Significant Differences was prepared in 2006 to memorialize changes in the remedy required at the Lower Rental residence and surrounding area. The ROD called for excavating contaminated soils from around the Lower Rental residence, consolidating the contaminated materials under the tailings pile cap, and returning the parcel to residential use. A soil sampling program was conducted around the Lower Rental residence as part of the remedial design process. The sampling indicated that the lateral and vertical extent of arsenic contamination was much larger than had been anticipated. The depth and areal extent of the contaminated soil surrounding the Lower Rental residence made it technically impracticable to remove the contaminated materials and maintain the property in residential use. Instead, USEPA determined that the Lower Rental residence should be demolished and the entire area covered with a vegetated soil cover similar to the other waste rock/tailings impacted areas.

Mobilization for construction activities was initiated in late May 2006. Primary construction was completed by January 2007 when work was halted for the winter. After January 2007, the work remaining included installation of portions of the vegetative cap in the western portion of the waste rock area, the lower mine residence area, and the southwestern segment of the tailings pile cap; final grading and cleanup in the onsite borrow area; backfilling and LCC reconstruction in the Tensy Lane area; and minor punch-list items. The bulk of the outstanding work was completed in June through August 2007, with final LCC enhancements and revegetation work in the Tensy Lane area completed in December 2007.

The mine discharge component of the Mine Area OU remedy only recently completed the treatability study phase. As part of the phased implementation of the Mine Area OU remedy, treatment of the mine discharge was 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 OU remedy components and provides an opportunity for additional pilot testing of passive treatment technologies for the mine discharge. There have been six phases of treatability testing of the Lava Cap Mine adit water performed to date. The testing phases are:

- **Phase 1—Ferric Chloride Co-precipitation Jar Tests (Fall 2001).** Batch jar testing results confirmed the effectiveness of ferric chloride ($FeCl_3$) co-precipitation for arsenic removal and provided estimates of operating parameters for use in the *Lava Cap Mine Area Feasibility Study* (USEPA, 2004).

- **Phase 2—Isotherm Testing (Winter 2004).** Batch isotherm tests were conducted to evaluate whether adsorption and ion exchange media could be more cost effective than co-precipitation coupled with microfiltration for arsenic removal. Zero valent iron (ZVI) had the greatest capacity for arsenic removal and the lowest cost by more than an order of magnitude. Therefore, additional study of ZVI was recommended.

- **Phase 3—ZVI Column Testing (Spring 2005).** Laboratory column testing of ZVI was conducted to further evaluate the feasibility of ZVI treatment for Lava Cap Mine adit discharge water.

- **Phase 4—ZVI Onsite Pilot Testing (Fall 2005).** The onsite pilot test was designed to evaluate overall effluent quality and process reliability, effectiveness of unit operations (i.e., aeration, settling, filtration, ZVI treatment), effects of pre-treatment (aeration and filtration) on ZVI performance, effect of hydraulic retention time on ZVI performance, scale-up sizing and economics, and waste characteristics of treatment residuals. Results of the study indicated that several auxiliary unit processes would need to be added to the ZVI reactor for the process as a whole to provide effective treatment of arsenic, iron, and manganese. These auxiliary processes would include aeration and filtration both prior to and after the ZVI reactor. Due to this increased complexity and associated cost of these auxiliary processes, ZVI was not recommended for further testing.

- **Phase 5—Semipassive Treatment Lab Testing (Summer-Winter 2007)**. A series of laboratory bench-scale tests were conducted to evaluate the feasibility of treating Lava Cap Mine adit water by two different semipassive technologies: sulfate-reducing bioreactor treatment and iron co-precipitation of arsenic with passive aeration, settling, and manganese removal. Sulfate-reducing bioreactor testing results indicated that the process could remove a substantial percentage of the influent arsenic but could not reduce arsenic concentrations to the discharge limit of 10 µg/L. The testing results for the semipassive iron co-precipitation process indicated that the total arsenic discharge limit could be met with pre-aeration of the adit water, adding (at least) 30 milligrams per liter of ferric chloride and allowing 48 hours of quiescent settling. Polymer addition did not improve settling effectiveness. Reduction of total manganese concentrations to less than the PDL of 50 µg/L was achieved by 2 hours of retention time in an aerobic limestone bed.

- **Phase 6—Semipassive Treatment Onsite Pilot Testing.** The onsite pilot test was designed to evaluate the effectiveness of the treatment technology and develop design information. The testing was recently completed and the results of the pilot test indicate that the technology is effective at reducing iron and manganese to below discharge limits. Although arsenic concentrations were significantly reduced (by greater than 95%), it was not demonstrated that the pilot plant could consistently achieve the arsenic discharge limit of 10 µg/L. USEPA will soon decide whether further pilot testing is warranted or if design of a conventional treatment plant should commence.

4.2 Operable Unit 4

The primary focus of the remedy was to excavate any contaminated soil present around the Mine Area residences, backfill the excavated areas with soil transported from a clean borrow source, and consolidate excavated material in the tailings disposal area for long-term management. Associated activities included stormwater control and paving roads/driveways that had been covered with mine waste materials. During remedial design, it was determined that only the rental residence located on parcel 39-160-16 required implementation of all OU4 remedy components. The main mine residence located on parcel 39-160-21 required only paving of a little-used access road located behind the residence.

Construction activities were initiated in mid-September 2005 with contractor mobilization. The soil removal and paving activities were completed by the end of October 2005. There were some delays experienced first in locating a source of clean fill for backfilling the excavated areas, then from wet weather in November. All backfilling, road construction, and stormwater control activities were complete by the end of November 2005. Final revegetation and yard construction work on parcel 39-160-16 was completed in December 2005 as weather allowed.

5.0 Comparison against Performance Standards

5.1 Operable Unit 1

Overall, the engineered tailings pile cap and vegetative caps installed as part of the Mine Area OU remedy have been performing as intended. There have not been any breaches of the caps or excessive erosion or settlement observed in the capped areas. The mine wastes remain under control.

The primary performance standards for the Mine Area OU are as follows:

- Construct the physical components of the remedy (e.g., waste rock and tailings pile caps, LCC and other drainage channels, rock buttress) in accordance with the approved design.
- Confirm that the rock buttress meets seismic stability requirements.
- Record deed restrictions that prevent inappropriate uses of the property and prevent intrusive activities that interfere with the constructed remedy.
- Conduct waste characterization analyses on the highly-contaminated materials removed from in and around the mine buildings and in selected excavation areas. Transport any materials that exceed hazardous waste characteristic criteria (i.e., California soluble threshold limit concentration and USEPA toxicity characteristic leaching procedure) offsite to an appropriate disposal facility.
- Compare post-excavation confirmation sample results with background data sets to ensure that cleanup has been achieved.

The remedy was constructed as designed, as documented in the Construction Quality Assurance/Quality Control section of the *Remedial Action Report, Mine Area Operable Unit (OU1), Lava Cap Mine Superfund Site, Nevada County, California* (Remedial Action Report)

(CH2M HILL, 2010). The modified rock buttress meets the seismic stability criteria specified in the ROD, as confirmed by supplemental calculations included as Appendix B to the Remedial Action Report. USEPA is still in the process of working with the California Environmental Protection Agency, Department of Toxic Substances Control and the property owner to make sure that the appropriate deed restrictions are recorded on the Mine Area OU parcels. The remaining two criteria, waste characterization, and confirmation sampling are summarized below.

5.1.1 Mine Building Area Waste Characterization

All of the soil/waste material removed from the mine buildings was temporarily stockpiled awaiting waste characterization results. The soil removed from the two small, highly contaminated areas discovered on the top of the ridge east of the mine buildings was also stockpiled awaiting characterization. Prior to excavation, 12 representative samples were collected from the mill and cyanide buildings, and one characterization sample was collected from the excavation areas on the ridge above the mine buildings. None of the 13 samples exceeded any of the toxicity characteristic leaching procedure limits. However, 12 of the 13 samples exceeded at least one soluble threshold limit concentration limit (see Table 2 of the Mine Area OU RA Report [CH2M HILL, 2010]). Based on the characterization results, all of the stockpiled materials were transported offsite for disposal.

5.1.2 Confirmation Sampling

Post-excavation confirmation samples were collected in three primary areas: the slopes adjacent to the drainage channels surrounding the waste rock and tailings piles, the excavation areas along the ridge above the Mine Buildings, and the LCC drainage in the Tensy Lane area (Figure 4). Sampling results for the Mine Area OU are shown in Table 1 and on Figure 4. The performance criteria described in the ROD was to remove contaminated soil or sediment that exceeded USEPA's cleanup targets of 20 mg/kg (soil) or 25 mg/kg (sediment). These cleanup goals represent sitewide background conditions developed during the remedial investigation/feasibility study. The background evaluations were based on samples of loose, organic surficial forest soils and of sediments accumulated in unimpacted drainage channels. However, in all three areas of the Mine Area OU remedy where post-excavation confirmation samples were collected, all surficial materials had been removed leaving only weathered bedrock at the ground surface. As was demonstrated during evaluation of parcel 39-160-21 (located immediately adjacent to and uphill from the Mine Area OU remedy areas), as part of the OU4 remedial design, the weathered bedrock in the mine area that has not been impacted by mining activities contains higher naturally occurring arsenic concentration than the surface soils that were sampled as part of the background soil investigation (see section 2 above for additional details). A TM (CH2M HILL, 2005) summarizes these findings for mine area parcel 39-160-21, where the arsenic concentrations detected in the naturally-occurring weathered bedrock ranged from 9.2 to 127 mg/kg.

In areas where all surface soils had been removed, confirmation samples were collected from the weathered bedrock present at the ground surface. Because of the higher, naturally-occurring arsenic concentrations present in the weathered bedrock, these confirmation samples contained arsenic above USEPA's target cleanup goals. Most of the confirmation sample arsenic results fall in the same concentration range (9.2 to 127 mg/kg) as detected in

the unimpacted, weathered bedrock on parcel 39-160-21, as shown in Table 1. Although the weathered bedrock does contain arsenic at higher concentrations than the cleanup goals, the concentrations are still much lower than the contaminated materials that had been present in the various areas prior to construction.

Slopes Adjacent to the Tailings Pile Cap and Mine Area Drainage Channels

Typically, arsenic concentrations in near surface samples of Lava Cap Mine tailings fall in the 400- to 800-mg/kg range, with occasional samples exceeding 1,000 mg/kg. As part of remedy construction, the thin layer of surface soil present on the lower slopes adjacent to the drainage channels surrounding the tailings pile and waste rock area was removed (if any surface soil was present) and was placed in the tailings pile. Confirmation samples were collected to confirm that no tailings remained on these lower slopes. As shown on Figure 4 and in Table 1, 15 confirmation samples were collected on these weathered bedrock slopes, with arsenic results ranging from 13 to 170 mg/kg. Although two of the samples collected towards the north end of the area (adjacent to the G1 and NW channels) contained arsenic above the range of weathered bedrock concentrations detected on parcel 39-160-21 (9.2 to 127 mg/kg), it is likely that they are still representative of the range of arsenic concentrations present in the naturally-occurring weathered bedrock in the Mine Area OU. There is no evidence of residual mine waste contamination in these areas.

Excavation Areas on Ridge above Mine Buildings

Highly-contaminated materials were excavated from two relatively small areas along the ridge to the east of the mine buildings. Pre-excavation arsenic concentrations exceeded 20,000 mg/kg in some samples from these areas. As shown on Figure 4 and in Table 1, final confirmation sample results were 18 and 33 mg/kg in the smaller upper excavation area. In the lower area, a composite sample from the excavation floor had an arsenic concentration of 58 mg/kg. Portions of the weathered bedrock walls surrounding the lower bermed area still contain elevated levels of arsenic (up to 570 mg/kg in one of six samples). However, close inspection of these bedrock walls does not provide any indication that mine wastes are present. It appears that historic mine operations in this area may have resulted in isolated impacts to the bedrock walls of the bermed area. It should be noted that the arsenic concentrations are still much lower than those present in the native bedrock materials removed from the mine (i.e., waste rock), which typically exceed 1,000 mg/kg.

LCC Drainage in the Tensy Lane Area – North and South

Several rounds of sampling were conducted in the Tensy Lane area during remedy construction as the full vertical extent of contamination in this area was becoming clearer. Ultimately, on the north side of the Tensy Lane crossing, essentially all materials were removed down to solid, competent bedrock, except beneath and immediately adjacent to Tensy Lane itself. This rock material is challenging to sample and analyze. On the south side of Tensy Lane, excavation extended down to a weathered bedrock material similar to that found on the mine property. Because the excavation extended to bedrock and most of the areas along the bottom of the excavation were to be covered with backfill, the final confirmation sample collection focused on the sidewalls/upper slopes of the excavated areas that would remain exposed at the completion of construction. The confirmation soil sample locations are shown on Figure 5.

On the south side of the Tensy Lane crossing, arsenic concentrations in the five confirmation samples ranged from 55 to 100 mg/kg, as shown on Figure 5 and in Table 1. This falls within the range of naturally occurring arsenic concentrations detected in weathered bedrock on mine area parcel 39-160-21 (9.2 to 127 mg/kg).

On the north side of Tensy Lane, 14 confirmation samples were collected from the east and west sides of the LCC drainage excavation (Figure 5). The materials sampled included weathered bedrock and some more competent bedrock. There was one anomalous concentration of 390 mg/kg, with the remaining results ranging from 15 to 140 mg/kg—essentially consistent with the mine area parcel concentrations. The location with the anomalous 390 mg/kg is located along the eastern side of the excavation about 200 feet north of Tensy Lane. This sample was chipped directly from fairly competent bedrock forming the eastern wall of LCC drainage at this location. There is no indication of any residual mine impacts at this location. It appears that this area may represent an outcrop of a more mineralized bedrock zone.

5.2 Operable Unit 4

The primary performance standard for the Mine Area Residences OU was to remove contaminated materials that exceed USEPA's cleanup standard of 20 mg/kg, except in roadways where contaminated materials were capped with asphalt. Confirmation of performance for the roads was based on visual assessment of the paving activities to ensure that the entire road was covered. To ensure that all contaminated materials were removed from the excavations, confirmation samples were collected from the floor and walls of the excavation in each separate excavation area (Figure 6). Preconstruction sample results of the contaminated materials generally ranged from 100 mg/kg to 2,200 mg/kg.

Results of the confirmation soil sampling in the excavation areas are presented on Figure 6 and in Table 2. Some of the initial confirmation samples were still well above the cleanup standards, but additional soil removal was performed and follow-up confirmation samples were collected. These follow-up samples were all below the cleanup goal except at one location (10UPRES30). The 10UPRES30 sample is a sidewall sample collected at the edge of the area that could be safely excavated without jeopardizing the integrity of the house and adjoining deck. Elevated arsenic concentrations were present in this sample. There is a narrow sliver of soil, approximately 12 inches wide, surrounding a portion of the house and deck footings, that could not be removed and likely still contains contaminated materials. Some of the area beneath the house also may still contain contaminated materials.

As indicated on Figure 6 and in Table 2, some of the individual confirmation samples slightly exceed the cleanup goal of 20 mg/kg with the maximum concentration being 32.2 mg/kg. However, the mean concentration in each excavation area is below the cleanup target of 20 mg/kg, and overall, the confirmation data set is consistent with the background data set.

6.0 Conclusions

Overall, the engineered tailings pile cap and vegetative caps installed as part of the Mine Area OU remedy have been performing as intended. Although there have been several instances of erosion observed on the vegetative caps covering different waste rock areas and

on the upper vegetative layer of the tailings pile cap, these have been readily repaired and the erosion did not compromise the integrity of the caps. There have not been any breaches of the caps or settlement observed in the capped areas. The mine wastes remain under control.

The primary performance standard for the Mine Area Residences OU was to remove contaminated materials that exceed USEPA's cleanup standard of 20 mg/kg, except in roadways where contaminated materials were capped with asphalt. Confirmation of performance for the roads was based on visual assessment of the paving activities to ensure that the entire road was covered.

Confirmation soil sampling results presented in Table 1 and Table 2 for OU1 and OU4, respectively, indicate that, with the exception of a limited amount of soil that could not be safely removed at OU4, contaminated material was removed from OU1 and OU4 to achieve the intended cleanup goals. Although several of the confirmation soil samples collected from native, weathered bedrock in OU1 exceeded cleanup goals, the concentrations are still much lower than the contaminated materials that had been present in the various areas prior to construction, and it is likely that these results are representative of the range of arsenic concentrations present in the naturally occurring bedrock in the Mine Area OU. There is no visual evidence of residual mine waste contamination in any of the areas following the remedial action.

7.0 References

CH2M HILL. 2005. *Main Residence Parcel – Evaluation of Arsenic in Soil, Lava Cap Mine Superfund Site*. September 16.

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

United States Environmental Protection Agency. 2004. *Mine Area Feasibility Study for the Lava Cap Mine Superfund Site, Nevada County, California, Public Release Draft*. February.

TABLE 1
Mine Area OU - Confirmation Soil Sampling Results
Technical Memorandum - Data Review for the Five-Year Review of the Lava Cap Superfund Site Operable Units 1 and 4

Sample ID	Location	Final Arsenic Concentration (mg/kg)
Slopes Adjacent to the Mine Area Drainage Ditches around the Waste Rock and Tailings Piles		
LCC-001	Slope east of LCC- near Station 17+50	29
LCC-002	Slope east of LCC- near Station 16+75	33
LCC-003	Slope east of LCC- near Station 16+00	85
LCC-005	Slope east of LCC- near Station 14+50	32
LCC-006	Slope east of LCC- near Station 13+75	19
LCC-007	Slope east of LCC- near Station 13+00	62
LCC-008	Slope east of LCC- near Station 12+00	66
LCC-009	Slope east of LCC- near Station 15+25	23
G1C-001	Slope west of G1 channel- near Station 10+75	170
G1C-002	Slope west of G1 channel- near Station 11+25	110
NWC-001	Slope east of NW channel- near Station 19+25	140
NWC-002	Slope east of NW channel- near Station 18+25	18
NWC-003	Slope east of NW channel- near Station 16+00	13
G6C-001	Slope south of G6 channel- near Station 11+75	68
G6C-002	Slope south of G6 channel- near Station 10+75	48
Excavation Areas on the Ridge Above and East of the Mine Buildings		
Upper-001	Upper excavation area	18
Upper-002	Upper excavation area	33
Lower-003	Floor of lower excavation area	58
Lower-004	West side of bedrock berm around lower area	500
Lower-004a	Deeper into bedrock at Lower-004 location	68
Lower-005	East side of bedrock berm around lower area	64
Lower-006	West side of bedrock berm around lower area	570
Lower-007	West side of bedrock berm around lower area	88
Lower-008	West side of bedrock berm around lower area	270
LCC Drainage in the Tensy Lane Area		
TNSW-06	North of Tensy Lane, east slope about 80' north of culvert	130
TNSW-07	North of Tensy Lane, east slope about 180' north of culvert	37
TNSW-08	North of Tensy Lane, east slope about 280' north of culvert	15
TNSW-09	North of Tensy Lane, east slope about 108' north of culvert	140
TNSW-10	North of Tensy Lane, east slope about 196' north of culvert	390
TNSW-11	North of Tensy Lane, west slope about 162' north of culvert	71
TNSW-12	North of Tensy Lane, west slope about 80' north of culvert	24
TNSW-13	North of Tensy Lane, west slope near mine property fence	15
TNSW-14	North of Tensy Lane, east slope near mine property fence	72

TABLE 1
Mine Area OU - Confirmation Soil Sampling Results
Technical Memorandum - Data Review for the Five-Year Review of the Lava Cap Superfund Site Operable Units 1 and 4

Sample ID	Location	Final Arsenic Concentration (mg/kg)
TNSW-15	North of Tensy Lane, west slope about 375' north of culvert	78
TNSW-16	North of Tensy Lane, east slope about 425' north of culvert	120
TNSW-17	North of Tensy Lane, west slope about 340' north of culvert	76
TNSW-18	North of Tensy Lane, east slope about 300' north of culvert	49
TNSW-19	North of Tensy Lane, west slope about 280' north of culvert	86
TLS-14	South of Tensy Lane, floor of excavation	55
TLS-15	South of Tensy Lane, floor of excavation	56
TLS-16	South of Tensy Lane, east slope at southeast corner	63
TLS-17	South of Tensy Lane, west slope downstream of pond	65
TLS-18	South of Tensy Lane, west slope about 125' south of culvert	100

TABLE 2
Parcel 39-160-16 (Upper Residence) – Confirmation Soil Sampling Results
Technical Memorandum - Data Review for the Five-Year Review of the Lava Cap Superfund Site Operable Units 1 and 4

Sample ID	Area	Location	Final Arsenic Concentration (mg/kg)
10UPRES01	Behind garage		8.9
10UPRES02	Behind garage		6.8
10UPRES03	Behind garage		4
10UPRES04	Behind garage		6.2
10UPRES05	Behind garage		8.5
10UPRES06	Behind garage		8.7
10UPRES07	Behind garage		ND
10UPRES08	Behind garage		ND
10UPRESBP-01	Behind garage	Burn pit at base of excavation	7.6
10UPRES09	W. and S. of house	Floor—near back steps	ND
10UPRES10	W. and S. of house		7.6
10UPRES11	W. and S. of house		15
10UPRES12	W. and S. of house		19.8
10UPRES13	W. and S. of house	Former pond area	7.6
10UPRES14	W. and S. of house		5.7
10UPRES15	W. and S. of house	Shallow excavation in yard	15.9
10UPRES16	W. and S. of house	Sidewall near flower bed	27.8
10UPRES17	W. and S. of house	Shallow excavation in yard	15.6
10UPRES26	W. and S. of house	Floor—near shed	27.5
10UPRES27	W. and S. of house	Floor—end of driveway	27.7
10UPRES28	W. and S. of house		13.2
10UPRES29	W. and S. of house	Floor—SE corner of excavation	32.2
10UPRES30	W. and S. of house	Sidewall near deck	189[a]
10UPRES31	W. and S. of house		7.6
10UPRES18	NE. of house	Sidewall at driveway	4.5
10UPRES19	NE. of house		18.9
10UPRES20	NE. of house		10.6
10UPRES21	NE. of house		13.4
10UPRES22	NE. of house	Excavation floor	6.3
10UPRES23	NE. of house		9.4
10UPRES24	NE. of house		19.3
10UPRES25	NE. of house	Excavation floor	17.3

Notes:
[a] Additional excavation could not be performed without compromising the structural integrity of the structure.

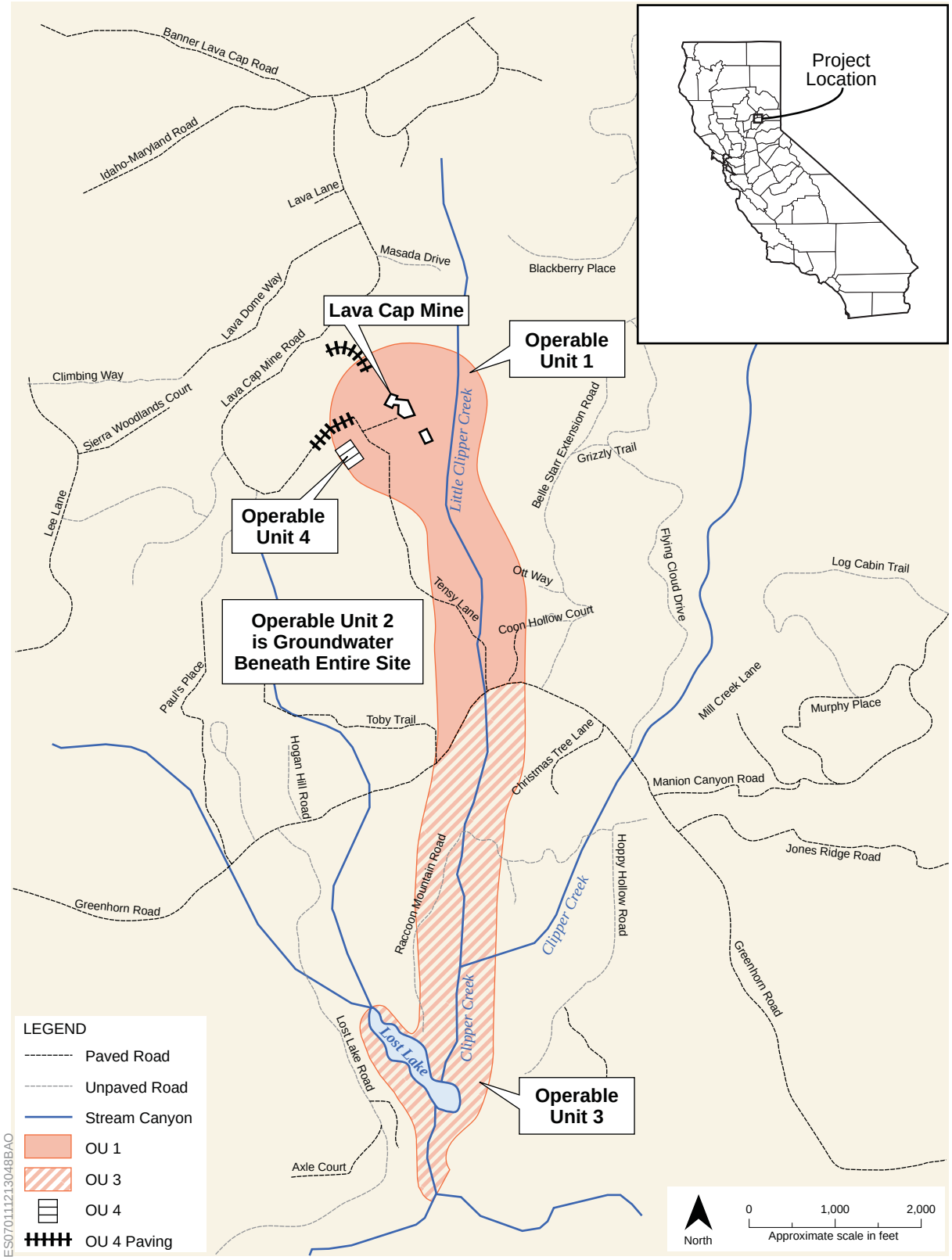
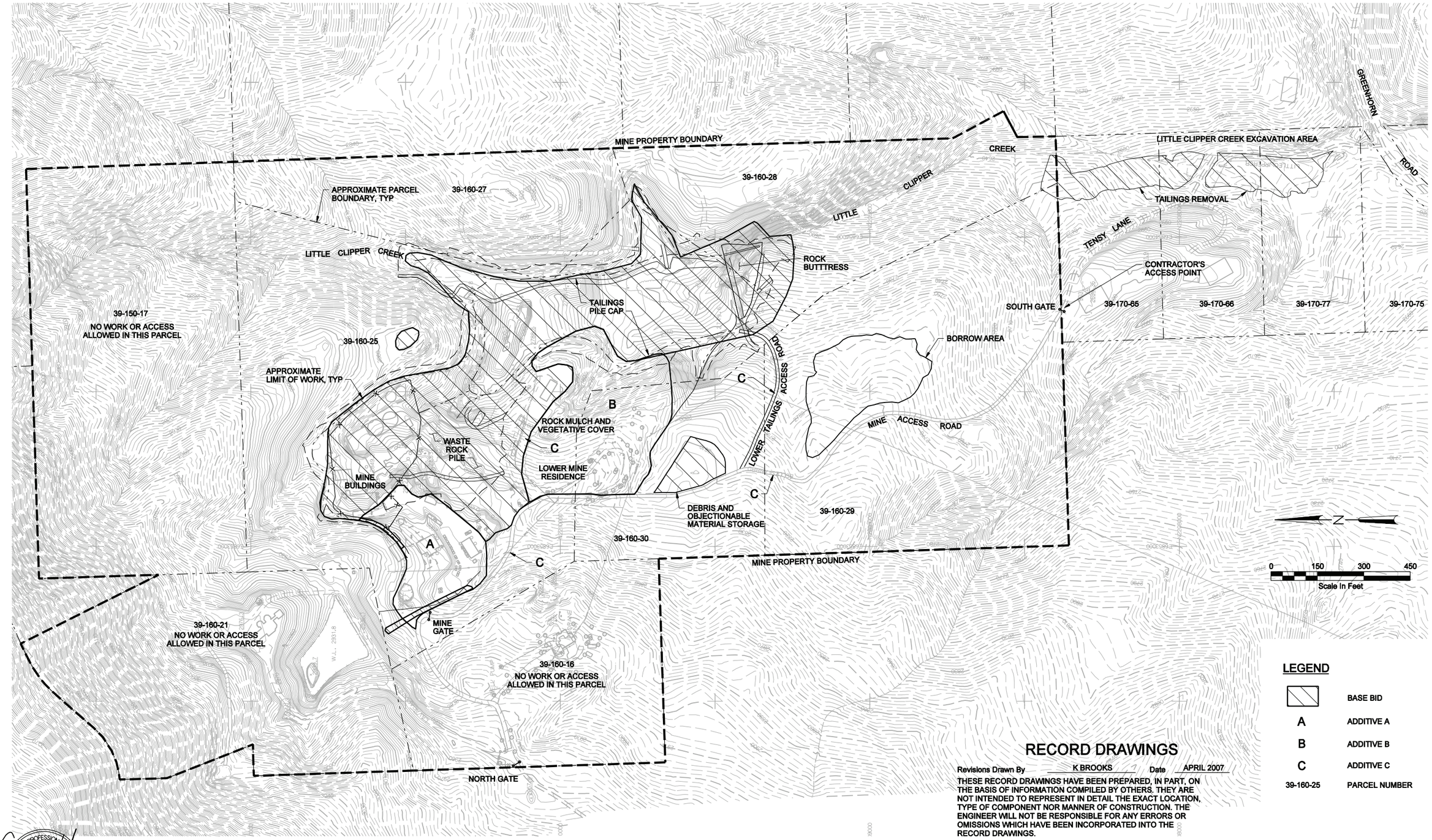


FIGURE 1
Lava Cap Mine Operable Units



LEGEND

	BASE BID
A	ADDITIVE A
B	ADDITIVE B
C	ADDITIVE C
39-160-25	PARCEL NUMBER

RECORD DRAWINGS

Revisions Drawn By K BROOKS Date APRIL 2007

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DR	J CHELONIS
CHK	D TOWELL
APVD	D TOWELL

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

MINE AREA (OU1) - PHASE 1 REMEDIAL DESIGN

Figure 2

PROJECT WORK AREAS

SHEET	3
DWG	C-1a
DATE	APRIL 2007
PROJ	335400

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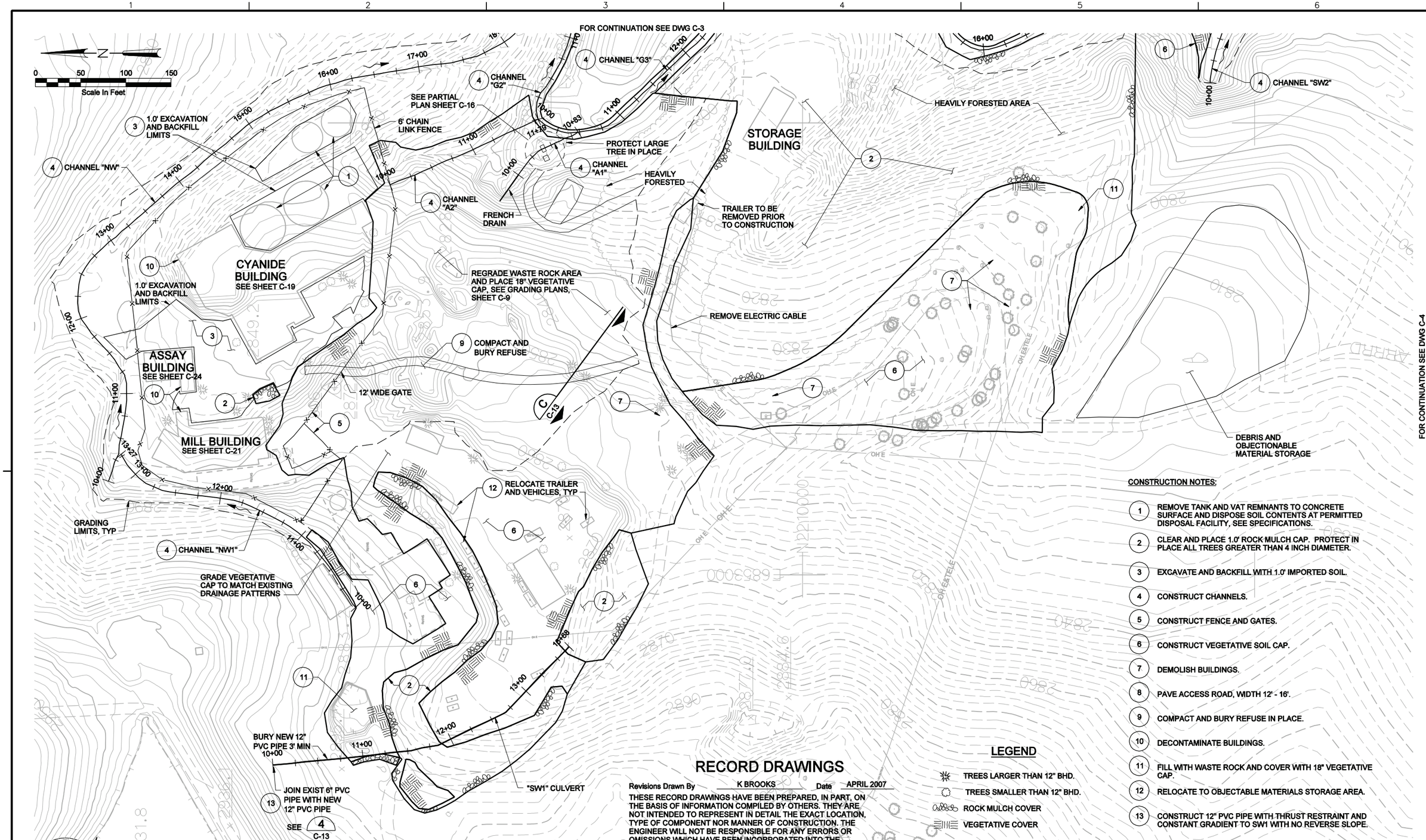

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LEGEND

- TREES LARGER THAN 12" BHD.
- TREES SMALLER THAN 12" BHD.
- ROCK MULCH COVER
- VEGETATIVE COVER

CONSTRUCTION NOTES:

1. REMOVE TANK AND VAT REMNANTS TO CONCRETE SURFACE AND DISPOSE SOIL CONTENTS AT PERMITTED DISPOSAL FACILITY, SEE SPECIFICATIONS.
2. CLEAR AND PLACE 1.0' ROCK MULCH CAP. PROTECT IN PLACE ALL TREES GREATER THAN 4 INCH DIAMETER.
3. EXCAVATE AND BACKFILL WITH 1.0' IMPORTED SOIL.
4. CONSTRUCT CHANNELS.
5. CONSTRUCT FENCE AND GATES.
6. CONSTRUCT VEGETATIVE SOIL CAP.
7. DEMOLISH BUILDINGS.
8. PAVE ACCESS ROAD, WIDTH 12' - 16'.
9. COMPACT AND BURY REFUSE IN PLACE.
10. DECONTAMINATE BUILDINGS.
11. FILL WITH WASTE ROCK AND COVER WITH 18" VEGETATIVE CAP.
12. RELOCATE TO OBJECTABLE MATERIALS STORAGE AREA.
13. CONSTRUCT 12" PVC PIPE WITH THRUST RESTRAINT AND CONSTANT GRADIENT TO SW1 WITH NO REVERSE SLOPE.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

MINE AREA (OU1) - PHASE 1 REMEDIAL DESIGN

Figure 3

SITE PLAN - MINE BUILDINGS

SHEET	4
DWG	C-2
DATE	APRIL 2007
PROJ	335400

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CONSTRUCTION NOTES:

1. REMOVE WASTE MOUND AND PLACE IN TAILINGS PILE TO BE CAPPED.
2. CLEAR AND PLACE 1.0' ROCK MULCH CAP.
3. CONSTRUCT ANCHOR TRENCH
4. CONSTRUCT DRAINAGE CHANNELS.
5. REMOVE MATERIAL AND DISPOSE AT PERMITTED DISPOSAL FACILITY, SEE SPECIFICATIONS.
6. REMOVE EXISTING HDPE CULVERT.
7. PAVE ACCESS ROAD, WIDTH 12'-16'.
8. GRADE AND CAP TAILINGS.
9. CONSTRUCT BUTTRESS.
10. RELOCATE TO OBJECTIONABLE MATERIAL STORAGE AREA.
11. ADJUST WELL TO GRADE, SEE TABLE, THIS SHEET.
12. DESTROY WELL, SEE TABLE, THIS SHEET.
13. SALVAGE LARGE ROCK FOR USE AS RIP RAP
14. PLACE CULVERT WITH FLARED END SECTION

WELL ELEVATIONS
SEE SHEET C-28

WELL NO.	DESTRUCTION CUT OFF ELEVATION	ADJUST TO NEW GRADE ELEVATION
5A	2788.4	
5-D	2747.3	
5-E	2740.8	
5-I	ABANDONED	
5-J	ABANDONED	
5PZ-1		2792.7
5PZ-2	2753.4	
5PZ-3	ABANDONED	

LEGEND:

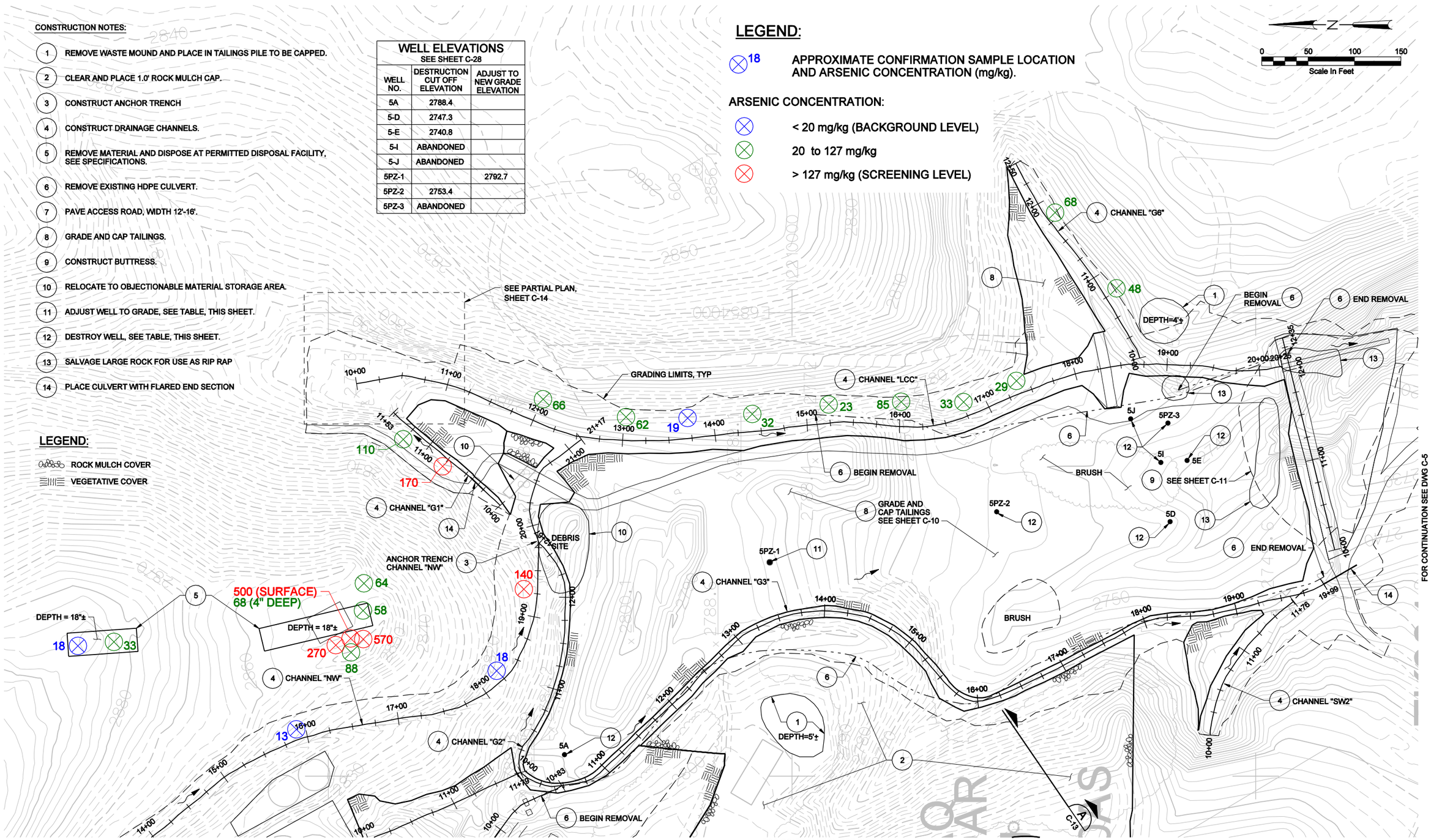
18 APPROXIMATE CONFIRMATION SAMPLE LOCATION AND ARSENIC CONCENTRATION (mg/kg).

ARSENIC CONCENTRATION:

- < 20 mg/kg (BACKGROUND LEVEL)
- 20 to 127 mg/kg
- > 127 mg/kg (SCREENING LEVEL)

LEGEND:

- ROCK MULCH COVER
- VEGETATIVE COVER



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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

FIGURE 4
ARSENIC CONCENTRATIONS IN MINE AREA CONFIRMATION SAMPLES
LAVA CAP MINE OU1

SHEET	FIGURE 1
DWG	
DATE	
PROJ	

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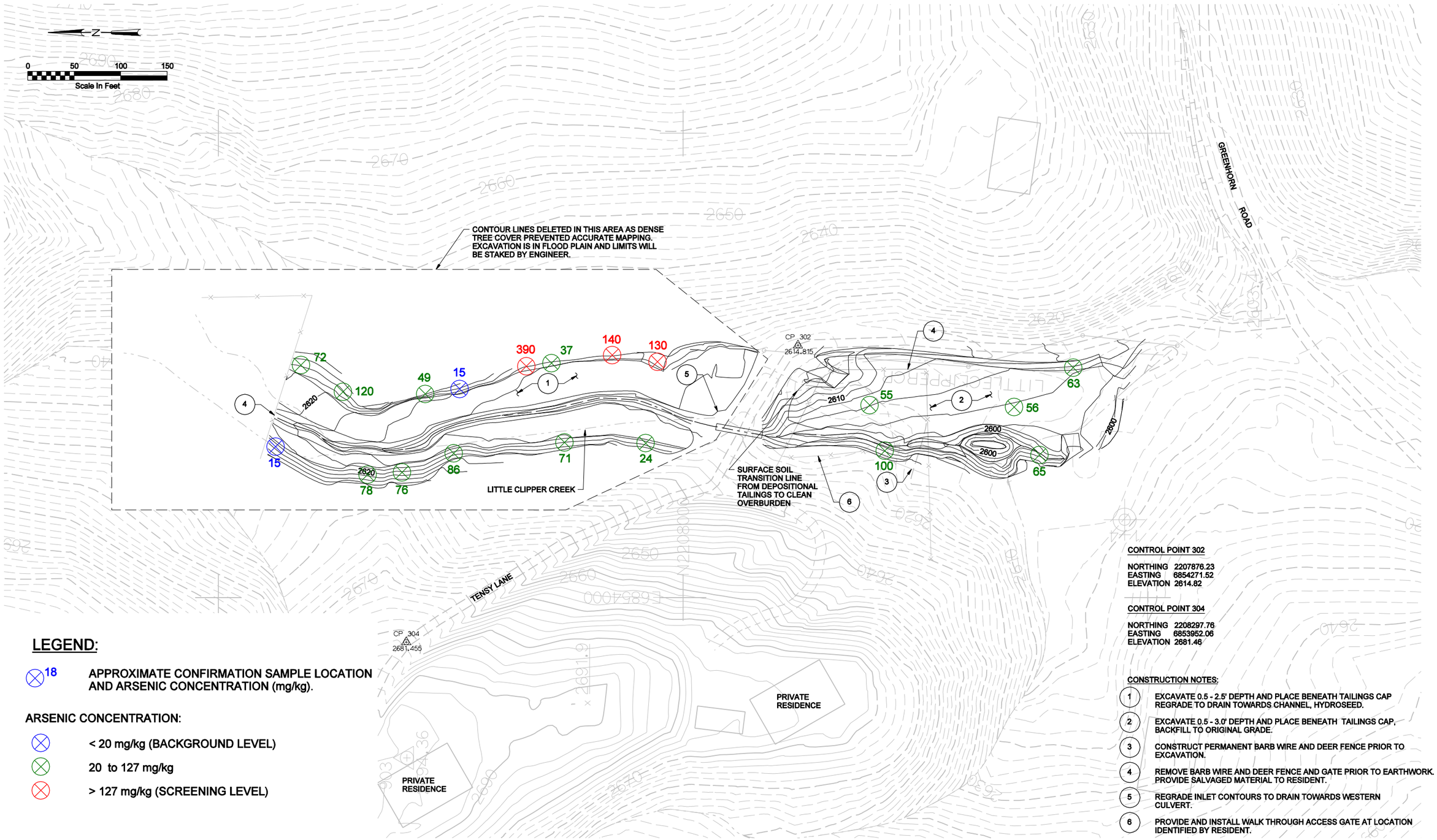

LEGEND:

⊗18 APPROXIMATE CONFIRMATION SAMPLE LOCATION AND ARSENIC CONCENTRATION (mg/kg).

ARSENIC CONCENTRATION:

- ⊗ < 20 mg/kg (BACKGROUND LEVEL)
- ⊗ 20 to 127 mg/kg
- ⊗ > 127 mg/kg (SCREENING LEVEL)

CONTROL POINT 302

NORTHING 2207876.23
EASTING 6854271.52
ELEVATION 2614.82

CONTROL POINT 304

NORTHING 2208297.76
EASTING 6853952.06
ELEVATION 2681.46

CONSTRUCTION NOTES:

1. EXCAVATE 0.5 - 2.5' DEPTH AND PLACE BENEATH TAILINGS CAP REGRADE TO DRAIN TOWARDS CHANNEL, HYDROSEED.
2. EXCAVATE 0.5 - 3.0' DEPTH AND PLACE BENEATH TAILINGS CAP, BACKFILL TO ORIGINAL GRADE.
3. CONSTRUCT PERMANENT BARB WIRE AND DEER FENCE PRIOR TO EXCAVATION.
4. REMOVE BARB WIRE AND DEER FENCE AND GATE PRIOR TO EARTHWORK. PROVIDE SALVAGED MATERIAL TO RESIDENT.
5. REGRADE INLET CONTOURS TO DRAIN TOWARDS WESTERN CULVERT.
6. PROVIDE AND INSTALL WALK THROUGH ACCESS GATE AT LOCATION IDENTIFIED BY RESIDENT.

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DSGN T KASHUBA						VERIFY SCALE	CH2MHILL	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY MINE AREA (OU1) - REMEDIATION LAVA CAP MINE	FIGURE 5 ARSENIC CONCENTRATIONS IN TENSY LANE AREA CONFIRMATION SAMPLES LAVA CAP MINE OU1
DR J CHELONIS						BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.			SHEET FIGURE 2
CHK D TOWELL				DSJ	TK				DWG
APVD D TOWELL	NO.	DATE	REVISION	BY	APVD				DATE
									PROJ

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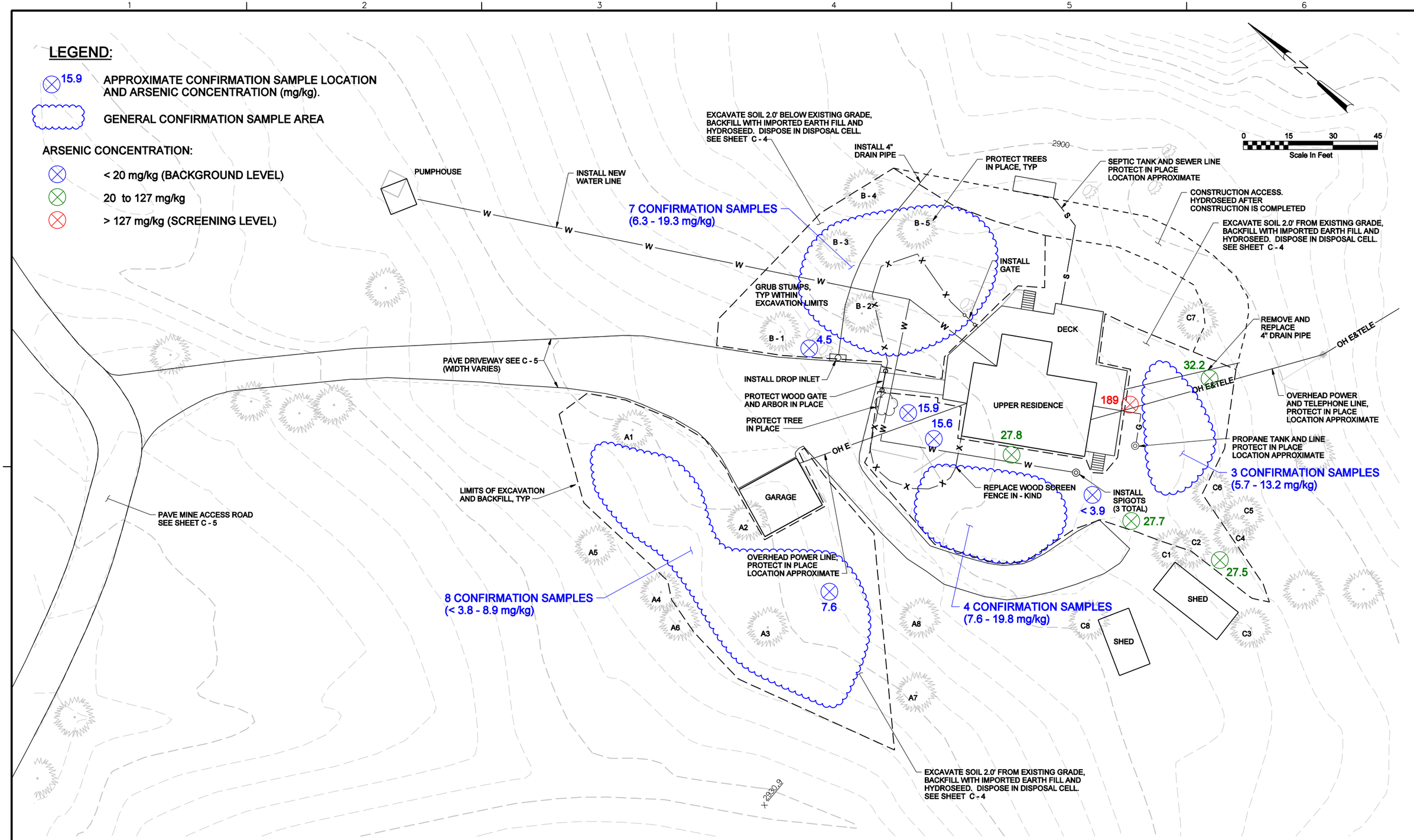
LEGEND:

15.9 APPROXIMATE CONFIRMATION SAMPLE LOCATION AND ARSENIC CONCENTRATION (mg/kg).

GENERAL CONFIRMATION SAMPLE AREA

ARSENIC CONCENTRATION:

- < 20 mg/kg (BACKGROUND LEVEL)
- 20 to 127 mg/kg
- > 127 mg/kg (SCREENING LEVEL)



DSGN T KASHUBA						VERIFY SCALE	
DR M BISHOP						BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1" IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.	
CHK J SPITZLEY							
APVD D TOWELL	NO.	DATE	REVISION	BY	APVD		

CH2MHILL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA RESIDENCES (OU4) - CONTAMINATED SOIL REMEDIATION
LAVA CAP MINE

FIGURE 6
ARSENIC CONCENTRATIONS IN CONFIRMATION SAMPLES
LAVA CAP MINE OU4

SHEET	FIGURE 3
DWG	
DATE	
PROJ	

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Appendix D
Site Inspection

I. SITE INFORMATION

Site name: Lava Cap Mine- Mine Area Operable Unit (OU1) and Mine Residences OU (OU4)	**Date of inspection:** October 27, 2010
Location and Region: Nevada County, California	**EPA ID:** CAD983618893
Agency, office, or company leading the five-year review: EPA Region 9	**Weather/temperature:** Clear and sunny, 60s

Remedy Includes: (Check all that apply)

- ☒ Tailings cover/containment
- ☒ Access controls
- ☒ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other: Vegetative covers, surface water channels, rock buttress, mine building fencing, mine adit discharge diversion, access road paving, backfill and restoration

Attachments:

☒ Site maps attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** David Towell (Name) CH2MHILL Former Project Manager (Title) 10/13/2010 (Date)
   Interviewed ☐ at site ☐ at office ☒ by phone Phone no. (213) 228-8285 x35485
   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 Regional Water Quality Control Board
   Contact Jeff Huggins (Name) Water Resources Control Engineer (Title) 10/20/2010 (Date)
   Problems; suggestions; ☒ Report attached

   Agency Nevada County Environmental Health Department
   Contact Wesley Nicks (Name) Director of Environmental Health (Title) 10/14/2010 (Date)
   Problems; suggestions; ☒ Report attached

   Agency Department of Toxic Substances Control
   Contact Steve Ross (Name) Hazardous Substances Engineer (Title) 10/13/2010 (Date)
   Problems; suggestions; ☒ Report attached

4. **Other interviews** (optional) ☒ Report attached.
Jerry Grant and Corinne Gelfan, residents
Doug Haussler, resident
Robert Shoemaker, resident
Craig and Joann Thurber, residents
Frans and Andrea Velthuijsen, residents

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: O&M manual and as-built drawings are up-to-date and are held by CH2M HILL, who is currently implementing O&M at the site under contract to EPA.

2. **Site-Specific Health and Safety Plan** ☒ Readily available ☒ Up to date

☒ Contingency plan/emergency response plan ☒ Readily available ☒ Up to date

Remarks: The Health and Safety Plan is maintained by CH2M HILL. Emergency response procedures are included in the O&M Manual.

3. **Settlement Monument Records** ☒ Readily available ☒ Up to date

Remarks: As per the O&M Manual, CH2M HILL surveys the settlement monuments annually and keeps a log of settlement results.

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 currently conducted by EPA Contractor (CH2M HILL)

2. **O&M Cost Records**

☒ Readily available ☒ Up to date

☒ Funding mechanism/agreement in place: EPA Task Order with CH2M HILL

Original O&M cost estimate: $42,000/year (2006 dollars)

Total cost year for review period:

From:	To:	
Oct. 2008	Oct. 2010	$102,000 (25 months)= ~$49,000/year
Date	Date	Total cost

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

A. Fencing

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

Remarks: No damage to the mine building/mine shaft fencing was observed and the gates are intact and locked.

B. Other Access Restrictions

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

Remarks: Locked gates control access to the mine property

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) Note that institutional controls have not been formerly implemented. However, site conditions are routinely monitored to ensure consistency with selected ICs, e.g., land use restrictions.
Frequency: Monthly
Responsible party/agency: CH2M HILL field staff

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
Violations have been reported ☐ Yes ☒ No

Other problems or suggestions: Deed restrictions have not yet been recorded. However, no on-site activities have occurred that significantly impact remedy performance.

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

Remarks: It is expected that ICs will be adequate once implemented. However routine monitoring of site conditions will continue to be required to ensure compliance. Also, the area that EPA is planning to implement ICs does not address two areas where wastes were not fully contained in the OU1/OU4 remedies: beneath the rental house on Parcel 39-160-16 and beneath Tensy Lane where it crosses Little Clipper Creek. These two areas should be considered for inclusion in the ICs.

D. General

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

2. **Land use changes on site** ☒ N/A

Remarks: None

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

Remarks: None

VI. GENERAL SITE CONDITIONS

A. Roads

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate

Remarks: Some areas of erosion on main mine access road near the upper end of the remedy area. Should be monitored closely and will likely require some grading repairs. Paved driveways/access roads on the mine residents parcels (OU4) are in good shape.

B. Vegetative Covers

Remarks: The covers look to be intact and in good shape in all areas, with no significant erosion. This includes the benches near the mine storage buildings, around the mine buildings, near the former lower rental residence and on the waste rock pile. However, the extent and density of vegetation in most of the areas is limited. The slow establishment of vegetation on the covers could lead to increased erosion. In some areas, the limited vegetation appears to be linked to horse grazing and vehicle use.

C. Little Clipper Creek in the Tensy Lane Area

Remarks: The restored Little Clipper Creek and reconstructed adjacent meadow area are doing very well. Extensive vegetation is growing and the area looks stable.

D. Upper Rental Residence (OU4)

Remarks: The backfilled, restored and revegetated areas around the residence are doing very well. Contaminated material is still present beneath the residence. If this house is ever torn down or replaced, there will likely be the need to address these materials.

E. Other Site Conditions

Remarks: The smaller mine storage buildings are deteriorating. If these buildings collapse, additional vegetative covers may need to placed to ensure protectiveness.

VII. TAILINGS COVER

A. Tailings Pile Surface

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

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident

Areal extent: Along western slope towards the southern end above the G3 channel- several erosional channels apparent within a ~75′ long segment of the bottom 15′ of the slope. The access road along Little Clipper Creek on the east side also has several erosional channels developing diagonally across the road.

4. **Holes** ☐ Location shown on site map ☒ Holes not evident

5. **Vegetative Cover** ☒ Grass ☐ Cover properly established ☐ No signs of stress

Remarks: The cover vegetation is sparse in select areas, primarily towards the northern end of the cap. Additional hydroseeding is planned.

6. **Alternative Cover (armored rock, concrete, etc.)**

Remarks: The two concrete-lined Arizona crossings are in good shape. The rock buttress at the downstream end of the tailings pile is in good shape and is not showing any signs of erosion or slumping. The spillway concrete is also in good shape.

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident

8. **Wet Areas/Water Damage**

☒ Wet areas — Areal extent: Some wet areas of limited extent are present near the southeast corner of the tailings pile, just above the rock buttress.

☒ Ponding — Areal extent: Very minor ponding on the inside border of the access road adjacent to Little Clipper Creek.

Remarks: There was a large (~7") rain storm at the site a few days before the inspection that caused the wet areas and minor ponding.

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

B. Benches ☐ Applicable ☒ N/A

C. Letdown Channels ☐ Applicable ☒ N/A

D. Cover Penetrations ☒ Applicable ☐ N/A

1. **Monitoring Wells** (within surface area of landfill)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance

Remarks: 1 piezometer, 1 chimney drain monitoring well and two chimney drain cleanouts are completed through the cover.

2. **Settlement Monuments** ☒ Located ☒ Routinely surveyed

Remarks: To date, the surveying indicates that almost no settlement has occurred.

F. Cover Drainage Layer ☐ Applicable ☒ N/A

G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A

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

1. **Siltation**

Areal extent: Siltation is apparent along much of the G3 channel. This channel carries mine adit discharge water and has been impacted by erosion off of the waste rock slope and the western slope of the tailings pile cap. The siltation is not currently a significant concern, but should be monitored.

2. **Vegetative Growth**

Areal extent: Similar to the siltation, vegetative growth is occurring along most of the G3 channel, which is flowing continuously with adit discharge. This vegetation is causing some restrictions to flow and should be removed on a more frequent basis.

3.	**Erosion**	☐ Location shown on site map ☒ Erosion not evident
4.	**Discharge Structure** ☒ Functioning Remarks: The spillway on Little Clipper Creek and the culvert at the end of the G3 channel are operating correctly and are in good shape.	
	VIII. **GROUNDWATER/SURFACE WATER REMEDIES**	
A. Groundwater Extraction Wells, Pumps, and Pipelines		☐ Applicable ☒ N/A
B. Surface Water Collection Structures, Pumps, and Pipelines		☒ Applicable ☐ N/A
1.	**Collection Structures, Pumps, and Electrical** ☒ Good condition ☐ Needs Maintenance Remarks: Mine adit discharge diversion structure and collection sump are in good shape. Diversion structure requires periodic cleanout.	
	IX. **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 consolidate and contain mine tailings, cover contaminated materials to minimize exposure and erosion and divert clean surface water runoff around the mine waste areas. The remedy is effective and functioning as designed. There are no major issues impacting remedy performance other than the need to eventually record land use covenants (ICs).	
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. The O&M procedures are adequate to ensure protectiveness of the remedy, as long as repairs (primarily of minor erosion) are made on a regular basis. Site inspections should occur soon after major rainfall events. Also, additional effort should be expended to enhance growth of vegetation on the various vegetative covers and portions of the tailings pile cap.	
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. The most significant potential future remedy problem is not directly related to the remedy. Immediately adjacent to the uphill end of the remedy, on the property owner's parcel, there is an earthen dam constructed to create a large pond. If this dam were to fail it would result in significant damage to the remedy and potential offsite transport of mine waste materials.	

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. None at this time. Monitoring activities are limited to routine site inspections. Routine O&M typically includes minor repairs of eroded areas along roadways or on the vegetative covers.

Photo 1: Mine Buildings, Protective Fence and Vegetative Cover

Photo 2: Vegetative Cover – Lower Rental Residence Area

Photo 3: N. End of Tailings Pile Cap, Waste Rock Area - Vegetative Cover, Cyanide Building and Fence

Photo 4: Mine Adit Discharge Diversion Structure and A1 Channel

Photo 5: G3 Perimeter Ditch with Vegetation, Looking South

Photo 6: Tailings Pile Cap, Vegetation on Western Slope

Photo 7: Erosion on Tailings Pile Cap, W. Side above G3 Channel

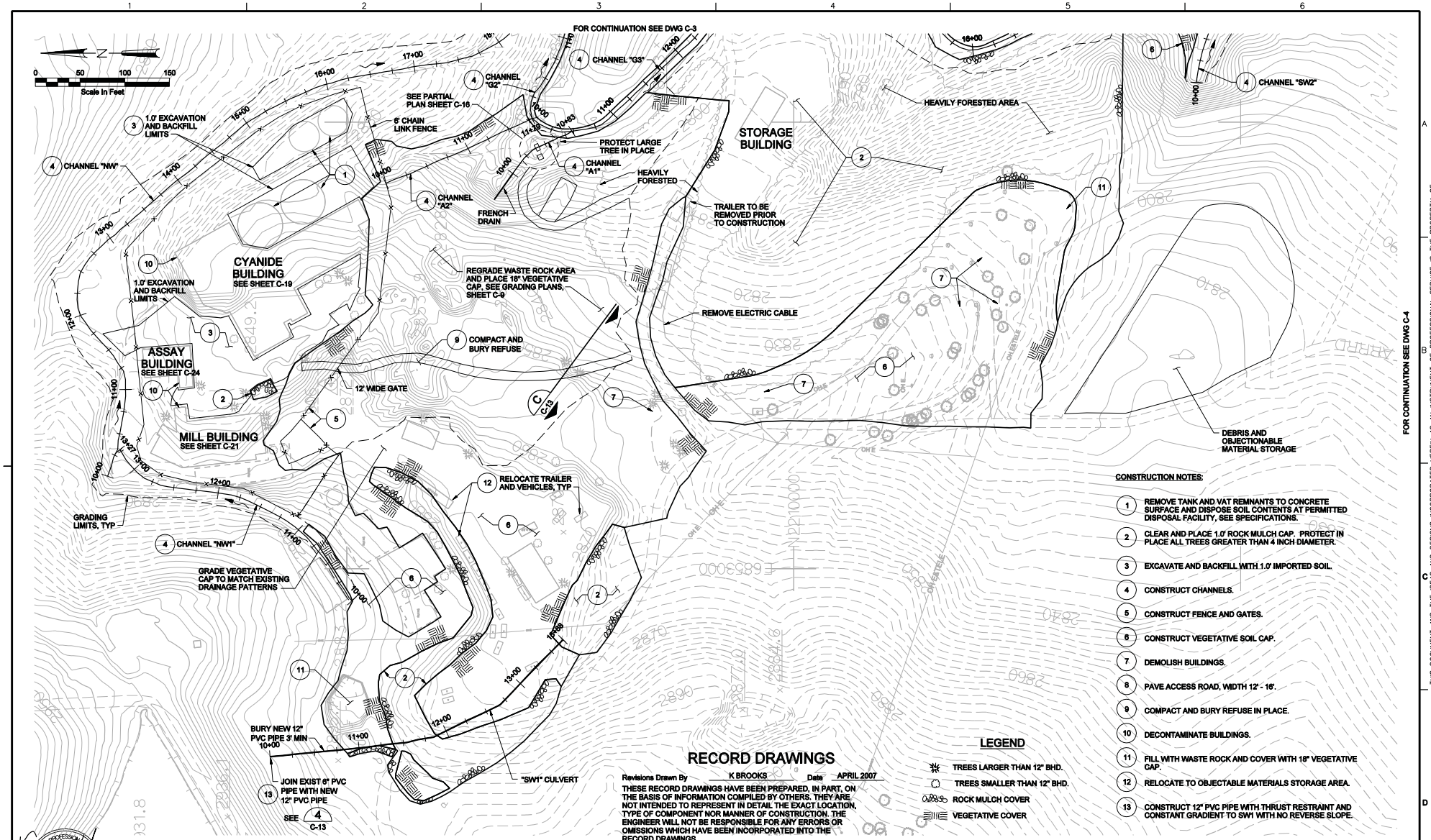
Photo 8: Erosion and Standing Water, E. Side of the Tailings Pile Cap, Looking South

Photo 9: Paved Access Road behind Mine Area Residence (OU4)

Photo 10: Restored Yard around Upper Rental Residence (OU4)

Photo 11: Reconstructed Little Clipper Creek and Adjacent Meadow; North of Tensy Lane

Photo 12: Reconstructed Little Clipper Creek and Adjacent Meadow; South of Tensy Lane



CONSTRUCTION NOTES:

1. REMOVE TANK AND VAT REMNANTS TO CONCRETE SURFACE AND DISPOSE SOIL CONTENTS AT PERMITTED DISPOSAL FACILITY, SEE SPECIFICATIONS.
2. CLEAR AND PLACE 1.0' ROCK MULCH CAP. PROTECT IN PLACE ALL TREES GREATER THAN 4 INCH DIAMETER.
3. EXCAVATE AND BACKFILL WITH 1.0' IMPORTED SOIL.
4. CONSTRUCT CHANNELS.
5. CONSTRUCT FENCE AND GATES.
6. CONSTRUCT VEGETATIVE SOIL CAP.
7. DEMOLISH BUILDINGS.
8. PAVE ACCESS ROAD, WIDTH 12' - 16'.
9. COMPACT AND BURY REFUSE IN PLACE.
10. DECONTAMINATE BUILDINGS.
11. FILL WITH WASTE ROCK AND COVER WITH 18" VEGETATIVE CAP.
12. RELOCATE TO OBJECTABLE MATERIALS STORAGE AREA.
13. CONSTRUCT 12" PVC PIPE WITH THRUST RESTRAINT AND CONSTANT GRADIENT TO SW1 WITH NO REVERSE SLOPE.

LEGEND

- TREES LARGER THAN 12" BHD.
- TREES SMALLER THAN 12" BHD.
- ROCK MULCH COVER
- VEGETATIVE COVER

RECORD DRAWINGS

Revisions Drawn By K BROOKS Date APRIL 2007

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REGISTERED PROFESSIONAL ENGINEER TIMOTHY JOHN LAWRENCE 039651 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA 12-1-06

DSGN	T KASHUBA					
DR	J CHELONIS					
CHK	D TOWELL					
APVD	D TOWELL	NO.	DATE	REVISION	BY	APVD

VERIFY SCALE
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0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

MINE AREA (OU1) - PHASE 1 REMEDIAL DESIGN

SITE PLAN - MINE BUILDINGS

SHEET	4
DWG	C-2
DATE	APRIL 2007
PROJ	335400

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CONSTRUCTION NOTES:

1. REMOVE WASTE MOUND AND PLACE IN TAILINGS PILE TO BE CAPPED.
2. CLEAR AND PLACE 1.0' ROCK MULCH CAP.
3. CONSTRUCT ANCHOR TRENCH
4. CONSTRUCT DRAINAGE CHANNELS.
5. REMOVE MATERIAL AND DISPOSE AT PERMITTED DISPOSAL FACILITY, SEE SPECIFICATIONS.
6. REMOVE EXISTING HDPE CULVERT.
7. PAVE ACCESS ROAD, WIDTH 12'-16'.
8. GRADE AND CAP TAILINGS.
9. CONSTRUCT BUTTRESS.
10. RELOCATE TO OBJECTIONABLE MATERIAL STORAGE AREA.
11. ADJUST WELL TO GRADE, SEE TABLE, THIS SHEET.
12. DESTROY WELL, SEE TABLE, THIS SHEET.
13. SALVAGE LARGE ROCK FOR USE AS RIP RAP
14. PLACE CULVERT WITH FLARED END SECTION

WELL ELEVATIONS
SEE SHEET C-28

WELL NO.	DESTRUCTION CUT OFF ELEVATION	ADJUST TO NEW GRADE ELEVATION
5A	2788.4	
5-D	2747.3	
5-E	2740.8	
5-I	ABANDONED	
5-J	ABANDONED	
5PZ-1		2792.7
5PZ-2	2753.4	
5PZ-3	ABANDONED	

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Revisions Drawn By K BROOKS Date APRIL 2007

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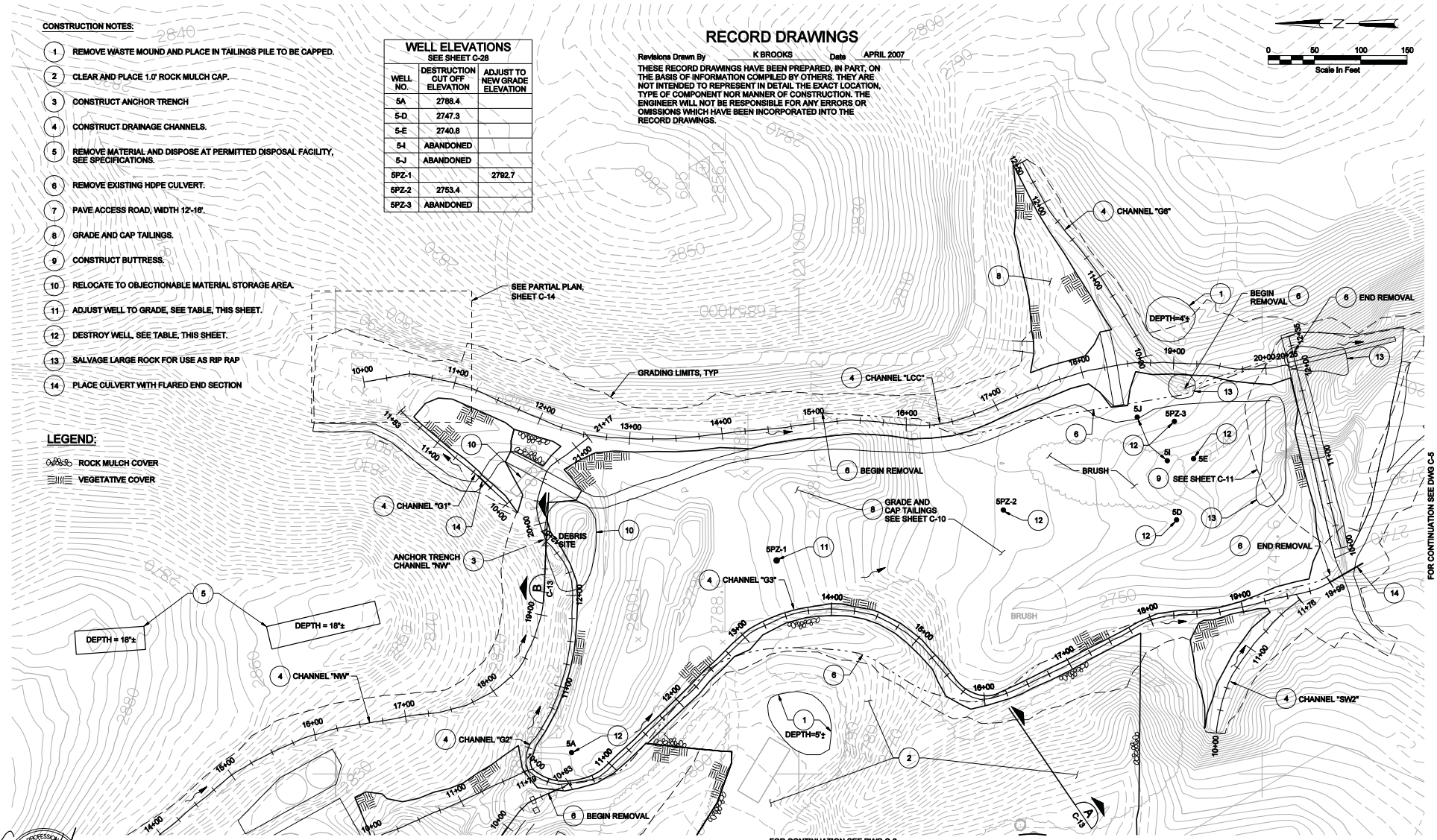

LEGEND:

ROCK MULCH COVER
VEGETATIVE COVER

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REGISTERED PROFESSIONAL ENGINEER (TIMOTHY JOHN CHELONIS) No. 039651 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA
12-1-06

DSGN	T KASHUBA
DR	J CHELONIS
CHK	D TOWELL
APVD	D TOWELL

NO.	DATE	REVISION	BY	APVD

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0 1"
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CH2MHILL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

MINE AREA (OU1) - PHASE 1 REMEDIAL DESIGN

SITE PLAN - TAILINGS CAP

SHEET	5
DWG	C-3
DATE	APRIL 2007
PROJ	335400

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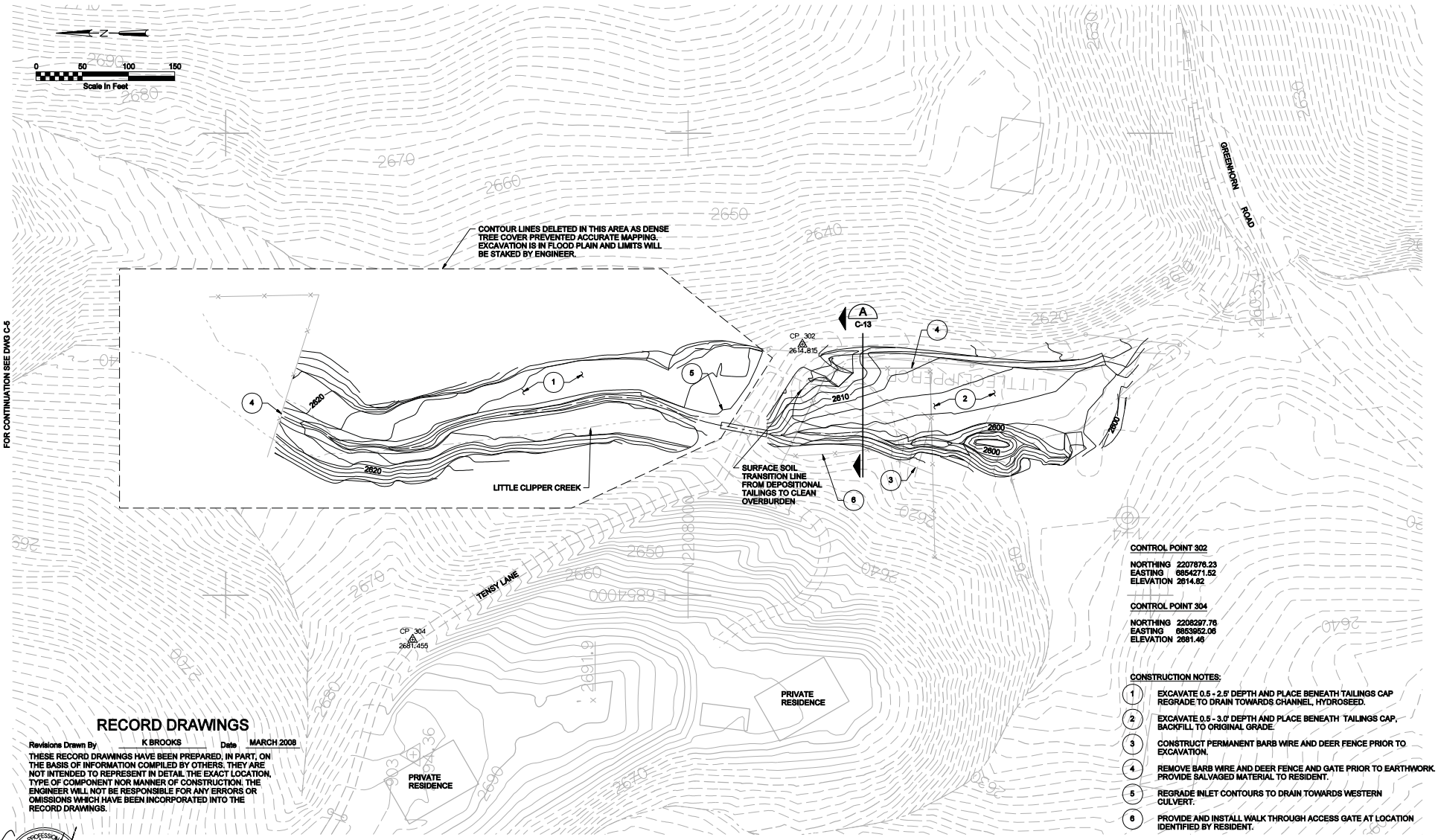

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RECORD DRAWINGS

Revisions Drawn By: K BROOKS Date: MARCH 2008

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REGISTERED PROFESSIONAL ENGINEER TIMOTHY JOHN LEWIS 043951 Exp. 12-31-08 CIVIL STATE OF CALIFORNIA
12-1-06

DSGN	T KASHUBA						
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IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
MINE AREA (OU1) - REMEDIATION
LAVA CAP MINE

MINE AREA (OU1) - PHASE 1 REMEDIAL DESIGN

SITE PLAN - LITTLE CLIPPER CREEK

SHEET	8
DWG	C-6
DATE	APRIL 2007
PROJ	335400

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Appendix E
Site Interview Reports

Site Interview
Lava Cap Mine Five Year Review

Name: Jerry Grant and Corinne Gelfan
Title/Position: Residents
Date: October 2, 2010

1. **What is your overall impression of the Superfund site?** I'm a little confused, because other than reading the newspaper, I don't have a lot of information. Nothing has visually changed for us from what you did up there; the water isn't dirtier. EPA is testing the lake water. I know the arsenic level in summer was 90 ppm and 20 ppm in winter, I had heard that the concentration before was 900 ppm. I haven't heard, since the cap, of any changes of arsenic levels in the lake. Originally we heard the plan was to fix lava cap mine then immediately work down here. Then we heard you ran out of money and were not moving down here. I'm not sure of level of arsenic in water. We check our well regularly, there is no sign of arsenic, but we continue to check. There seems to be more fish, we noticed that this summer. There are long fish, the lake seemed clearer and we noticed more fish. We have a kayak and while out on the lake, we noticed a few more fish.

2. **Is the remedy functioning as expected?** No visible change, but I don't know whether the level of arsenic has decreased. From 5 years ago to today, no visible change, but I would guess there are lower levels of arsenic. EPA has not sent any figures of the lake. We're not sure what we should have seen. Visibly, the reeds and cattails are growing, if the water remains. It will always flood here, it's a basin. There have been more Canadian geese in the last 2-3 years, and they stayed for the winter. When we have a lot of rain, things look clearer and better. We have a turtle. Bullfrogs in the summer. We haven't seen any other frogs. We haven't seen any in our little pond out front. We know in the past when we didn't get enough water and the pond would dry completely. Eric across the way saw a river otter, and they knew where he was and when it was dry he moved down to our area.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** We have a neighbor who just moved in 3 houses down. They were very nervous about taking the house. They are renting with option to buy. So were we when we bought, but it was disclosed. People who owned that house originally, they would swim but I wouldn't put my toe in. Our friends fish, but they catch and release. Personally, our first dog used to go in the lake water all the time, so asked the vet about arsenic poisoning, but our dog drank most of her water at the house. But what about the ducks and other wildlife? They forage. People who know about it genuinely think it is ok but don't want to touch it. The problem is we are so far from the remedy. We think we see more fish, more birds.

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** No. An article in paper 6 months ago was about the mine owner being prosecuted by EPA because he didn't fix the dam. He has several hundred acres and he was warned about it and did nothing about it and the dam broke. He was greedy, which prevented him from doing anything at this site when he was adequately warned.

5. **Do you think there may be any opportunities for future reuse? Do you have any comments, suggestions or recommendations?** DID NOT ASK QUESTION

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** Don't know of any.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** No, don't know anything about it. We have received fact sheets, but not for a very long time. (will email the EPA website to them)

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** Not aware of that. Would like to receive updates by email.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** Yes, 6, 5, 4 years ago we were looking for updates. At that time we knew they were working on the site up there, and thought they would be moving down here, but they didn't. Army Corps came three times over the summer to look at the dam, but I haven't heard anything since.

10. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** Email, hard copies, phone. Email is great.

11. **Is there anyone else that you think might be useful for us to talk with about the site?** Erik and April, Arthur and Cynthia Gould, Robert and Susan Wright, new residents have been here 4-5 months. I have names of people on the other side of the lake.

Site Interview
Lava Cap Mine Five Year Review

Name: Doug Haussler
Title/Position: Resident
Date: October 25, 2010

1. **What is your overall impression of the Superfund site?** I know that the cleanup included the new dam, new monitoring wells, new coffer dams, and part of the cleanup was the creek bed. The creek bed used to be forested; they found tailings, so they chopped down the trees at the bottom of the canyon bordering the creek and removed the first four feet of soil. My overall impression has been great. My wife had problems with the noise during the cleanup process, as they were running the heavy equipment all day. It looks good, it's first rate. I walk my dog up there and I've seen the channels, the rock work, and the dam. It is first rate.

2. **Is the remedy functioning as expected?** The remedy as far as I know, is to clean up the tailings so it didn't provide a hazard to the residents. I haven't monitored the water, which has been hot with arsenic, but you can see frogs and salamanders. I don't shy away from walking through the creek, but I don't drink it. I know there is still a contractor that monitors the levels of arsenic in my well, it has always ranged from 0-0.2 ppb. That hasn't changed since you've been on site. I think you would know better than I would regarding surrounding neighbor's wells. The bottom has changed immensely, chopped trees, and stream is flowing by design.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** Once a year there has been a community meeting in Whispering Pines. You've kept the public informed with what's going on. There has been concern from people downstream, from the confluence, where Little Clipper Creek joins with Clipper Creek. There are tailings there. They are concerned that there is cleanup up here but not downstream. If you are going to do the cleanup, make sure you do all of it, below too.

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** I have never heard or seen anything going on in there. The only thing is when the construction was going on, a fellow came up in a big rig truck and it had a tank on the back. The hydraulics failed and he was pinned between the truck and tank. He didn't lose his arm, but my wife had to assist and hit the button to remove the tank. From speaking with the contractor after the incident I was told he was ok and did not have life threatening injuries.

5. **Do you think there may be any opportunities for future reuse? Do you have any comments, suggestions or recommendations?** The owner, Steve Elder, he's a developer and he would love to see the mine reopened for development of

residential for homes. My personal opinion, I would not want to see the mine reopened, or the land developed.

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** No, the people that you have had out here have been great, CH2M HILL. There was another contractor that started the project Eco-? Everyone has been good. I'm not sure what the long term plan for this site is, but I've heard there are still hot spots out there.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** I'm not familiar.

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** No, I wasn't aware of that either.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** No, but I did correspond with Rusty a couple of times because I had trouble with my well after the cleanup. My recovery rate went from 8.8 gallons per minute to 3.3 gallons. They routed the water down to Greenhorn road and that summer we saw the sprinklers got to almost nothing. It burned out the pump. I replaced the pump, then contacted Rusty, asked him to do something about it. A water truck came up every other day and watered the lawn. Through litigation with Rusty, we got a storage tank, which was paid for by EPA. Peters Drilling installed the storage tank for me. The 2,500 gallon tank allowed me to water lawn and not run the well dry. Since then I've never pulled my well apart to determine if recovery rate is back to what it was. EPA resolved the problem that I had at the time. At the last public meeting, EPA discussed pipeline project to bring water down here to my neighbors. Through a letter to Rusty I requested to be tied into NID water. I wouldn't drink it, but wouldn't have any recovery issues. I never heard back from Rusty on this issue. This would provide me with a permanent source of water.

10. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** I receive mailings. Email, I check my email, but I prefer hardcopy.

11. **Is there anyone else that you think might be useful for us to talk with about the site?** The Bernbeck's and the people up the hill from them. Volkirk had a problem with his well. His well was hot so he sunk a well right outside my property line to get clean water. His well was getting hits like 200-300 ppb. Allan Stahler, a science guy. He has a radio program on KBMR and does article in local newspaper. He's been at the local meetings. He's an amateur astronomer. Al was concerned about the area, he's an environmental guy, and since it's a Superfund site, he's concerned.

Site Interview
Lava Cap Mine Five Year Review

Name: Jeff Huggins
Title/Position: Water Resources Control Engineer/Regional Water Quality Control Board
Date: October 20, 2010

1. **What is your overall impression of the Superfund site?** I grew up in Nevada County and worked on the initial Site Assessment on Lava Cap in early 90s, it seems like a small superfund site. But working with Mr. Elder, it's been a slow process and with site discharging waste into a residential neighborhood, this has been a difficult site. Considering the people involved, cost, and location, you have done a good job. This is a personal and professional opinion.

2. **Is the remedy functioning as expected?** We don't know enough yet to answer that. A waste like that and environment like that should have been put in a full containment cell and not capped as the amount of water during wet season might make this remedy not functional. In regards to OU1, yes and no, a complicated answer. You won't know until you do more monitoring of Little Clipper Creek, to know if there are higher levels of arsenic and where it's coming from.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** Specifically no. In general it's been a high profile site in Nevada County. Since mining was established, there has been a general awareness and concern about toxics from mining. People are pre-conditioned to think that all mine waste is toxic but that's not necessarily the case. There is general concern from the community. Some waste is turbidity and exceeds water quality standards, but there is a lack of understanding of mining waste and what risks they present.

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** The only issue I'm aware of is from a Site visit with EPA and DTSC and Mr. Elder was not notified before arriving and he made accusations of trespassing. By communicating with Mr. Elder, you can eliminate this problem. This happened in the winter 2008-2009, there was snow on the ground.

5. **Do you think there may be any opportunities for future reuse? Do you have any comments, suggestions or recommendations**? Yes, there is the potential for reuse up there; those houses had problems to begin with, so removal wasn't a detriment, but improvement. Mr. Elder has demonstrated that he can use the space up there. The opportunity is there for future reuse, if remedies are properly maintained there is no reason why people cannot reuse and enjoy this property.

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** In regards to OU3, the Lost Lake area, for the Water Board, this gets into waste characterization. Depending on waste characterization A, B or C, you determine what to do with the waste through a management plan. At another site where materials are not soluble, it is being managed as group c waste, so unless site conditions change it can be managed as a turbidity problem. The Water Board recommends managing this site according to classification of its waste, but this approach might not meet EPA ARARS. Some residents don't want the waste removed or managed. Clearing, de-grubbing and vegetative removal might do more damage than leaving waste in place and promoting natural vegetation. EPA should consider that, as sometimes a remedy causes more damage than leaving contamination in place and letting nature take its course. A lot of waste upstream from that has been stabilized. EPA had done good job of that.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** Yes, EPA and DTSC have done good job of laying out information on their websites. The weak link at this site is the Water Board's website.

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** Yes, I'm aware of library repositories and electronic repositories. The public can get to library easily.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** Well, goes back to, yes for the most part, in some cases we could work better together. The Water Board has a feeling that EPA is not aware of their waste classification system and this system provides other alternatives to managing and remediating mine waste. The Water Board tries to suggest or implement tools, but EPA has been reluctant.

10. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** The system that is in place has been working pretty good. Sometimes we don't hear from EPA for a length of time, but a quarterly update via an email would be helpful, a progress update. Process is working good, email or phone.

11. **Is there anyone else that you think might be useful for us to talk with about the site?** It's pretty important as you classify waste in Lost Lake area to have a good report with those residents, as the remedy will impact their property. This is a sensitive, even more so than with Mr. Elder. It has more houses, more congestion. You will want to have public consensus during the process.

Site Interview
Lava Cap Mine Five Year Review

Name: Wesley Nicks
Title/Position: Nevada County Director of Environmental Health
Date: October 14, 2010

1. **What is your overall impression of the Superfund site?** I'm impressed with the work at Lava Cap and your contractor CH2M HILL does excellent work. I have participated in tours and visited Clipper Creek. I believe the dam project to keep water off site is pretty smart and that the capping of the tailings was an excellent solution. During the last El Niño in 1998, Nevada County became aware of how big the situation was at Lava Cap. Nevada County is the primary responders to the site and we welcome the Federal government and DTSC response efforts. The County Board of Supervisors contacts my office for information on the Site and I would like to receive quarterly reports to stay up to date. I'm interested in participating in a site tour, and would like to have access to recent information to keep community members informed about Site activities.

2. **Is the remedy functioning as expected**? For OU1 the remedy is functioning as intended except some water contaminated with arsenic is draining down to the creek. I would like to see continued efforts removing arsenic until water stops flowing out of the creek. I have had discussions with local homeowners on how to treat water before it comes into their houses.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** People are concerned in general because it is a superfund site, but I have not received any specific comments. Community members were also concerned about truck traffic during remedy implementation. For residents at OU3, Lost Lake, their point of view is unknown as they wait for a remedy on that OU. I have some questions about this area: "was the Nevada irrigation district work completed?" and "what is the status on bringing in another water source that does not have arsenic in it?"

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** Nevada County has not had to respond. The fence seems to be intact. I have not received any reports of vandalism. The property owner, Mr. Elder, keeps people at bay.

5. **Do you think there may be any opportunities for future reuse? Do you have any comments, suggestions or recommendations?** Nevada County looks at land use decisions for the planning department and environmental health department. The property owner has approached the County inquiring whether or not he could construct a residential development. We have looked at the area that is not excluded in the center, but we have never determined if this is an option or not. If

Nevada County did authorize the development, it would have to be deemed safe by EPA, and would have to have appropriate safeguards to keep people out of the contaminated area.

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** I do not have any concerns and believe the site remediation is run very well.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** I have looked at them.

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** I am aware of the repositories but don't recall where they are. I have never used, them, instead I use web sites or have called EPA directly.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** I have contacted these agencies and feel that my questions were answered satisfactorily.

10. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** I prefer email for general information, and would like to receive direct contact in an emergency situation. If a PSA is needed in the future to disseminate information such as traffic congestion caused by cleanup efforts, you will need to use local media. I can provide that information.

11. **Is there anyone else that you think might be useful for us to talk with about the site?** I will meet with planning, community development, and the public health departments and will keep them up to date on the information I receive about the site.

Site Interview
Lava Cap Mine Five Year Review

Name: Steve Ross
Title/Position: DTSC Hazardous Substances Engineer
Date: October 13, 2010

1. **What is your overall impression of the Superfund site?** I think OU1 has proceeded quite rapidly and the added water part of it has proceeded to the extent that it can but there is still work to be done. Access has been a problem so I recommend establishing access agreements with the land owner.

2. **Is the remedy functioning as expected?** Yes, based on the results from the February 7th inspection.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** The only concern I have received had to do with the TAG's consultant, who is no longer working on the project. The oversight group, SYRCL (South Yuba River Citizen's League) decided not to use his services so the TAG consultant wanted to generate community interest in the site so his services could continue to be needed. The TAG consultant asked me what he could do to have his services employed. He was advised that there was not much community interest in the Site and therefore the TAG did not ask him to continue reviewing technical documents.

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** I am not aware of any issues of this nature. I have heard concerns about Mr. Elder's horse eating the top of the cap. There are no restrictions on where the horse is allowed to walk. This hasn't impacted the remedy, but might lead to potential erosion issues in the future.

5. **Do you think there may be any opportunities for future reuse? Do you have any comments, suggestions or recommendations?** The only potential reuse of the site would be mining. Reuse of this kind would require the property owner to go through the processes and demonstrate that mining reuse wouldn't impact the remedy in any way.

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** My only comment is with regards to access of the site. In the past the property owner has not been easily accommodating to the government employees gaining access and going to the site to do their work. The property owner has been belligerent and DTSC staff has had to have security escort them to the site. I have been advised by DTSC management to consult their criminal operations department to accompany me during site visits.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** Yes to both questions.

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** There is one repository at EPA Region 9 and one in the Nevada Library. I have received materials on the site, fact sheets, etc.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** Yes to both.

10. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** I am aware that the EPA Project Manager issues work assignments to and receives deliverables from contractors and I would like to know what those deliverables are. I am interested in knowing about upcoming groundwater monitoring reports, etc. I recommended receiving access to a FTP site at CH2M HILL to more easily access these documents. I would also like to receive a draft Five-year Review and be included in the upcoming Site Inspection.

11. **Is there anyone else that you think might be useful for us to talk with about the site?** I recommend you interview Jeff Huggins, Regional Water Quality Control Board for Central Valley who has been involved with Site and maybe Fred Lee, the former TAG consultant, but I'm not sure how much good that would do.

Site Interview
Lava Cap Mine Five Year Review

Name: Robert Shoemaker
Title/Position: Resident
Date: October 25, 2010

1. **What is your overall impression of the Superfund site?** Well I've only heard about it, never been out there. I think it's a complete waste of your money. I don't know how you got a hold of me, but I've been in the mining industry all my life. I'm a metallurgist. I think that it was a complete waste of money because I don't think the EPA knows what they are doing. The so-called toxic material is arsenic, in the form of arsenopyrite. I could eat a whole pound of arsenopyrite and it wouldn't hurt me. EPA has done a lot of work in trying assay in the nanogram and picogram areas, which as far as I'm concerned is absolutely ridiculous. I know something about what I'm talking about. The procedure that you use for determining arsenic in material is first you dissolve it in nitric acid, and nitric turns it into a poison. Paracelsus, a man who lived in the 1400-1500s, he's been called the father of toxicology. Everything is a poison, but everything is not a poison, it all depends on the dose. Every year in the US, there are 2-3 fraternity boys who want to act big in front of their girlfriends and they see how much water they can drink and they die. Every year. They aren't smart enough. You will find probably a few nanograms or picograms of arsenic at Lava Cap, but I don't know how you'll find it because you don't know how to assay for it. Assay procedure, you can't weigh the stuff, you do some calculations and you come up with how much arsenic there is, but it can't be accurate. And here you are declaring the whole place as toxic.

2. **Is the remedy functioning as expected?** Yeah, probably.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** No, and there really isn't anything in the newspapers about what you've been doing out there. I presume the Empire Mine State Park knows about it because they are excavating the horse and walking trails. They are excavating the diorite rock and they are shipping it off to the hazardous waste site in San Joaquin Valley and replacing it with white quartz to prevent dust from walking on it from being breathed in. It's an enormous amount of money they've spent there. They've even paved a road to keep down the dust, but they don't even know if there is dust, and it's a waste of money.

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** No, but I imagine there is some of it because that's the way it is around here. There is a tunnel behind here, rebar, and lock, but lock is broken, and squatters come. We try to run them off with police response.

5. **Do you think there may be any opportunities for future reuse? Do you have any comments, suggestions or recommendations?** (did not ask)

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** No, except it has cost you a lot of money. I understand it has cost you $10 million already. If there are only two people, why not just spend $5 million and move them out.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** Yes, vaguely, but I haven't looked at it because it would only make me mad.

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** Yes, I've known that. I've been at the Grass Valley library and dug through reams of paper. You could put all your pertinent info on one page.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** No, I've run into EPA people and talked with them about it. Don't know their names. I belong to a small group Sierra Mining Council. Meet monthly. I'm 85, this keeps me occupied. I was a docent for 5 years, now I'm the Director. We have the only Cornish pump that still works and pumps water. There were only two working machines when I got here and now there are 11.

10. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** Hard copy or internet.

11. **Is there anyone else that you think might be useful for us to talk with about the site?** (Did not ask)

Site Interview
Lava Cap Mine Five Year Review

Name: Craig and Joann Thurber
Title/Position: Resident
Date: October 19, 2010

1. **What is your overall impression of the Superfund site?** The original flood was in 1997, EPA got involved 1.5 years later, it's been 10 years plus. From Greenhorn Road, upstream, you have completed your cleanup. I live below that, towards the Reservoir, Lost Lake. I cannot comment on Greenhorn up, as I live below that. 10 years ago, someone called from EPA, and I made her promise to be part of the solution, not part of the problem. I'm not sure she understood gravity of my comment. I don't want the government to spend billions of dollars. From Greenhorn down, from this point down. The economy is going broke; I believe projects should be tabled until economy comes back. This is a luxury item; we cannot afford to spend money on things like this. I don't want the government to spend any more money until the economy improves, we cannot afford this spending at this site until unemployment is 4.9 percent and we can afford this luxury expenditures. If you are going to spend, go to Love canal, a place that needs this cleanup. We have spent a lot of money studying the situation and not fixing it. Spend 10% studying, and 90% fixing until things change. The individuals that we've worked with have been good people, Mr. Towell. I've had drills on my property, damage to my bridge, which was not really EPA's fault; he helped fix the bridge, bought 75% of the material and fixed it. I told Mr. Towell he could only cross bridge if he was part of solution. My opinion on things was not heeded, as a forester I know some things, they didn't listen, left items in a basin, spent $6,000-7,000 to retrieve equipment after big rains. I advised them to bring a skidder; instead they started spending money, which is taxpayer's money. This was 3-4 years ago. They were drilling new test wells in November. Big storms were coming so I advised them to move trucks to my property, get out of bottom land where it's muddy. But they didn't and trucks got stuck, so they brought in rock, which improved my road, but cost more than if I did it myself.

2. **Is the remedy functioning as expected?** I cannot answer fairly, only if there's another 50 year flood.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** Yes, but nothing serious, from people who live there. In general they feel good that there was a good effort to clean it up, but appalled at cost to clean it up.

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** I haven't heard any real issues.

5. **Do you think there may be any opportunities for future reuse? Do you have any comments, suggestions or recommendations?** In the area that was cleaned up, upstream of Greenhorn, if you delist the properties from the Superfund site property owners would appreciate it for property values. It might also help the County to reassess values for tax purposes. The people near the cleanup would be happy with delisting it, so kids can play without worry, but it's private land.

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** For the site that already improved on, I don't want to put my nose into it because it's not my property. If you work with those individuals you'll make them happy, but talk to them. Concerning my property, my site is, I have two parcels. One parcel I bought from Shirley Mullins, in bottom land, just approaching Lost Lake. It is mining country and we have had floods which left arsenic, but Mother Nature takes care of itself. After 1997 you could see much more soil and sand. The frog population dropped and now they are back. If this little issue even surfaces that it's a superfund site, or even in the top 1,000 sites, then this country is in a good place as this site is a minor issue. Sure there is concern for a 100 year flood, which could push this soil into Rollins Reservoir. But even if it went into Rollins Reservoir, with dilution it shouldn't be an issue. If this site attracts attention, then things are good in the US, since this is a minimal issue.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** I could, but I'm busy. I could find it, but I don't have time. I have visited a few years ago when there was testing on my property. I appreciate calls before coming to my property. But if EPA called and said they would not be coming out until economy improves, I would applaud that.

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** I have attended meetings at libraries, and as a forester I like the cool maps and aerial photos, but I see it as a great source of waste of money. I would like to see money spent on cleanup instead of investigation.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** I have talked to individuals from EPA and contractors who have always been courteous and polite, and they have responded to my satisfaction. But they don't understand what I am really saying about being part of solution and not the problem.

10. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** Telephone calls are best for me.

11. **Is there anyone else that you think might be useful for us to talk with about the site?** The new owners across creek from me, look up my APN, they are slightly southeast from me.

Site Interview
Lava Cap Mine Five Year Review

Name: David Towell
Title/Position: Former Project Manager, EPA Contractor
Date: October 13, 2010

1. **What is your overall impression of the Superfund site?** I believe the Superfund site is progressing as intended in regards to implementing remedies. The main issue in the remedy is the lack of institutional controls. Currently there are no formal restrictions on property use in the areas where waste is in place and is capped.

2. **Is the remedy functioning as expected?** Yes.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** I am only aware of concerns from the land owner, Mr. Elder. Mr. Elder feels there are overly restrictive requirements placed on his own property. As far as other residents and community members, there will be additional community concerns with the installation of the water pipeline.

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** There have been no incidents as described above. There have been concerns about Mr. Elder's horses impacting the remedy, but no other issues. The horses are getting in and grazing on the grasses that have been planted on the cap. It was part of the remedy to vegetate the cap, so it is creating a small issue in implementing and maintaining the remedy, but this is a minor component to the remedy.

5. **Do you think there may be any opportunities for future reuse**? **Do you have any comments, suggestions or recommendations?** In portions of OU1, on the property that is not physically capped, there is opportunity for additional development or reuse of the property. Mr. Elder has expressed interest in moving some trailers onto the property as rentals and has considered constructing other housing units at the site. He has also expressed other reuses than residential. Mr. Elder has mentioned there are gold reserves remaining and thinks it might be viable to reopen the mine. He has also mentioned he would like give tours highlighting historical operations; however these discussions were pre-OU1 remedy. He continues to hope to find ways to generate income from his property, including his current logging operation. However, these reuse ideas should be a valid concern for EPA because what Mr. Elder wants to do to generate income might complicate remedies. At one of the residential properties, a rental property, the EPA contractors removed contaminated soil and replaced it with clean soil in the garden, but not underneath the house. So there are tailings under the footprint

of the house. Below the mine, on Kenzie Lane, contaminated soil was removed from residential properties, but not removed from the underneath the private roadway, so if the road was reconstructed there are some materials that would need to be addressed. These residents need to be advised of this because it is not enforced by institutional controls. Waste left in place and not fully remediated could disturb contaminants during future reuse projects.

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** I encourage making an arrangement with Mr. Elder regarding land use restrictions. Mr. Elder was surprised that part of his property, the part impacted by the remedy, would have to remain undisturbed. EPA needs to document the land use restrictions.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** Yes to both.

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** Yes to both.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** Yes to both of these questions.

10. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** I am still affiliated with the site and receive the information I need from EPA and other project staff.

11. **Is there anyone else that you think might be useful for us to talk with about the site?** I provided a list of names to the EPA project manager during the Five-year review planning process. Most other stakeholders are not going to be up to date on the current site and remedy status and they will have limited knowledge of the site.

Site Interview
Lava Cap Mine Five Year Review

Name: Frans and Andrea Velthuijsen
Title/Position: Resident
Date: October 25, 2010

1. **What is your overall impression of the Superfund site?** I think that as I can see it, it's handled reasonably well. We moved here in 1999 and then learned we were living near a Superfund site. This was not disclosed in real estate contract, it was an upsetting discovery. I began going to community meetings in 2000-2001, the first meetings taking place concerning this site. I quickly discovered that most of the hazardous exposure is down from the mine, but the presence of fractured lava rock had us concerned. I still don't have clear, positive, confirmation that nothing happened to our groundwater. We are drawing our water from 185 feet, and have our water tested at own expense, extensively, and results show our water has been clean. Still, it is not used for drinking. We purchase filtered water, but we do use it for cooking and bathing. We are satisfied that EPA handled it reasonable well for us, but for those on Greenhorn, I'm not sure if they are happy, I might not be if I lived there.

2. **Is the remedy functioning as expected?** I have no way of answering that. The mine is private property. I know the owners personally, and know the history, and it isn't very inviting to go and explore because you are on private property.

3. **Are you aware of any community concerns regarding the site or its operation and maintenance?** I have never heard anybody talk about it, because we are uphill from it. But downhill, I'm sure there are many different discussions. There have been trucks moving things back and forth removing Sacher's (sp?) property tailings. He trucked out hazardous materials right down our road. But there were requirements including: trucks covered, watered down, go speed limit, and coordinate with school bus schedule. But on the first day, there's a truck with tailings going out, another one coming in, the school bus, and 12 cars with parents, and it was a jam. Trucks were not covered, but we didn't see any dust coming off the trucks. Owners who were involved in coordinating all this did not communicate to the truckers. After the first day, the requirements seem to have been met.

4. **Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.** No, I'm not aware. There are only about 20 cars a day, and we would know if there is a fire truck or police car.

5. **Do you think there may be any opportunities for future reuse? Do you have any comments, suggestions or recommendations?** Owner has one express goal

that he wanted to reopen the mine. The other use of the property is to divide it up into parcels and sell them. This concerns me.

6. **Do you have any comments, suggestions, or recommendations regarding the site's management or operation?** I didn't even know there was a management team, or someone overseeing the site. I don't know what you do. I would hope they were personally protected. I don't know about the safety of the site.

7. **Are you familiar with the EPA or DTSC web sites? Do you know where to find information on the Lava Cap Mine site?** Yes, it's been awhile ago. I've been on the EPA site, I don't know what the updates are, but I have visited information on Lava Cap on the EPA site.

8. **Are you aware of the information repositories for the site? Have you ever used them to find information for the site?** I was aware of it, but Andrea was not.

9. **Have you contacted DTSC or EPA in the past to inquire about the site? If so, did you feel that your questions or concerns were answered to your satisfaction?** Yes, I have. In the past five years. For my last letter to Rusty Harris, August 28, 2008, I have not received an answer. I went to several meetings and made sure I was on the list of commenters. I spoke with Kim Muratore at EPA. Through all these meetings I've gone to and where I've left comments, I've received one letter noting "I have received your comments and are considering them." I've got other things to do, so if nothing goes awfully wrong, I'm ok with no answer. But I would like to know see more communication. We need to get more funding for EPA projects by going through our congressman.

10. **How can we address your comments to make you feel respected and responded to?** Send individual responses noting what my comment was in the letter, "re: your comment on trucking…" but that would be labor intensive. Would like to see "you have a good comment, and we'll do it/consider it, or we can't do it because…"

11. **What is the best way for EPA or DTSC to communicate with you about this site in the future?** I'm someone who reads my email but there are people who don't read it, but I would read it. Facebook. Hard copies.

12. **Is there anyone else that you think might be useful for us to talk with about the site?** I have tried to engage my neighbors in this, and they figure as long as I'm involved, it's ok. Everybody has some interest, and now you're talking about the pipeline project. There would be benefits and disadvantages to this. We're glad you're keeping an eye on it.

Appendix F
Institutional Controls Evaluation

Lava Cap Mine Superfund Site Five Year Review Institutional Controls Evaluation

PREPARED FOR: United States Environmental Protection Agency, Region 9

PREPARED BY: CH2M HILL

DATE: December 20, 2010

This technical memorandum presents an evaluation of institutional controls (ICs) at the Lava Cap Mine Superfund Site (the Site).

ICs Background

ICs are non-engineered instruments used to prevent exposure to contamination, usually through restrictions on the use of or access to a site where contaminant levels do not allow for unlimited use and unrestricted exposure. When contamination remains on a property as part of a completed cleanup, ICs may be used alone or in combination with engineered controls to ensure protection of human health and the environment and the viability of the remedy. In addition to being part of a final completed remedy, ICs can be used during the implementation of the remedial investigation/feasibility study (RI/FS), the remedial action, and the operation and maintenance of a cleanup.

ICs can generally be categorized into the following four types:

1) **Government Controls –** includes local laws or permits (e.g., county zoning, building permits, land use ordinances, and Base Master Plans at military facilities);

2) **Proprietary Controls –** includes property use restrictions based on real property law (e.g., easements, land use covenants, and statutory covenants);

3) **Enforcement Tools –** includes government documents proscribing or prohibiting specific actions (e.g., environmental consent decrees or administrative orders on consent, unilateral orders, and permits); and

4) **Informational Devices –** includes public notices or advisories that alert and educate people about a potential hazard (e.g., deed notices, government advisories, and state registries).

Lava Cap Mine ICs

Because mine waste and contaminated materials were capped and left in place at the Site, ICs are required to minimize potential future exposure and protect the integrity of the remedy. As described in the Record of Decision (USEPA, 2004), the remedy required implementing land use restrictions (i.e., land use covenants), a proprietary control, to

protect the cap from physical disturbance and prohibit residential use of land parcels where such use is inconsistent with the constructed remedy.

USEPA has been working with the current property owner in an attempt to get land use covenants recorded that will provide the appropriate protections for the remedy. Land use covenants have been drafted for Mine Area OU Parcels 39-160-25, 39-160-27, 39-160-28, and 39-160-30, and USEPA has obtained concurrence from the State (California Department of Toxic Substances Control [DTSC]) on these draft documents. Surveyed maps showing the proposed restricted land within each parcel are provided in Attachment 1.

To date, the property owner has not agreed to record the restrictions. USEPA and DTSC will continue to work with the property owner to record these land use covenants and to ensure that in the interim none of the proscribed activities occurs on these parcels. USEPA 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. Currently, USEPA ensures compliance with the land use restrictions for these parcels through routine O&M inspections that evaluate whether the implemented remedy has been compromised.

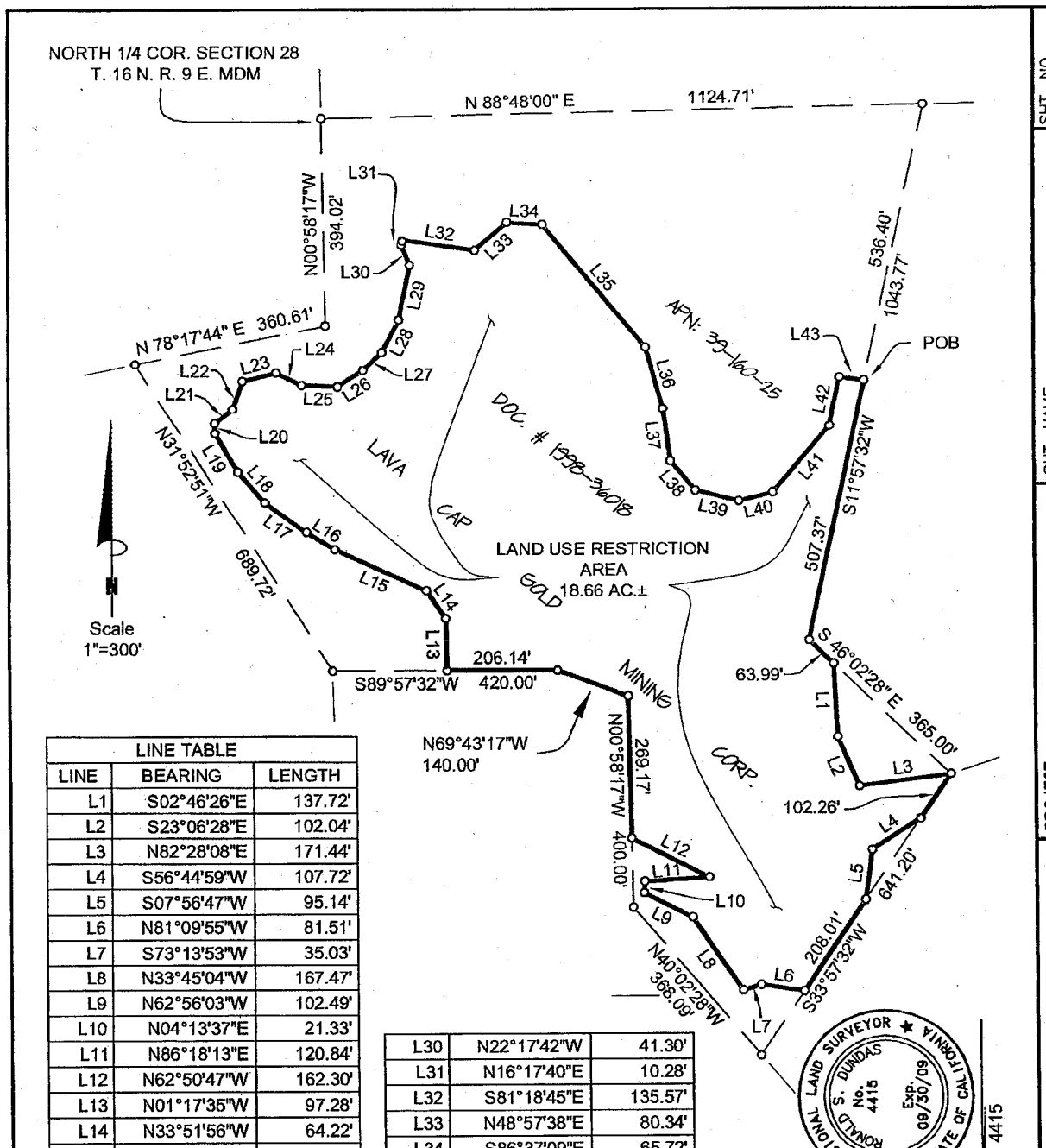
Need for Additional ICs

On one of the residential properties (Parcel 39-160-16) at the mine that contains a rental residence, contaminated soil was removed and replaced with clean fill as part of the OU4 remedy; however, contaminated soil could not be removed from beneath the house without jeopardizing the integrity of the house and adjoining deck. Similarly, on three residential properties downstream from the mine in the Tensy Lane area, contaminated soil was removed from Little Clipper Creek and the adjoining flood plain, but contaminated soil could not be removed from beneath Tensy Lane where it crosses Little Clipper Creek (Parcel 39-170-66). These two parcels are not addressed in the drafted final land use covenants that USEPA seeks to record nor are land use restrictions for these parcels discussed in the 2004 ROD or 2006 Explanation of Significant Differences (ESD) for OU4. USEPA will need to evaluate how to expand the selected remedy consistent with CERCLA and the NCP to include additional institutional controls for these two parcels to prevent disturbance of and/or exposure to these wastes left in place.

References

U.S. Environmental Protection Agency (USEPA). 2004. *Record of Decision for the Lava Cap Mine Superfund Site, Mine Area Operable Unit (OU1), Nevada City, California.* September.

Attachment 1



LINE TABLE		
LINE	BEARING	LENGTH
L1	S02°46'26"E	137.72'
L2	S23°06'28"E	102.04'
L3	N82°28'08"E	171.44'
L4	S56°44'59"W	107.72'
L5	S07°56'47"W	95.14'
L6	N81°09'55"W	81.51'
L7	S73°13'53"W	35.03'
L8	N33°45'04"W	167.47'
L9	N62°56'03"W	102.49'
L10	N04°13'37"E	21.33'
L11	N86°18'13"E	120.84'
L12	N62°50'47"W	162.30'
L13	N01°17'35"W	97.28'
L14	N33°51'56"W	64.22'
L15	N65°01'04"W	188.41'
L16	N57°20'31"W	62.12'
L17	N53°21'47"W	96.53'
L18	N40°23'54"W	76.84'
L19	N29°28'24"W	84.35'
L20	N02°59'17"W	19.27'
L21	N51°19'48"E	43.31'
L22	N18°09'59"E	56.62'
L23	N75°24'24"E	64.81'
L24	S63°33'35"E	53.27'
L25	S87°27'31"E	66.48'
L26	N56°53'51"E	56.85'
L27	N46°36'23"E	48.81'
L28	N26°52'21"E	69.63'
L29	N11°19'45"E	106.69'
L30	N22°17'42"W	41.30'
L31	N16°17'40"E	10.28'
L32	S81°18'45"E	135.57'
L33	N48°57'38"E	80.34'
L34	S86°37'09"E	65.72'
L35	S39°22'39"E	303.15'
L36	S15°31'22"E	121.57'
L37	S07°36'04"E	101.54'
L38	S39°46'53"E	72.36'
L39	S75°54'57"E	83.74'
L40	N75°50'23"E	65.50'
L41	N40°15'16"E	165.20'
L42	N11°30'20"E	94.72'
L43	S82°24'55"E	46.62'

AREAS:

GROSS PARCEL AREA:	33.83 AC±
RESTRICTION AREA:	18.66 AC±
NET AREA (LESS RESTRICTIONS):	15.17 AC±

PROFESSIONAL LAND SURVEYOR ★ STATE OF CALIFORNIA ★ RONALD S. DUNDAS No. 4415 Exp. 09/30/09

PREPARED BY: RONALD S. DUNDAS P.L.S. 4415

SHT. NO. 1

SHT. NAME EXHIBIT "B" APN: 39-160-25

PROJECT LAVA CAP MINE LAND USE COVENANT RESTRICTION AREAS

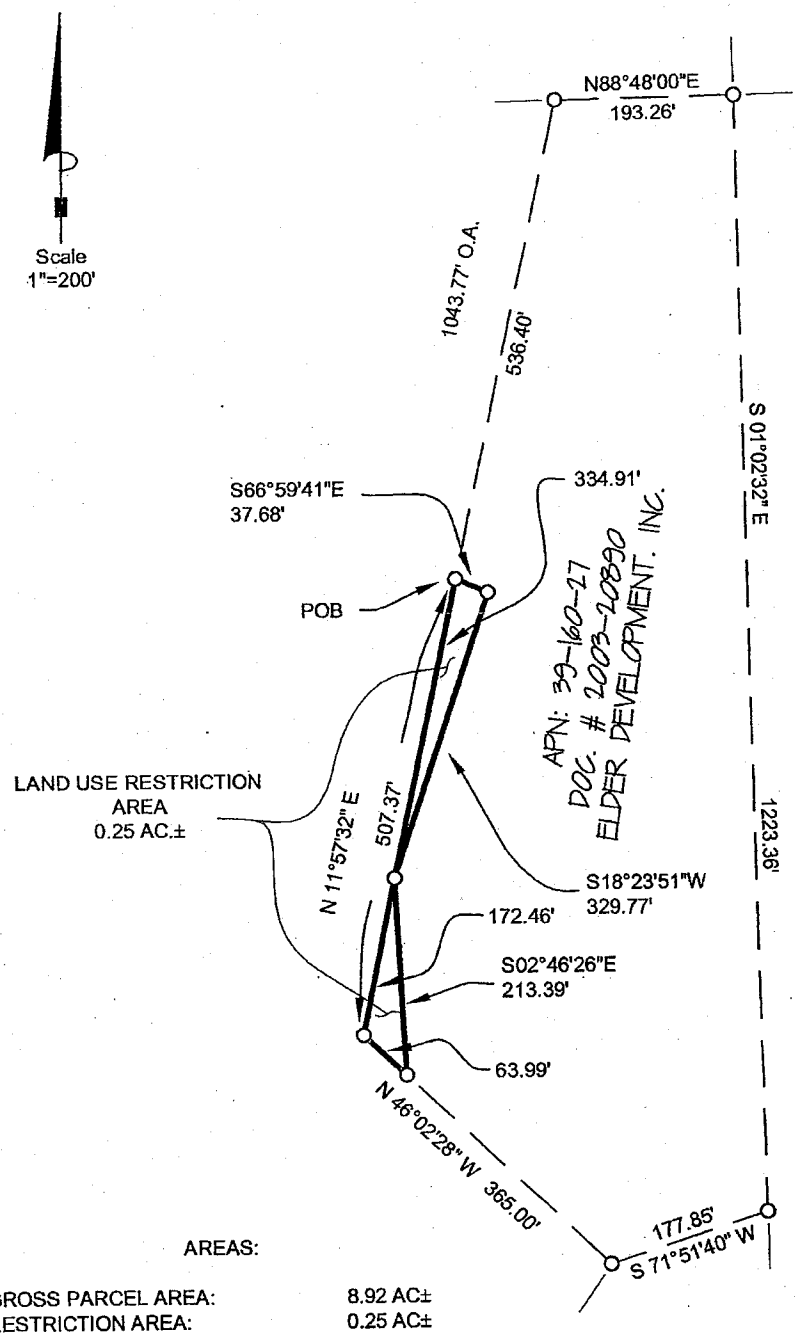
DUNDAS & DUNDAS
16906 AILEEN WAY
GRASS VALLEY, CA
(530) 274-1616

DRAWN BY: R.S.D

DATE: 05/01/09

DWG. NO.: 2009-04

APPROVED BY:



AREAS:

GROSS PARCEL AREA:	8.92 AC±
RESTRICTION AREA:	0.25 AC±
NET AREA (LESS RESTRICTIONS):	8.67 AC±

PROFESSIONAL LAND SURVEYOR
RONALD S. DUNDAS
No. 4415
Exp. 09/30/09
STATE OF CALIFORNIA

PREPARED BY: RONALD S. DUNDAS P.L.S. 4415

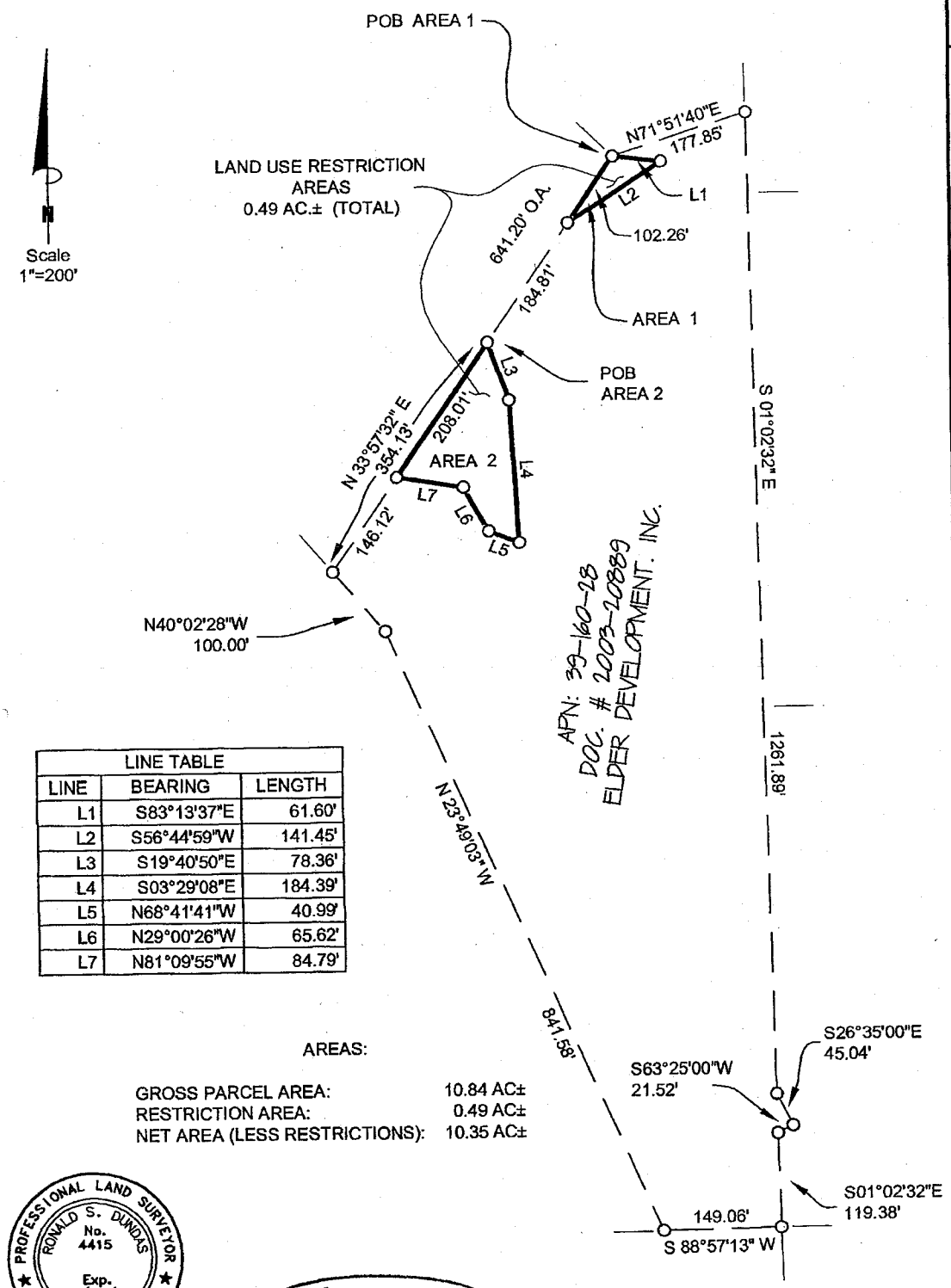
SHT. NO. 1

SHT. NAME EXHIBIT "B"
APN: 39-160-27

PROJECT LAVA CAP MINE
LAND USE COVENANT
RESTRICTION AREAS

DUNDAS & DUNDAS
16906 AILEEN WAY
GRASS VALLEY, CA
(530) 274-1616

DRAWN BY: R.S.D
DATE: 05/01/09
DWG. NO.: 2009-04
APPROVED BY:



LINE TABLE		
LINE	BEARING	LENGTH
L1	S83°13'37"E	61.60'
L2	S56°44'59"W	141.45'
L3	S19°40'50"E	78.36'
L4	S03°29'08"E	184.39'
L5	N68°41'41"W	40.99'
L6	N29°00'26"W	65.62'
L7	N81°09'55"W	84.79'

AREAS:

GROSS PARCEL AREA:	10.84 AC±
RESTRICTION AREA:	0.49 AC±
NET AREA (LESS RESTRICTIONS):	10.35 AC±

PROFESSIONAL LAND SURVEYOR
RONALD S. DUNDAS
No. 4415
Exp. 09/30/09
STATE OF CALIFORNIA

PREPARED BY: RONALD S. DUNDAS P.L.S. 4415

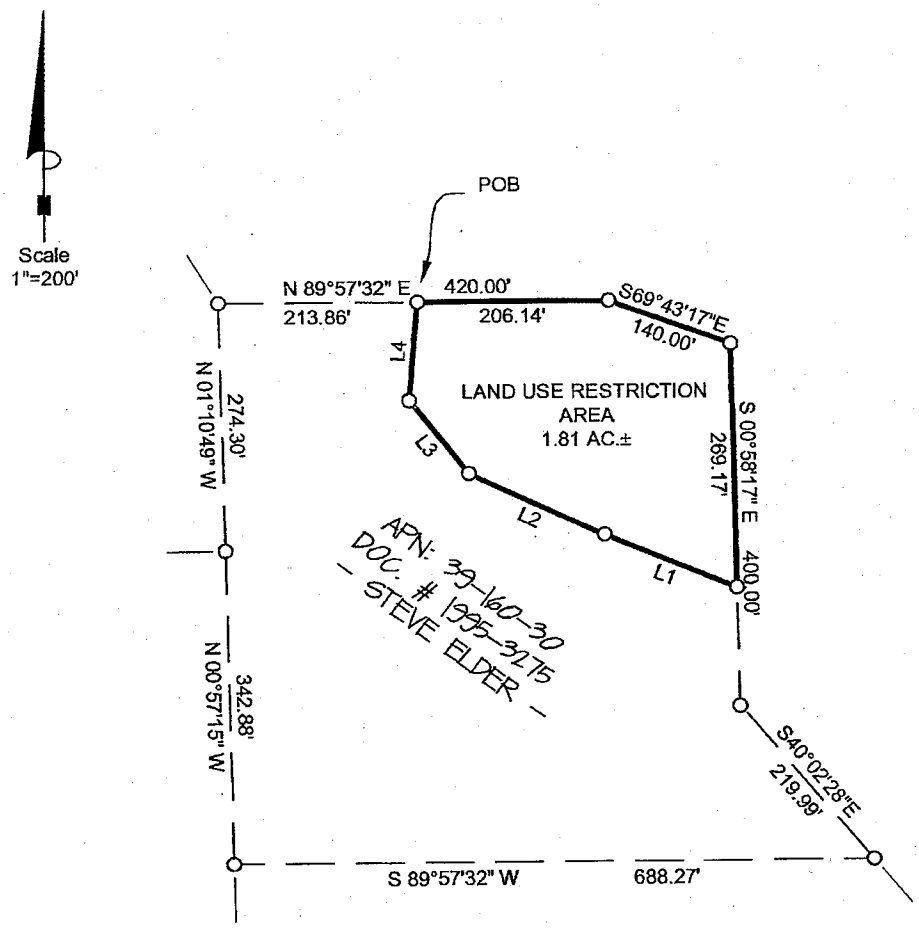
SHT. NO. 1

SHT. NAME EXHIBIT "B"
APN: 39-160-28

PROJECT LAVA CAP MINE
LAND USE COVENANT
RESTRICTION AREAS

DUNDAS & DUNDAS
16906 AILEEN WAY
GRASS VALLEY, CA
(530) 274-1616

DRAWN BY: R.S.D
DATE: 05/01/09
DWG. NO.: 2009-04
APPROVED BY:



LINE TABLE		
LINE	BEARING	LENGTH
L1	N67°32'02"W	154.06'
L2	N65°13'13"W	160.60'
L3	N37°33'53"W	103.78'
L4	N04°56'23"E	109.46'

AREAS:

GROSS PARCEL AREA:	7.98 AC±
RESTRICTION AREA:	1.81 AC±
NET AREA (LESS RESTRICTIONS):	6.17 AC±

PREPARED BY: RONALD S. DUNDAS P.L.S. 4415

SHT. NO. 1

SHT. NAME EXHIBIT "B"
APN: 39-160-30

PROJECT LAVA CAP MINE
LAND USE COVENANT
RESTRICTION AREAS

DUNDAS & DUNDAS
16906 AILEEN WAY
GRASS VALLEY, CA
(530) 274-1616

DRAWN BY: R.S.D
DATE: 05/01/09
DWG. NO.: 2009-04
APPROVED BY:

Appendix G
Applicable or Relevant and Appropriate Requirements (ARARs) Evaluation

ARARs Analysis

Five-Year Review of Operable Units 1 and 4, Lava Cap Mine Superfund Site, Nevada City, California

PREPARED FOR: United States Environmental Protection Agency, Region 9

PREPARED BY: CH2M HILL

DATE: January 7, 2011

This technical memorandum describes the applicable or relevant and appropriate standards (ARARs) review of Lava Cap Mine Superfund Site OUs 1 and 4, to determine if changes to standards, newly promulgated standards and To Be Considered guidance or advisories (TBCs) have occurred since issuance of the Record of Decision (ROD) and the Explanation of Significant Differences (ESD) that might affect current protectiveness of the remedy.

ARARs Background

Section 121(d) of CERCLA, 42 United States Code (USC) § 9621(d) 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 (ARAR). 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.

An ARAR may be either "applicable," or "relevant and appropriate," but not both. If there is no specific federal or state ARAR for a particular chemical or remedial action, or if the existing ARARs are not considered sufficiently protective, then other guidance or criteria to be considered (TBC) may be identified and used to ensure the protection of public health and the environment. The NCP, 40 CFR Part 300, defines "applicable," "relevant and appropriate," and "TBC" as follows:

- **Applicable requirements** are those cleanup standards, standards of control, or other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, RA, location, or other circumstances found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.
- **Relevant and appropriate requirements** are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal

environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, RA, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

- **TBCs** consist of advisories, criteria, or guidance that USEPA, other federal agencies, or states developed that may be useful in developing CERCLA remedies. The TBC values and guidelines may be used as USEPA deems appropriate. Once a TBC is adopted, it becomes an enforceable requirement.

ARARs are identified on a site-specific basis from information about the chemicals at the site, the remedial actions contemplated, the physical characteristics of the site, and other appropriate factors. ARARs include only substantive, not administrative, requirements and pertain only to onsite activities. Section 121(e) of CERCLA, USC 9621(e), states that no federal, state, or local permit is required for remedial action conducted entirely onsite. Offsite activities, however, must comply with all applicable federal, state, and local laws, including both substantive and administrative requirements that are in effect when the activity takes place. There are three general categories of ARARs:

- **Chemical-Specific ARARs** are health- or risk-based concentration limits, numerical values, or methodologies for various environmental media (i.e., groundwater, surface water, air, and soil) that are established for a specific chemical that may be present in a specific media at the site, or that may be discharged to the site during remedial activities. These ARARs set limits on concentrations of specific hazardous substances, pollutants, and contaminants in the environment. Examples of this type of ARAR include federal and state drinking water standards.

- **Location-Specific ARARs** restrict certain types of activities based on site characteristics. Federal and state location-specific ARARs are restrictions placed on the concentration of a contaminant or the activities to be conducted because they are in a specific location. Examples of special locations possibly requiring ARARs include floodplains, wetlands, historical sites, and sensitive ecosystems or habitats.

- **Action-Specific ARARs** are technology- or activity-based requirements that are triggered by the specific type of remedial activities. Examples of this type of ARAR include the Resource Conservation and Recovery Act regulations for waste treatment, storage, or disposal.

Review of Existing and Potential ARARs

A review of ARARs was conducted for the selected remedy at OU1 and OU4 of Lava Cap Mine. The review was conducted to determine if changes to ARARs have occurred in the last five years that might affect current protectiveness of the selected remedy.

Tables 1 (Chemical–Specific ARARs), 2 (Location–Specific ARARs), and 3 (Action-Specific ARARs) provide an evaluation of ARARs. These tables were created from ARARs identified in the 2004 ROD. ARARs relevant to regulations that changed in the last five years were added to

the tables. The evaluation includes a determination of whether the regulation is currently "applicable," "relevant and appropriate," "TBC," or "not applicable."

Current versions of the following were consulted via the internet or in hardcopy to review pertinent updates:

- USEPA Comprehensive Five-Year Review Guidance: http://www.epa.gov/superfund/accomp/5year/index.htm
- United States Code of Federal Regulations (CFR): http://www.gpoaccess.gov/cfr/index.html
- CFR Title 40, Protection of the Environment: http://www.epa.gov/lawsregs/search/40cfr.html
- California Code of Regulations (CCR): http://government.westlaw.com/linkedslice/default.asp?Action=TOC&RS=GVT1.0&VR=2.0&SP=CCR-1000
- Central Valley Regional Water Quality Control Board (RWQCB) Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan): http://www.waterboards.ca.gov/centralvalley/water_issues/basin_plans/index.shtml
- CA State Water Resources Control Board (SWRCB) Construction General Permit for Storm Water Discharges: http://www.swrcb.ca.gov/water_issues/programs/stormwater/constpermits.shtml
- Northern Sierra Air Quality Management District (NSAQMD) Rules: http://www.myairdistrict.com/index.php/rules

TABLE 1

CHEMICAL-SPECIFIC ARARS

Source	Citation	Description	2004 ROD ARAR Status and Comments	2010 5-Year Review ARAR Status and Comments
National Drinking Water Standards – Safe Drinking Water Act	40 CFR 141.61	Establishes National primary drinking water standards, maximum contaminant levels (MCLs), to protect quality in public water systems. MCLs represent maximum contaminants permissible in water systems delivered to the public.	Relevant and Appropriate The National Contingency Plan (NCP) defines MCLs as Relevant and Appropriate for water determined to be a current or potential source of drinking water where MCL Goals (MCLGs) are not ARARs.	Relevant and Appropriate There have been no significant changes affecting the ARAR status
California Safe Drinking Water Standards, CA MCLs	22 CCR 64435 and 64444.5	Establishes California primary drinking water standards, MCLs, for contaminants that cannot be exceeded in public water systems. In some cases the CA MCLs are more stringent than Federal MCLs.	Relevant and Appropriate Like Federal MCLs, CA MCLs are applicable as cleanup goals for waters determined to be a current or potential source of drinking water.	Relevant and Appropriate There have been no significant changes affecting the ARAR status
National Toxics Rule (NTR) applicable in California and known as the California Toxics Rule (CTR)	40 CFR 131.36;	Federal regulation establishes numeric aquatic life and human health criteria for priority toxic pollutants – applies to inland surface waters, bays, and estuaries in California and other states not complying with CWA 303(c)(2)(B).	Applicable Establishes criteria for surface water quality.	Applicable There have been no significant changes affecting the ARAR status
CA State Water Resources Control Board (SWRCB)	SWRCB Resolution 68-16	Requires continued maintenance of high-quality water of the state. Water quality may not be degraded below what is necessary to protect the "beneficial uses" of a water source.	Applicable Actions at Lava Cap Mine that involve discharges to surface water (or drainage courses) must take into account protection of beneficial uses.	Applicable There have been no significant changes affecting the ARAR status
Central Valley Regional Water Quality Control Board (RWQCB) Sacramento Office	RWQCB's Water Quality Control Plan for the Sacramento River and San Joaquin River Basins	Establishes beneficial uses for groundwater and surface water, water quality objectives designed to protect those beneficial uses, and implementation plans to achieve	Applicable Narrative objectives described in Basin Plan are considered ARARs. Numeric values based on non-	Applicable There have been no significant changes affecting the ARAR status

TABLE 1

CHEMICAL-SPECIFIC ARARS

Source	Citation	Description	2004 ROD ARAR Status and Comments	2010 5-Year Review ARAR Status and Comments
(5S)	(Basin Plan)	water quality objectives.	promulgated guidance documents and developed on a site-by-site basis are not considered ARARs, but may be recognized as TBCs	

TABLE 2

LOCATION-SPECIFIC ARARS

Source	Citation	Description	2004 ROD ARAR Status and Comments	2010 5-Year Review ARAR Status and Comments
National Historic Preservation Act National Historic Landmarks Program National Register of Historic Places	16 United States Code (U.S.C.) 470 et seq.; 36 CFR Part 800; 40 CFR 6.301(b) 36 CFR Part 65 36 CFR Part 60	Establishes identification of historic properties/cultural resources.	Applicable If historic properties or landmarks eligible for, or included in, the National Register of Historic Places exist within remediation areas, then activities must be designed to minimize the effect.	Applicable There have been no significant changes affecting the ARAR status
Archaeological and Historical Preservation Act	16 U.S.C. 469 et seq.; 40 CFR 6.301(c)	Establishes procedures for preservation of historical and archaeological data.	Applicable Presence or absence of such data on site must be verified. If historical or archaeological artifacts are present in remediation areas, then activities must be designed to minimize adverse effects.	Applicable There have been no significant changes affecting the ARAR status
Archaeological Resources Protection Act of 1979	16 U.S.C. 470aa-ii; 43 CFR 7	Steps must be taken to protect archaeological resources and sites on public and Indian lands to preserve data. Investigators of archaeological sites must fulfill professional requirements.	Applicable The potential presence of archaeological sites has not been determined.	Applicable There have been no significant changes affecting the ARAR status
Fish and Wildlife Coordination Act	16 U.S.C. 661 et seq.; 40 CFR 6.302(g)	Requires consultation with U.S. Fish and Wildlife Service (USFWS) and CA Department of Fish and Game (CDFG) for authorization of modifications to stream or other water body.	Applicable Certain remedies may result in temporary or permanent modification of naturally occurring water bodies and may require construction of mitigated wetlands in other areas.	Applicable There have been no significant changes affecting the ARAR status
Fish and Game Code	Fish and Game Code 1600 and 1603	Establishes requirements for construction that will change natural flow, or use material from beds, or result in disposal into	Relevant and Appropriate	Relevant and Appropriate There have been no significant changes affecting the ARAR status

TABLE 2

LOCATION-SPECIFIC ARARS

Source	Citation	Description	2004 ROD ARAR Status and Comments	2010 5-Year Review ARAR Status and Comments
		designated waters by, or on behalf of any state or local agency.		
Clean Water Act (CWA); Dredge or Fill Requirements	CWA Section 404; 33 U.S.C. 1251-1376; 40 CFR 230	Establishes requirements that limit discharge of dredged or fill material into waters of the U.S. EPA guidelines specify consideration of alternatives that have fewer adverse impacts and prohibit discharges that would result in exceedance of surface water quality standards, exceedance of toxic effluent standards, or jeopardy of threatened/endangered species.	Applicable	Applicable There have been no significant changes affecting the ARAR status
Protection of Floodplains	Executive Order 11988; 40 CFR 6.302(b); 40 CFR Part 6, Appendix A	Requires federal agencies to evaluate potential effects of action they may take in a floodplain – avoid adverse impacts associated with direct and indirect development of a floodplain.	Applicable Applicable for activities that may occur within the 100-year floodplain.	Applicable There have been no significant changes affecting the ARAR status
Protection of Wetlands	Executive Order 11990; 40 CFR 6.302(a); 40 CFR Part 6, Appendix A	Requires federal agencies to take action to avoid adversely affecting wetlands, to minimize wetlands destruction, and to preserve the value of the land.	Applicable Applicable if wetlands are identified.	Applicable There have been no significant changes affecting the ARAR status
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	CERCLA 121(d)(3); 42 U.S.C. Section 9621(d); 40 CFR 300.440	Establishes requirements regarding offsite disposal of hazardous substances from a Superfund site. Procedures for planning and implementing off-site response actions applies to any remedial or removal action involving the off-	Applicable CERCLA and EPA regulations establish independently applicable requirements.	Applicable There have been no significant changes affecting the ARAR status.

TABLE 2

LOCATION-SPECIFIC ARARS

Source	Citation	Description	2004 ROD ARAR Status and Comments	2010 5-Year Review ARAR Status and Comments
		site transfer of any hazardous substance, pollutant, or contaminant as defined under CERCLA.		

TABLE 3

ACTION-SPECIFIC ARARS

Source	Citation	Description	2004 ROD ARAR Status and Comments	2010 5-Year Review ARAR Status and Comments
Land Use Covenants Regulations	22 CCR 67391.1	A Land Use Covenant (LUC) imposing appropriate limitations shall be executed and recorded when hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels that are not suitable for unrestricted use of the land. LUCs are to run with the land and be recorded in the county where the property is located.	Relevant and Appropriate Substantive provisions are relevant and appropriate	Relevant and Appropriate There have been no significant changes affecting the ARAR status
Air Quality	Northern Sierra Air Quality Management District (NSAQMD) Rules 205 and ~~225~~ 226.	Rule 205 prohibits discharges of air contaminants that cause a nuisance. Rule 226 requires activities be designed to take all reasonable precautions to prevent particulate matter from becoming airborne including use of water or chemicals as dust suppressants, covering of trucks, and prompt removal and handling of excavated material.	Applicable	Applicable Original citation in ROD of Rule 225 (Compliance Testing) should have been Rule 226 (Dust Control) There have been no significant changes affecting the ARAR status
National Pollutant Discharge Elimination System (NPDES)	40 CFR 122	NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the U.S.	Applicable Independently applicable to discharges from the treatment system to Little Clipper Creek	Applicable There have been no significant changes affecting the ARAR status

TABLE 3

ACTION-SPECIFIC ARARS

Source	Citation	Description	2004 ROD ARAR Status and Comments	2010 5-Year Review ARAR Status and Comments
California Storm Water Permit Program	CA State Water Resources Control Board (SWRCB) Order 97-03-DWQ; 40 CFR 122, 123, 124	SWRCB Order 97-03-DWQ Regulates pollutants in the discharge of storm water associated with construction activities.	Applicable Applicable to storm water discharges to Little Clipper Creek	Applicable New CA General Permit for Construction SW Discharges 2009-00090-DWQ effective July 1, 2010. There have been no significant changes affecting the ARAR status.
Property Use where Hazardous Substances are Present	CA Health and Safety Code (HSC) Section 25355.5	Establishes requirements for covenants to restrict use of property where hazardous substances are present.	Relevant and Appropriate	Relevant and Appropriate There have been no significant changes affecting the ARAR status
Property Use where Hazardous Substances are Present	CA Civil Code Section 1471(c)	Establishes requirements for deed restrictions such as environmental restrictions and LUCs.	Applicable Requirements for LUCs to run with land by applying to successors in title to the land.	Applicable There have been no significant changes affecting the ARAR status
Mining Closure Requirements	CA Water Code Section 13172; 27 CCR 21090(a), (b) and (c); 23 CCR 21400(a) and (b)(1)	Establishes requirements for closure of mines including waste piles and surface impoundments.	Relevant and Appropriate Group A and B waste piles to be closed in compliance with 27 CCR 21090. Group A and B surface impoundments to be closed in compliance with 23 CCR 21400 – some surface impoundments with clay liners may be closed in place.	Relevant and Appropriate There have been no significant changes affecting the ARAR status

Summary of ARARs Review Findings

A review of the existing ARARs indicates that, to date, there have been no significant changes or updates that would impact the ARARs status, including approval of the ESD in 2006. Therefore, the existing ARARs remain applicable or relevant and appropriate for the protection of human health and the environment with the following notes:

- The 2004 ROD identified SWRCB Order 97-03-DWQ, General Permit for discharge of storm water associated with construction activities, as an applicable ARAR. General Permit 97-03-DWQ was replaced by General Permit 2009-00090-DWQ effective July 1, 2010. There have been no significant changes affecting the ARAR status; however, construction activities at the Lava Cap Mine must comply with the requirements in construction storm water General Permit 2009-00090-DWQ.
- The 2004 ROD identified NSAQMD Rule 225 as an applicable ARAR that requires activities be designed to take all reasonable precautions to prevent particulate matter from becoming airborne including use of water or chemicals as dust suppressants, covering of trucks, and prompt removal and handling of excavated material. It appears that the original citation in the 2004 ROD of Rule 225 (Compliance Testing) as an ARAR should have been Rule 226 (Dust Control) as an applicable ARAR. Therefore, NSAQMD Rule 226 is an applicable ARAR for the Lava Cap Mine.

Appendix H
Human Health Risk Assessment and Toxicology Analysis

Human Health Risk Assessment and Toxicology Analysis
Five-Year Review of Operable Units 1 and 4
Lava Cap Superfund Site, Nevada City, California

PREPARED FOR: United States Environmental Protection Agency, Region 9

PREPARED BY: CH2M HILL

DATE: December 20, 2010

This technical memorandum presents a human health risk assessment and toxicology analysis to support the Five-Year Review of the Lava Cap Superfund Site in Nevada County, California. The Record of Decision (ROD) (U.S. Environmental Protection Agency [USEPA], 2004) selecting the remedy for the Mine Area Operable Unit (OU) was issued by EPA in 2004 and was revised by the Explanation of Significant Differences (ESD), Mine Area Operable Unit (OU1) and Mine Area Residences Operable Unit (OU4) in 2006 (USEPA, 2006). The ROD addresses soil, sediment, and surface water contaminated with mine waste (primarily arsenic). The Mine Area OU ROD requirements include the following components:

- **Mine Buildings and Surrounding Area –** Remove tanks, vats, sumps, and contaminated soil from in and around the main mine buildings (Mill, Assay, and Cyanide Buildings) and ship the highly contaminated materials offsite for disposal; restrict unauthorized access to the buildings through the installation of fencing; and cover areas around the mine storage buildings with a vegetative cap.
- **Waste Rock –** Contour, cover and revegetate the entire waste rock disposal area to promote runoff and reduce surface infiltration.
- **Mine Tailings and Rock Buttress –** Consolidate tailings and adjacent contaminated soil from around the site and from Little Clipper Creek (LCC) in the Tensy Lane area into the tailings pile; regrade and cap the tailings with a low-permeability engineered cover system, including a vegetative layer; and replace the failed log dam with a rock buttress at the downstream end of the tailings pile.
- **LCC and Smaller Mine Area Drainage Channels –** Construct engineered channels to divert LCC and all other clean surface water flows around the mine buildings, tailings pile, and waste rock pile.
- **Mine Discharge.** Pump water out of the mine workings to reduce or eliminate discharge from the adit; construct an adit structure to measure seepage flow rates and to collect any remaining adit seepage not captured by pumping from the mine workings; and

construct a water treatment plant to treat surface water collected from the mine working and/or adit and from the mine tailings.

- **Mine Area Residences –** The ROD called for one residence (referred to as the Upper Rental residence) to be demolished because it was constructed immediately on or adjacent to the waste rock pile. After demolition, this area was to be addressed as part of the waste rock area with contouring and installation of a vegetative cover. After the ROD was signed, it was determined that a second residence would need to be demolished. This second residence is referred to as the Lower Rental residence and the remedy requirements for this area are summarized below in the Explanation of Significant Differences section. Two other residential areas at the mine were addressed as part of the Mine Area Residences OU. On one of the parcels, the only exposed mine waste was a thin layer of waste rock that had been used as road base on a little-used access road. The access road was paved to prevent contact with the waste rock. For the other residential parcel, contaminated soil removal was required from throughout the vicinity of the house and several adjacent storage buildings.
- **Institutional Controls –** Because mine waste and contaminated materials were to be capped and left in place, institutional controls are required to minimize potential future exposure. The 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 (such land use restrictions shall be implemented as land use covenants under California civil code, Section 1471 (c)).
- **LCC from the Mine to Greenhorn Road –** Excavate the tailings and arsenic-contaminated sediment that has accumulated along the LCC drainage and surrounding floodplain as far south as Greenhorn Road; consolidate these materials under the tailings pile cap on the mine property; and regrade the excavated areas. Following remedy implementation, this downstream area will not require land use restrictions and is available for any future use.

An Explanation of Significant Differences was prepared to document changes in the remedy required at the Lower Rental residence and surrounding area. The ROD called for excavating contaminated soils from around the Lower Rental residence, consolidating the contaminated materials under the tailings pile cap and returning the parcel to residential use. A soil sampling program was conducted around the Lower Rental residence as part of the remedial design process. The sampling indicated that the lateral and vertical extent of arsenic contamination was much larger than previous data had indicated. The depth and areal extent of the contaminated soil surrounding the Lower Rental residence made it technically impracticable to remove the contaminated materials and maintain the property in residential use. Instead, USEPA determined that the area should be demolished and the entire area addressed consistent with other waste rock/tailings impacted areas and be capped and revegetated.

The baseline human health risk assessment (HHRA) was conducted as part of the RI for Lava Cap Superfund Site (CH2M HILL, 2001) and was reviewed as part of this evaluation. The Remedial Action Reports for OU1 (CH2M HILL, 2010) and OU4 (CH2M HILL, 2007) were also reviewed.

As described in the guidance for USEPA's Comprehensive Five-Year Reviews (USEPA, 2001), a key purpose of the Five-Year Review process for a site is to determine if the remedy is, or upon completion, will be protective of human health and the environment. Protectiveness is generally defined in the National Contingency Plan (NCP) by the risk range and the Hazard Index (HI). The following three questions are part of the technical assessment of the protectiveness of the remedy, as outlined in the USEPA Five-Year Review guidance document:

- Question A – Is the remedy functioning as intended by the decision documents?
- Question B - Are the exposure assumptions, toxicity data, and remedial action objectives (RAOs) used at the time of remedy selection still valid?
- Question C – Has any other information come to light that could call into question the protectiveness of the remedy?

To determine whether the remedy at the Lava Cap Mine site remains protective of human health, the sections below evaluate changes in site conditions, exposure pathways, and toxicity values since completion of the HHRA and selection of the site remedy. An evaluation for the ecological assessment is provided in a separate technical memorandum.

1.0 Summary of the Baseline Human Health Risk Assessment Results

The 2001 HHRA (CH2M HILL, 2001) evaluated risks at the Mine Area Operable Unit to three categories of potentially exposed individuals: (1) theoretical regularly employed outdoor workers (there are currently no regularly employed workers); (2) residents on the mine property; and (3) residents and recreational users of LCC below the mine.

The most significant routes of exposure are through the incidental ingestion of arsenic in soil, sediment, surface water, and airborne dust. Residents are also potentially exposed to risk from ingestion of elevated levels of arsenic in contaminated groundwater used as domestic water supply. USEPA concluded that conditions at the Mine Area Operable pose unacceptable risks to human health for both cancer and noncancer effects. The acceptable risk range cited in the NCP for excess cancer risk is between 1 in 10,000 and 1 in 1 million exposed individuals. In contrast, at the Mine Area Operable Unit, the excess lifetime cancer risk (the risk of contracting cancer above and beyond such risks in the general population) was estimated by USEPA to be as high as 1 case per 200 exposed individuals for the theoretical worker scenario and for residents of the mine property.

2.0 Changes in Site Conditions

Construction of the cap on the mine area has been completed. Excavated tailings and contaminated soils from LCC and the surrounding residences have been consolidated under the multi-layered cap. Surface water is routed around the cap and over the rock buttress, preventing water from infiltrating the mine tailings. Revegetation along LCC was completed in November 2007.

Currently, there is surface water drainage from the mine adit. This drainage contains elevated levels of arsenic and flows via engineered channels along the tailings pile into LCC below the rock buttress. As part of the phased implementation of the Mine Area OU remedy, treatment of the mine drainage is planned to be the final remedy component.

The mine discharge component of the Mine Area OU remedy has not yet been completed. As part of the phased implementation of the Mine Area OU remedy, treatment of the mine drainage is planned to be the final remedy component.

3.0 Changes in Exposure Pathways

The human health 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. Also ingestion of groundwater from private wells and dermal contact with well water through showering.
- Residents and recreational users along 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 remedial actions conducted and described in Section 2 have eliminated (or will eliminate) most of these exposure pathways. 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 occurring. 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 addition, the interim remedy being implemented for the Lava Cap Mine Groundwater OU (OU2) will provide a replacement water supply for residents with arsenic-contaminated domestic wells. Once implemented, this OU2 remedy will eliminate potential residential exposure to contaminated groundwater.

The presence of the cap and routine maintenance of the cap ensure that the soil and vegetation over the waste rock and tailings piles are maintained to minimize erosion, and therefore prevent human exposure to mine wastes. 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 areas. After they are in place, these ICs will be protective of human health.

4.0 Changes in Toxicity Values

USEPA published draft proposed changes to the cancer slope factor for inorganic arsenic in February 2010 (USEPA, 2010), which proposes a 20-fold increase (from 1.5 to 25.7 milligrams

per kilogram per day [mg/kg-day^{-1}]) in the oral cancer slope factor for inorganic arsenic in USEPA's Integrated Risk Information System (IRIS).

The performance criteria described in the ROD was to remove contaminated soil or sediment that exceeded USEPA's cleanup targets of 20 milligrams per kilogram (mg/kg) (soil) or 25 mg/kg (sediment). These cleanup goals represent site-wide background conditions developed during the RI/FS. The ROD states that the selected cleanup goals will ensure that the remedial action reduces human health and ecological risks from the Site to acceptable levels, specifically, post-cleanup lifetime excess cancer risks for all exposure scenarios will fall within the acceptable risk range of 10^{-6} to 10^{-4} set in the NCP.

If USEPA amends the current arsenic cancer slope factor in favor of a more health-protective value, this would result in an increase in the calculated risk for both the oral and dermal exposure pathways, and would cause the cleanup target of 20 mg/kg to exceed the risk management range of 10^{-6} to 10^{-4}. However, Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) guidance states, "In cases where a health or ecological risk-based cleanup goal for a constituent of concern is below background concentrations, the cleanup level may be established based on background" (USEPA, 2002). Therefore, the cleanup goal will not change if the proposed arsenic slope factor is adopted.

5.0 Conclusions

Based on the above assessment, the following three questions related to the protectiveness of the OU1 and OU4 Remedy are answered as follows:

- Question A - Is the remedy functioning as intended by the decision documents? Construction of a cap and routine maintenance of the cap minimizes erosion, and therefore prevent human exposure to the waste. Additionally, areas outside the main sources that were impacted by mine tailings and contamination have been excavated and removed. A portion of the OU1 remedy (mine discharge treatment) has not yet been implemented.
- Question B – Are the exposure assumptions, toxicity data, and remedial action objectives (RAOs) used at the time of remedy selection still valid? The exposure and toxicity factors used at the time of remedy selection have not changed. Although there is a proposed change for the arsenic cancer slope factor that would increase the toxicity 20-fold, this change would not affect the remedy because the target cleanup goal is based on background levels.
- Question C – Has any other information come to light that could call into question the protectiveness of the remedy? During this review, no other information has come to light that could call into question the protectiveness of the remedy.

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Appendix I
Ecological Risk Assessment

Ecological Risk Assessment
Five-Year Review of Operable Units 1 and 4
Lava Cap Superfund Site, Nevada City, California

PREPARED FOR: United States Environmental Protection Agency, Region 9

PREPARED BY: CH2M HILL

DATE: December 20, 2010

1.0 Introduction

The purpose of this Technical Memorandum (TM) is to support the Five-Year Review of the Lava Cap Mine Operable Units OU1 (Mine Area) and OU4 (Mine Area Residences, originally a component of the Mine Area) in Nevada County, California. Specifically, this TM provides the current status of the Site relative to changes in ecological risk exposure pathways after completion of the remedial action and describes how remaining risks, if any, are being managed.

The Record of Decision (ROD) selecting the remedy for the Mine Area OU was issued by the United States Environmental Protection Agency (USEPA) in September 2004 (USEPA, 2004a). The ROD addresses soil, sediment, and surface water contaminated with arsenic in the Mine Area including the mine buildings, waste rock pile, tailings pile, log dam at the south end of the tailings pile, and tailings deposition along Little Clipper Creek (LCC) downstream to Greenhorn Road. Additionally, the ROD addresses soil contamination at two residences (Upper and Lower Rentals) included in OU1. An Explanation of Significant Differences was signed in September 2006 to document changes to the remedy required at the Lower Rental residence in OU1 (USEPA, 2006a). In 2005, two other residences in the Mine Area OU were designated as a separate OU after the ROD was approved. These are known as the Mine Area Residences OU (OU4). The ecological risk assessment (ERA) for the Lava Cap Mine was completed in 2001 as part of the Remedial Investigation (RI) (USEPA, 2001a) and was reviewed as part of this evaluation. The Remedial Action Reports for OU1 (CH2M HILL, 2010) and OU4 (CH2M HILL, 2007) were also reviewed.

As described in USEPA's guidance for conducting Five-Year reviews (USEPA 2001b), a key purpose of the review process for a site is to determine if the remedy is, or upon completion will be, protective of human health and the environment. The following three questions are part of the technical assessment of the protectiveness of the remedy (USEPA 2001b):

- Question A: Is the remedy functioning as intended by the decision documents?
- Question B: Are the exposure assumptions, toxicity data, and remedial action objectives used at the time of remedy selection still valid?

- Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

To determine whether the remedy at Lava Cap Mine OUs 1 and 4 remains protective of the environment, this TM summarizes the ERA results and evaluates changes in site conditions, exposure pathways, and toxicity values since completion of the ERA and selection of the remedy. An evaluation for human health risks is provided in a separate TM.

2.0 Ecological Risk Assessment – Summary of Results

The ERA for the Site was performed in accordance with USEPA and California Department of Toxic Substances Control (DTSC) guidance and the results were presented in Appendix F of the RI report (USEPA 2001a). Potential risks to fish, sediment biota (benthic invertebrates), amphibians (e.g., red-legged frog), terrestrial plants, soil invertebrates (earthworms), soil microbial processes, and birds and mammals (e.g., American dipper, red-tailed hawk, green heron, California quail, mink, ornate shrew, California vole, and long-tailed weasel) from Site-related contamination in surface water, sediment, and soil in four areas at the Lava Cap Mine were evaluated in the ERA. Operable Units 1 and 4 are represented in the ERA by the Mine Area and the upper half of the Midgradient Area (Figure 1). Conservative estimates of exposure for each receptor were compared to literature-derived ecotoxicity screening values and available site-specific toxicity thresholds. Results of site-specific ambient media toxicity bioassays and biological surveys were used as additional lines of evidence in the evaluation.

2.1 Mine Area

This subarea includes the vicinity of the mine itself (i.e., the historic mine buildings and the waste rock/tailings pile source areas) (Figure 1), and sampling of surface soil, surface water, sediment, groundwater, air, and biota focused on areas adjacent to or near those source areas. Surface water and sediment were collected in a seasonally-ponded portion of LCC channel located northeast of the waste rock/tailings and from a pond near the residence located northwest of the historic mining operations (one of the OU4 residences).

Risks to plants and animals from exposure to Mine Area surface water, sediment, and/or soil are summarized in Table 1. Antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, cyanide, lead, manganese, mercury, nickel, selenium, silver, and zinc were found to present risk to aquatic and terrestrial receptors. Bird and mammal receptors that were assumed to forage in close association with affected media were primarily at risk from arsenic (all receptors, except for the red-tailed hawk, which has a large home range).

2.2 Midgradient

This subarea encompasses the LCC drainage below the mine and serves as the link between the contaminant source area and the primary downstream deposition and accumulation areas, including Lost Lake (Figure 1). The creek has a steep gradient in this area, and significant tailings deposition occurs only in isolated areas (i.e., those areas included in OU1). Overall, this section is approximately 1 mile long, but the portion included in OU1 is only about a third of this). Samples of surface soil and water, sediment, groundwater and biota were collected.

Risks to plants and animals from exposure to Midgradient Area surface water, sediment, and/or soil are summarized in Table 1. Antimony, arsenic, barium, cadmium, cyanide, lead mercury, silver, and zinc were found to present risk to aquatic and terrestrial receptors. Bird (only American dipper) and mammal (all) receptors were primarily at risk from arsenic.

3.0 Changes in Site Conditions

Remedial actions at OU1 included the removal of tanks, vats, sumps, and contaminated soil from in and around the main mine buildings and the installation of fencing as well as a vegetative cap to cover areas around the mine storage buildings. The waste rock pile was also contoured, covered, and revegetated to promote runoff and reduce surface infiltration. As part of this area, the Upper Rental residence and Lower Rental residence (addressed in the Explanation of Significant Differences) were demolished and the areas were included in the contouring and revegetation of the waste rock pile. Tailings and adjacent contaminated soil or sediment from around the site and from LCC in the Tensy Lane area (Figure 1) were consolidated into the tailings pile, which was regraded and capped with a low-permeability engineered cover system, including a vegetative layer. Additionally, the failed log dam was replaced with a rock buttress at the downstream end of the tailings pile. LCC and smaller Mine Area drainage channels were engineered to divert LCC and all other clean surface water flows around the mine buildings, tailings pile and waste rock pile. Excavated areas were regraded and, in some cases, backfilled with soil from a clean borrow source. In November 2007, areas along LCC were revegetated.

The implementation of institutional controls including land use restrictions to protect the remedy from physical disturbance and prohibit residential use is in progress for the capped and vegetated areas. Namely, USEPA is currently working with the property owner to record deed restrictions that will provide for remedy protection. The downstream areas of LCC (where sediment was excavated near Tensy Lane and down to Greenhorn Road) are not under post-remedy restrictions for future uses. Currently, there is continuing surface water drainage from the mine adit. This drainage contains elevated levels of arsenic and flows, via engineered channels, along the tailings pile and into LCC below the rock buttress. As part of the phased implementation of the Mine Area OU remedy, treatment of the mine drainage is planned as the final component of the OU1 remedy.

The primary focus of the remedy at OU4 was to excavate contaminated soil from around two Mine Area residences located northwest and west of the main mine buildings, backfill the excavated areas with soil transported from a clean borrow source, and consolidate excavated material in the tailings disposal area for long-term management. Associated activities included stormwater control and paving roads/driveways that had been covered with mine waste materials. This remedy was completed as described for one of the parcels (39-160-16); however, additional investigation at parcel 39-160-21 indicated that arsenic concentrations in soils surrounding the residence were within the range of naturally occurring levels for the bedrock in this area (CH2M HILL, 2005). Furthermore, the parcel is located at a higher elevation than the mine area and, other than the access road, has not been affected by mine waste. Therefore, the remedy for this parcel only included paving the access road.

Post-excavation confirmation samples were collected in three areas: the slopes adjacent to the drainage channels surrounding the waste rock and tailings piles, the excavation areas along the ridge above the Mine Buildings, and the LCC drainage in the Tensy Lane area (CH2M HILL, 2010a). All surficial materials had been removed in all three areas, leaving only weathered bedrock at the ground surface. As was observed in parcel 39-160-21, the weathered bedrock in the mine area that has not been affected by mining activities contains higher naturally-occurring arsenic concentrations than surface soils sampled as part of the background soil investigation. Therefore, these confirmation samples that were collected from weathered bedrock contained arsenic above USEPA's target cleanup goal of 20 milligrams per kilogram (mg/kg). However, arsenic concentrations in these areas are currently much lower than the contaminated materials that were removed, and there is generally no evidence of residual mine waste contamination in these areas. The one exception is on the ridge above the Mine Buildings where historical mine operations may have resulted in isolated impacts to the bedrock walls of the bermed area. However, arsenic concentrations in this bedrock area are much lower than in the native bedrock materials removed from the mine (i.e., the waste rock).

Recent anecdotal information provided by local residents suggests that fish and amphibian populations may be increasing since completion of the OU1 and OU4 remedies (Crull, 2010). These observations were primarily made in areas south of OU1 and OU4, where residents noted that frog populations seemed to drop after 1997 but are now coming back and that vegetation as well as fish and other wildlife (e.g., Canada geese) appear more abundant. Furthermore, one resident also observed frogs and salamanders in an area near OU1.

4.0 Changes in Exposure Pathways

The following exposure pathways were evaluated in the ERA:

- Fish, amphibians, aquatic birds, and mammals exposed to surface water via direct contact, ingestion, and bioaccumulation through the foodweb
- Benthic invertebrates and aquatic birds and mammals exposed to sediment via direct contact, ingestion, and bioaccumulation through the foodweb
- Soil microbial processes exposed directly to soil, plants exposed to soil via direct contact and root uptake, soil invertebrates exposed to soil via direct contact and ingestion, and terrestrial birds and mammals exposed to soil via direct contact, ingestion, and bioaccumulation through the foodweb

The Mine Area OU remedy has eliminated or significantly limited exposure pathways to key source areas (i.e., the tailings pile is capped, so the exposure pathway from elevated metals in this area to ecological receptors is incomplete; contouring and vegetative cover over the waste rock pile limits infiltration of rainwater, preventing leaching of contaminants into surface water at the site; and diversion of LCC and engineered drainage channels prevent surface water from flowing through the capped areas, which also prevents leaching of contaminants from these areas). Removal of tailings and contaminated sediments along LCC near Tensy Lane has also eliminated an exposure pathway to site-related contaminants. Although areas of the site (including those areas on one of the residential parcels in OU4) 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. The one exception identified above (i.e., on the ridge above the Mine Buildings) is limited to isolated patches on the bedrock walls of the bermed area that may have been affected by mine operations. These isolated areas are unlikely to be significant exposure pathways for ecological receptors. Institutional controls (i.e., deed restrictions) to protect the remedy from physical disturbance and prohibit residential use will, when implemented, ensure that these pathways remain incomplete. Currently, routine operations and management inspections are used to confirm that the remedy components have not been compromised.

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, risks to these receptors from exposure to arsenic may be occurring. 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.

5.0 Changes in Toxicity Values

The primary contaminant of concern at the Mine Area OU is arsenic. Because arsenic is an indicator chemical for areas that have been affected by releases for the Lava Cap Mine (USEPA, 2004b), it is assumed that areas cleaned up to meet arsenic thresholds are the same areas that had contained elevated concentrations of other metals. Therefore, remedies that address arsenic contamination are likely to also address contamination from all of the inorganics of concern. Arsenic cleanup goals determined by USEPA to be protective of human health and the environment and to meet regulatory requirements were 10 micrograms per liter (µg/L) in surface water, 25 mg/kg in sediment, and 20 mg/kg in soil. The surface water cleanup goal is the drinking water maximum concentration limit (MCL), and the sediment and soil goals represent background for the site. Arsenic benchmarks for earthworms, microbes, aquatic invertebrates, and aquatic organisms have not changed since 2001 (Table 2). Additionally, toxicity reference values for birds have not changed, and those for mammals have only slightly increased (0.396 to 1.04 milligrams per kilogram per day [mg/kg-day] for the no observed adverse effects level [NOAEL] and 1.58 to 1.66 mg/kg-day for the lowest observed adverse effects level [LOAEL]; Table 3) such that changes to risks and potential cleanup goals are not expected. The soil benchmark for plants has been revised from 11.2 mg/kg to 18 mg/kg (Table 2). Because this value is below background (20 mg/kg), cleanup to background soil concentrations is still recommended and would also not affect cleanup goals or the remedy.

Soil, sediment, and surface water toxicity benchmarks were last evaluated in a TM dated October 6, 2003, and titled *Proposed Cleanup Concentrations for Ecological Risks at Lava Cap Mine, Nevada County, California* (CH2M HILL 2003). These and additional relevant updates to toxicity benchmarks since 2003 are described in the following sections.

5.1 Soil

Since 2003, the USEPA has published updates to the Ecological Soil Screening Levels (Eco-SSLs) for antimony (2005a), arsenic (2005b), barium (2005c), beryllium (2005d), cadmium (2005e), cobalt (2005f), copper (2007a), lead (2005g), manganese (2007b), nickel (2007c), selenium (2007d), silver (2006b), and zinc (2007e). These documents derive screening levels for plants, invertebrates, birds, and mammals as possible, given the available toxicity literature. Table 3 provides new avian and mammalian NOAELs and LOAELs developed from these updated Eco-SSL reports. Updated Eco-SSLs for plants and soil invertebrates (earthworms) are provided in Table 2. There have been no updates to the soil screening benchmarks for microbes (from Efroymson et al., 1997).

The updated benchmarks for plants and invertebrates presented in Table 2 were taken directly from their respective Eco-SSL reports. For birds and mammals, the new NOAELs and LOAELs were derived from studies provided in the development of the NOAEL-based Eco-SSLs. The Eco-SSLs are generally based on the geometric mean of NOAELs from studies with endpoints on growth, reproduction, and mortality for the chemical of interest. In some cases, a geometric mean could not be derived, and a NOAEL was selected from the available toxicity studies. The dietary dose (in mg/kg-day) associated with the Eco-SSL (a soil concentration reported in mg/kg) is presented as the NOAEL in Table 3. The LOAEL shown in Table 3 was derived from the studies used in the Eco-SSL development and provided in the respective reports for each metal. The updated TRVs for thallium are from the *Wildlife Toxicity Assessment for Thallium* developed by the United States Army Center for Health Promotion and Preventive Medicine (USACHPPM, 2007).

Plant and earthworm toxicity tests were performed on soil from the Lava Cap Mine site and used to develop site-specific toxicity levels. Because the earthworm bioassay data allowed for the development of site-specific no observed effects concentrations (NOECs) and lowest observed effects concentrations (LOECs), it was recommended that preference be given to the site-specific values over literature-derived LOECs. In contrast, 100 percent of seeds failed to germinate in the sample from the mine property and no effect was observed in other samples used in the plant toxicity tests. Therefore, only a 100 percent effects concentration (EC_{100}) was developed. In cases where the EC_{100} exceeds the literature benchmark, the literature benchmark (10th percentile LOEC) is recommended, as the metal of interest likely contributed to the toxicity observed. If, however, the EC_{100} is less than the plant benchmark, then this metal is unlikely to be a driver in the toxicity observed, and the EC_{100} is recommended over the more conservative literature benchmark.

5.2 Sediment

There were no updates to sediment benchmarks for the aquatic invertebrates. The NOECs and LOECs presented in Table 2 were developed from site-specific ambient media toxicity tests, and were considered sufficient for determining risks to aquatic invertebrates. Therefore, literature-based sediment quality criteria were not evaluated for updates.

5.3 Surface Water

Although the California Water Quality Standards document known as the California Toxics Rule (USEPA, 2000) has not been updated, federal water quality criteria have been updated several times since 2003. The latest version was released in 2009 and the criteria are now

referred to as National Recommended Water Quality Criteria (NRWQC) (USEPA, 2009). Cadmium was the only chemical of ecological concern (COEC) at Lave Cap Mine with an updated continuous chronic criterion (CCC) (Table 2). There have been no updates to the amphibian benchmarks.

No effects were observed in the surface-water bioassays using Lava Cap Mine site surface water; therefore, only a NOEC was developed in the ERA. Because these tests were considered acute, an uncertainty factor was applied to the NOEC. If the adjusted NOEC (i.e., NOEC multiplied by 0.1) is lower than the literature value, then the literature value takes precedence. If the adjusted NOEC is higher, the use of the adjusted NOEC is recommended because no effects were observed in the toxicity test, indicating the lower benchmark is overly conservative.

6.0 Conclusions

Based on the above technical assessment, the three questions presented in the Introduction that relate to the protectiveness of the OU1 and OU4 remedies are answered as follows:

- Question A – Is the remedy functioning as intended by the decision documents? Onsite construction and caps over the waste rock and tailings piles has eliminated ecological exposure pathways to source areas. Although the institutional controls (i.e., deed restrictions) needed to protect the remedy from physical disturbance and prohibit residential use are not complete, routine operations and management inspections are currently used to confirm that the remedy components have not been compromised and that these exposure pathways remain incomplete. Areas outside the main sources that were affected by mine tailings and contamination have also been excavated and removed. During the remedial design phase for Parcel 39-160-21 in OU4, it was determined that the weathered bedrock that has not been affected by mining activities contains higher naturally-occurring arsenic concentrations than surface soils sampled as part of the background soil investigation. Naturally-occurring arsenic concentrations were similarly high in areas in OU1 that were excavated to weathered bedrock based on confirmation sampling results. Although there may be some uncertainty as to the protectiveness of the remedy based on these results, there is no indication of residual mine affects in the excavation areas around LCC that are likely to be used by ecological receptors. Drainage from the Mine adit currently contributes to arsenic loading in LCC below the rock buttress. However, the final remedy for this drainage (i.e., treatment) is expected to reduce arsenic concentrations to the action level. Therefore, the remedy is (or will be in the case of the mine drainage) functioning as intended by the decision documents. Furthermore, recent anecdotal information suggests that ecological receptors such as fish and amphibian populations may be increasing in areas down-gradient from OU1.

- Question B – Are the exposure assumptions, toxicity data, and remedial action objectives used at the time of remedy selection still valid? The exposure assumptions used at the time of remedy selection have not changed. Since the ERA was completed in 2001, toxicity benchmarks for several inorganic-receptor combinations have been updated. Some of these benchmarks are currently lower than those used in the ERA (Tables 2 and 3) and may result in an increase in estimated ecological risks. However, toxicity

thresholds for arsenic (the primary contaminant of concern) have either not changed or have only slightly increased (for plants and mammals only), indicating that selected cleanup goals remain protective. The Mine Area OU remedy included excavation and removal of soil and sediment in areas with arsenic greater than background (20 mg/kg) and capping of source areas. Because these areas also represent source areas for the other site-related metals, the uncertainties related to changes in toxicity thresholds and risk are not likely to affect the protectiveness of the remedy.

- Question C – Has any other information come to light that could call into question the protectiveness of the remedy? The presence of naturally-occurring arsenic in weathered bedrock at concentrations that may pose a risk to ecological receptors may affect the degree of risk reduction provided by the remedy. However, these naturally occurring levels are not site-related, except in one isolated excavated area that is unlikely to adversely affect ecological receptors. Therefore, the remedy is considered protective.

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TABLE 1
Summary of Assessment Endpoints and Risk Drivers By Lava Cap Mine Site Area
Lava Cap Mine Superfund Site, Nevada County, California

Assessment Endpoint							Weight-of-Evidence Conclusions	
Entity	**Attribute**	**Effect Level**	**Conceptual Model Group**	**Representative Receptor**	**Assessment Level**	**Available Lines of Evidence**	**Mine Area**	**Midgradient Area**
Fish	Growth, reproduction, or survival	20% reduction of attribute	Aquatic Organism	NA	Community	Single-chemical Toxicity Data Body-burden Toxicity Data Ambient Media Toxicity Tests	Ag, As, Ba, Be Cd, Cyanide, Co, Cu, Hg, Mn, Ni, Pb, Sb, Zn	As, Ba, Cd, Cyanide, Pb, Zn
Benthic Invertebrates	Growth, reproduction, or survival	20% reduction of attribute	Sediment Biota	NA	Community	Single-chemical Toxicity Data Ambient Media Toxicity Tests Biological Surveys	Ag, As, Cd, Cu, Hg, Pb, Sb, Se	Ag, Pb
Amphibians	Individual health and survival	No acceptable effect	Aquatic Organism	Red-legged Frog	Individual	Single-chemical Toxicity Data	Ag, As, Cu, Hg, Mn, Ni, Pb, Zn	As
Terrestrial Plants	Growth, reproduction, or survival	20% reduction of attribute	Soil Biota	NA	Community	Single-chemical Toxicity Data Ambient Media Toxicity Tests	Ag, As, Cyanide, Cd, Co, Cu, Hg, Pb, Sb, Se, Zn	Ag, As, Cd, Hg, Sb, Zn
Soil Invertebrates	Growth, reproduction, or survival	20% reduction of attribute	Soil Biota	NA	Community	Single-chemical Toxicity Data Ambient Media Toxicity Tests	Ag, As, Cyanide, Cd, Co, Cu, Hg, Pb, Sb, Se, Zn	Hg
Soil Microbial Processes	Growth, reproduction, or survival	20% reduction of attribute	Soil Biota	NA	Ecosystem	Single-chemical Toxicity Data	Ag, As, Cd, Cu, Ni, Pb, Zn	As
Birds	Growth, reproduction, or survival	20% reduction of attribute	Aquatic Insectivore	American Dipper	Population	Single-chemical Toxicity Data Target Organ Toxicity Data	As, Co, Cu, Hg, Mn, Pb, Se	As, Se
	Growth, reproduction, or survival	20% reduction of attribute	Piscivore	Green Heron	Population	Single-chemical Toxicity Data	As	None
	Growth, reproduction, or survival	20% reduction of attribute	Carnivore	Red-tailed Hawk	Population	Single-chemical Toxicity Data	None	None
	Growth, reproduction, or survival	20% reduction of attribute	Herbivore	Califonia Quail	Population	Single-chemical Toxicity Data	As	None
Mammals	Growth, reproduction, or survival	20% reduction of attribute	Herbivore	California Vole	Population	Single-chemical Toxicity Data Target-organ Toxicity Data	As, Cyanide, Pb	As
	Growth, reproduction, or survival	20% reduction of attribute	Insectivore	Ornate Shrew	Population	Single-chemical Toxicity Data Target Organ Toxicity Data	As, Cyanide, Pb, Sb	As
	Growth, reproduction, or survival	20% reduction of attribute	Piscivore	Mink	Population	Single-chemical Toxicity Data	As	As
	Growth, reproduction, or survival	20% reduction of attribute	Carnivore	Long-tailed Weasel	Population	Single-chemical Toxicity Data	As	As

TABLE 2

Comparison of Updated Toxicity Benchmarks for Soil, Sediment, and Surface Water to Those Used in the 2001 Ecological Risk Assessment[a]

Lava Cap Mine Superfund Site, Nevada County, California

	Soil											Sediment			Surface Water					
	Earthworms					Plants				Microbes[a]		Aquatic Invertebrates[b]			Aquatic Organisms				Amphibians[b]	
Ecological Risk Driver	Site-specific NOEC	Site-specific LOEC	Literature LOEC	Updated Literature Eco-SSL[c]	Change in Toxicity	Site-specific EC100	Literature LOEC	Updated Literature Eco-SSL[c]	Change in Toxicity	Literature LOEC	Soil Background[d]	Site-specific NOEC[e]	Site-specific LOEC[e]	Sediment Background[d]	Site-specific NOEC[f]	Chronic Literature Threshold	Updated Chronic Threshold[g]	Change in Toxicity	Literature LOEC[h]	Surface Water Background[d]
Ag	15.3	30.7	NA	NC	same	15.4	2	NC	same	50	0.28	0.709	1.19	0.22	0.032	3.60[i]	NC	same	4.1	0.04
As	3725	7450	68	NC	same	1862.5	11.2	18	less toxic	187.3	*20/104*[n]	206	3400	24.6	116	150[j]	NC	same	40	1.80
Ba	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.42	4[k]	NC	same	-	*27*
Be	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.001	5.3[k]	NC	same	-	0.23
Cd	4.725	9.45	18	140	less toxic	2.36	4	32	less toxic	19.6	0.41	0.341	0.938	0.269	0.016	2.12[l]	0.24[m]	more toxic	-	0.46
Cyanide	23.6	47.2	NA	NC	same	11.8	NA	NC	same	-	0.68	-	-	-	0.4	5.2[j]	NC	same	-	1.50
Co	19.5	27	NA	NC	same	27	32	13	more toxic	-	18.9	-	-	*13.8*	0.059	23[k]	NC	same		1.04
Cu	94.4	122	66.5	80	less toxic	121.5	100	70	more toxic	186	*86.5*	7.89	42.3	*64.6*	0.291	8.49[l]	NC	same	25.7	1.83
Hg	0.21	0.43	0.5	NC	same	0.21	0.3	NC	same	-	*0.14*	0.031	0.144	*0.129*	0.0018	1.3[k]	NC	same	0.3	0.004
Mn	-	-	-	-	-	-	-	-	-	-	*1736*	-	-	*987*	16.5	120[k]	NC	same	1420	*239*
Ni	-	-	-	-	-	-	-	-	-	174.5	54.3	-	-	-	0.229	49.31[l]	NC	same	59.6	1.74
Pb	80.1	160	500	1700	less toxic	80.1	80	120	less toxic	960	*43.4*	5.39	5.46	*15.2*	0.151	2.41[l]	NC	same	46	0.59
Sb	14.6	29.3	78	NC	same	7.31	5	NC	same	-	1.22	0.516	1.24	1.01	0.366	30[k]	NC	same	-	0.08
Se	0.71	1.42	77	4.1	more toxic	0.354	1	0.52	more toxic	-	*0.6*	0.082	0.364	*0.4*	-	-	-	-	-	-
Zn	645	1290	189.2	160	more toxic	322.5	43.6	120	less toxic	107	*95.7*	-	-	-	15.9	112.02[j]	NC	same	900	3.30

[a] A dash indicates that the analyte was not a risk driver for the receptor and/or medium.

[b] There were no updates to benchmarks for microbes, aquatic invertebrates (site-specific values used), and amphibians.

[c] Ecological Soil Screening Values (EcoSSLs) that have been updated since the October 6, 2003 Technical Memorandum (CH2M HILL, 2003).

[d] Background concentration as presented in the Public Release Draft Mine Area FS (EPA, 2004b).

Background values shown in italics are higher than one or more of the risk-based concentrations (except NOEC values).

[e] An acute to chronic uncertainty factor of 10 was applied.

[f] Only site-specific NOECs are available, no effects were observed in site-specific bioassays. An acute to chronic uncertainty factor of 10 was applied.

[g] National Recommended Water Quality Criteria (NRWQC; EPA 2009) that have been updated since the October 6, 2003, Technical Memorandum (CH2M HILL, 2003).

[h] The lowest of either the larval or embryo LOEC was selected.

[i] Value derived from California ambient water quality standard (CAWQS) criterion maximum concentration (EPA, 2000; no chronic value available). Adjusted for site-specific water hardness. The median value from the four Lava Cap Mine sites was selected.

[j] Value is the CAWQS criterion continuous concentration (CCC).

[k] Value is the Oak Ridge National Laboratory aquatic Tier II secondary chronic value (Suter and Tsao, 1996).

[l] Value derived from California ambient water quality standard (CAWQS) CCC. Adjusted for site-specific water hardness. The median value from the four Lava Cap Mine sites was selected.

[m] Value derived from NRWQC CCC. Adjusted for site-specific water hardness. The median value (95.5 mg/L) from the four Lava Cap Mine sites was selected.

[n] Arsenic background (95th Percentile) estimated for the Main Residence Parcel (39-160-21) which contains higher naturally-occurring arsenic concentrations than surface soils sampled as part of the background soil investigation (CH2MHILL 2005). This was also observed in areas that were excavated to weathered bedrock (CH2MHILL 2010a).

NA = no literature threshold was available.

NC = no change

TABLE 3

Summary of Updated Wildlife Toxicity Data for the Lava Cap Mine Site[a]

Lava Cap Mine Superfund Site, Nevada County, California

Analyte	Taxon	NOAEL	LOAEL	New NOAEL	New LOAEL	New Source	Change in Toxicity
Antimony	mammal	0.059	0.59	NC	NC	USEPA 2005a	same
Arsenic	bird	9.3	40.3	NC	NC		same
Arsenic	mammal	0.396	1.58	1.04	1.66	USEPA 2005b	less toxic
Barium	bird	20.8	41.7	NC	NC		same
Barium	mammal	5.1	NA	51.8	75	USEPA 2005c	less toxic
Beryllium	mammal	0.66	NA	0.532	NA	USEPA 2005d (same study with different BW)	more toxic
Cadmium	bird	0.16	0.61	1.47	2.37	USEPA 2005e	less toxic
Cadmium	mammal	1	10	NC	NC		same
Cobalt	bird	0.49	0.98	7.61	7.8	USEPA 2005f	less toxic
Cobalt	mammal	0.545	5.45	7.33	10.9	USEPA 2005f	less toxic
Copper	bird	47	61.7	4.05	12.1	USEPA 2007a	more toxic
Copper	mammal	11.7	15.4	5.6	9.34	USEPA 2007a	more toxic
Cyanide	mammal	0.15	0.5	NC	NC		same
Lead	bird	0.113	3.52	1.63	3.26	USEPA 2005g	more toxic
Lead	mammal	1	4.7	NC	NC		same
Manganese	bird	98	977	179	348	USEPA 2007b	more toxic
Manganese	mammal	88	284	51.5	71	USEPA 2007b	more toxic
Mercury	bird	0.068	0.37	NC	NC		same
Mercury	mammal	0.077	0.11	NC	NC		same
Nickel	bird	77.4	106.9	6.71	11.5	USEPA 2007c	more toxic
Nickel	mammal	6.8	31.63	1.7	3.4	USEPA 2007c	more toxic
Selenium	bird	0.4	0.8	0.29	0.579	USEPA 2007d	more toxic
Selenium	mammal	0.2	0.33	0.143	0.215	USEPA 2007d	more toxic
Silver	mammal	2.38	23.8	6.02	60.2	USEPA 2006b	less toxic
Thallium	mammal	0.0074	0.074	0.015	0.075	USACHPPM 2007	less toxic
Zinc	bird	14.5	131	66.1	66.5	USEPA 2007e	more toxic
Zinc	mammal	9.7	1220	75.4	75.9	USEPA 2007e	more toxic

Notes:

[a]Toxicity data are shown as a dietary dose of miligram analyte per kilogram body weight per day (mg/kg-day)

NC = no change from either the original 2001 Ecological Risk Assessment (ERA) (EPA, 2001a) or the 2003 Technical Memorandum titled *Proposed Cleanup Concentrations for Ecological Risks at Lava Cap Mine, Nevada County, California* dated October 6, 2003 (CH2M HILL, 2003).

New = updated toxicity information since either USEPA (2001a) or CH2MHILL (2003); primarily updates to the Ecological Soil Screening Values (Eco-SSLs) from USEPA

USEPA = United States Environmental Protection Agency

USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

Shaded studies are those that were updated in 2003 from toxicity studies used in the 2001 ERA.