



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
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**Final Removal Action Report for  
Black Butte Mine  
Cottage Grove, Oregon**

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**REMOVAL ACTION REPORT  
BLACK BUTTE MINE SITE  
COTTAGE GROVE, OREGON**

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BLACK BUTTE MINE SITE  
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## LIST OF ACRONYMS

<u>Acronym</u>	<u>Definition</u>
AINW	Archaeological Investigations Northwest
BBM	Black Butte Mine
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
E & E	Ecology and Environment, Inc.
EQM	Environmental Quality Management, Inc.
EPA	United States Environmental Protection Agency
ERRS	Emergency and Rapid Response Services
H&S	health and safety
mg/kg	milligrams per kilogram
mg/m <sup>3</sup>	milligrams per cubic meter
NCP	National Contingency Plan
ODEQ	Oregon Department of Environmental Quality
OSC	On-Scene Coordinator
POLREP	pollution report
PRG	preliminary remediation goal
PRP	potentially responsible party
PST	Pacific Strike Team
SLV	Screening Level Values
SSSP	Site-Specific Sampling Plan
SHPO	State Historical Preservation Office
START	Superfund Technical Assessment and Response Team
SPLP	Synthetic Precipitate Leaching Procedure
TCLP	Toxicity Characteristic Leaching Procedure
TDD	Technical Direction Document
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
XRF	X-ray Fluorescence



## **EXECUTIVE SUMMARY**

The United States Environmental Protection Agency (EPA) has completed a Removal Action at the Black Butte Mine site near Cottage Grove, Oregon in Lane County. The site is the location of a former mercury mine and previous environmental investigations indicated widespread mercury contamination in site surface soils and mine waste-rock and tailings.

The site is currently owned by the Land and Timber Company who purchased it in 1994. Site investigations have been performed by the Oregon Department of Environmental Quality, Oregon State University and others since the early 1990s. The EPA completed a removal assessment at the site in 2006 and recommended a removal action (E & E 2006).

The Removal Action was performed between August 20 to September 3, 2007. During the Removal Action, the EPA and its contractors regraded the steep slopes of the site's Main Tailings Pile along one of the three creeks at the site to prevent tailings material to continue washing into the creek. The action level for water quality in the impacted creeks was defined as three times the background concentration.

A substantial amount of tailings were removed during the regrading and used as capping material for two other highly contaminated areas on the site. The material used for capping contained mercury at concentrations less than the action level established for dermal contact, and was confirmed by on-site sampling and analysis.

During the Removal Action, additional analytical assessment was performed on Furnace Creek sediments and banks. The results indicated there was much more extensive contamination than anticipated. In addition, the creek was highly vegetated and any clearing and excavation of these materials had a potential for environmental damage. Excavation of all the contaminated materials within and along Furnace Creek was beyond the budgeted ceiling and duration for the planned Removal Action. Clean up of that area was referred to the EPA Site Assessment group to evaluate for listing the site on the National Priorities List, however further removal actions at the site may also be identified.

The final report is organized into the following sections: Summary of Events (Section I), Effectiveness of Removal Action (Section II), Difficulties Encountered (Section III), Recommendations (Section IV), and References (Section V). Selected photographs of site activities are included in Appendix A.



## **I. SUMMARY OF EVENTS**

### **A. SITE CONDITIONS AND BACKGROUND**

This section includes a description of the site location, site layout, a brief summary of the history of operations at the site, and previous investigations.

#### **1. Initial Situation**

The Black Butte Mine (BBM) is a former mercury mine located in southern Lane County, in the Coast Fork Willamette River Basin; approximately ten miles south of Cottage Grove, Oregon (see Figure 1-1). The BBM is located on the northwest flank of Black Butte at latitude 43 degrees 34 minutes 42 seconds north, longitude 123 degrees 3 minutes 58 seconds west in Section 6, Township 23 South, Range 3 West of the Willamette Baseline and Meridian. The site is bordered to the northeast by Dennis Creek, to the southwest by Furnace Creek, to the southeast by Black Butte mountain, and to the northwest by Garoutte Creek and the Pooler residence. Both Dennis Creek and Furnace Creek flow west–northwest to Garoutte Creek which flows northward approximately six miles to the Coast Fork of the Willamette River. The Coast Fork of the Willamette River empties into Cottage Grove Reservoir. Motor vehicle access to the site is restricted by locked gates. The road leading to one of the gates crosses private property owned by Michael Pooler. Mr. Pooler is a former BBM worker and currently lives at the entrance to the site.

The site layout is presented as Figure 1-2. The primary features of the site include a former mill structure containing a rotary kiln, mercury condenser, and ore storage/crushing equipment (New Furnace Area), another mill and furnace area (Old Ore Furnace), several old dilapidated buildings, waste rock / tailings piles, a system of unimproved roads, and mine adits. The main tailings pile, containing both waste rock and mill tailings, is located in a relatively flat area below the New Furnace Area. It is bordered on the northeast by Dennis Creek. Remnants of a second waste pile lie to the northwest of the Old Ore Furnace. This area borders Furnace Creek to the southwest.

The BBM was first operated in the late 1890s. The mine operated intermittently through the late 1960s, with peak production occurring during the period from 1927 to 1943. Between the years 1900 and 1957, a total of 16,904 flasks of elemental mercury were produced at the mine (one flask equals 76 pounds). The current owner, Land and Timber Company, has used the property for logging.

There have been no previous removal actions at the BBM Site. However, there have been a number of previous sampling events. Prior sampling or assessment events include:

- Oregon State University (OSU), Department of Fisheries and Wildlife (OSU 1990);
- U.S. Fish and Wildlife Service (USFWS 1992);
- U.S. Geological Survey (USGS 1993);
- OSU Department of Fisheries and Wildlife (OSU 1992, 1994);
- Oregon Department of Environmental Quality (ODEQ) Preliminary Assessment (ODEQ 1996);
- E & E for U.S. Environmental Protection Agency (EPA) Region 10 Site Inspection (E & E 1999)
- OSU for U.S. Army Corps of Engineers, Portland, Oregon, Sources and Chronology of Mercury Contamination in Cottage Grove Reservoir (OSU 2003);
- OSU for ODEQ, Reconnaissance Soil Sampling at the BBM (ODEQ 2004).

These investigations are described in the “Black Butte Mine removal assessment Report” (E & E 2006).

In July 2004, ODEQ asked EPA to conduct a removal assessment . The removal assessment focused on the five main areas of contamination identified through previous investigations (Figure 1-2):

- Main Tailings Pile;
- Old Ore Furnace Area;
- New Furnace Area;
- Other areas of potential contamination (including adits and associated waste rock, seeps); and
- Sediment and water in Furnace Creek, Dennis Creek, and Garoutte Creek.

Field work for the removal assessment was performed in September 2005, and the final report with Removal Action recommendations was delivered to EPA in March 2006. Each of the five main areas of contamination were assessed based on the results of sampling and analysis for the removal assessment (E & E 2006) and on the results of the 1998 EPA site inspection (E & E 1999). Analytical methods utilized in site characterization included analyses for total mercury and arsenic, toxicity characteristic leaching procedure (TCLP), synthetic precipitate leaching procedure (SPLP), and selective sequential extraction of mercury. Removal Action

recommendations were made for the Main Tailings Pile, Old Ore Furnace Area, New Furnace Area, and Furnace Creek.

## **2. Action Levels**

The contaminant of concern, mercury, is a hazardous substance and pollutant or contaminant as defined by sections 101(14) and 101(33) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. § 9601(14) and (33).

The EPA Region 9 Preliminary Remediation Goal (PRG) for mercury in soil in a residential setting is 23 milligrams per kilogram (mg/kg)<sup>1</sup>. This value is based on the toxicity of mercuric chloride for dermal contact. Where the removal assessment's selective sequential extraction results indicated mercury was present in a soluble form, and the conceptual site model indicated the transport mechanism was strictly dermal contact, the clean up level was set at 23 mg/kg (Parker 2007). This action level was applied at the Old Ore Furnace area.

For areas of the site where selective sequential extraction results indicated that mercury was in tightly bound form, ODEQ recalculated the PRG based on mercuric sulfide rather than the more soluble mercuric chloride and determined that 115 mg/kg would be an equivalent action level. The action level for areas where dermal contact was a concern, and selective sequential extraction results indicated that mercury was in tightly bound form, was set at 115 mg/kg. This action level was applied at the New Furnace area, the regraded slopes of the Main Tailings Pile, and the material taken from the Main Tailings Pile to be used as clean cover.

In areas with potential for flooding or erosion into a creek and water quality was the primary concern, the action level was set at 10 mg/kg. This value was calculated by first determining the average background mercury concentration in the area (outside of the local area of soil formed from mercury bearing ore) and then multiplying this value by three. This action level was applied to the the Main Tailings Pile where material could move into Dennis Creek, to the Old Ore Furnace area where material could move into Furnace Creek, and to Furnace creek itself.

## **3. Location of Hazardous Substances**

The following sections summarize the results and recommendations from the removal assessment for BBM as well as additional characterization and confirmation sampling conducted during the Removal Action.

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<sup>1</sup> Note EPA Region 9 PRGs were used at the time of the Removal Assessment. The EPA Region 6 Human Health Medium Specific Screening Levels now in current use instead of the PRGs.

### **a) Main Tailings Pile**

Total mercury in waste rock / tailings samples collected from the Main Tailings Pile during the removal assessment ranged from 0.14 to 2,420 milligrams per kilogram (mg/kg). The maximum concentration of mercury was found in a sample from a depth of 16 to 20 feet below ground surface (bgs) and was located in the approximate middle of the Main Tailings Pile. This distribution of mercury was determined in the removal assessment to result from heterogeneity of tailings in terms of mineral and chemical composition, as well as a wide grain-size distribution. This heterogeneity is believed to be due to changes in ore processing equipment and techniques, the nature of the ore extracted over the period of mine operations, and the depositional history of mine waste rock / tailings. Leaching of mercury from tailings as precipitation migrates through the tailings was also considered to be a potential factor in this distribution. However, results of SPLP analysis for mercury in tailings samples from the Main Tailings Pile indicated that leaching is either not occurring or is occurring at a very low level. Sequential selective extraction of mercury also indicated that the mercury present in this area is not highly soluble. Based on these results, it was determined that the main mechanism for mercury within the tailings to migrate to adjacent creeks was through mechanical means such as erosion.

The waste rock / tailings along the northeast side of the Main Tailings Pile followed a steep angle down toward Dennis Creek. The waste rock / tailings along this side of the pile was unstable and subject to erosion and undercutting by unnamed drainages that were tributaries to Dennis Creek. Stabilization of waste rock / tailings in this area of the Main Tailings Pile was recommended to reduce the likelihood the material would continue to erode into Dennis Creek.

Additional sampling and analyses of the material from the Main Tailings Pile was completed during the Removal Action using a field portable x-ray fluorescence instrument (XRF). Results of the sampling and analyses are presented in Figures 2A, 2K, 2L, and 2N and are also summarized in Table I-1. Samples 10EK-1001 through 10EK-1028 were collected prior to excavation and re-grading of the slope to determine if mercury concentrations in these materials were low enough to be used as “clean cover” in other parts of the BBM Site. Total mercury concentrations in tailings samples, analyzed using an XRF, ranged from non-detect (or less than 9.7 mg/kg) to 340 mg/kg. Five of the 28 samples collected were above 115 mg/kg. Only material with a mercury concentration less than 115 mg/kg was used for capping other areas of the site. Material with mercury concentrations higher than 115 mg/kg were placed in the repository.

Samples 10EK-1031 through 10EK-1050 were collected from the eastern end of the Main Tailings Pile along Dennis Creek (see Figure 2A) after slope re-grading was completed to confirm that total mercury in exposed tailings was below the 115 mg/kg action level. Total mercury concentrations ranged from 18.5 mg/kg to 61.1 mg/kg. Samples 10EK-1051 through 10EK-1074 were collected from the western end of the Main Tailings Pile along Dennis Creek (see Figure 1L) after slope re-grading was completed to confirm that total mercury in exposed tailings was below the 115 mg/kg action level. Total mercury concentrations ranged from non-detect (or less than 10.8 mg/kg) to 36.4 mg/kg.

#### **b) Old Ore Furnace Area**

A thin layer of waste rock / tailings covered the majority of the area immediately adjacent to the Old Ore Furnace. Historically, tailings were reportedly removed from this area and reprocessed through the New Furnace after it became operational. Further downslope from the Old Ore Furnace, tailings were thicker and may not have been reprocessed. These tailings appeared to have spilled into Furnace Creek. Total mercury concentrations in tailings samples from the Old Ore Furnace Area, collected during the removal assessment, ranged from 16.1 mg/kg to 1,180 mg/kg. The highest concentration of total mercury (1,180 mg/kg) was detected in a tailings sample from 0 to 4 feet depth and located downslope of the Old Ore Furnace. Results of SPLP analysis for mercury in samples from the Old Ore Furnace area indicate that leaching is either not occurring or is occurring at a very low level. Sequential selective extraction mercury analyses of samples from this area suggested that the majority of mercury present in this area could be characterized as insoluble and but some of it was in a readily methylated form. Based on these results, it was determined that the primary mechanism for mercury transport was by mechanical processes such as erosion, however the lower action level of 23 mg/kg was used to address the more methylated forms of mercury present.

Additional sampling and analyses of the tailings and soil near the Old Ore Furnace Area was completed during the Removal Action using an XRF and a Lumex Mercury Analyzer with a soil attachment (Lumex). Results of the sampling and analyses are presented in Figures 2C through 2G and are also summarized in Table I-2. Samples 10EK-3001 through 10EK-3018 and 10EK-3019 through 10EK-3087 were collected to further delineate the extent of contamination in the area immediately adjacent to the Old Ore Furnace and upslope of the Old Ore Furnace, respectively. Further delineation was conducted to insure that any removal action conducted in this area would be complete. The action level for dermal exposure to mercury in this area was 23 mg/kg. Total mercury concentrations ranged from non-detect (or less than 12.4 mg/kg) to 10,500 mg/kg (Table I-2). Seventy-five of a total of 80 samples collected

immediately adjacent as well as upslope of the Old Ore Furnace were above the action level of 23 mg/kg.

Samples 10EK-3089 through 10EK-3109 were collected from the areas immediately adjacent and upslope of the Old Ore Furnace, after the area was capped, to confirm that total mercury was below the 115 mg/kg action level for the capping material. Total mercury concentrations by XRF in these 21 confirmation samples ranged from non-detect (or less than 12.5 mg/kg) to 22.9 mg/kg.

### **c) New Furnace Area**

During the removal assessment, the New Furnace Area was inaccessible to the Geoprobe so borings were not collected in this area. Instead, data from the Site Inspection were used in characterization. Total mercury concentrations in samples collected around the New Furnace ranged from 91.9 to 54,300 mg/kg. The highest concentrations of mercury were in the immediate area of the mill structure and furnace, possibly due to spillage of elemental mercury during processing activities.

Downslope from the New Furnace Area, total mercury concentrations in waste rock / tailings samples were less than 23 mg/kg. The low concentrations of mercury in these samples may be attributable to higher efficiency of the “New Furnace”. Mercury was detected in the SPLP leachate, at a low concentration of 0.00149 mg/L, from a tailings sample collected downslope from the New Furnace Area. In addition, sequential selective extraction analysis for mercury suggested that the mercury present in the waste rock / tailings in this area was not highly soluble or readily methylated.

To identify the edge of the area to be capped, additional sampling and analyses of the tailings and soil around the New Furnace Area were completed during the Removal Action using an XRF. Results of the sampling and analyses are presented in Figure 2B and are also summarized in Table I-3. Samples 10EK-2001 through 10EK-2023 were collected for this purpose and total mercury concentrations as analyzed using an XRF ranged from 32.6 mg/kg to 1,630 mg/kg (Table I-3).

Samples 10EK-2024 through 10EK-2046 were collected from the cap on the New Furnace Area to confirm that total mercury at the surface was below the 115 mg/kg action level. Total mercury concentrations in cap confirmation samples ranged from non-detect (or less than 11.4 mg/kg) to 94.1 mg/kg.

#### **d) Furnace Creek, Dennis Creek, Garoutte Creek**

Sampling of sediment and water from Furnace Creek, Dennis Creek, and Garoutte Creek was completed as part of the removal assessment. All of the sediment samples collected for the removal assessment, including the background samples, exceeded ecological screening criteria for mercury. Background concentrations were also higher than the selected criteria. Elevated background concentrations are natural and can be expected in a mineralized area such as the area surrounding BBM. Interpretation and recommendations were thus based on how mercury concentrations in downstream sediments compared to background sediment concentrations. Additional sampling and analyses of the tailings and sediment in Furnace Creek, Dennis Creek, and Garoutte Creek were completed during the Removal Action using both an XRF and a Lumex. Results of both sets of sampling and analyses are summarized for each creek in the following subsections.

##### **(1) *Furnace Creek***

Total mercury in only one of the sediment samples collected during the removal assessment substantially exceeded three times the background concentration of 1.7 mg/kg<sup>2</sup>. This sample was collected from Furnace Creek in the area where tailings downslope from the Old Furnace are in contact with the creek. This sample also was analyzed for monomethylmercury. The resulting monomethylmercury concentration of 0.0127 mg/kg exceeded the ODEQ Level II soil Screening Level Values (SLV) for plants.

Additional sampling and analyses of the tailings and sediment in Furnace Creek was completed during the Removal Action using both an XRF and a Lumex instrument. Sample locations extended upslope from the Old Furnace Area to Garoutte Creek. Results of the sampling and analyses of sediment and bank samples from Furnace Creek are presented in Figures 2C through 2J and are also summarized in Table I-4. Sediment and tailing samples 10EK-4001 through 10EK-4072 were collected from Furnace Creek itself. Total mercury concentrations in these samples ranged from 1.62 mg/kg to 486 mg/kg. Sediment and tailing samples 10EK-4001 through 10EK-4022, which are adjacent or upslope of the Old Furnace appear to represent background concentrations with the exception of 10EK-4010 (5.39 mg/kg). Total mercury concentrations ranged from 1.62 mg/kg to 5.39 mg/kg. Sediment and tailings samples 10EK-4023 through 10EK-4072 are located adjacent to the Old Furnace and extend down to Garoutte Creek. All samples had total mercury concentrations above background.

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<sup>2</sup> Note for Furnace Creek, three times the background concentration of 1.7 mg/kg is 5.1 mg/kg.

Total mercury concentrations for samples 10EK-4023 through 10EK-4072 ranges from 21.1 mg/kg to 486 mg/kg.

Soil and tailings samples 10EK-4101 through 10EK-4173 were collected from the northeast bank of Furnace Creek approximately five feet up from the creek itself. Total mercury concentrations from samples 10EK-4101 through 10EK-4122 appeared to represent background concentrations. Total mercury concentrations in these samples ranged from non-detect (or less than 0.08 mg/kg) to 3.99 mg/kg, with the exception of a single sample that had a concentration of 16.0 mg/kg. Total mercury concentrations in samples 10EK-4123 through 10EK-4173 were quite variable and ranged from non-detect (less than 0.08 mg/kg) to 9,160 mg/kg. These sample locations are adjacent to the Old Furnace and extend down to Garoutte Creek. Forty-four of the fifty-one samples collected from adjacent to or downslope of the Old Furnace exceeded three times the background concentration determined for Furnace Creek sediment.

Soil and tailings samples 10EK-4201 through 10EK-4273 were collected from the northeast bank of Furnace Creek approximately ten feet up from the creek itself. Total mercury concentrations from samples 10EK-4201 through 10EK-4223 appeared to represent background concentrations. Total mercury concentrations in these samples ranged from non-detect (less than 0.47 mg/kg) to 2.04 mg/kg. Total mercury concentrations in samples 10EK-4224 through 10EK-4273 were variable and ranged from non-detect to 358 mg/kg. These sample locations are adjacent to the Old Furnace and extend downstream to Garoutte Creek. Thirty-eight of the fifty samples collected from adjacent to or downslope from the Old Furnace exceeded three times the background concentration determined for Furnace Creek sediment.

Soil and tailings samples 10EK-6101 through 10EK-6273 were collected from the southwest bank of Furnace Creek, approximately five feet up from the creek bed. Total mercury concentrations ranged from non-detect (less than 0.60 mg/kg) to 267 mg/kg. Fifty-nine of the seventy-eight samples collected from the southwest bank exceeded three times the background concentration determined for Furnace Creek sediment.

## ***(2) Dennis Creek***

The background concentration for mercury in Dennis Creek sediments was determined to be 7 mg/kg, based on sampling completed in the removal assessment. Total mercury concentrations from sediment samples collected during the removal assessment ranged from 0.54 mg/kg to 7 mg/kg. The sample containing 7 mg/kg was taken from approximately 200 feet upgradient of the confluence of Dennis Creek with the drainage from the Dennis Creek Adit

area. The background concentration therefore may reflect the influence of mining activities further upslope of Dennis Creek Adit and 404 Adit<sup>3</sup> or aerial deposition of mercury from inefficient recovery during early processing operations (OSU 2004).

Sediment samples 10EK-8001 through 10EK-8041 were collected from within Dennis Creek. Sample locations extended upslope from the Main Tailings Pile and New Furnace Area to the confluence of Dennis Creek with Garoutte Creek. Results of the sampling and analyses of sediment from Dennis Creek are presented in Figures 2A, 2L, 2M, and 2N and are also summarized in Table I-5. Total mercury concentrations ranged from non-detect (less than 0.46 mg/kg) to 17.9 mg/kg. None of the forty-one samples collected from Dennis Creek sediments exceeded three times the Dennis Creek background concentration.<sup>4</sup>

### **(3) Garoutte Creek**

The background concentration for mercury in Garoutte Creek sediments was determined to be 0.45 mg/kg, based on sampling from the removal assessment. Total mercury concentrations from sediment samples collected during the removal assessment ranged from 0.45 mg/kg to 1.2 mg/kg.

Sediment samples 10EK-9001 through 10EK-9009 were collected from within Garoutte Creek during the Removal Action. Sample locations extended upslope from the Main Tailings Pile and New Furnace Area to the confluence of Dennis Creek with Garoutte Creek. Results of the sampling and analyses of sediment from Garoutte Creek are presented in Figure 2N and are also summarized in Table I-6. Total mercury concentrations ranged from non-detect (less than 0.17 mg/kg) to 2.02 mg/kg. One of the nine samples collected from Garoutte Creek sediments exceeded three times the Garoutte Creek background concentration<sup>5</sup>.

## **4. Cause of Release or Discharge**

Mercury occurs naturally at the BBM Site in mercury-bearing ore. The distribution of mercury throughout the BBM Site, however is primarily the result of the mining operations that occurred from the late 1890s through the late 1960s.

The primary ore mineral at the site was cinnabar, a mercuric sulfide. Minor amounts of metacinnabar (another form of mercuric sulfide) and elemental mercury were also naturally present in the ore (Brooks 1971). The extraction and processing of the mercury-bearing ore (including roasting of crushed ore) alters the mercury-bearing ore both physically and

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<sup>3</sup> Dennis Creek Adit and 404 Adit are adits associated with mining activities at Black Butte Mine that were investigated in the Removal Assessment (E & E 2006).

<sup>4</sup> Note for Dennis Creek, three times the background concentration of 7 mg/kg is 21 mg/kg.

<sup>5</sup> Note for Garoutte Creek, three times the background concentration of 0.45 mg/kg is 1.35 mg/kg.

chemically. Physically, the materials left after processing (waste rock and particularly tailings) are more vulnerable to mechanical movement through natural processes due to the smaller grain-size and are in unstable settings, such as in huge piles with steep slopes adjacent to rivers and creeks. Chemically, some of the mercury sulfide in the mercury-bearing ore is converted into other forms of mercury that are more reactive and more soluble and therefore more mobile in the environment.

During the removal assessment, analyses were completed to determine the species and solubility of mercury present on site. Based on the low concentrations of total mercury in leachates produced using SPLP and on the low solubility of the predominant mercury species indicated by sequential selective extraction, the main mechanism for the transportation of mercury in the environment at BBM was determined to be mechanical (i.e. erosion).

### **5. Efforts to Obtain Response by Responsible Parties**

The property was purchased by the Land and Timber Company in January 1994. The Land and Timber Company still owned the property and was in the processes of logging part of it at the time of the Removal Action. (Parker 2007)

In 2002 ODEQ designated the BBM as an “Orphan Site” and made the site account available for funding of stabilization and cleanup of the mine because the land owner, The Land and Timber Company, was unwilling to complete the investigation/cleanup of the BBM site (Spencer 2002). ODEQ subsequently requested that EPA carry out a removal action at the site.

EPA contacted the lawyer for the company, Robert Smejkel, in 2006 and in 2007 requesting that the company perform the cleanup but was told that the company lacked the funds to do so.

## **B. ORGANIZATION OF THE RESPONSE**

EPA was the lead agency in charge of the Removal Action. Throughout the Removal Action, EPA worked closely with ODEQ. EPA On-Scene Coordinator (OSC) Kathy Parker was on site throughout the Removal Action to oversee the cleanup activities.

The cleanup work was performed by Environmental Quality Management, Inc. (EQM), as the Environmental and Rapid Response Services (ERRS) contractor to EPA Region 10.

Members of the United States Coast Guard (USCG) Pacific Strike Team (PST) were on site during the RA to oversee site health and safety (H&S) and to perform air monitoring.

Ecology and Environment, Inc. (E & E), the Superfund Technical Assessment and Response Team (START)-3 contractor, provided engineering designs, analytical support, and documentation support for the Removal Action.

### **C. INJURY / POSSIBLE INJURY TO NATURAL RESOURCES**

Based on the pre-Removal Action conditions at the site, EPA determined that the site was a threat to the public health or welfare or the environment and that a removal action was appropriate under Section 300.415(b)(2) of the National Contingency Plan (NCP) (Parker 2007).

The elevated concentrations of mercury in waste rock and tailings of the Main Tailings Pile, Old Furnace Area, New Furnace Area, and Furnace Creek, and the proximity of the site to Dennis, Furnace, and Garoutte Creeks, indicated the presence of human exposure pathways. A previous report concluded that the BBM is the source of elevated levels of mercury in Cottage Grove Reservoir fish (Park and Curtis 1997).

The mine waste-contaminated soils were not vegetated, thus the soils were susceptible to migration due to water- and wind-borne influences. Erosion throughout the contaminated materials was widespread and moved material into the active waterways of Dennis, Furnace, and Garoutte Creeks and elsewhere throughout the site.

Mine wastes were slumping and eroding directly into the creeks with subsequent transport downstream. During the springtime, snow melt, rainfall or other run-off inducing events tended to spread the contaminated materials further from the site. The warmer temperatures and dry weather typical in the summer and fall months in and near the site contributed to wind-borne dispersal of mine contaminants.

Ecological receptors had been exposed to site contaminants through direct contact with mine-waste contaminated materials and with water and sediments contaminated by mine-waste materials; ingestion of mine-waste materials and water and sediments contaminated by mine-waste materials; and/or ingestion of contaminated food (e.g., sediment- or soil-dwelling insects, vegetation). Highly contaminated sediment from the mine site was believed to be transported downstream.

The concentration of mercury in Furnace Creek was likely the result of mine-waste materials migrating off the site. Excavation of the mine waste-contaminated materials was expected to have a positive effect on surface water quality and the sensitive aquatic ecosystem of Furnace Creek.

There was cause for concern near the BBM Site and for some distance downstream in Dennis, Furnace, and Garoutte Creeks because of the likelihood for continued erosion of

contaminated materials into the stream and subsequent downstream material migration. Recover and restoration efforts for fish and other species should be enhanced with improved water quality in Cottage Grove Reservoir and the Willamette River drainage. (Parker 2007)

### **1. Content and Time of Notice to Natural Resource Trustees**

In June 2006, Preston Sleeper of the U.S. Department of Interior was notified of the proposed removal action activities and provided background information on the site. There were no tribes on the BBM drainage area but the proposed removal work was shared at that time with the Confederated Tribes of the Coos, the Lower Umpqua and Siuslaw, the Cow Creek, The Cow Creek Band of Umpqua, and the Confederated Tribes of the Siletz.

### **2. Trustee Damage Assessment and Restoration Activities**

No assessment or restoration activities are known to have been attempted but any trustees.

## **D. CHRONOLOGICAL NARRATIVE OF RESPONSE ACTIONS**

### **1. Threat Abatement Actions Taken**

This response was conducted under the authority of CERCLA Section 104(a). To mitigate the potential hazards to human health and the environment from mercury contaminated waste rock and tailings, EPA performed a cleanup action which included the stabilization of slopes and the construction of protective covers over contaminated areas.

The following summarizes the chronology of BBM Removal Activities:

- **July 2004:** ODEQ requested that EPA conduct a removal assessment at the Black Butte Mine site.
- **September 2005:** START conducted field activities for the removal assessment including specialized analyses for mercury. The removal assessment report was completed in March 2006 (E & E 2006).
- **September 2006:** A topographic survey was conducted of areas to be addressed in the removal action.
- **December 2006:** A cultural resources survey was conducted of areas to be addressed in the removal action.
- **February-March 2007:** START submitted a conceptual design for the removal action to EPA.

- **August 20 to September 3, 2007**, the Removal Action (RA) and further assessment was performed at the site:
- **August 20, 2007:** EPA, USCG, ODEQ and ERRS personnel and equipment mobilized to the Black Butte Mine Site. On-site activities for the RA began with site orientation meetings. Resident Michael Pooler located and marked his above-ground household water holding tank and line which ran through the Old Furnace area. ERRS cleared, grubbed, widened and graded the access roads to the site and repository area. ODEQ, USCG and EPA analyzed soils and mine tailings in the Old Furnace Area, New Furnace Area, and the repository area for mercury by XRF.
- **August 21, 2007:** Soils upslope from the Old Ore Furnace were analyzed for mercury by XRF. ERRS started grading and laying back the east slope of the Main Tailings Pile and filled the water truck at an approved location on Cottage Grove Lake. ERRS cleared, grubbed, widened and graded the access roads to the Main Tailings piles and the New Furnace Area.
- **August 22, 2007:** START arrived on site to provide on-site field laboratory analyses for mercury and collected tailings samples from the east Main Tailings Pile for mercury analysis. ERRS continued excavating the west Main Tailings pile and started hauling tailings, which had been verified to have less than 115 mg/kg mercury concentration, from the Main Tailings pile to the New Furnace area for capping and compacting them.
- **August 23, 2007:** ODEQ, START and USCG started collecting samples from Furnace Creek for mercury analysis by XRF and Lumex. ERRS continued regrading the Main Tailings piles and hauling “clean” tailings to the New Furnace area and the repository.
- **August 24, 2007:** Tailings samples were collected from the west Main Tailings Pile for mercury analysis. START determined the Lumex can not accurately analyze tailings due to the mercury being too tightly bound chemically. Only XRF will be used for tailings analysis. ERRS continued regrading the Main Tailings piles and hauling “clean” tailings to the New Furnace area and the repository.
- **August 25, 2007:** ERRS started clearing, grubbing and filling in holes and a large tank on the Old Furnace Area and continued regrading the Main Tailings piles and contouring drainage benches. Tailings samples were collected from the

west Main Tailings Pile for mercury analysis. START began mercury method detection limit analyses on the XRF and Lumex.

- **August 26, 2007:** No site work performed.
- **August 27, 2007:** ERRS continued clearing, grubbing and filling the Old Furnace Area and started hauling capping material from the Main Tailings piles to the Old Furnace Area. ERRS continued regrading the Main Tailings piles and contouring drainage benches. START and USCG continued collecting samples from Furnace Creek for mercury analysis by XRF and Lumex. Soil and tailings samples were collected for mercury analysis from the New Furnace Area.
- **August 28, 2007:** ERRS continued regrading the Main Tailings piles and contouring drainage benches and hauling capping material from the Main Tailings piles to the Old Furnace Area. ERRS made a road from the main site road to a large tailings pile overlooking Furnace creek then dug a test pit to determine the depth of the tailings on the banks of Furnace creek. START and USCG continued collecting samples from Furnace Creek for mercury analysis by XRF and Lumex.
- **August 29, 2007:** ERRS continued regrading the Main Tailings piles and contouring drainage benches and hauling capping material from the Main Tailings piles to the Old Furnace Area. USCG continued analyzing samples from Furnace Creek for mercury analysis by XRF. One USCG personnel demobilized.
- **August 30, 2007:** ERRS continued hauling capping material from the Main Tailings piles to the Old Furnace Area. Final confirmation samples were collected from the east Main Tailings Pile for mercury analysis. Mercury analyses were performed on soil and tailings around the Old Furnace to delineate the area for capping. Analyzed soil from borrow slope to determine if mercury concentrations are low enough to use as clean topsoil cover in capped areas. TV and newspaper reporters (KEZI, KVAL, Cottage Grove Sentinel) on site for interviews with EPA, ODEQ and Oregon State Governor's office.
- **August 31, 2007:** West Main Tailings Slope re-grading was completed. Final mercury confirmation analyses were performed on tailings on the surface of the re-graded slope of the west Main Tailings Pile. Completed hauling capping material from the Main Tailings piles to the Old Furnace Area and finished clearing and capping Old Furnace Area. ERRS started hauling clean topsoil from the borrow slope to the east Main Tailings pile. ERRS started placing straw bales

on the Main Tailings piles for erosion control. A new gate was installed at the entrance to the site. Sediment samples were collected from Dennis Creek and Garoutte Creek for mercury analysis using the Lumex. Three ERRS and one START personnel demobilized

- **September 1, 2007:** Grading and compacting of slopes and benches on the west Main Tailings pile was completed and straw bales and water bars were installed. Continued to spread topsoil on both east and west slopes. XRF analyses performed on dried sediments from Dennis Creek.
- **September 3, 2007:** Mercury analyses of samples from Dennis Creek, Furnace Creek, and Garoutte Creek and final confirmation analyses of the Old Furnace cap were completed. ERRS Continued to spread topsoil on both east and west slopes. START personnel and equipment demobilized from the site.
- **September 4, 2007:** ERRS cleaned up the borrow slope area and placed slash on it and on the road to the New Furnace cap. USCG personnel and equipment demobilized from the site.
- **September 5, 2007:** ODEQ arrived on site, picked up ODEQ equipment and walked the site with the OSC for a debriefing on the RA. ERRS and EPA personnel and equipment demobilized from the site.

## **2. Treatment / Disposal / Alternative Technology Approaches Pursued**

The selected removal activities performed by EPA involved both regrading and capping with tailings that contained mercury concentrations lower than the cleanup level. The removal activities did not involve treatment or disposal. No specific alternative technologies were required to cost effectively achieve the objectives of the removal assessment.

As described above, ODEQ established a site-specific cleanup level for mercury in soil which was derived from the EPA Region 9 PRG for mercury in soil in a residential setting. ODEQ calculated the site-specific cleanup level based on the reduced toxicity of mercuric sulfide in comparison to mercuric chloride, which was used for the EPA Region 9 PRG. Therefore, the site specific action level, for areas where dermal contact was a concern, was 115 mg/kg.

In addition, because mercury concentrations were naturally elevated in area creeks, concentrations of three times background were calculated for Furnace Creek, Dennis Creek, and Garoutte Creek sediments in the removal assessment (E & E 2006). Based on these

calculated values and the available analytical capability, 10 mg/kg was chosen as the action level for the creeks and areas where sediment could move into the creeks.

### **3. Public Information and Community Relations Activities**

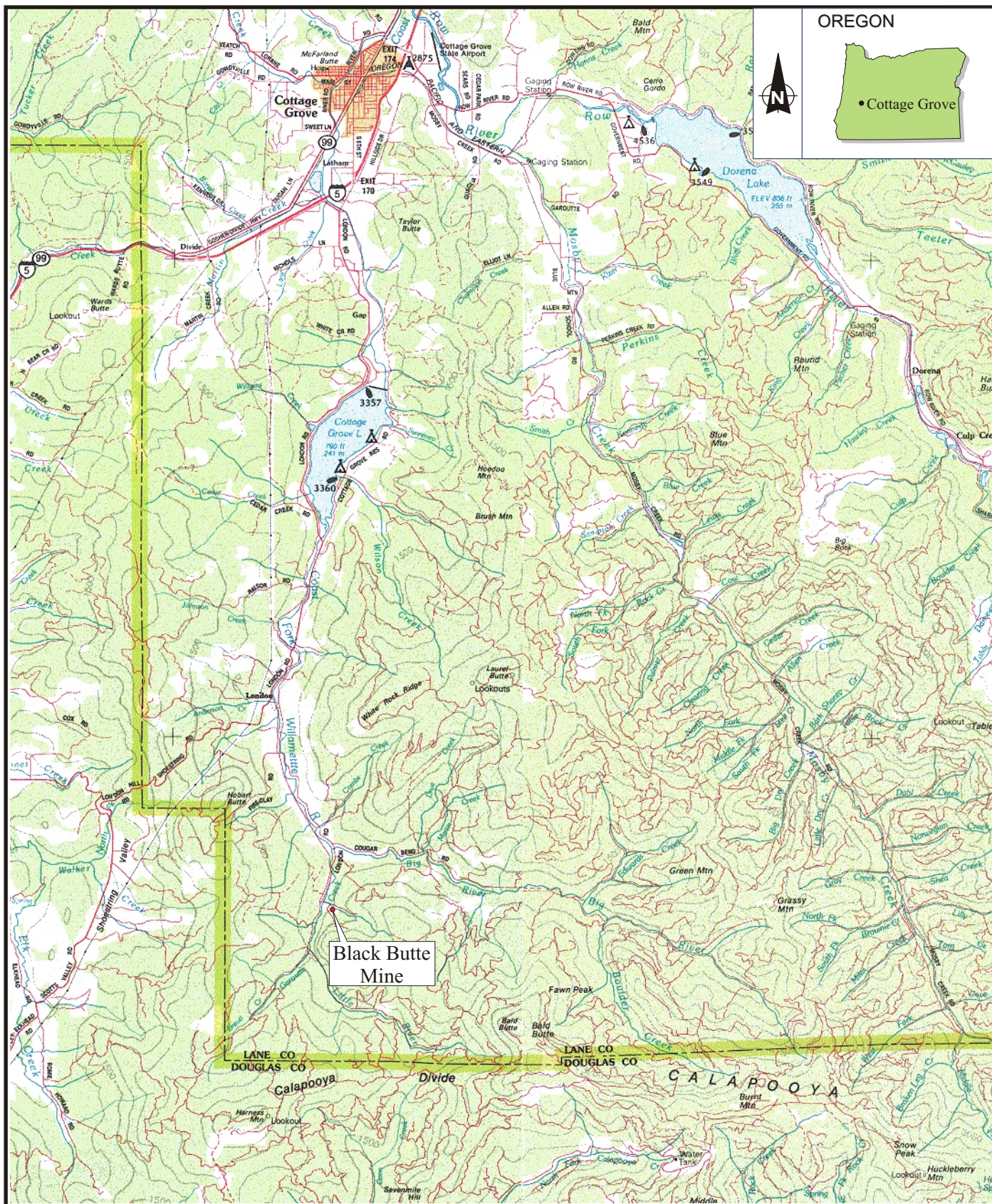
Throughout the removal activities, EPA provided the public with ongoing information regarding the site and the progress of the cleanup actions. EPA prepared and distributed a fact sheet for the Removal Action.

The OSC issued periodic pollution reports (POLREPs) and maintained a website with information about the site and the ongoing cleanup: [www.epaosc.org/BlackButteMine](http://www.epaosc.org/BlackButteMine). Examples of the public notifications, including a screenshot of the website, the POLREPS, the Fact Sheet, and a newspaper clipping, are presented in Appendix B.

## **E. RESOURCES COMMITTED**

EPA costs for the Black Butte Mine RA included direct EPA costs (intramural) and contractors (extramural). Estimated costs for the RA as of May 31, 2008, are summarized below:

	<b><u>Cost to Date</u></b>
<b><u>Intramural Costs</u></b>	
EPA Direct Costs	\$43,980
EPA Indirect Costs	\$81,649
 <b><u>Extramural Costs</u></b>	
ERRS	\$214,800
USCG	\$7,500
START	\$124,219
 Estimated Total Project Costs	 \$472,148



Black Butte Mine



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Seattle, Washington

**BLACK BUTTE MINE**  
Lane County, Oregon

**SOURCE:** DeLorme, 1991,  
Scale 1:150,000

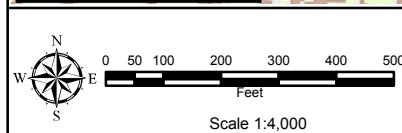
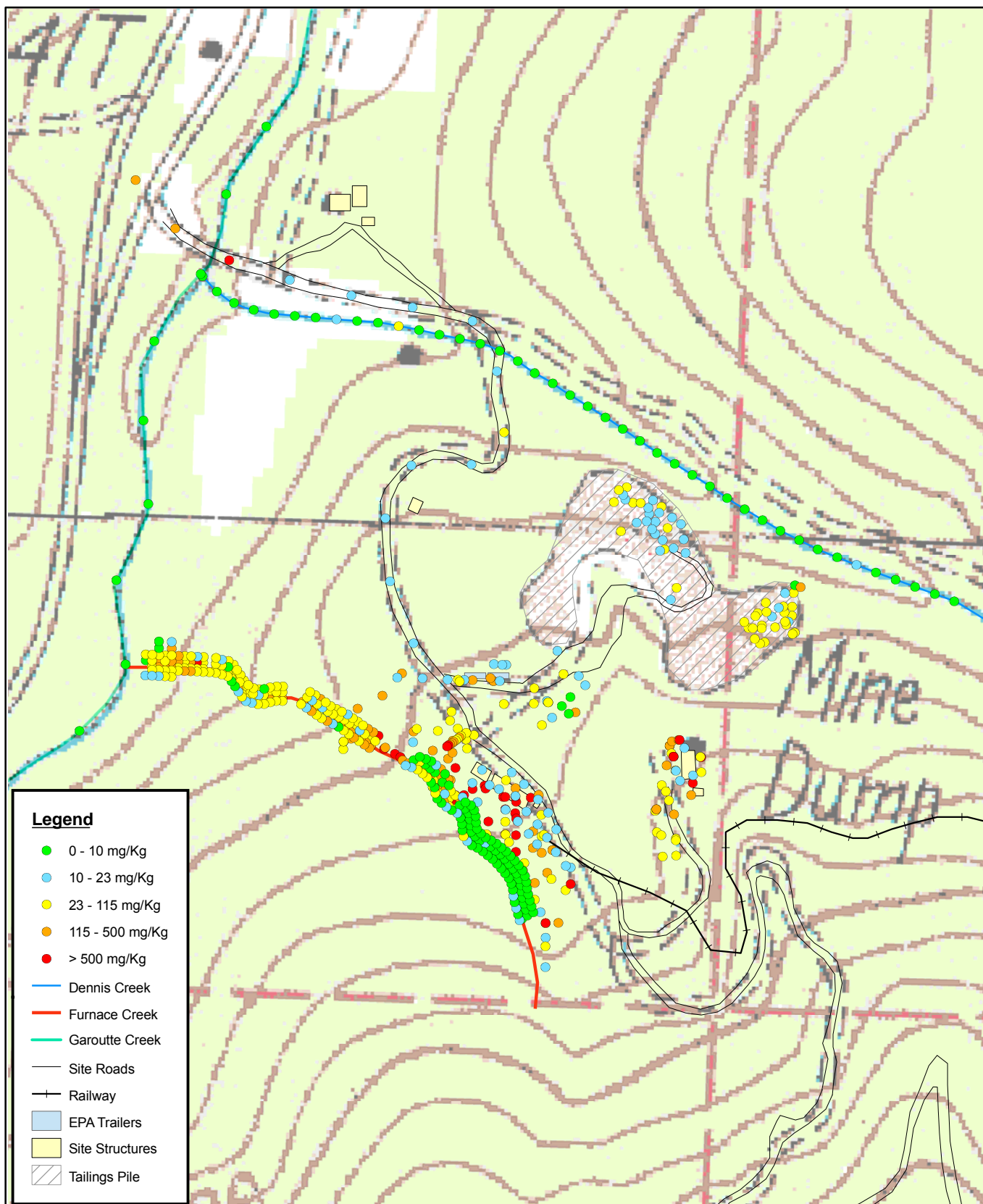
Figure 1

**SITE LOCATION MAP**

Date:  
1-23-06

Drawn by:  
AES

10:START-3\06010005\fig 1



## BLACK BUTTE MINE

Lane County, Oregon

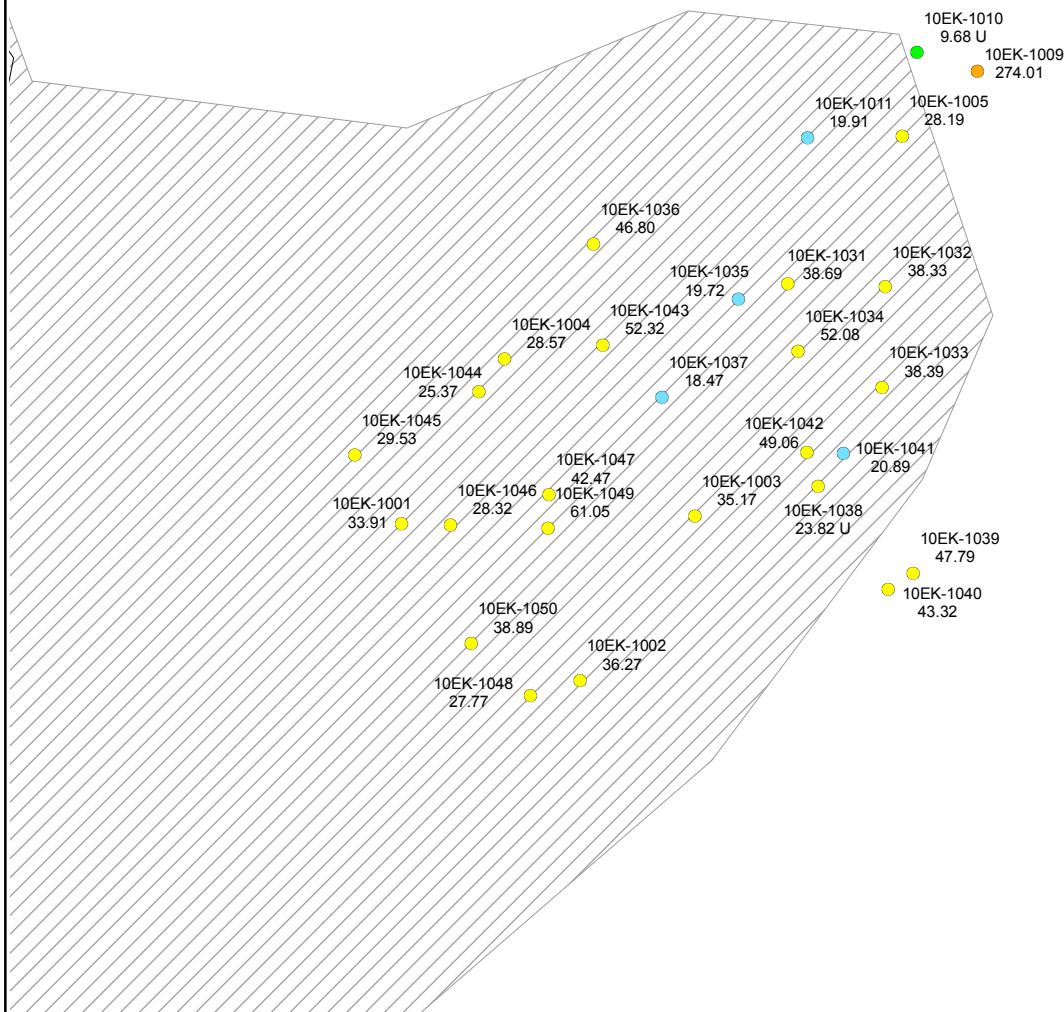
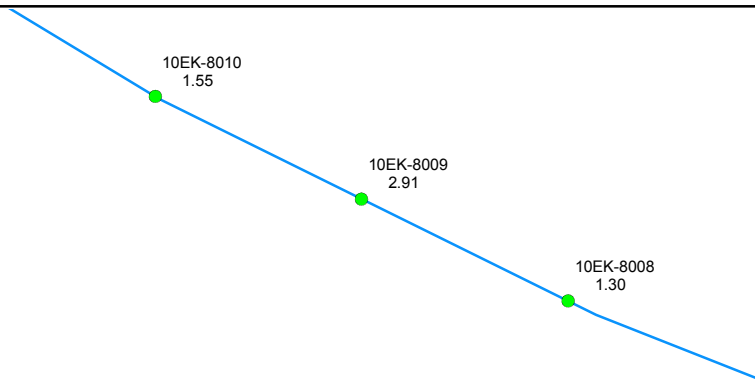
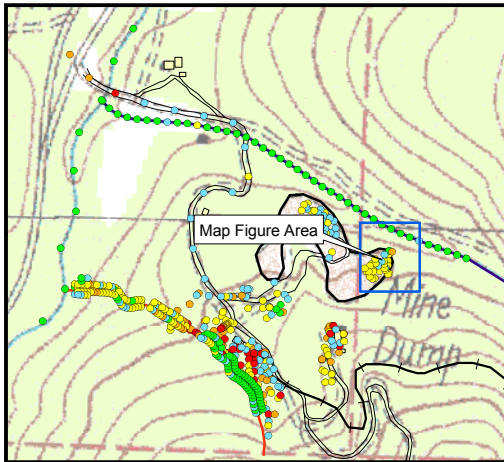
Figure 2  
**Field Mercury Concentrations  
 Site Map**

Job Id:  
 002233.0026.011A

Date:  
 10/15/2007

GIS Analyst:  
 avh

Map Source Information: USGS Topographic Map.  
 Harness Mountain, Oregon. Scale 1-24,000 .



**Legend**

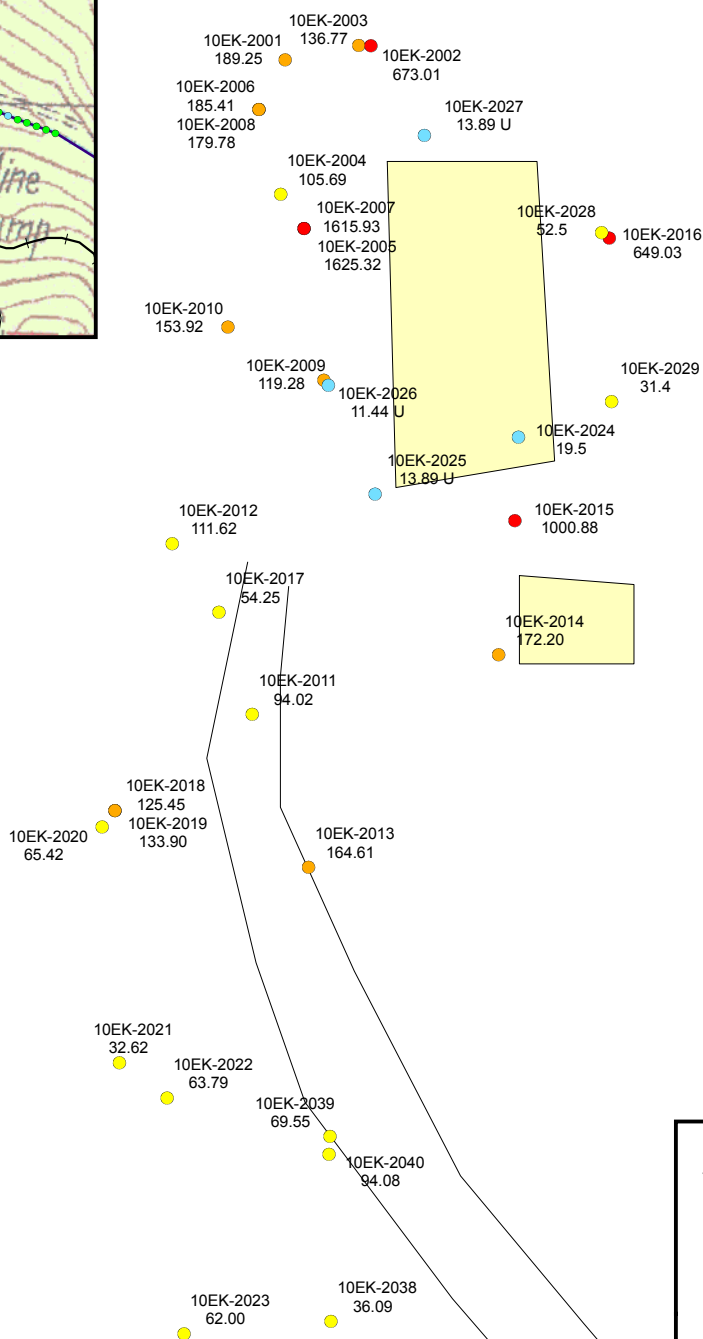
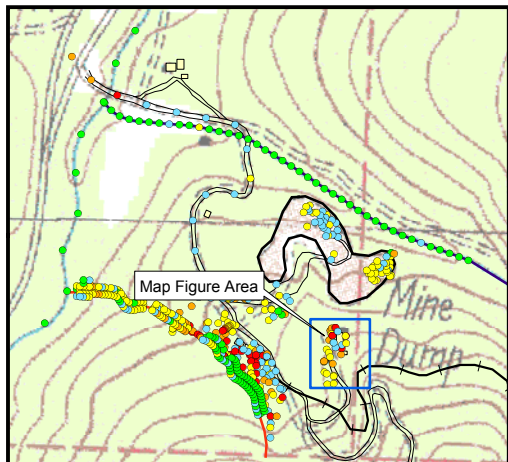
- 0 - 10 mg/Kg
- 10 - 23 mg/Kg
- 23 - 115 mg/Kg
- 115 - 500 mg/Kg
- > 500 mg/Kg
- Dennis Creek
- Site Roads
- ▨ Tailings Pile

**BLACK BUTTE MINE**

Lane County, Oregon

Figure 2A  
**Field Mercury Concentrations  
East Main Tailings Pile**

Job Id: 002233.0026.011A	
Date: 10/15/2007	GIS Analyst: avh
Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000.	



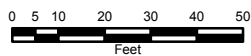
#### Legend

- 0 - 10 mg/Kg
- 10 - 23 mg/Kg
- 23 - 115 mg/Kg
- 115 - 500 mg/Kg
- > 500 mg/Kg

— Site Roads

—+— Railway

■ Site Structures



Scale 1:500



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## BLACK BUTTE MINE

Lane County, Oregon

Figure 2B

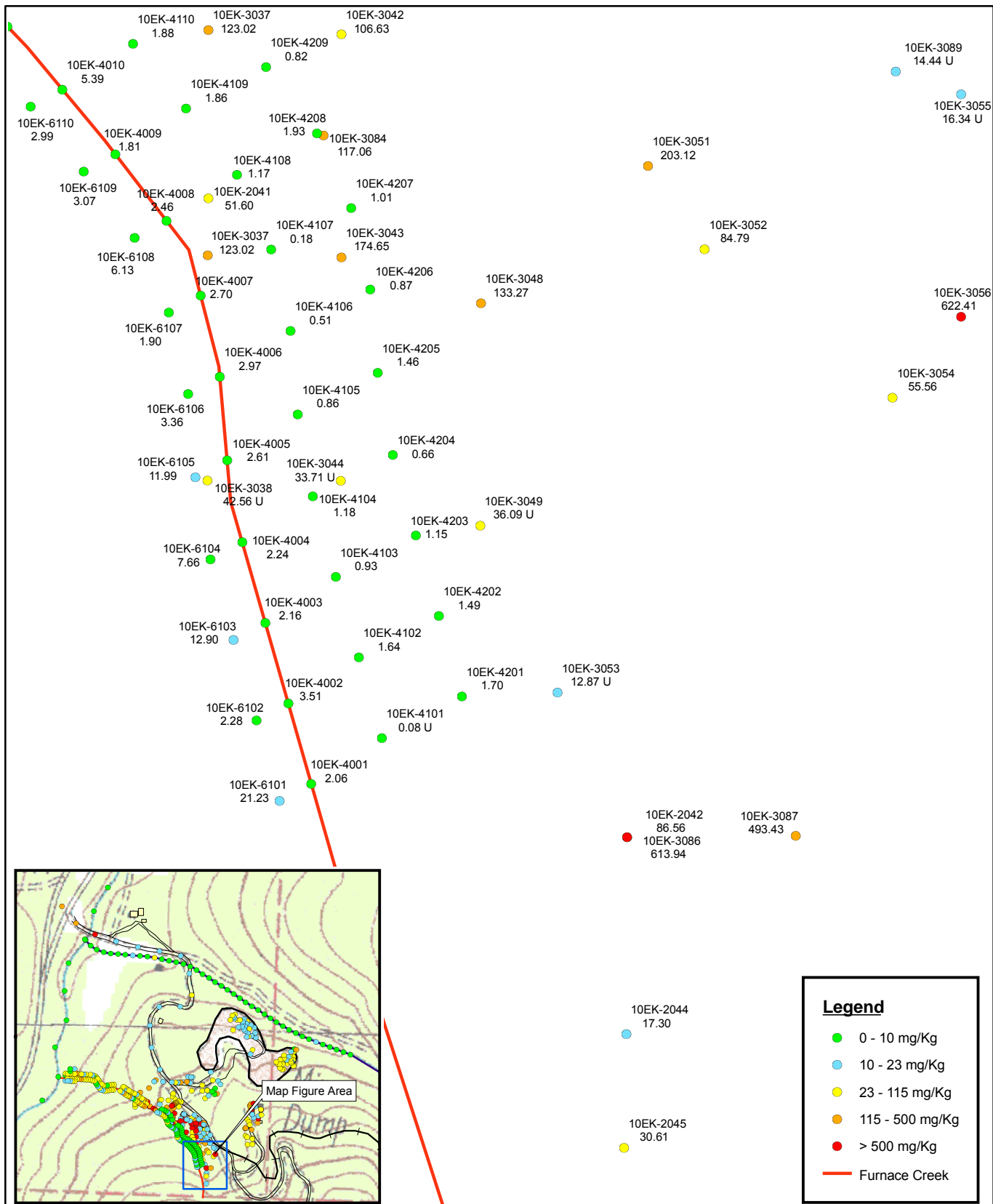
### Field Mercury Concentrations New Furnace Area

Job Id:  
002233.0026.011A

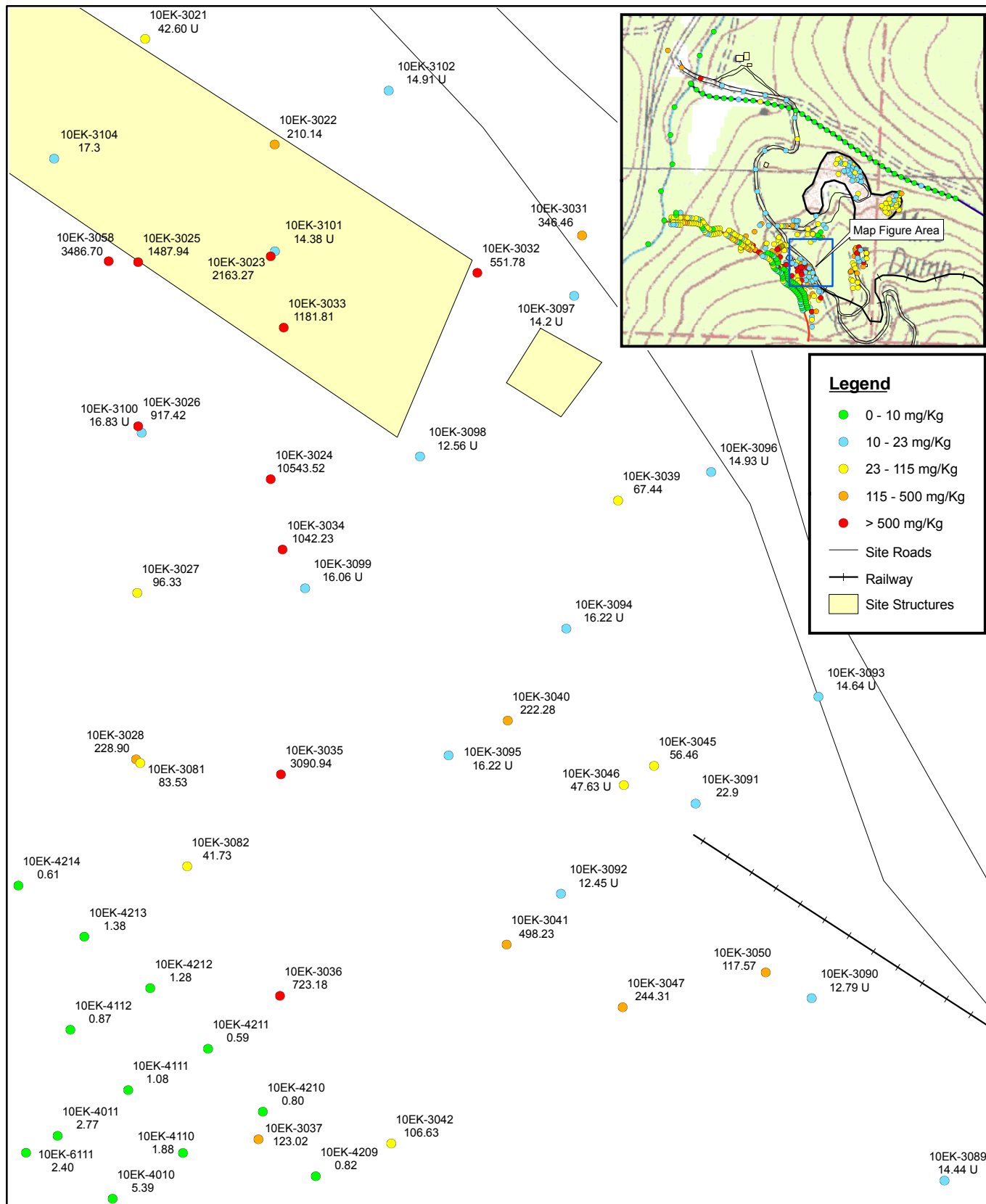
Date:  
10/15/2007

GIS Analyst:  
avh

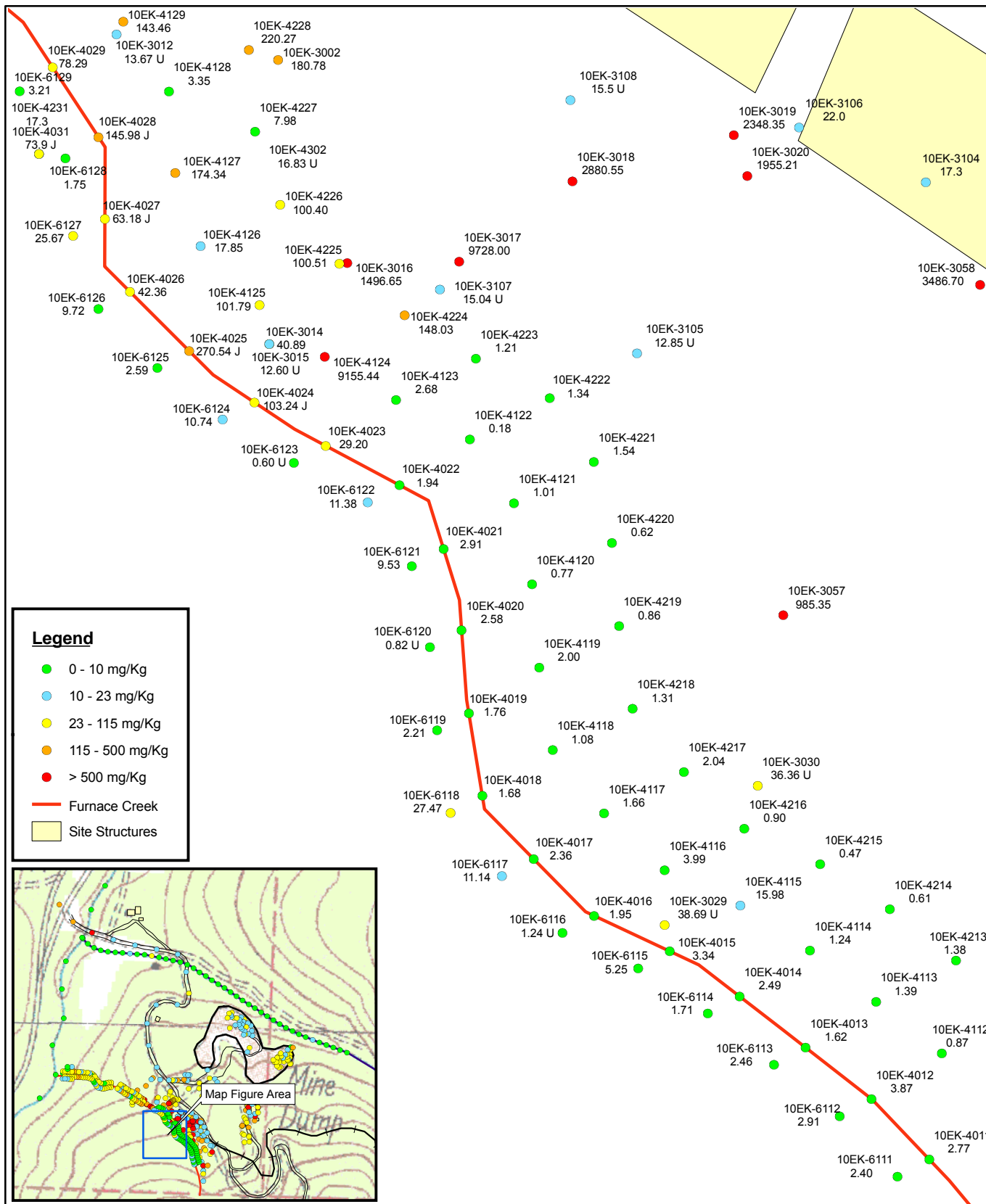
Map Source Information: USGS Topographic Map.  
Harness Mountain, Oregon. Scale 1-24,000 .

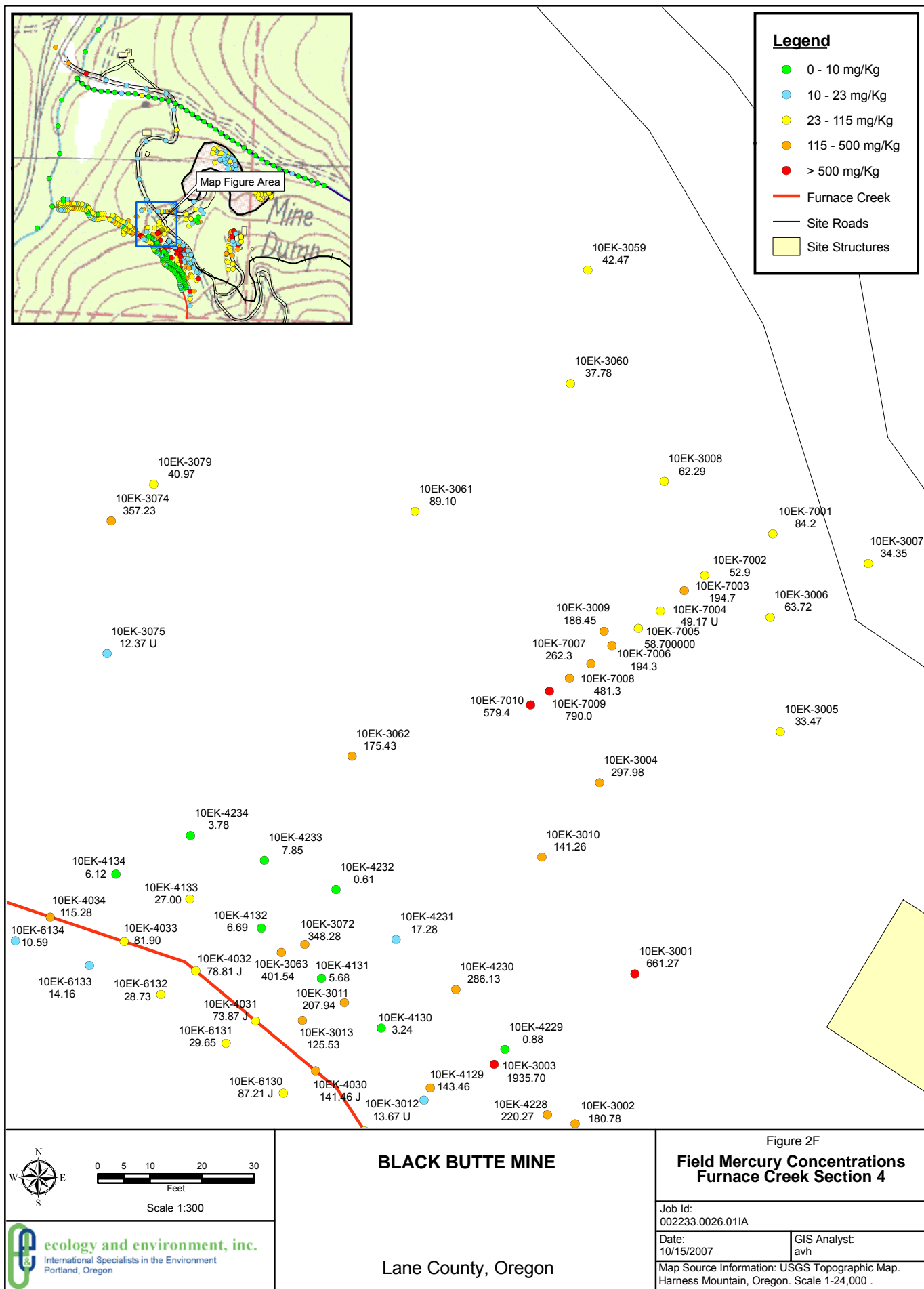


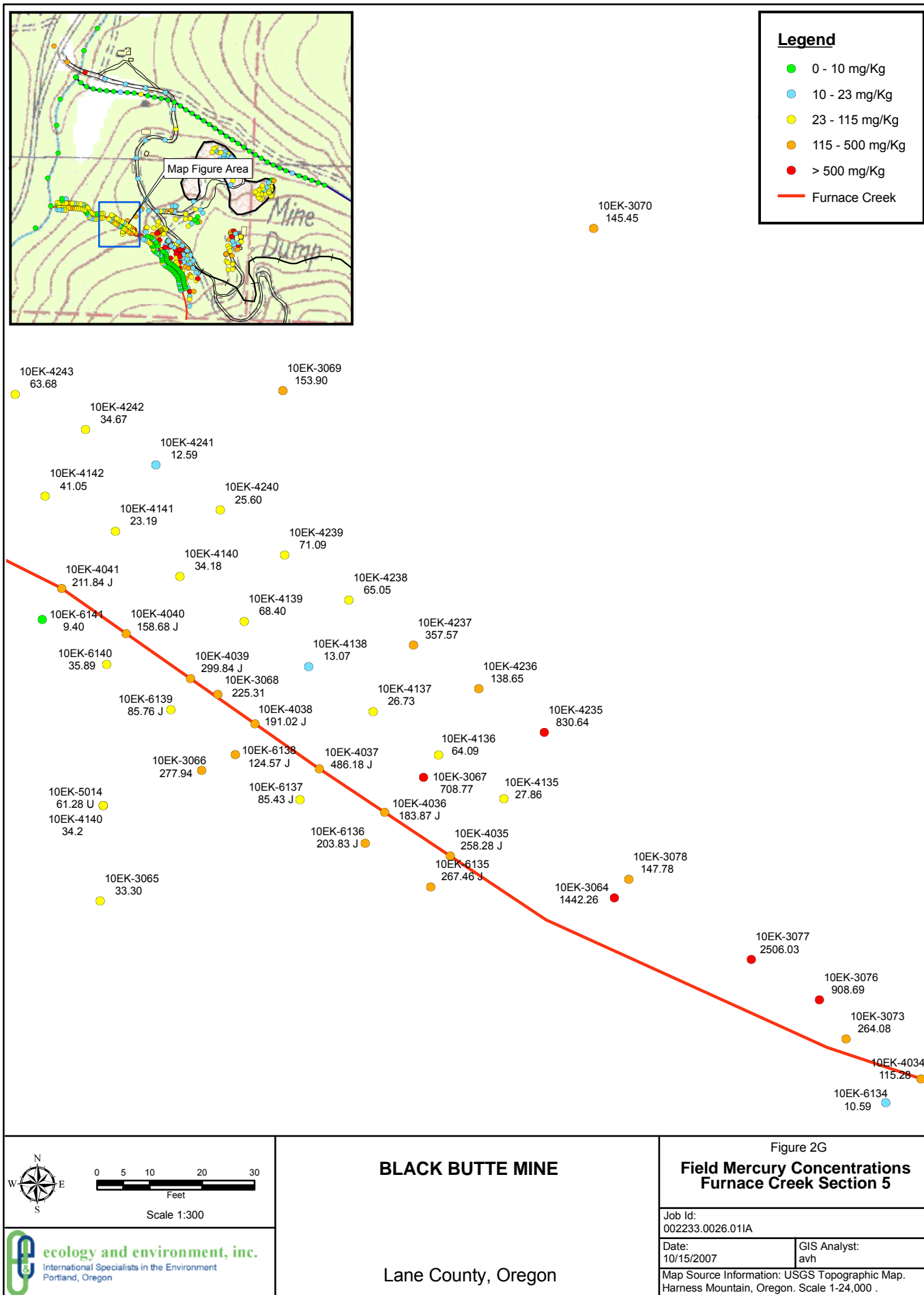
  Scale 1:300	<b>BLACK BUTTE MINE</b>		Figure 2C	
			<b>Field Mercury Concentrations Furnace Creek Section 1 (East End)</b>	
	ecology and environment, inc. International Specialists in the Environment Portland, Oregon		Job Id: 002233.0026.011A	
			Date: 10/15/2007	GIS Analyst: avh
Lane County, Oregon		Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000.		

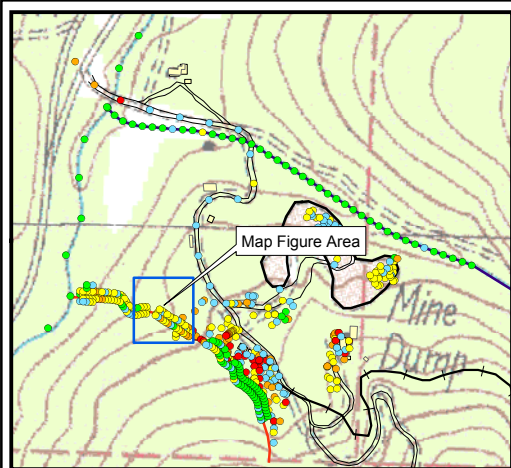


	<p><b>BLACK BUTTE MINE</b></p> <p>Lane County, Oregon</p>	<p>Figure 2D</p> <p><b>Field Mercury Concentrations</b></p> <p><b>Old Furnace Area</b></p> <p><b>Furnace Creek Section 2</b></p>	
		<p>Job Id:</p> <p>002233.0026.011A</p>	
		<p>Date:</p> <p>10/15/2007</p>	<p>GIS Analyst:</p> <p>avh</p>
		<p>Map Source Information: USGS Topographic Map.</p> <p>Harness Mountain, Oregon. Scale 1-24,000 .</p>	



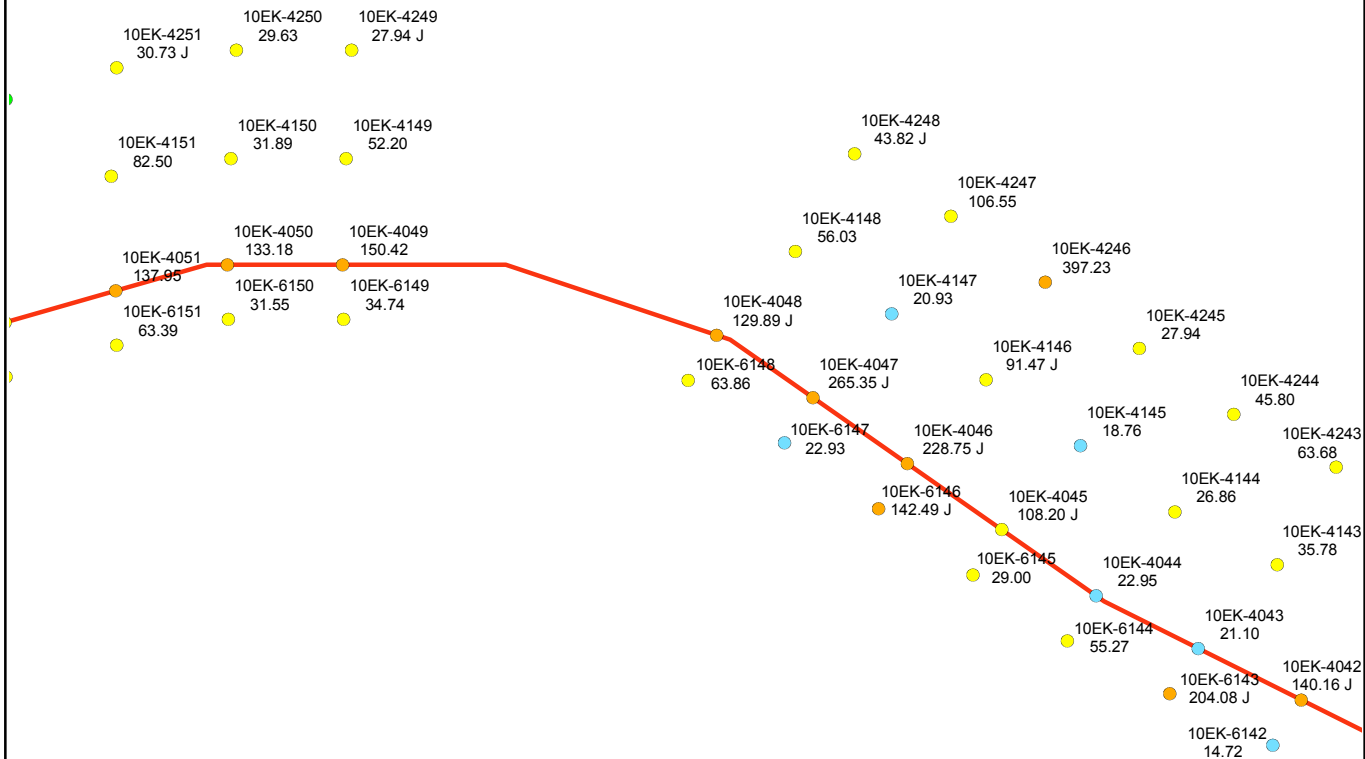






### Legend

- 0 - 10 mg/Kg
- 10 - 23 mg/Kg
- 23 - 115 mg/Kg
- 115 - 500 mg/Kg
- > 500 mg/Kg
- Furnace Creek



Scale 1:300



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Portland, Oregon

## BLACK BUTTE MINE

Lane County, Oregon

Figure 2H

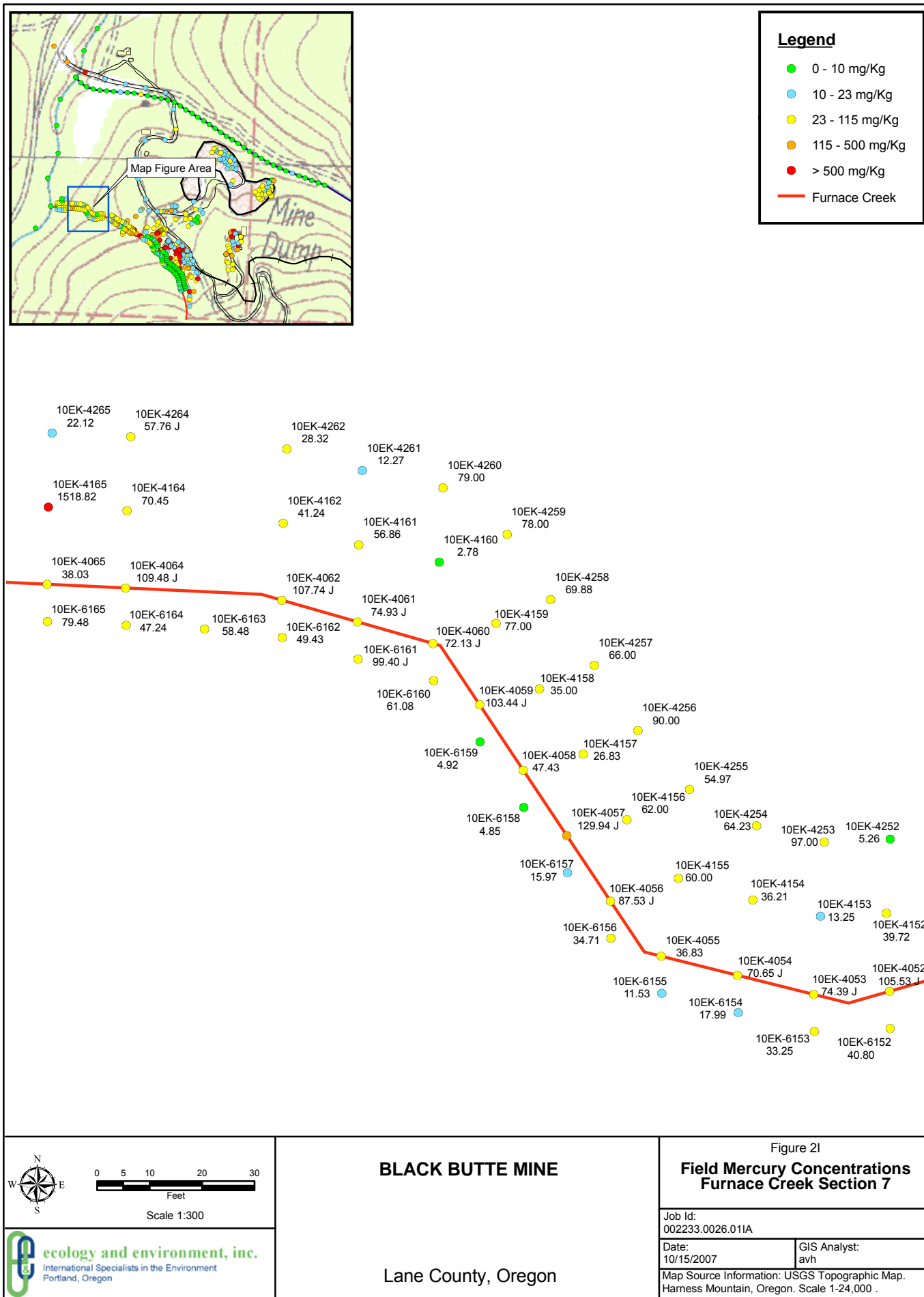
### Field Mercury Concentrations Furnace Creek Section 6

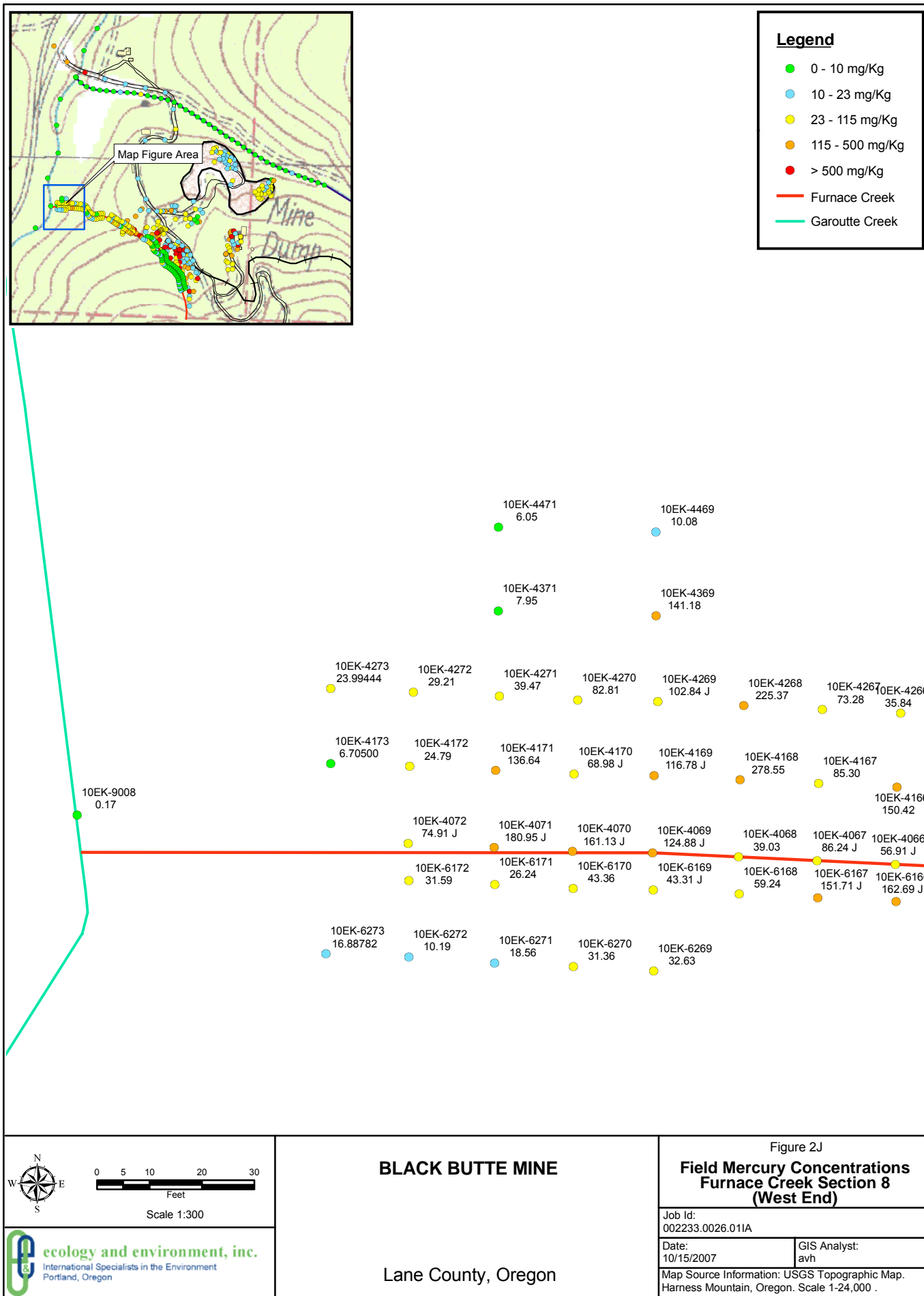
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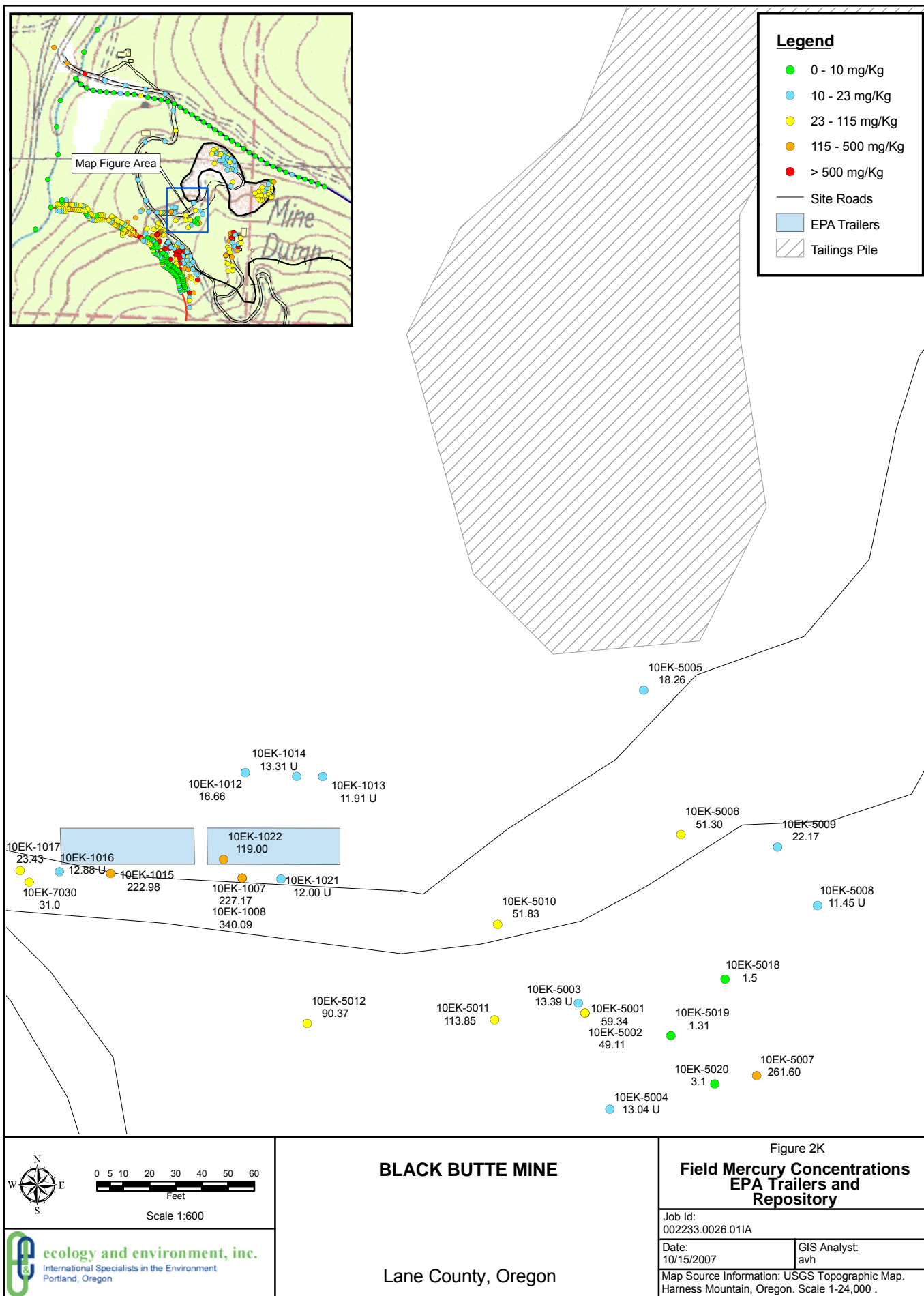
Date:  
10/15/2007

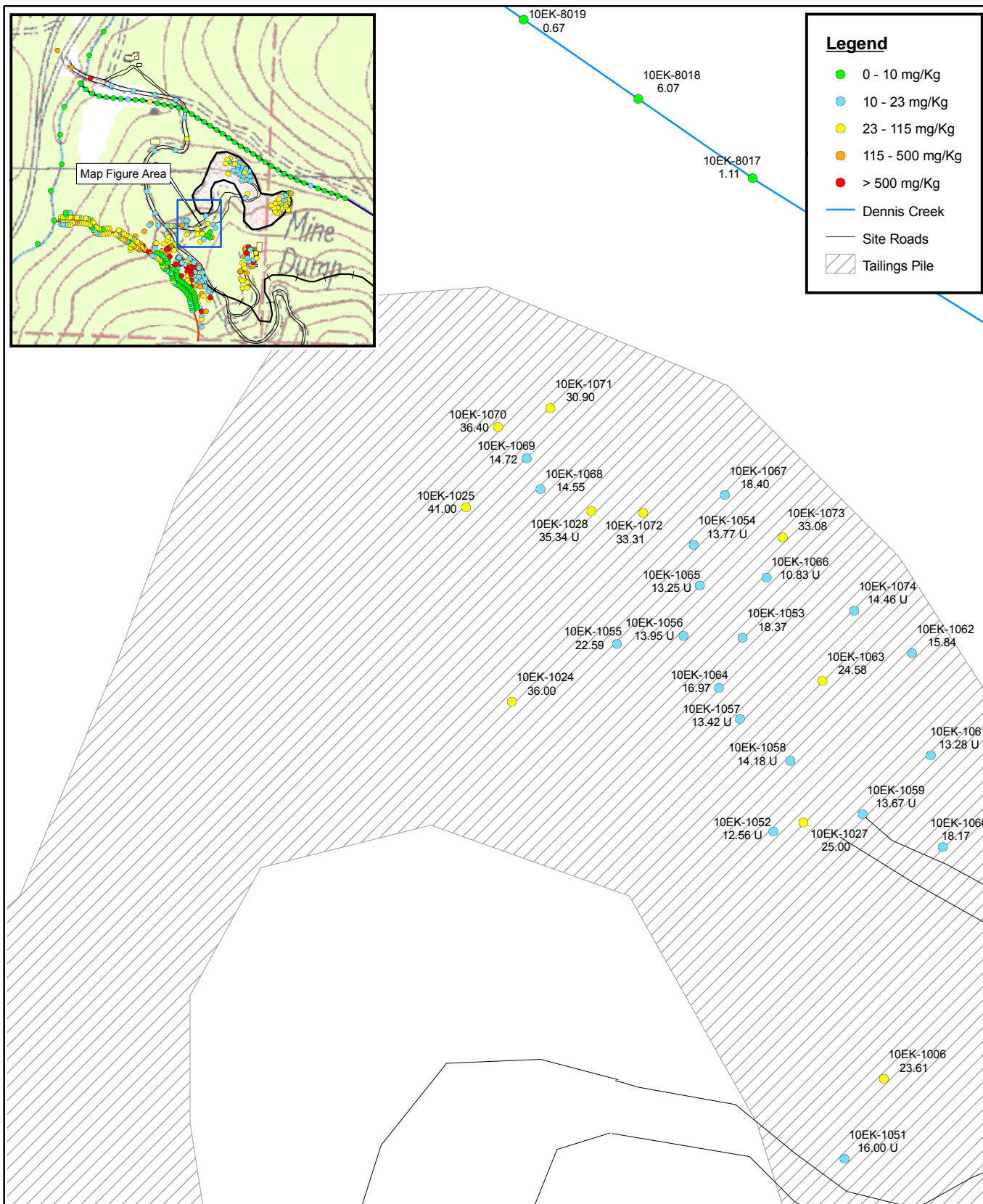
GIS Analyst:  
avh

Map Source Information: USGS Topographic Map.  
Harness Mountain, Oregon. Scale 1-24,000 .

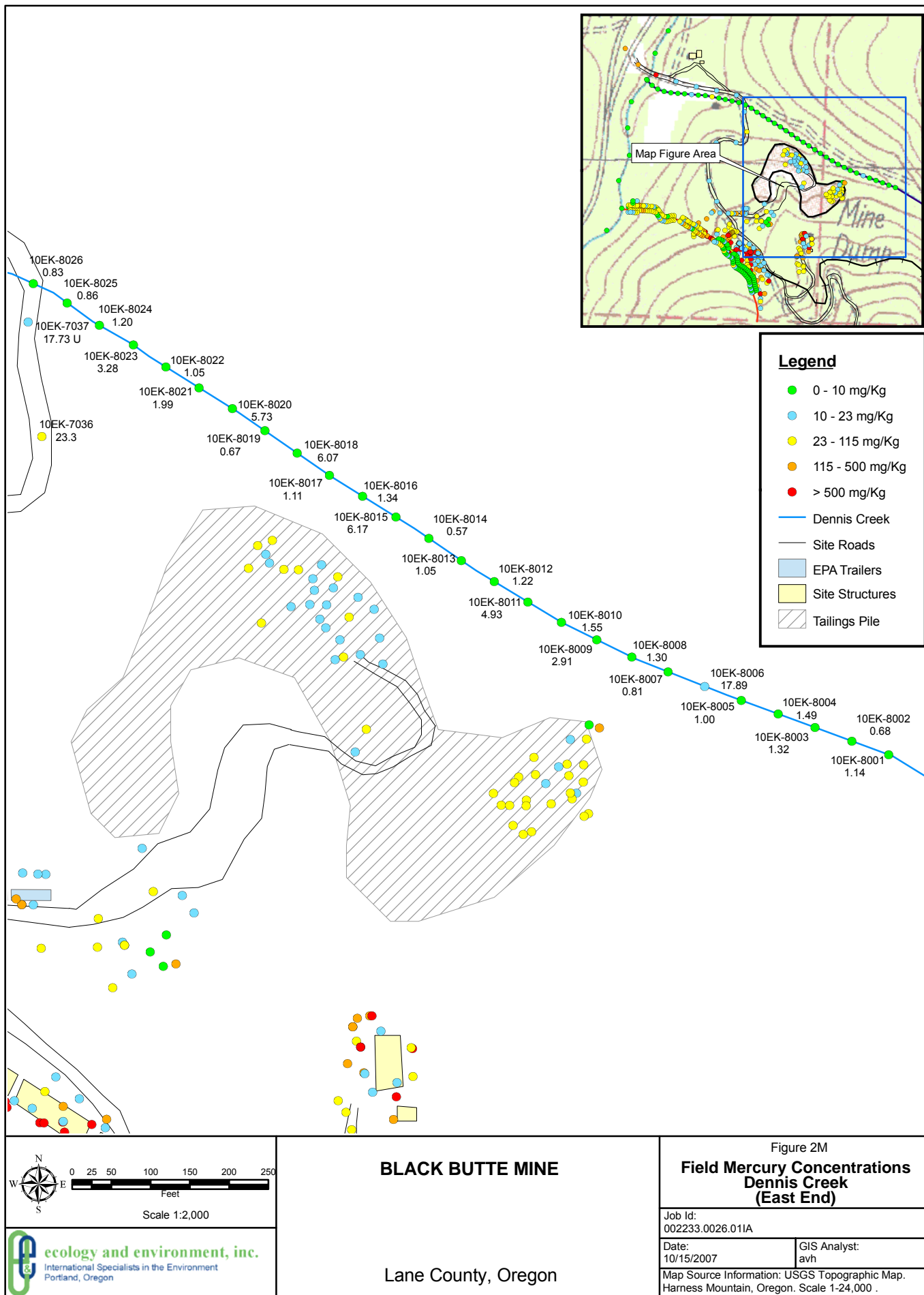


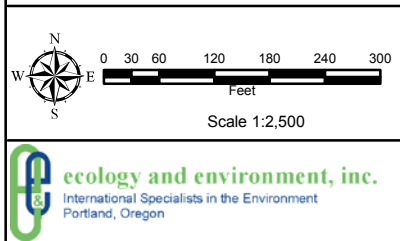
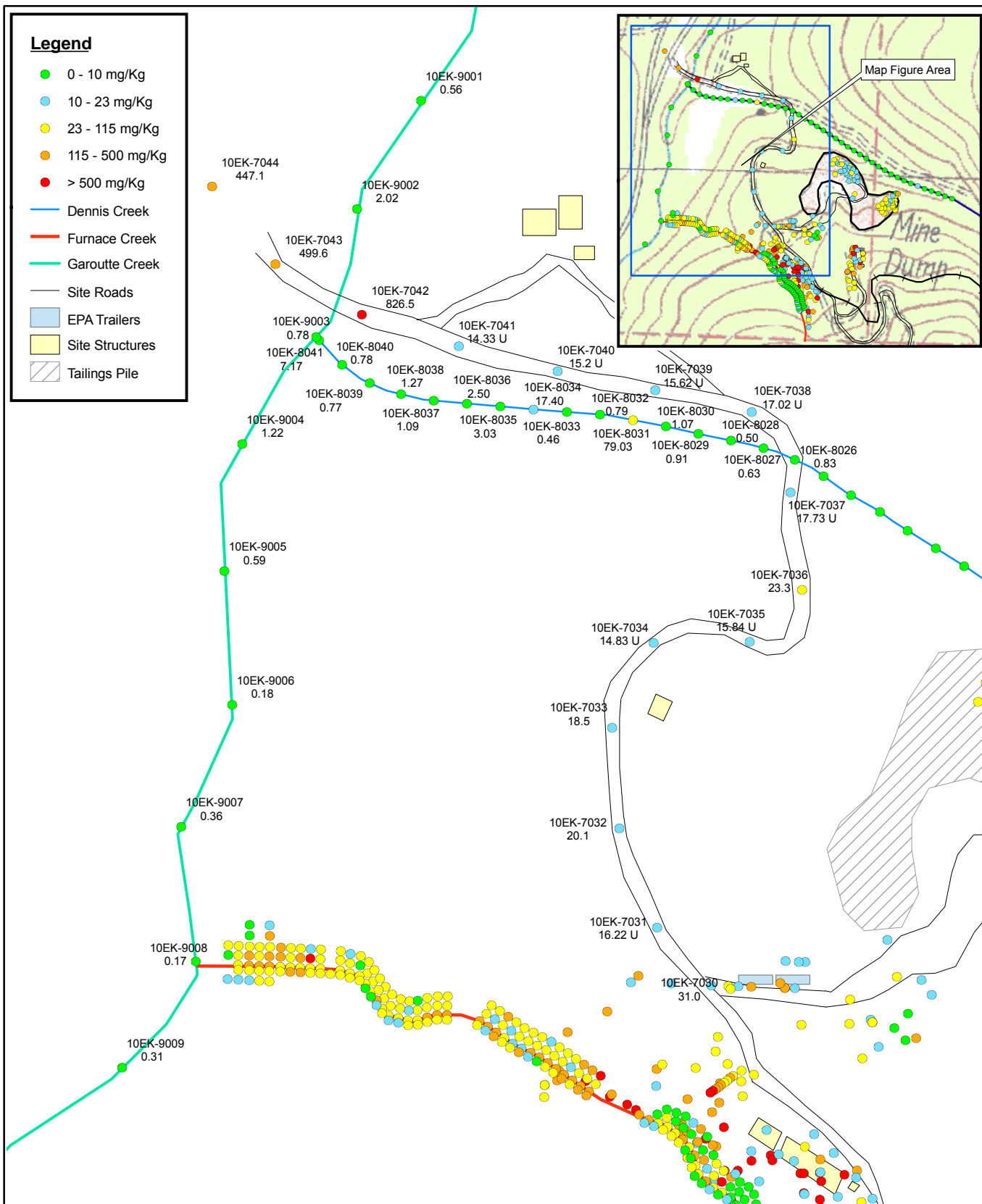






<p>Scale 1:600</p>	<p><b>BLACK BUTTE MINE</b></p>		<p>Figure 2L</p>	
			<p><b>Field Mercury Concentrations West Main Tailings Pile</b></p>	
	<p>Lane County, Oregon</p>		<p>Job Id: 002233.0026.011A</p>	
			<p>Date: 10/15/2007</p>	<p>GIS Analyst: avh</p>
<p>ecology and environment, inc. International Specialists in the Environment Portland, Oregon</p>		<p>Map Source Information: USGS Topographic Map. Harness Mountain, Oregon. Scale 1-24,000 .</p>		





**BLACK BUTTE MINE**

Lane County, Oregon

Figure 2N  
**Field Mercury Concentrations  
Dennis Creek (West End),  
Garoutte Creek, and Site Road**

Job Id:  
002233.0026.011A

Date:  
10/15/2007

GIS Analyst:  
avh

Map Source Information: USGS Topographic Map.  
Harness Mountain, Oregon. Scale 1-24,000 .

**Table I-1**  
**TOTAL MERCURY IN TAILINGS SAMPLES FROM MAIN TAILINGS PILE**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
1	10EK-1001	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	33.9	5.80	
2	10EK-1002	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	36.2	5.77	
3	10EK-1003	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	35.2	5.55	
4	10EK-1004	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	28.6	5.13	
5	10EK-1005	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	28.2	5.73	
6	10EK-1006	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	23.6	4.60	
7	10EK-1007	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	227	8.89	
8	10EK-1008	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	340	11.34	
9	10EK-1009	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	274	11.46	
10	10EK-1010	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	9.7	9.68	U
11	10EK-1011	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	19.9	4.63	
12	10EK-1012	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	16.7	4.35	
13	10EK-1013	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	11.9	11.91	U
14	10EK-1014	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	13.3	13.31	U
15	10EK-1015	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	222	11.18	
16	10EK-1016	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	12.9	12.88	U
17	10EK-1017	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	23.4	4.71	
18	10EK-1018	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	11.8	11.83	U
19	10EK-1019	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	11.6	11.61	U
20	10EK-1020	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	12.0	12.00	U
21	10EK-1021	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	12.0	12.00	U
22	10EK-1022	Main Tailings/PreRegrading/East	Tailings	8/22/07	mg/kg	119	0.00	
24	10EK-1024	Main Tailings/PreRegrading/West	Tailings	8/24/07	mg/kg	36.0	0.00	
25	10EK-1025	Main Tailings/PreRegrading/West	Tailings	8/24/07	mg/kg	41.0	0.00	
27	10EK-1027	Main Tailings/PreRegrading/West	Tailings	8/24/07	mg/kg	25.0	0.00	
28	10EK-1028	Main Tailings/PreRegrading/West	Tailings	8/25/07	mg/kg	35.3	35.34	U
31	10EK-1031	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	38.7	5.91	
32	10EK-1032	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	38.3	5.93	
33	10EK-1033	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	38.4	5.91	
34	10EK-1034	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	52.1	6.63	
35	10EK-1035	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	19.7	5.29	
36	10EK-1036	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	46.8	6.88	

**Table I-1**  
**TOTAL MERCURY IN TAILINGS SAMPLES FROM MAIN TAILINGS PILE**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
37	10EK-1037	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	18.5	5.19	
38	10EK-1038	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	23.8	23.82	U
39	10EK-1039	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	47.8	6.84	
40	10EK-1040	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	43.3	6.25	
41	10EK-1041	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	20.9	5.26	
42	10EK-1042	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	49.1	6.77	
43	10EK-1043	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	52.3	6.68	
44	10EK-1044	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	25.4	5.82	
45	10EK-1045	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	29.5	5.41	
46	10EK-1046	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	28.3	5.36	
47	10EK-1047	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	42.5	6.30	
48	10EK-1048	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	27.8	5.40	
49	10EK-1049	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	61.1	6.79	
50	10EK-1050	Main Tailings/Confirmation Sampling/East	Tailings	8/30/07	mg/kg	38.9	6.33	
51	10EK-1051	Main Tailings/Confirmation Sampling/West	Tailings	8/31/07	mg/kg	16.0	16.00	U
52	10EK-1052	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	12.6	12.56	U
53	10EK-1053	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	18.4	4.64	
54	10EK-1054	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.8	13.77	U
55	10EK-1055	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	22.6	5.91	
56	10EK-1056	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.0	13.95	U
57	10EK-1057	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.4	13.42	U
58	10EK-1058	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.2	14.18	U
59	10EK-1059	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.7	13.67	U
60	10EK-1060	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	18.2	4.80	
61	10EK-1061	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.3	13.28	U
62	10EK-1062	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	15.8	4.67	
63	10EK-1063	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	24.6	5.15	
64	10EK-1064	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	17.0	4.92	
65	10EK-1065	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	13.3	13.25	U
66	10EK-1066	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	10.8	10.83	U
67	10EK-1067	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	18.4	4.82	
68	10EK-1068	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.6	4.50	

**Table I-1**  
**TOTAL MERCURY IN TAILINGS SAMPLES FROM MAIN TAILINGS PILE**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
69	10EK-1069	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.7	4.78	
70	10EK-1070	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	36.4	5.73	
71	10EK-1071	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	30.9	5.18	
72	10EK-1072	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	33.3	5.56	
73	10EK-1073	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	33.1	5.16	
74	10EK-1074	Main Tailings/Clean Cap Confirmation/West	Tailings	8/31/07	mg/kg	14.5	14.46	U

Key:           mg/kg = milligrams per kilogram  
                  U = not detected above this concentration  
                  XRF = X-ray Fluorescence

**Table I-2**  
**TOTAL MERCURY IN SAMPLES FROM OLD ORE FURNACE AREA**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
121	10EK-3001	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	661	18.86	
122	10EK-3002	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	181	9.66	
123	10EK-3003	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	1940	32.34	
124	10EK-3004	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	298	11.99	
125	10EK-3005	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	33.5	5.66	
126	10EK-3006	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	63.7	7.09	
127	10EK-3007	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	34.4	5.93	
128	10EK-3008	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	62.3	7.20	
129	10EK-3009	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	186	9.50	
130	10EK-3010	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	141	10.38	
131	10EK-3011	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	208	10.44	
132	10EK-3012	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	13.7	13.67	U
133	10EK-3013	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	126	9.14	
134	10EK-3014	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	40.9	5.72	
135	10EK-3015	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	12.6	12.60	U
136	10EK-3016	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	1500	29.03	
137	10EK-3017	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	9730	109.93	
138	10EK-3018	Old Ore Furnace/Immediately Adjacent	Tailings	8/21/07	mg/kg	2880	41.06	
139	10EK-3019	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	2350	36.16	
140	10EK-3020	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1960	32.03	
141	10EK-3021	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	42.6	42.60	U
142	10EK-3022	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	210	29.27	
143	10EK-3023	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	2160	76.39	
144	10EK-3024	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	10500	319.74	
145	10EK-3025	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1490	66.14	
146	10EK-3026	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	917	58.57	
147	10EK-3027	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	96.3	23.63	
148	10EK-3028	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	229	24.15	
149	10EK-3029	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	38.7	38.69	U
150	10EK-3030	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	36.4	36.36	U
151	10EK-3031	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	346	30.60	
152	10EK-3032	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	552	41.01	

**Table I-2**  
**TOTAL MERCURY IN SAMPLES FROM OLD ORE FURNACE AREA**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
153	10EK-3033	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1180	61.40	
154	10EK-3034	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1040	70.80	
155	10EK-3035	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	3090	127.80	
156	10EK-3036	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	723	48.87	
157	10EK-3037	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	123	21.08	
157	10EK-3037	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	123	21.08	
158	10EK-3038	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	42.6	42.56	U
159	10EK-3039	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	67.4	18.44	
160	10EK-3040	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	222	23.80	
161	10EK-3041	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	498	51.49	
162	10EK-3042	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	107	21.00	
163	10EK-3043	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	175	24.17	
164	10EK-3044	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	33.7	33.71	U
165	10EK-3045	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	56.5	16.11	
166	10EK-3046	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	47.6	47.63	U
167	10EK-3047	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	244	26.44	
168	10EK-3048	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	133	26.93	
169	10EK-3049	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	36.1	36.09	U
170	10EK-3050	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	118	21.44	
171	10EK-3051	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	203	10.55	
172	10EK-3052	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	84.8	7.57	
173	10EK-3053	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	12.9	12.87	U
174	10EK-3054	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	55.6	6.31	
175	10EK-3055	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	16.3	16.34	U
176	10EK-3056	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	622	18.90	
177	10EK-3057	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	985	20.15	
178	10EK-3058	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	3490	47.17	
179	10EK-3059	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	42.5	5.79	
180	10EK-3060	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	37.8	6.29	
181	10EK-3061	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	89.1	7.83	
182	10EK-3062	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	175	10.01	
183	10EK-3063	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	402	14.11	

**Table I-2**  
**TOTAL MERCURY IN SAMPLES FROM OLD ORE FURNACE AREA**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
184	10EK-3064	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	1440	31.19	
185	10EK-3065	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	33.3	5.52	
186	10EK-3066	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	278	12.55	
187	10EK-3067	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	709	18.15	
188	10EK-3068	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	225	10.31	
189	10EK-3069	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	154	8.71	
190	10EK-3070	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	145	8.67	
191	10EK-3071	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	148	8.67	
192	10EK-3072	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	348	13.88	
193	10EK-3073	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	264	11.86	
194	10EK-3074	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	357	13.33	
195	10EK-3075	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	12.4	12.37	U
196	10EK-3076	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	909	21.25	
197	10EK-3077	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	2510	40.44	
198	10EK-3078	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	148	9.42	
199	10EK-3079	Old Ore Furnace/Upgradient	Tailings	8/21/07	mg/kg	41.0	6.23	
201	10EK-3081	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	83.5	7.71	
202	10EK-3082	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	41.7	5.57	
204	10EK-3084	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	117	7.74	
206	10EK-3086	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	614	15.56	
207	10EK-3087	Old Ore Furnace/Upgradient	Tailings	8/30/07	mg/kg	493	14.28	
619	10EK-3089	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.4	14.44	U
620	10EK-3090	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	12.8	12.79	U
621	10EK-3091	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	22.9	6.54	
622	10EK-3092	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	12.5	12.45	U
623	10EK-3093	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.6	14.64	U
624	10EK-3094	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.2	16.22	U
625	10EK-3095	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.2	16.22	U
626	10EK-3096	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.9	14.93	U
627	10EK-3097	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.2	14.20	U
628	10EK-3098	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	12.6	12.56	U
629	10EK-3099	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.1	16.06	U

**Table I-2**  
**TOTAL MERCURY IN SAMPLES FROM OLD ORE FURNACE AREA**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
630	10EK-3100	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.8	16.83	U
631	10EK-3101	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.4	14.38	U
632	10EK-3102	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	14.9	14.91	U
633	10EK-3103	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	16.1	16.11	U
634	10EK-3104	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	17.3	4.88	
635	10EK-3105	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	12.9	12.85	U
636	10EK-3106	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	22.0	5.79	
637	10EK-3107	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	15.0	15.04	U
638	10EK-3108	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	15.5	15.50	U
639	10EK-3109	Old Ore Furnace/Confirmation	Tailings	9/3/07	mg/kg	15.0	15.04	U
552	10EK-7001	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	84	18.45	
553	10EK-7002	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	53	15.17	
554	10EK-7003	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	195	29.05	
555	10EK-7004	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg		49.17	U
556	10EK-7005	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	59	15.51	
557	10EK-7006	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	194	25.55	
558	10EK-7007	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	262	32.42	
559	10EK-7008	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	481	39.84	
560	10EK-7009	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	790	55.97	
561	10EK-7010	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	579	37.83	
562	10EK-7011	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	111	19.82	
563	10EK-7012	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	1205	63.26	
564	10EK-7013	Old Ore Furnace/Downgradient	Tailings	8/28/07	mg/kg	1124	64.25	

**TABLE I-3**  
**TOTAL MERCURY IN SAMPLES FROM NEW FURNACE AREA**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF Result	XRF Reporting Limit	Qualifier
75	10EK-2001	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	189	10.38	
76	10EK-2002	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	673	15.93	
77	10EK-2003	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	137	7.23	
78	10EK-2004	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	106	6.93	
79	10EK-2005	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	1630	28.55	
80	10EK-2006	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	185	9.05	
81	10EK-2007	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	1620	29.45	
82	10EK-2008	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	180	8.96	
83	10EK-2009	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	119	7.69	
84	10EK-2010	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	154	8.46	
85	10EK-2011	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	94	7.01	
86	10EK-2012	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	112	7.66	
87	10EK-2013	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	165	8.41	
88	10EK-2014	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	172	8.66	
89	10EK-2015	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	1000	20.32	
90	10EK-2016	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	649	16.20	
91	10EK-2017	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	54.3	5.89	
92	10EK-2018	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	125	7.28	
93	10EK-2019	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	134	7.99	
94	10EK-2020	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	65.4	5.92	
95	10EK-2021	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	32.6	6.57	
96	10EK-2022	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	63.8	6.12	
97	10EK-2023	New Furnace Area/Pre-Capping	Tailings	8/20/07	mg/kg	62.0	6.29	
98	10EK-2024	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	19.5	4.85	
99	10EK-2025	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	13.9	13.89	U
100	10EK-2026	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	11.4	11.44	U
101	10EK-2027	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	13.9	13.89	U
102	10EK-2028	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	52.5	6.30	
103	10EK-2029	New Furnace Area/Confirmation	Tailings	8/27/07	mg/kg	31.4	5.94	
112	10EK-2038	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	36.1	5.31	
113	10EK-2039	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	69.6	6.83	
114	10EK-2040	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	94.1	6.27	

**TABLE I-3**  
**TOTAL MERCURY IN SAMPLES FROM NEW FURNACE AREA**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

<b>Record Number</b>	<b>Sample Number</b>	<b>Sample Location</b>	<b>Sample Type</b>	<b>Collection Date</b>	<b>Result units</b>	<b>XRF Result</b>	<b>XRF Reporting Limit</b>	<b>Qualifier</b>
115	10EK-2041	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	51.6	5.83	
116	10EK-2042	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	86.6	6.73	
118	10EK-2044	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	17.3	4.73	
119	10EK-2045	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	30.6	5.09	
120	10EK-2046	New Furnace Area/Confirmation	Tailings	8/30/07	mg/kg	19.4	4.61	

Key:           mg/kg = milligrams per kilogram  
                   U = not detected above this concentration  
                   XRF = X-ray Fluorescence

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
209	10EK-4001	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.06	0.50	
210	10EK-4002	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	3.51	0.50	
211	10EK-4003	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.16	0.50	
212	10EK-4004	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.24	0.50	
213	10EK-4005	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.61	0.50	
214	10EK-4006	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.97	0.50	
215	10EK-4007	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.70	0.50	
216	10EK-4008	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.46	0.50	
217	10EK-4009	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.81	0.50	
218	10EK-4010	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	5.39	0.50	
219	10EK-4011	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.77	0.50	
220	10EK-4012	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	3.87	0.50	
221	10EK-4013	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.62	0.50	
222	10EK-4014	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.49	0.50	
223	10EK-4015	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	3.34	0.50	
224	10EK-4016	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.95	0.50	
225	10EK-4017	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.36	0.50	
226	10EK-4018	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.68	0.50	
227	10EK-4019	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.76	0.50	
228	10EK-4020	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.58	0.50	
229	10EK-4021	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	2.91	0.50	
231	10EK-4022	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	1.94	0.50	
232	10EK-4023	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	29.2	0.50	
233	10EK-4024	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	103	0.50	
234	10EK-4025	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	271	0.50	J
235	10EK-4026	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	42.4	0.50	
236	10EK-4027	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	63.2	0.50	
237	10EK-4028	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	146	0.50	
238	10EK-4029	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	78.3	0.50	
239	10EK-4030	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	141	0.50	
240	10EK-4031	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	73.9	0.50	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
	10EK-4031	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	73.9	0.50	
241	10EK-4032	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	78.8	0.50	
242	10EK-4033	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	81.9	0.50	
243	10EK-4034	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	115	0.50	
244	10EK-4035	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	258	0.50	J
245	10EK-4036	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	184	0.50	J
246	10EK-4037	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	486	0.50	J
247	10EK-4038	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	191	0.50	J
248	10EK-4039	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	300	0.50	J
249	10EK-4040	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	159	0.50	J
250	10EK-4041	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	212	0.50	J
251	10EK-4042	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	140	0.50	
252	10EK-4043	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	21.1	0.50	
253	10EK-4044	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	23.0	0.50	
254	10EK-4045	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	108	0.50	
255	10EK-4046	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	229	0.50	J
256	10EK-4047	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	265	0.50	J
257	10EK-4048	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	130	0.50	
258	10EK-4049	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	150	0.50	
259	10EK-4050	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	133	0.50	
260	10EK-4051	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	138	0.50	
261	10EK-4052	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	106	0.50	
262	10EK-4053	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	74.4	0.50	
263	10EK-4054	Furnace Creek/within Creek	Sediment/Tailings	8/23/07	mg/kg	70.7	0.50	
264	10EK-4055	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	36.8	0.50	
265	10EK-4056	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	87.5	0.50	
266	10EK-4057	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	130	0.50	
267	10EK-4058	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	47.4	0.50	
269	10EK-4059	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	103	0.50	
270	10EK-4060	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	72.1	0.50	
271	10EK-4061	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	74.9	0.50	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
272	10EK-4062	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	108	0.50	
273	10EK-4064	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	109	0.50	
274	10EK-4065	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	38.0	0.50	
275	10EK-4066	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	56.9	0.50	
276	10EK-4067	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	86.2	0.50	
277	10EK-4068	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	39.0	0.50	
278	10EK-4069	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	70.8	5.61	
279	10EK-4070	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	104	6.75	
280	10EK-4071	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	181	0.50	J
281	10EK-4072	Furnace Creek/within Creek	Sediment/Tailings	8/28/07	mg/kg	74.9	0.50	
282	10EK-4101	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.08	0.50	U
283	10EK-4102	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.64	0.50	
284	10EK-4103	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.93	0.50	
285	10EK-4104	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.18	0.50	
286	10EK-4105	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.86	0.50	
287	10EK-4106	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.51	0.50	
288	10EK-4107	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.18	0.50	U
289	10EK-4108	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.17	0.50	
290	10EK-4109	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.86	0.50	
291	10EK-4110	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.88	0.50	
292	10EK-4111	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.08	0.50	
293	10EK-4112	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.87	0.50	
294	10EK-4113	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.39	0.50	
295	10EK-4114	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.24	0.50	
296	10EK-4115	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	16.0	0.50	
297	10EK-4116	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	3.99	0.50	
298	10EK-4117	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.66	0.50	
299	10EK-4118	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.08	0.50	
300	10EK-4119	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	2.00	0.50	
301	10EK-4120	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.77	0.50	
302	10EK-4121	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	1.01	0.50	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
303	10EK-4122	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.18	0.50	U
304	10EK-4123	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	10.6	10.60	U
305	10EK-4124	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	9160	107.27	
306	10EK-4125	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
307	10EK-4126	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	45.2	5.67	
308	10EK-4127	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
309	10EK-4128	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	55.0	6.01	
310	10EK-4129	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
311	10EK-4130	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	3.24	0.50	
312	10EK-4131	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	5.68	0.50	
313	10EK-4132	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	6.69	0.50	
314	10EK-4133	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	27.0	0.50	
315	10EK-4134	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	6.12	0.50	
316	10EK-4135	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	30.7	5.39	
317	10EK-4136	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
318	10EK-4137	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	26.7	0.50	
319	10EK-4138	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	14.3	14.27	U
320	10EK-4139	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
321	10EK-4140	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	34.2	0.50	
	10EK-4140	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	34.2	0.50	
322	10EK-4141	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	23.2	0.50	
323	10EK-4142	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	41.1	0.50	
324	10EK-4143	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	35.8	0.50	
325	10EK-4144	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	26.9	0.50	
326	10EK-4145	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	18.8	0.50	
327	10EK-4146	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	91.5	0.50	
328	10EK-4147	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	20.9	0.50	
329	10EK-4148	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	56.0	0.50	
330	10EK-4149	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	52.2	0.50	
331	10EK-4150	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	31.9	0.50	
332	10EK-4151	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	82.5	6.73	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
333	10EK-4152	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	39.7	0.50	
334	10EK-4153	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	13.3	0.50	
335	10EK-4154	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/23/07	mg/kg	36.2	0.50	
336	10EK-4155	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	60.0	0.00	
337	10EK-4156	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	62.0	0.00	
338	10EK-4157	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	26.8	0.50	
339	10EK-4158	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	35.0	0.00	
340	10EK-4159	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	77.0	0.00	
341	10EK-4160	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	2.78	0.50	
342	10EK-4161	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	56.9	0.50	
343	10EK-4162	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	41.2	0.50	
344	10EK-4164	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	70.5	7.34	
345	10EK-4165	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	1520	25.52	
346	10EK-4166	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	150	8.39	
347	10EK-4167	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	85.3	7.14	
348	10EK-4168	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	279	10.76	
349	10EK-4169	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	117	0.50	
350	10EK-4170	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	69.0	0.50	
351	10EK-4171	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	137	8.15	
352	10EK-4172	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	24.8	0.50	
353	10EK-4173	Furnace Creek/Bank Sample NE Side - 5 ft	Tailings/Soil	8/28/07	mg/kg	6.71	0.50	
354	10EK-4201	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.70	0.50	
355	10EK-4202	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.49	0.50	
356	10EK-4203	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.15	0.50	
357	10EK-4204	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.66	0.50	
358	10EK-4205	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.46	0.50	
359	10EK-4206	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.87	0.50	
360	10EK-4207	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.01	0.50	
361	10EK-4208	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.93	0.50	
362	10EK-4209	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.82	0.50	
363	10EK-4210	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.80	0.50	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
364	10EK-4211	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.59	0.50	
365	10EK-4212	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.28	0.50	
366	10EK-4213	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.38	0.50	
367	10EK-4214	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.61	0.50	
368	10EK-4215	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.47	0.50	U
369	10EK-4216	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.90	0.50	
370	10EK-4217	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	2.04	0.50	
371	10EK-4218	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.31	0.50	
372	10EK-4219	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.86	0.50	
373	10EK-4220	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.62	0.50	
374	10EK-4221	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.54	0.50	
375	10EK-4222	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.34	0.50	
376	10EK-4223	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	1.21	0.50	
377	10EK-4224	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	148	8.23	
378	10EK-4225	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	101	7.38	
379	10EK-4226	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	100	7.46	
380	10EK-4227	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	7.98	0.50	
381	10EK-4228	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	220	10.87	
382	10EK-4229	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.88	0.50	
383	10EK-4230	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	286	11.96	
384	10EK-4231	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	17.3	0.50	
	10EK-4231	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	17	0.50	
385	10EK-4232	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.61	0.50	
386	10EK-4233	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	7.85	0.50	
387	10EK-4234	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	3.78	0.50	
388	10EK-4235	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
389	10EK-4236	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	139	8.59	
390	10EK-4237	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	358	12.35	
391	10EK-4238	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	47.6	5.73	
392	10EK-4239	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
393	10EK-4240	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	37.1	5.21	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
394	10EK-4241	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	12.6	0.50	
395	10EK-4242	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	34.7	0.50	
396	10EK-4243	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
397	10EK-4244	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	54.7	5.90	
398	10EK-4245	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	27.9	0.50	
399	10EK-4246	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.00	
400	10EK-4247	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	107	5.55	
401	10EK-4248	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	36.0	5.01	
402	10EK-4249	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	27.9	0.50	
403	10EK-4250	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	29.6	0.50	
404	10EK-4251	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	30.7	0.50	
405	10EK-4252	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	5.26	0.50	
406	10EK-4253	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	0.00	0.50	
407	10EK-4254	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/23/07	mg/kg	40.0	0.00	
408	10EK-4255	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	55.0	0.50	
409	10EK-4256	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	0.00	0.50	
410	10EK-4257	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	66.0	0.00	
411	10EK-4258	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	51.0	0.00	
412	10EK-4259	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	0.00	0.50	
413	10EK-4260	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	79.0	0.00	
414	10EK-4261	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	18.4	4.87	
415	10EK-4262	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	28.3	0.50	
416	10EK-4264	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	57.8	0.50	
417	10EK-4265	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	22.1	0.50	
418	10EK-4266	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	35.8	0.50	
419	10EK-4267	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	0.00	0.50	
420	10EK-4268	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	225	10.17	
421	10EK-4269	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	28.9	4.28	
422	10EK-4270	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	0.00	0.50	
423	10EK-4271	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	34.1	5.38	
424	10EK-4272	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	29.2	0.50	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
425	10EK-4273	Furnace Creek/Bank Sample NE Side - 10 ft	Tailings/Soil	8/28/07	mg/kg	24.0	0.50	
426	10EK-4301	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	0.00	0.00	
427	10EK-4302	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	16.8	16.83	U
428	10EK-4303	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	12.6	3.87	
429	10EK-4304	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	25.4	5.29	
430	10EK-4305	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	99.9	7.66	
431	10EK-4306	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	384	13.08	
432	10EK-4307	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	750	17.41	
433	10EK-4308	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	2470	36.27	
434	10EK-4309	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/29/07	mg/kg	2920	41.18	
435	10EK-4369	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/28/07	mg/kg	141	8.29	
437	10EK-4371	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/28/07	mg/kg	7.95	0.50	
438	10EK-4469	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/28/07	mg/kg	10.1	0.50	
439	10EK-4471	Furnace Creek/Specific Target on NE Side	Sediment/Tailings	8/28/07	mg/kg	6.05	0.50	
475	10EK-6101	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	21.2	0.5	
476	10EK-6102	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.28	0.5	
477	10EK-6103	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	12.9	0.5	
478	10EK-6104	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	7.66	0.5	
479	10EK-6105	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	12.0	0.5	
480	10EK-6106	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	3.36	0.5	
481	10EK-6107	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	1.90	0.5	
482	10EK-6108	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	6.13	0.5	
483	10EK-6109	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	3.07	0.5	
484	10EK-6110	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.99	0.5	
485	10EK-6111	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.40	0.5	
486	10EK-6112	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.91	0.5	
487	10EK-6113	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.46	0.5	
488	10EK-6114	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	1.71	0.5	
489	10EK-6115	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	5.25	0.5	
490	10EK-6116	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	1.24	0.5	U
491	10EK-6117	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	11.1	0.5	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
492	10EK-6118	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	27.5	0.5	
493	10EK-6119	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.21	0.5	
494	10EK-6120	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	0.82	0.5	U
495	10EK-6121	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	9.53	0.5	
496	10EK-6122	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	11.4	0.5	
497	10EK-6123	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	0.60	0.5	U
498	10EK-6124	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	10.7	0.5	
499	10EK-6125	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	2.59	0.5	
500	10EK-6126	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	9.72	0.5	
501	10EK-6127	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	25.7	0.5	
502	10EK-6128	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	1.75	0.5	
503	10EK-6129	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	3.21	0.5	
504	10EK-6130	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	87.2	0.5	J
505	10EK-6131	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	29.7	0.5	
506	10EK-6132	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	28.7	0.5	
507	10EK-6133	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	14.2	0.5	
508	10EK-6134	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	10.6	0.5	
509	10EK-6135	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	267	0.5	J
510	10EK-6136	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	204	0.5	J
511	10EK-6137	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	85.4	0.5	J
512	10EK-6138	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	125	0.5	J
513	10EK-6139	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	85.8	0.5	J
514	10EK-6140	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	35.9	0.5	
515	10EK-6141	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	9.40	0.5	
516	10EK-6142	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	14.7	0.5	
517	10EK-6143	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	334	11.4	
518	10EK-6144	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	55.3	0.5	
519	10EK-6145	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	29.0	0.5	
520	10EK-6146	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	142	0.5	J
521	10EK-6147	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	22.9	0.5	
522	10EK-6148	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	63.9	0.5	

**TABLE I-4**  
**TOTAL MERCURY IN TAILINGS/SEDIMENT/SOIL FROM FURNACE CREEK AND FURNACE CREEK BANKS**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

Record Number	Sample Number	Sample Location	Sample Type	Collection Date	Result units	XRF/ Lumex Result	XRF/ Lumex Reporting Limit	Qualifier
523	10EK-6149	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	34.7	0.5	
524	10EK-6150	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	31.5	0.5	
525	10EK-6151	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	63.4	0.5	
526	10EK-6152	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	40.8	0.5	
527	10EK-6153	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	33.3	0.5	
528	10EK-6154	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	18.0	0.5	
529	10EK-6155	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	11.5	0.5	
530	10EK-6156	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	34.7	0.5	
531	10EK-6157	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	16.0	0.5	
532	10EK-6158	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	4.85	0.5	
533	10EK-6159	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	4.92	0.5	
534	10EK-6160	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	61.1	0.5	
535	10EK-6161	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	99.4	0.5	J
536	10EK-6162	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	49.4	0.5	
537	10EK-6163	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	58.5	0.5	
538	10EK-6164	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	47.2	0.5	
539	10EK-6165	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	79.5	0.5	
540	10EK-6166	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	212	10.0	
541	10EK-6167	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	266	10.6	
542	10EK-6168	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/29/07	mg/kg	59.2	0.5	
543	10EK-6169	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	43.3	0.5	J
544	10EK-6170	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	43.4	0.5	
545	10EK-6171	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	26.2	0.5	
546	10EK-6172	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	31.6	0.5	
547	10EK-6269	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	32.6	0.5	
548	10EK-6270	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	31.4	0.5	
549	10EK-6271	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	18.6	0.5	
550	10EK-6272	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	10.2	0.5	
551	10EK-6273	Furnace Creek/Bank Sample SW Side - 5 ft	Sediment/Tailings	8/28/07	mg/kg	16.9	0.5	

**TABLE I-5**  
**TOTAL MERCURY IN SEDIMENT FROM DENNIS CREEK**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

<b>Record Number</b>	<b>Sample Number</b>	<b>Sample Location</b>	<b>Sample Type</b>	<b>Collection Date</b>	<b>Result units</b>	<b>Lumex Result</b>	<b>Lumex Reporting Limit</b>	<b>Qualifier</b>
565	10EK-8001	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.14	0.5	
566	10EK-8002	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.68	0.5	
567	10EK-8003	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.32	0.5	
568	10EK-8004	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.49	0.5	
569	10EK-8005	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.00	0.5	
570	10EK-8006	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	17.9	0.5	
571	10EK-8007	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.81	0.5	
572	10EK-8008	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.30	0.5	
573	10EK-8009	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	2.91	0.5	
574	10EK-8010	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.55	0.5	
575	10EK-8011	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	4.93	0.5	
576	10EK-8012	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.22	0.5	
577	10EK-8013	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.05	0.5	
578	10EK-8014	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.57	0.5	
579	10EK-8015	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	6.17	0.5	
580	10EK-8016	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.34	0.5	
581	10EK-8017	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.11	0.5	
582	10EK-8018	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	6.07	0.5	
583	10EK-8019	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.67	0.5	
584	10EK-8020	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	5.73	0.5	
585	10EK-8021	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.99	0.5	
586	10EK-8022	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.05	0.5	
587	10EK-8023	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	3.28	0.5	
588	10EK-8024	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.20	0.5	
589	10EK-8025	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.86	0.5	
590	10EK-8026	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.83	0.5	
591	10EK-8027	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.63	0.5	
592	10EK-8028	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.50	0.5	
593	10EK-8029	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.91	0.5	
594	10EK-8030	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.07	0.5	
615	10EK-8031	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.6	0.5	
596	10EK-8032	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.79	0.5	

**TABLE I-5**  
**TOTAL MERCURY IN SEDIMENT FROM DENNIS CREEK**  
**BLACK BUTTE MINE**  
**LANE COUNTY, OREGON**

<b>Record Number</b>	<b>Sample Number</b>	<b>Sample Location</b>	<b>Sample Type</b>	<b>Collection Date</b>	<b>Result units</b>	<b>Lumex Result</b>	<b>Lumex Reporting Limit</b>	<b>Qualifier</b>
597	10EK-8033	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.46	0.5	U
598	10EK-8034	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	17.4	0.5	
599	10EK-8035	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	3.03	0.5	
600	10EK-8036	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	2.50	0.5	
601	10EK-8037	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.09	0.5	
602	10EK-8038	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	1.27	0.5	
603	10EK-8039	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.77	0.5	
604	10EK-8040	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	0.78	0.5	
605	10EK-8041	Dennis Creek/within Creek	Sediment	8/31/2007	mg/kg	7.17	0.5	



## **II. EFFECTIVENESS OF REMOVAL ACTIONS**

### **A. ACTIONS TAKEN BY PRPS**

Since 1994, the site has been owned by the Land and Timber Company and who is considered a PRP. No other viable potentially responsible party (PRP) has been identified.

### **B. ACTIONS TAKEN BY STATE AND LOCAL FORCES**

Since the early 1990s, ODEQ, in conjunction with Oregon State University and others, has conducted on-going investigations of the Black Butte Mine and surrounding areas. During the Removal Action, ODEQ continued involvement at the site and provided support to EPA.

ODEQ agreed to conduct post-removal sampling to verify the removal effectiveness and determine if any additional cleanup work is required and also agree to conduct annual inspections of the Main Tailings Pile slope, repository, and capped areas.

The State Archaeologist, with the State Historic Preservation Office (SHPO), was sent information about the planned removal work. Based on the feedback from the SHPO, a Cultural Resource Survey was initiated. Archaeological Investigations Northwest, Inc. (AINW) was contracted through E & E to conduct an archaeological survey of the project Area of Potential Effects to address the project's possible impacts on significant archaeological resources. As the project is a federal undertaking, AINW's work was done in compliance with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations (36 C.F.R. § 800), and according to the requirements of the Secretary of the Interior's Standards and Guidelines for Archaeology and Historic Preservation.

Records from the Oregon SHPO were reviewed to determine if archaeological sites had been recorded or if archaeological surveys had been conducted in the vicinity of the Black Butte Mine. A review of the National Register of Historic Places was also conducted to determine if any listed archaeological or historic properties are located in or near the proposed project area. The results indicated that no listed archaeological sites were in or near the proposed project area. A review of the SHPO database, which is a listing of the Oregon Inventory of Historic Properties, indicated no inventoried resources were located in the proposed project area.

## **C. ACTIONS TAKEN BY FEDERAL AGENCIES AND SPECIAL TEAMS**

Patricia McGrath of the EPA Region 10 Mining Team was briefed on the pending removal and agreed with the need for a clean-up at the BBM and the proposed removal actions. The BBM is the only mercury mine with drainage to the Cottage Grove Reservoir.

At the request of the OSC, the USCG participated in the RA to perform Health and Safety oversight and dust monitoring and assist with onsite mercury analyses. Two USCG members were on-site for the RA.

## **D. ACTIONS TAKEN BY CONTRACTORS, PRIVATE GROUPS, AND VOLUNTEERS**

The Removal Action was performed by ERRS under the direction of the OSC. START assisted with field sampling and on-site analysis.

### **1. Removal Activities**

The BBM Removal Action was performed from August 20 through September 3, 2007. Removal Action activities began with the mobilization of the personnel, equipment, and supplies to be used for the Removal Action. Earth-moving equipment used by ERRS for the RA and Office trailers were mobilized to the site. Several bridges on the county road accessing the site had weight restrictions that made it necessary for ERRS to get permission for the heavier equipment to use a private road to the site. The heaviest equipment was unloaded and driven across the final bridge at the entrance to the site to avoid damaging the bridge.

Once site personnel arrived on site, a general site Health and Safety meeting was held to discuss the planned cleanup activities and related issues. Topics included a discussion of the health risks for the contaminants of concern (mercury) and other safety topics, such as working around heavy equipment and heat stress. In addition to the initial general meeting, the site workers participated in daily Health and Safety meetings at the start of each work day.

The following subsections describe the Removal Activities undertaken at the BBM site.

#### **a) Main Tailings Pile**

Where waste rock and tailings along the northeast side of the Main Tailings Pile followed a steep angle down toward Dennis Creek, the angle of the slope was decreased to reduce the likelihood that tailings would continue to erode into Dennis Creek. Drainage benches, topsoil, slash and straw bales were installed to minimize erosion and control the flow of water and sediment off the slopes and into Dennis Creek. This process involved the removal of a

substantial volume of tailings from the slope. These tailings were analyzed using an XRF to determine if the mercury concentration was less than the 115 mg/kg action level for dermal contact and suitable for use as cover in other areas of the site. The material that was not used as cover was placed on-site in an area designated as the repository.

#### **b) Old Ore Furnace Area and New Furnace Area**

ERRS used tailings removed from the Main Tailings Pile to cover areas around the Old Ore Furnace and the New Furnace that exceeded the 115 mg/kg cleanup criteria for dermal exposure. Confirmation sampling and analysis completed once the cap was in place confirmed that the capping material used was lower than the 115 mg/kg action level.

#### **c) Furnace Creek**

Extensive sampling and analysis of the tailings and sediment in Furnace Creek was performed during the Removal Action using both an XRF and a Lumex. Sample locations started upstream from the Old Furnace Area and extended to Garoutte Creek. Results of the sampling and analyses of sediment and bank samples from Furnace Creek indicated that the area adjacent to the Old Furnace and extending down to the confluence with Garoutte Creek consistently exceeded 10 mg/kg mercury. In some areas, total mercury concentrations were at least an order of magnitude above the action level. Furnace creek was heavily vegetated and the bank areas immediately adjacent to the creek were very stable for nearly the entire extent of Furnace Creek below the Old Furnace. The extent of contamination along Furnace Creek was not anticipated prior to the Removal Action, despite the work performed during the removal assessment. Based on the anticipated cost and duration of a clean-up necessary to excavate mercury-contaminated tailings and soils along Furnace Creek and the high potential for environmental damage, this area was not addressed by the Removal Action.

### **2. Dust Monitoring**

Dust monitoring was performed by the USCG using DataRAM 4000 airborne particulate monitors with data loggers. The air monitoring program was designed and implemented for site H&S as well as to ensure that no unnecessary off-site migration of dust occurred. Dust monitoring was performed daily while site activities continued. On days that dust monitoring was performed, the USCG set out a DataRAM instruments near and downwind of daily site activities.

The dust action limit established for the site was 10 micrograms per cubic meter (mg/m<sup>3</sup>) of air. Throughout the RA, average dust levels were generally at about 0.1 mg/m<sup>3</sup> or less. Occasionally, brief periods of higher dust concentrations (e.g., “spikes”) were observed,

although most dust readings were less than 1.0 mg/m<sup>3</sup>. Only three instantaneous readings over 1.0 mg/m<sup>3</sup> were observed, with the highest being 2.9 mg/m<sup>3</sup>. Dust levels never exceeded the site action limit of 10 mg/m<sup>3</sup>.

Raw data collected by the data loggers of the dust monitoring instruments are maintained in EPA's site file.

### **III. DIFFICULTIES ENCOUNTERED**

#### **A. ITEMS THAT AFFECTED THE RESPONSE**

With the exception of Furnace Creek, the Removal Activities were performed as intended and finished on schedule. Although there were no major issues that significantly affected the Removal Action, there were some minor issues that were overcome to complete the RA.

**Equipment.** ERRS had trouble with some of the rental equipment, including the dozer and the excavator. These pieces of equipment frequently did not work properly when received and required either maintenance or replacement, which caused some delays. After several days the equipment rental subcontractor had replaced most of these items and ERRS continued to work without further delay.

**Dust Monitoring Equipment.** Occasionally throughout the RA, the DataRAM 4000 dust monitors were not operated properly and the data was not captured.

#### **B. ISSUES OF INTERGOVERNMENTAL COORDINATION**

There were no issues that arose while EPA was working with state and local governmental agencies for this RA. ODEQ was well prepared to help with the RA, exceptionally cooperative and assisted with the initial on-site analyses to delineate the areas to be capped. ODEQ also performed the study to determine the local background concentration for mercury and participated in the consensus decisions on the actions levels chosen.

#### **C. DIFFICULTIES INTERPRETING, COMPLYING WITH, OR IMPLEMENTING POLICIES AND REGULATIONS**

None



#### **IV. RECOMMENDATIONS**

##### **A. MEANS TO PREVENT A RECURRENCE OF THE DISCHARGE OR RELEASE**

Contamination was present from the historic mining operations. Mine operations began in the late 1890s and the mine was operated intermittently through the late 1960s. It is believed that much of the soil contamination occurred before the development of environmental regulations and industry practices to prevent such contamination. EPA is not aware of a specific incident or management practices that caused the release so no specific recommendation to prevent a recurrence can be made at this time.

##### **B. MEANS TO IMPROVE RESPONSE ACTIONS**

The Removal Action was effective and efficient for the work that could be performed within the EPA Region 10 Removal Program's budget. One recommendation for future Removal Actions is that the removal assessment thoroughly identify the breadth of the contamination, both laterally and in depth, prior to establishing a removal action budget.

##### **C. PROPOSALS FOR CHANGES IN REGULATIONS AND RESPONSE PLANS**

None



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- United States Fish and Wildlife Service (USFWS), 1992, *Results of Cottage Grove Bald Eagle Egg Analysis*, Fact Sheet.
- United States Geological Survey (USGS), 1993, *Sediment Mercury Data, Multiple Station Analysis, 1992 and 1993*, unpublished.



# Appendix A

## Photographic Documentation



Photo 1 XRF testing of mercury in tailings removed from Main Tailings Pile - West slope.

Direction: West Date: 8/22/2007 Time: By: KP



Photo 3 Native soil under tailings on Main Tailings Pile - West slope.

Direction: West Date: 8/23/2007 Time: By: KP



Photo 2 Moving tailings from Main Tailings Pile - West slope up slope.

Direction: West Date: 8/22/2007 Time: By: KP



Photo 4 Main Tailings Pile - West slope excavator making water bars at

Direction: North Date: 8/31/2007 Time: 9:22 By: BC



Photo 5 Main Tailings Pile - West slope with soil cap.

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*Direction: North      Date: 9/3/2007      Time: 16:26      By: BC*

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Photo 7 Straw bales placed on Main Tailings Pile - West slope.

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*Direction: Northwest      Date: 9/3/2007      Time:      By: KP*

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Photo 6 Main Tailings Pile - West slope showing soil cap and water bar.

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*Direction: North      Date: 9/3/2007      Time: 16:26      By: BC*

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Photo 8 Straw bales placed on Main Tailings Pile - West slope.

Direction: East Date: 9/3/2007 Time: By: KP



Photo 10 Dataram monitoring air at top of Main Tailings Pile - West slope.

Direction: Northwest Date: 9/3/2007 Time: By: KP



Photo 9 Clean soil placed on top of Main Tailings Pile - West slope.

Direction: West Date: 9/3/2007 Time: By: KP



Photo 11 Main Tailing Pile - West slope showing soil cap with woody debris on surface.

Direction: North Date: 9/4/2007 Time: 9:58 By: BC



Photo 12 Main Tailing Pile - West slope showing soil cap with woody debris on surface .

Direction: North Date: 9/4/2007 Time: 10:01 By: BC



Photo 13 Main Tailings Pile - West slope showing woody debris placed on surface.

Direction: West Date: 9/4/2007 Time: By: KP



Photo 14 Starting to clear Main Tailings Pile - West slope.

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Direction: West Date: 8/21/2007 Time: By: KP

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Photo 15 Main Tailings Pile - Starting to clear East slope.

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Direction: East Date: 8/21/2007 Time: By: KP

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Photo 16 Moving tailings from Main Tailings Piles to New Furnace Area for capping.

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Direction: North Date: 8/22/2007 Time: By: KP

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Photo 17 Main Tailing Pile - East slope tailings removal.

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Direction: East Date: 8/22/2007 Time: By: KP

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Photo 18 Cutting water bars on Main Tailings Pile - East Slope.

Direction: North Date: 8/24/2007 Time: By: KP



Photo 19 Keying tailings into top of Main Tailings Pile - East slope.

Direction: Northeast Date: 8/25/2007 Time: By: KP



Photo 20 Main Tailings Pile - East slope prior to topsoil and hydroseed.

Direction: East Date: 8/31/2007 Time: 9:24 By: BC



Photo 21 Main Tailings Pile - East slope prior to topsoil and hydroseed.

Direction: Northwest Date: 8/31/2007 Time: 9:24 By: BC



Photo 22 Main Tailings Pile - East slope note straw bales at base.

Direction: Northeast Date: 8/31/2007 Time: 9:24 By: BC



Photo 24 Clean cover soil placed on Main Tailings Pile - East slope.

Direction: East Date: 9/3/2007 Time: By: KP



Photo 23 Main Tailings Pile - East slope adding soil cap.

Direction: East Date: 9/3/2007 Time: 16:27 By: BC



Photo 25 Straw bales at base of Main Tailings Pile - East slope.

Direction: Northeast Date: 9/3/2007 Time: By: KP



Photo 26 Clean soil placed on top of Main Tailings Pile - East slope.

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*Direction: Northeast    Date: 9/3/2007    Time:    By: KP*

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Photo 27 Woody debris placed on final slope of Main Tailings Pile - East slope.

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*Direction: East    Date: 9/5/2007    Time:    By: KP*

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Photo 28 Opening buried tank in Old Ore Furnace Area.

Direction: Southeast Date: 8/25/2007 Time: By: KP



Photo 29 Starting to cap Old Ore Furnace Area.

Direction: Southeast Date: 8/25/2007 Time: By: KP



Photo 30 Object found and relocated off Old Furnace Area.

Direction: North Date: 8/27/2007 Time: By: KP



Photo 31 High visibility flagging around residential water line.

Direction: South Date: 8/27/2007 Time: By: KP



Photo 32 Tailings at area down slope of Old Ore Furnace.

*Direction: Southwest Date: 8/29/2007 Time: 13:03 By: BC*



Photo 34 Hauler taking capping materials to Old Ore Furnace for capping.

*Direction: South Date: 8/30/2007 Time: 16:03 By: BC*



Photo 33 Capped tailings at area down slope of Old Ore Furnace.

*Direction: Southwest Date: 8/30/2007 Time: 15:59 By: BC*



Photo 35 Old Ore Furnace Area cap over debris near Old Ore Furnace.

*Direction: West Date: 8/31/2007 Time: 9:35 By: BC*



Photo 36 Command Post from Old Ore Furnace Area cap.

*Direction: North Date: 8/31/2007 Time: 9:35 By: BC*



Photo 38 Old Ore Furnace.

*Direction: Southwest Date: 8/31/2007 Time: 9:37 By: BC*



Photo 37 Water tank from Old Ore Furnace Area cap.

*Direction: East Date: 8/31/2007 Time: 9:35 By: BC*



Photo 39 Completed Old Ore Furnace Area cap over debris field near Old Ore Furnace.

*Direction: West Date: 8/31/2007 Time: 16:32 By: BC*



Photo 40 Completed Old Ore Furnace Area cap over debris field near Old Ore Furnace.

*Direction: South Date: 8/31/2007 Time: 16:33 By: BC*



Photo 42 Old Ore Furnace Area cap looking west towards Old Ore Furnace.

*Direction: East Date: 8/31/2007 Time: 9:33 By: BC*



Photo 41 Eastern finger of Old Ore Furnace Area cap.

*Direction: Southeast Date: 8/31/2007 Time: 9:33 By: BC*



Photo 43 Eastern finger of Old Ore Furnace Area cap.

*Direction: South Date: 8/31/2007 Time: 9:34 By: BC*



Photo 44 Old Ore Furnace Area cap.

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*Direction: Southeast    Date: 9/3/2007    Time:    By: KP*

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Photo 45 Cap material pushed up to Old Ore Furnace structure.

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*Direction: East    Date: 9/4/2007    Time:    By: KP*

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Photo 46 Piling tailings around buildings in New Furnace Area.

Direction: Northeast Date: 8/24/2007 Time: By: KP



Photo 47 Partial cap in New Furnace Area.

Direction: North Date: 8/24/2007 Time: By: KP



Photo 48 Smoothing cap around buildings in New Furnace Area.

Direction: East Date: 8/27/2007 Time: By: KP



Photo 49 Smoothing cap around buildings in New Furnace Area.

Direction: East Date: 8/27/2007 Time: By: KP



Photo 50 Soil removal area near New Furnace for final Main Tailings Pile slope cover.

Direction: East Date: 8/31/2007 Time: 16:28 By: BC



Photo 51 Soil removal area near New Furnace for final Main Tailings Pile slope cover.

Direction: East Date: 8/31/2007 Time: 16:28 By: BC



Photo 52 South of New Furnace - Slope reconstruction after fill material removal.

Direction: East Date: 9/4/2007 Time: 11:25 By: BC



Photo 53 South of New Furnace - Slope reconstruction after fill material removal.

Direction: East Date: 9/4/2007 Time: 11:31 By: BC



Photo 54 Furnace Creek Near Old Ore Furnace, looking up stream.

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*Direction: South Date: 8/29/2007 Time: 12:59 By: BC*

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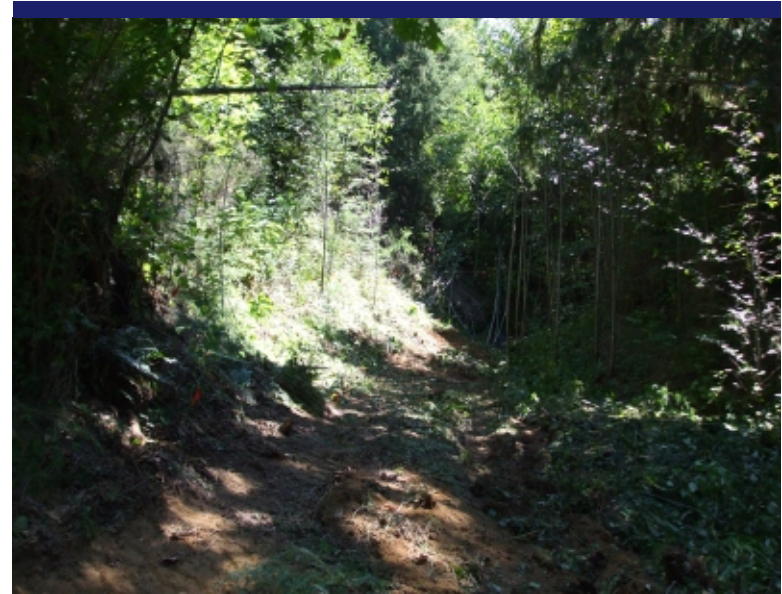


Photo 55 Furnace Creek Near Old Ore Furnace, looking up stream.

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*Direction: South Date: 8/29/2007 Time: 12:59 By: BC*

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Photo 56 Furnace Creek up stream of Old Ore Furnace, looking down stream.

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*Direction: Northwest Date: 8/29/2007 Time: 13:00 By: BC*

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Photo 57 Furnace Creek up stream of Old Ore Furnace, looking down stream.

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*Direction: Northwest Date: 8/29/2007 Time: 13:00 By: BC*

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Photo 58 Bricks in Furnace Creek near Old Ore Furnace.

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*Direction: Down Date: 8/29/2007 Time: 13:01 By: BC*

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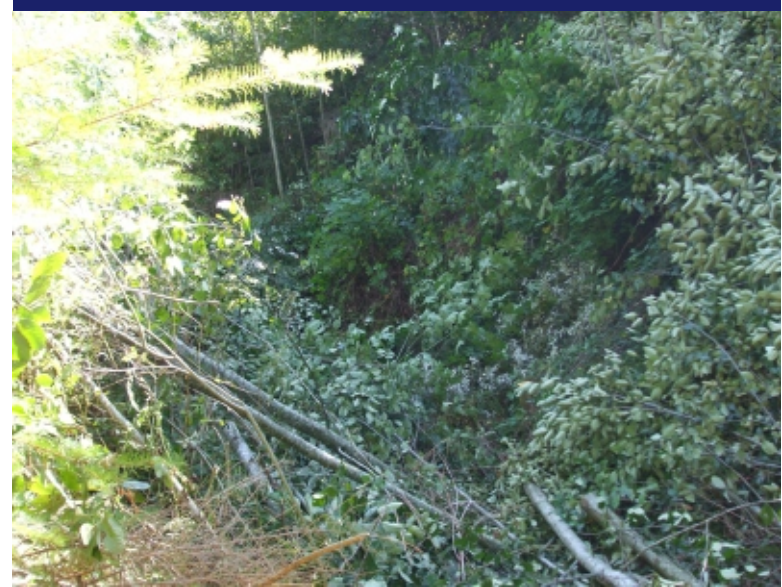


Photo 59 Brush clearing in furnace creek below 'son of the biting area'.

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*Direction: Southwest Date: 8/29/2007 Time: 13:05 By: BC*

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Photo 60 Furnace Creek test hole to determine depth of contamination. Showing ash layer high in mercury.

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*Direction: Northwest Date: 8/29/2007 Time: By: KP*

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Photo 61 EPA OSC Parker walking up unimproved mine road.

*Direction: South Date: 8/30/2007 Time: 15:58 By: BC*



Photo 63 Caterpillar shaping repository.

*Direction: Northeast Date: 8/31/2007 Time: 9:19 By: BC*

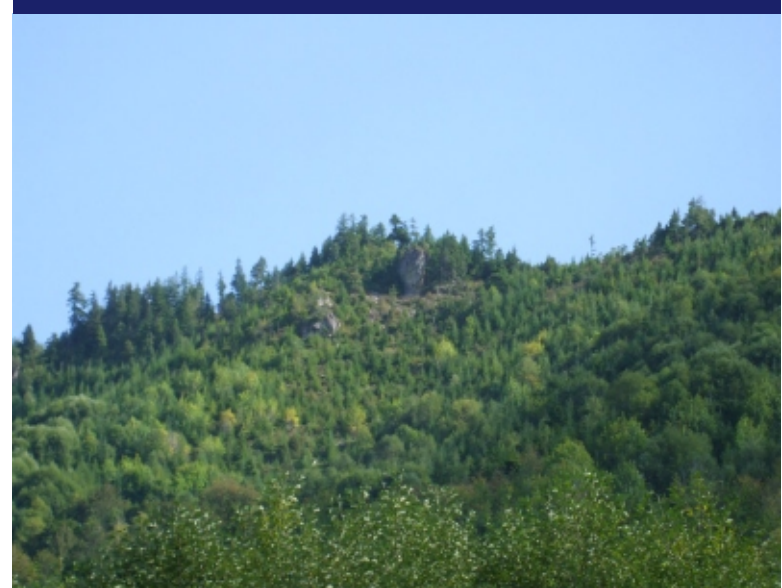


Photo 62 Top of Black Butte - Glory Hole.

*Direction: Southeast Date: 8/30/2007 Time: 16:04 By: BC*



Photo 64 Representative of Oregon Governor's Office, Representative of ODEQ, OSC, Television Reporter.

*Direction: South Date: 8/30/2007 Time: By: KP*



Photo 65 Television Crew, OSC Parker.

Direction: Northwest Date: 8/30/2007 Time: By: KP



Photo 66 New gate installed at entrance to site.

Direction: East Date: 8/31/2007 Time: By: KP



Photo 67 Repository.

Direction: North Date: 9/4/2007 Time: By: KP



Photo 68 Main Tailing Pile - West slope tailings stockpile.

Direction: East Date: 8/30/2007 Time: 16:04 By: BC

## Appendix B

### Action Memorandum, Post Removal Site Controls Document, Community Relations Documents

# ENVIRONMENTAL Fact Sheet



## **Black Butte Mine, Lane County, Oregon**

U.S. Environmental Protection Agency, Region 10

August 2007

### **Black Butte Mine to be cleaned up**

Beginning this August, the U.S. Environmental Protection Agency (EPA), in partnership with the Oregon Department of Environmental Quality (DEQ), will begin a cleanup of the Black Butte Mine in southern Lane County, Oregon. The cleanup is expected to take about six weeks to complete. Black Butte Mine is an abandoned mercury mine near Dennis and Furnace Creeks. These are both tributaries to Garoutte Creek, which run into the Cottage Grove Reservoir which in turn drains into the Coast Fork of the Willamette River.

The cleanup will involve excavating, consolidating and stabilizing more than an estimated 40,000 cubic yards of contaminated waste material. This material includes tailings waste rock, mill waste, and sediments from private lands on the north edge of the site. Exposed mine tailings and nearby soils are contaminated with elevated levels of mercury, arsenic and other metals.

EPA cleanup plans call for excavating and moving the tailings along the mine's creek banks, and highly contaminated areas ("hotspots"), to a safe on-site repository away from the creeks. A protective layer of clean soil will cover these contaminated materials. While the cleanup work takes place, methods designed to prevent or reduce erosion will be carried out to prevent contaminated soil from moving off site into the nearby creek waters.

After the waste material is moved, EPA will re-slope the site, and replant disturbed areas. When finished, clean soils where the bank excavation took place will be seeded to further reduce potential movement of tailings into nearby creeks and downstream waterways. Long-term monitoring of the site is expected to be done by DEQ.

The goal of the cleanup is to prevent people from coming into contact with contaminated soils and sediments, and to reduce the migration of mercury contaminated tailings to the Cottage Grove, Oregon Reservoir.



*EPA and the Oregon Department of Environmental Quality examine a tailings pile before beginning cleanup at Black Butte Mine site.*

EPA will post more information about the cleanup on its website as soon as it becomes available. Visit <http://www.epa.gov/region10/>. Click on Index A-Z, then click on B for Black Butte Mine.

### **Site History**

The Black Butte Mine operated between the 1890s and 1960s and was the fourth largest producer of mercury in Oregon. Waste rock, mill waste, and tailings remain on site as a byproduct of processing the ore. Contaminants from mining activities include mercury and arsenic. Since the mine closed in 1969, several individuals and companies have owned the property but did no mining.

*(continued on back)*



U.S. Environmental Protection Agency  
1200 Sixth Avenue, ETPA-081  
Seattle, Washington 98101-1128

Black Butte Mine  
Cottage Grove, Oregon  
August 2007

## Site History *continued*

In 1996, DEQ's study, called a "Preliminary Assessment," identified possible public health and environmental threats related to contamination from this mine. In 2005, EPA did a removal assessment to study the contamination and found elevated levels of mercury and arsenic in mine tailings and soil.

## About Mercury

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas. Exposure to high levels of mercury may damage the brain, kidneys, and developing fetus.

Mercury can be found in the air, water and soil. Mercury enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants. It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity. For more information about possible health effects from Mercury exposure, go to the Agency for Toxic Substances and Diseases Registry (ATSDR) Web page: <http://www.atsdr.cdc.gov/tfacts46.html>.

## For More Information:

### On the internet:

[www.epaossc.net/BlackButteMineRemoval](http://www.epaossc.net/BlackButteMineRemoval)

### Kathy Parker

EPA On-Scene Coordinator  
206-553-0062 or toll free: 800-424-4372  
[parker.kathy@epa.gov](mailto:parker.kathy@epa.gov)

### Judy Smith

EPA Community Involvement Coordinator  
503-326-6994  
[smith.judy@epa.gov](mailto:smith.judy@epa.gov)

## Information Repository

To view information about this project, please visit:

Cottage Grove Public Library  
40 South 6th  
Cottage Grove, OR 97424  
541-942-3828

If you are not on the Black Butte Mine mailing list and would like to be, please contact Judy Smith.



*If you need materials in an alternative format, please contact Judy Smith. TTY users, please call the Federal Relay Service at 800-877-8339 and give the operator Judy Smith's number.*



# Oregon

Theodore Kulongoski, Governor

## Department of Environmental Quality

Western Region Eugene Office

1102 Lincoln Street, Suite 210

Eugene, OR 97401

(541) 686-7838

FAX (541) 686-7551

TTY (541) 687-5603

August 14, 2007

AUG 16 2007

Kathy Parker  
U.S. EPA Region 10  
1200 Sixth Avenue, Mailstop ECL-116  
Seattle, WA 98101

**Re: O&M Following EPA Removal Action  
Black Butte Mine – Lane County, OR**

Dear Kathy:

The Oregon Department of Environmental Quality (DEQ) thanks EPA for its efforts to clean up the former Black Butte mine site. DEQ understands that EPA will complete a planned removal action designed to reduce the potential of future erosion and runoff from tailings and other contaminated soil areas this summer. Further, it is our understanding that the post-removal site control document and EPA anticipate only limited O&M will be necessary following completion of the proposed removal action. We have reviewed the control document provided by your contractor for post-removal operations and maintenance (O&M).

To facilitate implementation of the removal and required follow-up work, DEQ is willing to conduct limited O&M at the site after the removal is completed. Subject to availability of funds and as DEQ's Orphan Account allows, DEQ will conduct annual site inspections of the areas of excavation, sloping, and the soil repository for a period of 10 years. DEQ will identify areas of erosion and may conduct minor repairs as needed. DEQ also may re-seed areas where seed did not provide a reasonable vegetative cover to reduce erosion. DEQ will conduct post removal action sampling and analysis, not to exceed \$5,000/year, of surface water and sediment areas to evaluate the effectiveness of the removal. DEQ may be able to conduct additional annual sampling events if funding is available. DEQ will not address any significant failure of the slopes or repository.

Again, DEQ greatly appreciates EPA's support at the former Black Butte mine site and we look forward to the completion of the removal. Please call me at (541) 687-7424 if you have any questions.

Sincerely,

Bryn Thoms, R.G.  
Project Manager

Cc: Jeff Christensen, DEQ HQ  
Max Rosenberg, DEQ-WR Eugene





**Black Butte Mine Site Cleanup  
Documents Available for Review**

Lane County, OR -- During August 2007, the U.S. Environmental Protection Agency (EPA) cleaned up the former Black Butte Mine Site, located approximately ten miles south of Cottage Grove, Oregon. During the cleanup, mine waste containing mercury and other contaminants was removed from areas adjacent to streams. Waste disposal is on-site under a protective cap.

The Administrative Record containing documents related to the cleanup is available for review at:

Cottage Grove Library  
40 South 6th  
Cottage Grove, OR 97424  
541/942-3828

EPA Records Center  
1200 6th Avenue  
Seattle, WA 98101  
(206) 553-4494.

For more information about the cleanup, please contact: On-Scene Coordinator Kathy Parker at 206-321-3796, [parker.kathy@epa.gov](mailto:parker.kathy@epa.gov); or visit <http://www.epaosc.net/BlackButteMineRemoval>

**Theodore R. Kulongoski**  
Governor



**Statement by Governor Kulongoski on Black Butte Mine**  
**August 30, 2007**

“The clean up of Black Butte Mine represents an important event for communities in this region, and for those who care about a healthy Willamette River – a river that supports our economy and communities, and enhances the quality of life for all Oregonians.

“It took several years – and many resources – to assess the scope and impact of mercury contamination at Black Butte Mine. This clean up is happening now as a result of the work of many state and federal agencies and organizations to understand the problem and determine the best way to clean up the site.

“I first visited Black Butte Mine in 2004, and made cleaning up the site a priority as part of my efforts to repair and restore the Willamette River Basin. Last year I asked EPA for assistance and they agreed to fund these clean up actions in partnership with the Oregon Department of Environmental Quality. I am grateful for EPA’s commitment to this project to DEQ’s continuous efforts.

“As a result of perseverance and a commitment to work together at every level of government, this clean up is finally happening and we can reassure the public that we are protecting our fish and wildlife from further mercury contamination, which in turn is protecting the health and well-being of our children and families.

“While we have much more to do to clean up the entire Willamette River Basin, today represents a significant step forward in restoring the state’s treasured gem so that future generations can enjoy a revitalized and healthy river.”



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
**REGION 10 Emergency Response Unit**  
**1200 Sixth Avenue**  
**Seattle, Washington 98101**

**Reply To Attn Of: ECL-116**

**MEMORANDUM**

**DATE:** April 13, 2007

**SUBJECT:** Request for a Removal Action to be Conducted at the Black Butte Mine,  
Cottage Grove, Oregon

**FROM:** Kathy Parker, On-Scene Coordinator *Kathy Parker*  
Carl Kitz, On-Scene Coordinator

**THRU:** Chris D. Field, Unit Manager *Chris D. Field*  
Emergency Response Unit, Office of Environmental Cleanup

**TO:** Daniel D. Opalski, Director  
Office of Environmental Cleanup

**I. Purpose**

The purpose of this action memorandum is to request and document approval of the proposed time-critical removal action described herein for the Black Butte Mine, Cottage Grove, Oregon. The CERCLIS ID No. is OR000515759 and the Site ID No. is 10EK.

This action meets the criteria for initiating a removal action under the National Contingency Plan (NCP), 40 C.F.R. §300.415.

**II. Site Conditions And Background**

**A. Site Description**

**1. Physical Location**

The Black Butte Mine (BBM) is located in southern Lane County, in the Coast Fork Willamette River basin, approximately ten miles south of Cottage Grove, Oregon. The BBM is located on the northwest flank of Black Butte (see Figures I & II.). The legal description of the BBM Site is: Section 16, Township 23 South, Range 3 West, Willamette Meridian.

The BBM is a former mercury mine. From 1927 to 1940, BBM was one of Oregon's largest producers of mercury. Motor vehicle access to the Site is restricted by a locked gate. The road leading to this gate crosses private property owned by Michael Pooler. Michael Pooler is a former BBM worker and currently lives at a home located near the entrance to the Site.

The primary features of the Site include a former mill structure containing a rotary kiln, mercury condenser, and ore storage/crushing equipment (New Furnace Area), another mill and furnace area (Old Ore Furnace), several old dilapidated buildings, a system of unimproved roads, mine adits, and piles of waste rock and mill tailings.

The pile of waste rock and mill tailings located in a relatively flat area below the New Furnace Area is referred to as the Main Tailings Pile. It is bordered on the northeast by Dennis Creek. A mine access road leads from the Pooler's residence up to and over the main tailings pile and continues up beyond the "404" Adit. Tailings in the Main Tailings Pile are gravel-sized with lesser amounts of fine- to sand-sized material. Tailings on the northeast edge of the Main Tailings Pile dip steeply to the northeast toward Dennis Creek.

Remnants of a second waste pile lie to the northwest of the Old Ore Furnace. This area borders Furnace Creek to the southwest. Materials in this area are finer grained than in the Main Tailings Pile. The "404" Adit is located up gradient of the Old Ore Furnace and New Furnace Area. Ore from the "404" Adit historically was transported to the Old Ore Furnace via a tramway. The Dennis Creek Adit is located up-gradient of the New Furnace Area. Ore historically was transported from the Dennis Creek Adit to the New Furnace Area via a railway. Seven adits have been identified in unpublished work completed by the Oregon Department of Environmental Quality (ODEQ). Four or more of these adits are located above the "404" Adit.

Between 1957 and 1995, the mean monthly wind speed averaged between 6.7 and 8.2 mph at the nearest meteorological station in Eugene with recorded wind gusts of up to 56 mph. Between 1943 and 2006, the mean monthly temperature at the Cottage Grove Dam averaged between 32.3F and 79.9F with an average annual precipitation of 47.7 inches/year and an average snow fall of 5 inches per year.

Potential human health and environmental impacts from historic mine wastes present at the BBM Site include public health and safety risks, increased metal concentrations in surface water, and increased sediment load to surface water. Elevated mercury levels in fish found in the Cottage Grove Reservoir pose health risks when eaten. The potential negative health effects of mercury relate to these risk factors:

1. Chemical form of mercury ,
2. Dose,
3. Age of the person exposed (fetuses are more susceptible),
4. Duration of exposure,

5. Route of exposure: inhalation, ingestion, dermal contact,

6. Health of the person exposed.

### ***Surrounding Land Use and Distance to Nearest Populations***

The BBM area drains to Dennis Creek and Furnace Creek. Smaller unnamed creeks drain into Dennis Creek from the area above the Main Tailings Pile. Dennis Creek borders the northeast side of the Site and flows westward into Garoutte Creek, approximately 0.25 miles downstream of BBM. The Main Tailings Pile fronts approximately 600 feet of Dennis Creek and mine tailings are located within thirty feet of the creek bed.

Furnace Creek, an intermittent stream, borders the southwest side of the BBM area. Furnace Creek also flows into Garoutte Creek. Furnace Creek is adjacent to the Old Ore Furnace Area and mine tailings are in contact with the creek.

Garoutte Creek flows northward approximately one mile to the Coast Fork Willamette River, which in turn empties into Cottage Grove Lake, a reservoir used extensively for recreational activities including contact recreation (i.e. swimming, canoeing, and scuba diving) and fishing. This lake is visited by almost a half-million people every year for camping, picnicking, swimming, water skiing, fishing and boating.

The aquifers in the vicinity of the BBM are the Fisher Formation (bedrock aquifer) and the alluvial aquifer along Dennis Creek, Garoutte Creek, and the Coast Fork Willamette River. Depth to groundwater and hydraulic conductivity of these aquifers at the BBM Site are unknown. Well logs in the vicinity of the BBM indicate that the shallowest depth to water-bearing strata in bedrock is twenty-nine feet below ground surface (bgs). Local groundwater gradients are unknown but are likely toward the streams. The nearest spring is London Springs, located approximately four miles north of the Site. Its source, use, and quality are unknown.

### ***Vulnerable or Sensitive Populations, Habitats, and Natural Resources***

The BBM was identified in recent Total Maximum Daily Load (TMDL) investigations as a significant contributor of mercury to sediment and fish tissue in Cottage Grove Reservoir, located approximately six miles downstream of BBM. Cottage Grove Reservoir and the main stem of the Willamette River, is the nation's thirteenth largest watershed. The Oregon Department of Human Services has issued health advisories to limit consumption of fish harvested from the Cottage Grove Reservoir due to elevated mercury concentrations in fish tissue.

### ***Other Mines in the Area***

BBM is located in the upper portion of the Coast Fork Willamette River Watershed (CFW) approximately four miles north of the Calapooya Divide which separates the Willamette River

Basin from the Umpqua River Basin. Two tributaries, Furnace Creek and Dennis Creek, drain the Site and enter Garoutte Creek about 1000 feet west and about 1500 feet northwest of the Site, respectively. Approximately one mile north of the Site Garoutte Creek enters the Coast Fork Willamette which continues northward about six miles where it drains into Cottage Grove Reservoir. The Coast Fork Willamette River continues northward towards the Eugene-Springfield area where it finally meets with the Willamette River.

The Site is situated in the Black Butte-Elkhead Mercury District (District) along with about seven prospects and one other historical mercury producing mine, Elkhead, which is located in the Umpqua Basin. The District spans the Calapooya Divide. The only mercury-producing mine within the CFW is the BBM. There are several prospects within a few miles of the Site, and within the CFW, where cinnabar and related mineralogy have been historically noted, but production did not take place at those locations. BBM is the only significant mercury source in the CFW beyond the local background mercury load from the District soils. Recent reports have shown that the BBM is a significant source of mercury contamination of the Cottage Grove Reservoir as described next.

The abstract of the J.G. Park and L.R. Curtis report dated July 22, 1997 “Mercury Distribution in Sediments and Bioaccumulation by Fish in Two Oregon Reservoirs: Point Source and Nonpoint-Source Impacted Systems” states, “These results indicated that a point source, Black Butte Mine, contributed amounts of mercury greatly in excess of mobilization from natural deposits, atmospheric deposition, and small scale uses of the metal as an amalgamating agent in gold mining (to Cottage Grove Reservoir).” The final report for the U.S. Army Corps of Engineers “Sources and Chronology of Mercury in the Cottage Grove Reservoir” by Lawrence R. Curtis, Department of Environmental and Molecular Toxicology dated May 20, 2003 also demonstrates that the BBM is the source of mercury contamination found in the Cottage Grove Reservoir. On page 37 in the Conclusions Section, the report states “Elevated mercury concentrations in soils surrounding the Black Butte Mine supports the conclusion that the Black Butte Mine is a point source of contamination to the reservoir”.

### **3. Site Characteristics**

The BBM was first put into operation by S. P. Garoutte in 1890 and a 40-ton-per-day Scott-Hutner furnace was installed at the Site. In 1897, the Quicksilver Mining Company took over the property until 1909, when the mine was closed due to depressed mercury prices. During that period of operation, the capacity of the furnace was increased and 15,000 feet of development work was completed.

In 1916, the BBM was reopened by an unnamed New York based company operated by Earl B. Crane. A flotation unit and a redesigned Scott furnace were used from 1916 until 1919, when declining mercury prices again forced the shutdown of the mine.

The BBM was operated by the Quicksilver Syndicate from 1927 to 1942. Two rotary furnaces were installed increasing the mines capacity to 150 tons per day. During this period, old furnace

tailings were re-treated. The mine was closed again in 1943.

In 1956 and 1957, the mine was leased by Mercury & Chemicals Corporation of New York. The uppermost levels of the mine (900 and 1,100 foot levels) were explored and developed during this time. Mining operations ceased during 1957.

In January 1994, BBM was purchased by the Land and Timber Company, which is still the current owner.

#### **4. Release or Threatened Release Into The Environment Of A Hazardous Substance, Or Pollutant Or Contaminant**

The contaminant of concern, mercury, is a hazardous substance and pollutant or contaminant as defined by sections 101(14) and 101(33) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §9601(14) and (33).

EPA's technical support contractor, Ecology & Environment, Inc. completed a Site investigation of the BBM Site in 2005. This investigation characterized mining-related impacts. Sampling data was collected from the five main areas. These are the Main Tailings Pile, the new furnace area, the Old Furnace Area, the three creeks, Dennis Creek Adit and the "404" Adit. The extent of mercury contamination is summarized in the investigation and compared to various benchmarks. Table 1 lists these benchmarks by media type and constituent. Analytical results also are presented in Tables 2 through 6. Mercury and arsenic concentrations in waste rock and tailings were compared to EPA Region 9 Preliminary Remediation Goals (PRGs) and ODEQ Maximum Allowable Soil Concentrations (MASCs) for both residential and industrial soils. Concentrations of mercury in sediment were compared to EPA Region 9 residential soil PRGs, National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SquiRT) threshold effects levels (TELs) and probable effects levels (PELs) for fresh water sediment (Buchman 1999), and ODEQ Level II Screening Level Values (SLVs) for soil. Concentrations of mercury in surface water were compared to EPA National Recommended Water Quality Criteria (NRWQC) and ODEQ Level II SLVs for fresh water. For the purpose of interpretation of sampling results, analytical data are compared to the most conservative criteria of those listed above and in Table 1.

Total mercury in waste rock/tailings samples collected during the 2005 Removal Assessment and the 1999 Site Investigation of Black Butte Mine ranged in concentration from 1.13 to 54,300 mg/kg. Total mercury concentrations in waste rock/tailings samples collected from the Main Tailings Pile and near the Old Ore Furnace ranged from 1.13 to 2,420 mg/kg. In the New Furnace area, total mercury concentrations in waste rock/tailings/soil samples ranged from 91.9 to 54,300 mg/kg. The high concentrations of mercury in the immediate area of the mill structure and furnace are likely the result of localized spillage of elemental mercury during processing activities. SPLP analyses for mercury leachate were non-detects indicating mercury is being transported from the Black Butte Mine to surrounding creeks via erosion and not leaching.

Total mercury in sediment samples collected during the 2005 Removal Assessment from Dennis Creek, Furnace Creek, and Garoutte Creek ranged in concentration from 0.45 to 37.4 mg/kg. The total mercury concentration of 37.4 mg/kg was from a location in Furnace Creek where tailings were present in the creek.

In 2002, Oregon State University (OSU) collected six surface sediment samples along a longitudinal transect through the center of Cottage Grove Reservoir. Total mercury in these sediment samples ranged in concentration from 0.7 to 3.6 mg/kg. OSU also collected three sediment cores from the Cottage Grove Reservoir to examine the variation of mercury deposition within the reservoir over time. Total mercury in sediment cores ranged in concentration from 0.5 to 3.9 mg/kg. The concentration of total mercury varied over core depth with the highest values occurring from 32 to 34 cm depth (corresponding to a period of deposition in the mid-1960's).

Tissue samples from five largemouth bass were analyzed in an OSU study from 1990. Muscle tissue from the oldest two fish showed mercury concentrations of 1.49 to 1.79 ppm (or mg/kg). Ten largemouth bass were also collected from Cottage Grove Reservoir in 1998 by Oregon DEQ. Total mercury concentrations in muscle tissue from ten fish ranged in concentration from 0.86 to 1.6 mg/kg.

The owner, Land and Timber Company, has used the property for logging. Future use of this Site may continue to be logging or may eventually become recreational. Because of the possibility of recreational use, the residential PRGs and MASCs are referenced for interpretation of analytical results. Although residential values are more conservative than industrial values, the ODEQ considers residential values more appropriate to evaluate potential recreational use than industrial values.

The total mercury concentration in the surface water sample, where waste rock/tailings are in contact with Furnace Creek exceeded both the NRWQC - CMC for mercury and the ODEQ Level II SLV (aquatic) for mercury.

All of the sediment samples, including the background samples, exceeded ODEQ Level II soil SLV for invertebrates for mercury. However, only the sediment sample from Furnace Creek substantially exceeded the background total mercury concentration.

The EPA Region 9 PRG (residential) for total mercury was exceeded for soil samples in the Main Tailings Pile, the Old Ore Furnace area, and the New Furnace area.

## **5. NPL Status**

The Site is not listed on the National Priorities List (NPL) nor has the Site been proposed for the NPL.

### **B. Other Actions To Date**

## **1. Previous Actions**

There have been no previous removal actions at the BBM Site. However, there have been a number of previous sampling events. In July 2004, ODEQ asked EPA to conduct a removal assessment. In May 2005, the EPA Region 10, Office of Environmental Cleanup tasked Ecology and Environment to conduct a removal assessment. The field work was performed in September 2005, and the final report delivered to EPA on March 31, 2006. Prior sampling or assessment events include:

- 1990, an OSU study of mercury in fish in the Cottage Grove and Dorena Reservoirs, published in the report: “An Ecosystem Approach to Mercury Bioaccumulation by Fish in Reservoirs” by S.M. Allen-Gil, D.J. Gilroy and L.R.Curtis, Oregon State University Department of Fisheries and Wildlife, 1990;
- 1996, an ODEQ preliminary assessment, published in the report: “Preliminary Assessment, Black Butte Mine...” by Keith Andersen, Oregon Department of Environmental Quality, for David Bennet, April 1, 1998;
- 1998, an EPA Site inspection published in the report: “Black Butte Mine Site Inspection Report TDD 98-04-0004” by Ecology and Environment, Inc., prepared for Mark Ader, April 1998;
- 2003, U.S.ACE study published in the report: “Sources and Chronology of Mercury Contamination in Cottage Grove Reservoir for U.S. Army Corps of Engineers, Portland, Oregon” by L.R. Curtis, Oregon State University, May 20, 2003;
- 2004, an ODEQ study published in the report: “Reconnaissance Soil Sampling at the BBM for ODEQ”, by Oregon State University, August 9, 2004.

## **2. Current Actions**

There are no current EPA actions at the Site, other than the planning for a Superfund Lead Removal Action.

## **C. State and Local Authorities’ Roles**

### **1. State and Local Actions To Date**

The ODEQ performed a preliminary assessment (PA) in 1996. The PA was conducted to identify potential public health and environmental threats related to the Site. The scope of the investigation included a review of available file information, interviews, a target survey, and an on-site reconnaissance inspection. No new sampling was conducted for this assessment. Based on the work conducted under this PA, ODEQ recommended a Site Inspection be carried out to

more fully evaluate the threat associated with the mine and tailings pile. There have been no other state or local actions conducted within the affected waters to address the mine waste contaminants. August 12, 2002 memorandum by Amanda Spencer, ODEQ requested official designation of the BBM as an “Orphan Site” and to make (the) Site account available for funding of stabilization and cleanup of the mine. In that memorandum Amanda Spencer stated that the land owner, The Land and Timber Company, was unwilling to complete the investigation/cleanup the BBM Site. A letter dated May 26, 2006 from Kerri L. Nelson, ODEQ, to Chris Field, requested EPA carry out a removal action. This request was made “due to limited funding in the ODEQ Orphan Account”.

## **2. Potential for Continued State and Local Response**

ODEQ will conduct post removal sampling to verify removal effectiveness and help to determine if any additional cleanup work is required by the state and conduct yearly inspections of the repository and covered areas.

## **3. Tribes and Cultural Resources**

### **a. Tribes**

In June 2006, OSC Carl Kitz notified Preston Sleeper with the U.S. Department of Interior by phone and by email of the pending removal action and provided background information on the Site. Mr. Sleeper informed Mr Kitz that there are no tribes in the BBM drainage area, including the Willamette River. To help ensure that no Tribal concerns were overlooked, information concerning the proposed removal work was shared with the Confederated Tribes of Coos, Lower Umpqua and Siuslaw, Cow Creek, The Cow Creek Band of Umpqua Indians, and the Confederated Tribes of Siletz. No concerns regarding the proposed removal action have been reported by any Tribes.

### **b. Cultural Resources**

The State Archaeologist, with the State Historic Preservation Office (SHPO), was sent information about the planned removal work. Based on the concerns/feedback from the SHPO a Cultural Resource Survey was initiated. Archaeological Investigations Northwest, Inc. (AINW) was contracted through Ecology and Environment, Inc. to conduct an archaeological survey of the project Area of Potential Effects (APE) to address the project’s possible impacts on significant archaeological resources . As the project is a federal undertaking, AINW’s work was done in compliance with Section 106 of the National Historic Preservation Act, as amended, and its implementing regulations (36 C.F.R. § 800), and according to the requirements of the Secretary of the Interior’s Standards and Guidelines for Archaeology and Historic Preservation.

Records from the Oregon State Historic Preservation Office (SHPO) were reviewed to determine if archaeological Sites had been recorded or if archaeological surveys had been conducted in the vicinity of the Black Butte Mine. A review of the National Register of Historic Places was also

conducted to determine if any listed archaeological or historic properties are located in or near the proposed project area. The results indicated that no listed archaeologicals are in or near the proposed project area. A review of the SHPO database, which is a listing of the Oregon Inventory of Historic Properties, indicated no inventoried resources were located in the proposed project area.

#### **4. EPA Region 10 Regional Mining Team**

Patricia McGrath of the EPA Region 10 Mining team was briefed on the pending removal and agreed with the need for a clean-up at the BBM and the proposed removal actions. The BBM is the only mercury mine with drainage to the Cottage Grove Reservoir.

### **III. Threats To Public Health Or Welfare Or The Environment, And Statutory And Regulatory Authorities**

In determining the appropriateness of this removal action, EPA considered all the factors listed in Section 300.415(b)(2) of the NCP. The factors set forth below apply to this removal action based upon the current conditions at the BBM Site. EPA has determined that the Site is a threat to the public health or welfare or the environment, and a removal action is appropriate under Section 300.415(b)(2) of the NCP. Any or all of these factors may be present at a Site, and any one of these factors may determine the appropriateness of a removal action.

#### **A. Threats to Public Health or Welfare**

##### **1. Exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants (300.415[b][2][i])**

The elevated concentrations of mercury in waste rock and tailings of the Main Tailings Pile, Old Furnace area, New Furnace Area, and Furnace Creek and proximity to Dennis, Furnace and Garoutte Creeks indicate that human exposure pathways exist. A report by J.-G. Park and L.R. Curtis dated July 22, 1997 “Mercury Distribution in Sediments and Bioaccumulation by Fish in Two Oregon Reservoirs: Point-Source and Nonpoint-Source Impacted Systems” states that the BBM is the source of elevated levels of mercury in Cottage Grove Reservoir fish. Table 5-3 of the 2005 EPA Removal Assessment Report shows the elevated levels of mercury in sediments that were deposited as a result of the BBM.

##### **2. High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate (300.415[b][2][iv])**

The mine waste contaminated soils are not vegetated, thus the soils are susceptible to migration because of water- and wind-borne influences. Erosion throughout the contaminated materials is widespread and moving this material into the active waterways of Dennis, Furnace and Garoutte Creeks and elsewhere throughout the Site.

**3. Minimization or elimination of the effects of weather conditions that may cause hazardous substances, pollutants or contaminants to migrate or to be released (300.415[b][2][v])**

Mine wastes are slumping and eroding directly into the creeks with subsequent transport downstream. During the springtime, snow melt, rainfall or other run-off inducing events tend to spread the contaminated materials further from the Site. The warmer temperatures and dry weather typical in the summer and fall months in and near the Site contribute to wind-borne dispersal of mine-contaminants.

**4. Availability of other appropriate federal or state response mechanisms to respond to the release (300.415[b][2][vii])**

The ODEQ does not have the resources to provide the appropriate timely response needed to address actual or potential human health and ecological risks associated with the mine waste contaminants described herein. No other state or federal resources have been identified to provide a timely response.

**B. Threats to the Environment**

**1. Exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants or contaminants (300.415[b][2][i])**

Ecological receptors have been exposed to Site contaminants through direct contact with mine waste contaminated materials and with water and sediments contaminated by mine-waste materials; ingestion of mine-waste materials and water and sediments contaminated by mine-waste materials; and / or ingestion of contaminated food (e.g., sediment- or soil-dwelling insects, vegetation). Highly contaminated sediment from the mine Site is likely being transported downstream.

**2. Actual or potential contamination of drinking water supplies or sensitive ecosystems (300.415[b][2][ii])**

The concentration of mercury in Furnace Creek is likely a result of mine waste materials migrating off the Site. Excavation of the mine waste contaminated materials is anticipated to have a positive effect on surface water quality and the sensitive aquatic ecosystem of Furnace Creek.

**3. High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate (300.415[b][2][iv])**

There is cause for concern near the Black Butte Mine Site and for some distance downstream in Dennis, Furnace and Garoutte Creeks because of the likelihood for continued erosion of contaminated materials into the stream and subsequent downstream material migration.

Recovery and restoration efforts for fish and other species could only be enhanced with improved water quality in Cottage Grove Reservoir and the Willamette River drainage.

#### **IV. Endangerment Determination**

Actual or threatened releases of hazardous substances from this Site may present an imminent and substantial endangerment to public health, welfare, or the environment.

#### **V. Proposed Actions And Estimated Costs**

The following objectives, which are designed to address the aforementioned threats to human health or welfare and the environment, have been developed for the Site:

- Mitigate exposure pathways to mine waste contaminated soils and sediments through excavation and containment of the contaminated materials.
- Reduce sediment loading in Dennis and Furnace Creeks to reduce mercury contamination in the creeks, Cottage Grove reservoir and Willamette River.

Starting and completion dates for the proposed work depend on the weather. Based on the analysis of the nature and extent of mine waste contamination and the response objectives listed in the preceding paragraph, the following three alternative actions were evaluated for the BBM:

- Alternative 1 - No action. Site conditions remain unaltered and risks to human health and the environment persist.
- Alternative 2 – Construction of an engineer designed on-site repository for permanent storage of excavated materials; excavation of mercury contaminated mine tailings along adjacent creeks, and other highly mercury contaminated soils located on the Site; consolidation of such material in the repository. After completion of the excavation work, capping the repository with clean soil and hydro-seeding the cap to prevent erosion.
- Alternative 3 - Excavation of mine waste, contaminated soil and sediment, and transport to an off-site landfill; reconstruction of the creek channels; and grading, revegetation, and erosion protection of disturbed areas.

Alternative 1 was not selected because it would not address the actual or potential imminent and substantial human health and ecological threats posed by the mine-waste-contaminated soils and sediments. Alternative 3 was not selected because of the substantial disposal-related costs which would be incurred with transport to an off-site repository, and damage to the creek beds. Alternative 2 was selected as it would provide protection from direct contact and significantly reduce the off Site migration of mercury to adjacent creeks and downstream waterways.

## **A. Proposed Actions**

### **1. Proposed Action Description**

Alternative 2 is the proposed action (as described below) consisting of excavation of mine tailings and contaminated soils, and consolidation beneath a soil capped repository constructed on-site. The identification of mine waste contaminated materials will be accomplished by removing the visible mine tailings, and with confirmation by systematic field screening of surface soils with a field portable X-ray fluorescence (FPXRF) instrument using ODEQ soil cleanup guidelines for mercury. The following excavation work is proposed:

- 30,000 cubic yards tailings excavated from the Main Tailings Pile.
- 3,000 cubic yards excavated from the Old Ore Furnace and Furnace Creek areas.
- 2,000 cubic yards excavated from the New Furnace Area.

The cleanup goal for mercury in the Main Tailings Pile is 8 to 10 mg/kg (background levels). Cleanup in other highly contaminated areas identified above will be excavation, to the extent practicable, to less than EPA region 9 PRG of 115 mg/kg (adjusted for mercury sulfide).

#### ***REPOSITORY***

The repository area has been surveyed and the conceptual design has also been completed. Final design plans for the removal work, including repository design, excavation work, and cover for excavated areas and repository were prepared by E&E in March 2007. A post cleanup plan is currently being prepared by E&E which will describe the necessary actions, such as deed

restrictions, required to maintain the integrity of the repository after the removal is completed.

#### ***MAIN TAILINGS PILE***

The waste rock/tailings on the north-northeast edge of the main waste rock/tailings on the side sloping toward Dennis Creek are unstable and subject to erosion and undercutting by water erosion from unnamed tributaries of Dennis Creek. Removal and stabilization of the waste rock/tailings in this area will be performed.

#### ***NEW FURNACE AREA***

In the New Furnace Area, contaminated soils in the immediate area of the mill structure will be covered with clean soil.

#### ***OLD ORE FURNACE***

In the Old Ore Furnace area, contaminated soils will be removed in the immediate area of the furnace structure and Furnace Creek.

## **Best Management Practices**

Temporary Best Management Practices (BMPs) will be employed throughout the removal action. This will include control of erosion, control of fugitive dust, and storm water management.

### **2. Contribution to Remedial Performance**

ODEQ concurs on the proposed removal action and the consistency of that action with any future actions the state may take with regard to the Black Butte Mine Site.

### **3. Description of Alternative Technologies**

No other technologies were considered practical from economic, engineering, and/or timing perspectives.

### **4. EE/CA**

An engineering evaluation/cost analysis (EE/CA) is not required for an EPA time-critical response action.

### **5. Applicable or relevant and appropriate requirements**

The NCP requires that removal actions attain Applicable or Relevant and Appropriate Requirements (ARARs) under federal or state environmental or facility siting laws, to the extent practicable (40 C.F.R §300.415[j]). In determining whether compliance with ARARs is practicable, EPA may consider the scope of the removal action and the urgency of the situation. (40 C.F.R. §300.415[j]).

#### **a. Federal**

1. The substantive provisions of Section 404 of the Clean Water Act (CWA), 33 U.S.C. §1344, are applicable requirements and will be met to the extent practicable. For example, the proposed removal action will be conducted to avoid the discharge of dredged or fill material into navigable waters, through the use of BMPs, such as silt fences, hay bales, or other means necessary to control potential discharge from the Site.
2. In accordance with the Endangered Species Act of 1973, 16 U.S.C. §1531 et. seq., EPA will consult with the U.S. Fish and Wildlife Service regarding potential effects on federally listed species and their habitats prior to performing the proposed removal action.
3. The tailings left from mining activities at Black Butte Mine were created from beneficiation and extraction processes at the Site and hence are subject to the “Bevill Exemption,” described in 40 C.F.R. §261.4(b)(7), which exempts the tailings from being defined as RCRA hazardous

waste. Although the two furnaces on the Site were used by the mine, no process waste has been identified in any of the areas that this removal action will address.

#### **b. State**

1. To the extent practical, O.A.R. 340-122-70 (removals) Oregon Cleanup Rules will be addressed. Oregon Cleanup Rules allow consideration for the lowest cost cleanup measure, which often is capping in place. In addition, a removal action under state rules is not considered a final remedy thus allowing for flexibility in generating a Site-specific cleanup level. Residual risk, cost, and practicality should all be evaluated in order to make a reasonable Site-specific cleanup level. Final remedy-specific actions, such as the hot spot evaluation and a  $10^{-6}$  risk evaluation for residual contaminants should be addressed, if practical.
2. Any discharge to the waters of the state fall under the Oregon Water Quality Rules, O.A.R. 340, Division 41. The substantive requirements of these rules will be met during the removal action. In general, the ODEQ rules mimic the federal rules and therefore the substantive requirements of O.A.R. 340-41 will be met as long as the federal requirements are met. BMPs and erosion-control will limit the runoff of turbidity and heavy metals.
3. The Oregon Air Pollution Control Regulations and Oregon Emission Standards for Hazardous Air Pollutants, O.A.R. 340, Division 200 and 246, respectively, are potentially applicable if heavy-metal contaminated dust is generated above regulatory thresholds. BMPs such as dust control will be used to mitigate the generation of fugitive dust which will meet the substantive requirements of these rules.
4. Oregon Hazardous Waste Regulations, O.A.R. 340, division 100 through 103, may be applicable if liquid mercury waste is found on Site. The substantive requirement of this rule will be met if hazardous wastes are encountered during the removal.
5. Oregon Department of State Lands Rules, O.A.R. 141, division 85, may be applicable if excavation activities are conducted below the seasonal high water line of Dennis or Furnace Creeks. Work conducted below the seasonal high water mark of the creeks is considered work within waters-of-the-state and therefore the substantive requirements of these rules should be met.
6. Oregon Fish and Wildlife Department Rules for in-stream water rights and fish passage, O.A.R. 635, Division 400 and 412, may be applicable if excavation activities are conducted below the seasonal high water line of Dennis or Furnace Creeks. The substantive requirements of these rules will be met if excavation is conducted below the seasonal high water line of Dennis or Furnace Creeks.

#### **6. Project Schedule**

The starting date for the Removal Action is dependent on weather conditions and snow at the

Site. We anticipate beginning removal action work in the Spring of 2007, with the on-site work taking approximately 30 to 40 days.

#### **B. Estimated Costs**

<u>Regional Removal Allowance Costs</u>	
ERRS (Construction, equipment, and material including 15% contingency)	\$587,000
<u>Other Extramural Costs Not Funded from the Regional Allowance</u>	
START	\$100,000
Coast Guard Strike Team	\$10,000
<u>Total Extramural costs</u>	\$697,000
<u>Project Cost Contingency (20%)</u>	\$140,000
<b>TOTAL REMOVAL PROJECT CEILING</b>	<b>\$837,000</b>

#### **VI. Expected Change In The Situation Should Action Be Delayed Or Not Taken**

The Action Memorandum approval process was initiated in September 2006. Weather conditions at the Site did not allow the removal action to start until the Spring of 2007. If the response action should be delayed or not taken hazardous substances will remain as potential human health and ecological threats, based on ingestion exposure pathways; and hazardous substances will remain a continuing source of solid and dissolved-phase contaminants.

#### **VII. Outstanding Policy Issues**

None.

#### **VIII. Enforcement**

See attached Confidential Enforcement Addendum.

#### **IX. Recommendation**

This decision document presents the selected removal action for the BBM Site, Lane County, Oregon, developed in accordance with CERCLA, as amended. It is not inconsistent with the NCP. This decision is based on the administrative record for the Site.

## VII. Outstanding Policy Issues

None.

## VIII. Enforcement

See attached Confidential Enforcement Addendum.

## IX. Recommendation

This decision document presents the selected removal action for the BBM Site, Lane County, Oregon, developed in accordance with CERCLA, as amended. It is not inconsistent with the NCP. This decision is based on the administrative record for the Site.

Conditions at the Site meet the NCP, 40 C.F.R. § 300.415(b)(2), criteria for a removal action and we recommend your approval for the proposed removal action. The total project ceiling if approved will be \$ 831,900. Of this, an estimated \$523,250 comes from the Regional removal allowance.

Approval:

Signature:

  
Daniel D. Opalski, Director  
Office of Environmental Cleanup

Date:

6/27/07

Disapproval:

Signature:

\_\_\_\_\_  
Daniel D. Opalski, Director  
Office of Environmental Cleanup

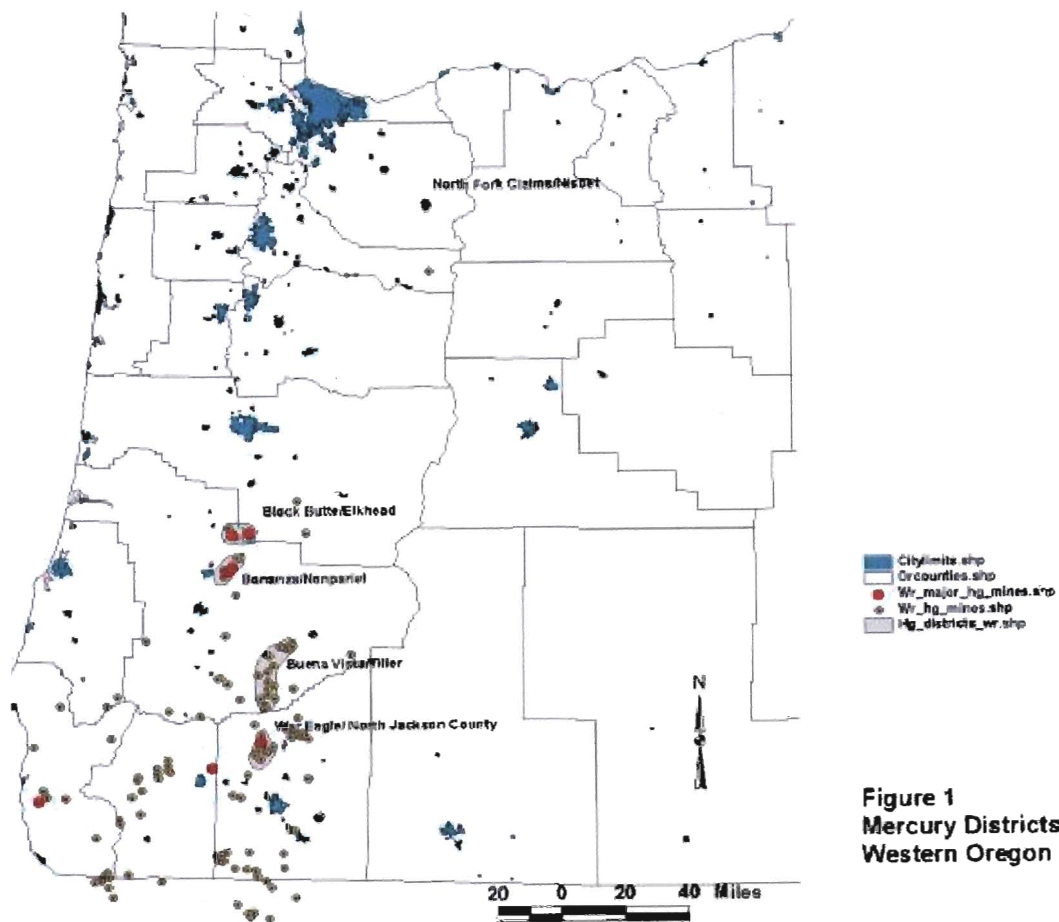
Date:

### **Documents Referenced for Administrative Record:**

1. "Water to Woods, Part II: Cottage Grove Community and Parks System Overview", Cottage Grove Community Development Department. 3/16/2007 website: <http://www.cottagegrove.org/commdev/parksplan/Part%20II.pdf>.
2. "Sources and Chronology of Mercury Contamination in Cottage Grove Reservoir for U.S. Army Corps of Engineers, Portland, Oregon" by L.R. Curtis, Oregon State University, May 20, 2003.
3. "Elevated Levels of Mercury in Sport Caught Fish From Cottage Grove Reservoir in Lane County" April 22, 2004, Bonnie Widerburg, Environmental Toxicology, Oregon Department of Human Services. 3/16/2007 website: <http://www.oregon.gov/DHS/ph/envtox/2004-0422.shtml>.
4. "Fish Advisories: Consumption Guidelines", 3/16/2007 website: <http://www.oregon.gov/DHS/ph/envtox/fishconsumption.shtml>.
5. "Mercury Distribution in Sediments and Bioaccumulation by Fish in Two Oregon Reservoirs in Point Source and Non-Point Source Impacted Systems", J-G. Park, L.R. Curtis, OSU, Archives of Environmental Contamination and Toxicology 33,423-429 (1997), accepted July 22, 1997.
6. "Black Butte Mine Site Removal Assessment Report, Lane County, Oregon, TDD 06-01-0005" by Ecology and Environment, Inc., prepared for Marc Callaghan, March 21, 2006.
7. "Reconnaissance Soil Sampling at the BBM for ODEQ", by Oregon State University, August 9, 2004.
8. "Black Butte Mine Site Inspection Report TDD 98-04-0004" by Ecology and Environment, Inc., prepared for Mark Ader, April 1998.
9. "Preliminary Assessment, Black Butte Mine" by Keith Andersen, Oregon Department of Environmental Quality, for David Bennet, April 1, 1998.
10. "An Ecosystem Approach to Mercury Bioaccumulation by Fish in Reservoirs" by S.M. Allen-Gil, D.J. Gilroy and L.R. Curtis, Oregon State University Department of Fisheries and Wildlife, 1990.
11. "Archeological Survey at the Black Butte Mine, Lane County, Oregon", by Archeological Investigations Northwest, Inc. for EPA, February 20, 2007.
12. "Mercury in Oregon Lakes" by A. Newell, D. Drake, and B.L. Stifel, Oregon Department of Environmental Quality, May 1996.

13. "DEQ Request for EPA Removal at Black Butte Mine – Lane County, OR", Letter from Kerri L. Nelson ODEQ Western Regional Administrator to Chris Field, EPA Removal Manager, May 26, 2006.
14. "Independent Government Cost Estimate (IGCE), Black Butte Mine, Cottage Grove, Oregon", prepared by Carl Kitz, 2006.
15. Western Regional Climate Center, Historical Climate Information, accessed on 4/12/2007 from web site: <http://www.wrcc.dri.edu/climatedata.html>.
16. Personal Conversation log between Carl Kitz and Patricia McGrath, EPA Mining Coordinator, June 12, 2006.
17. Phone Conversation log between Carl Kitz and Preston Sleeper, Department of Interior, June 2006.
18. "Black Butte Mine Preliminary Potentially Responsible Party Search", EPA Memorandum from Gretchen F. Schmidt to Carl Kitz, June 22, 2006.

# Figure # 1



**Figure 1**  
**Mercury Districts**  
**Western Oregon**

• 2007-2008



Figure 3. Black Butte Mine Area Map

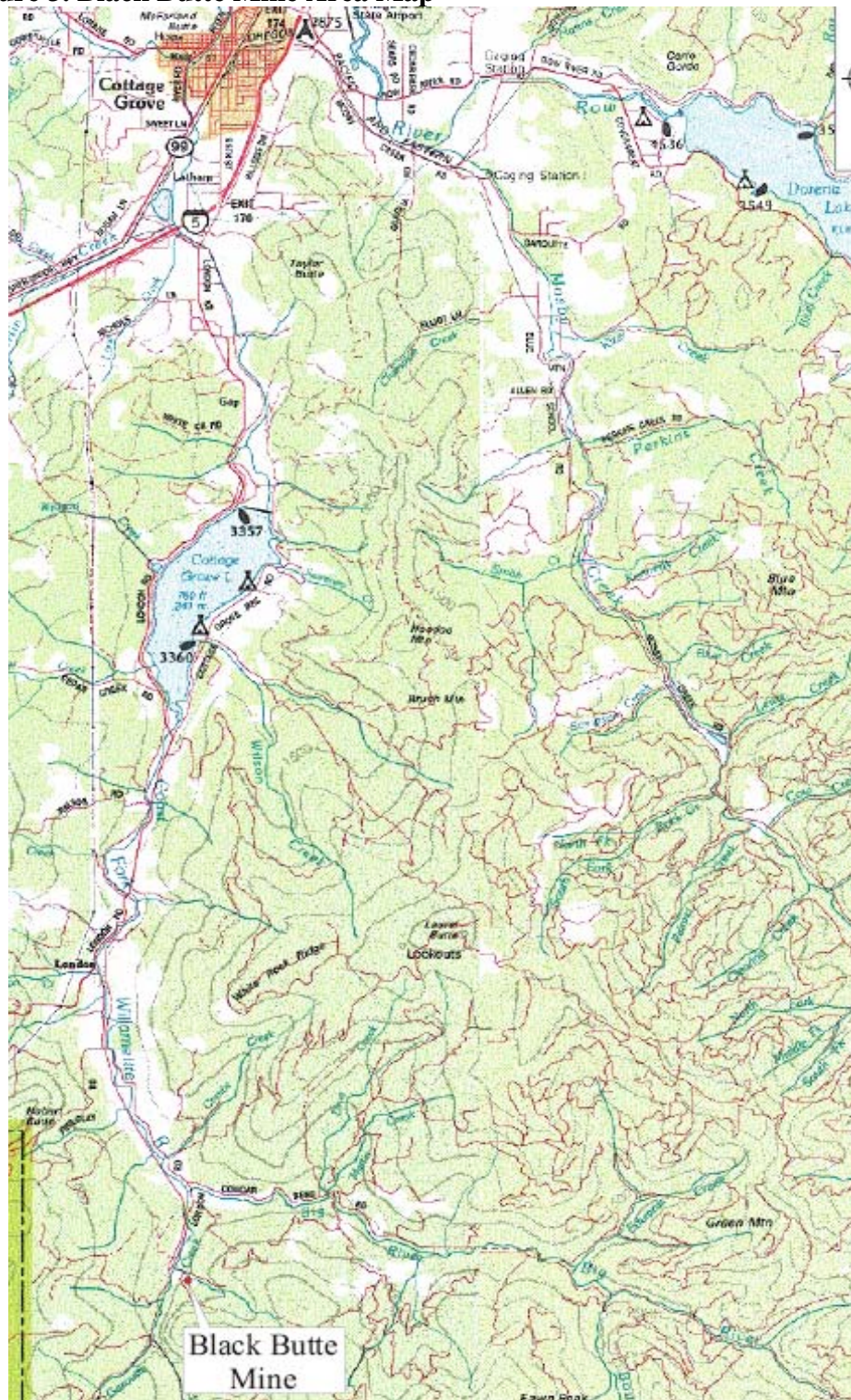


Figure # 4



Old Ore Furnace

Figure # 5



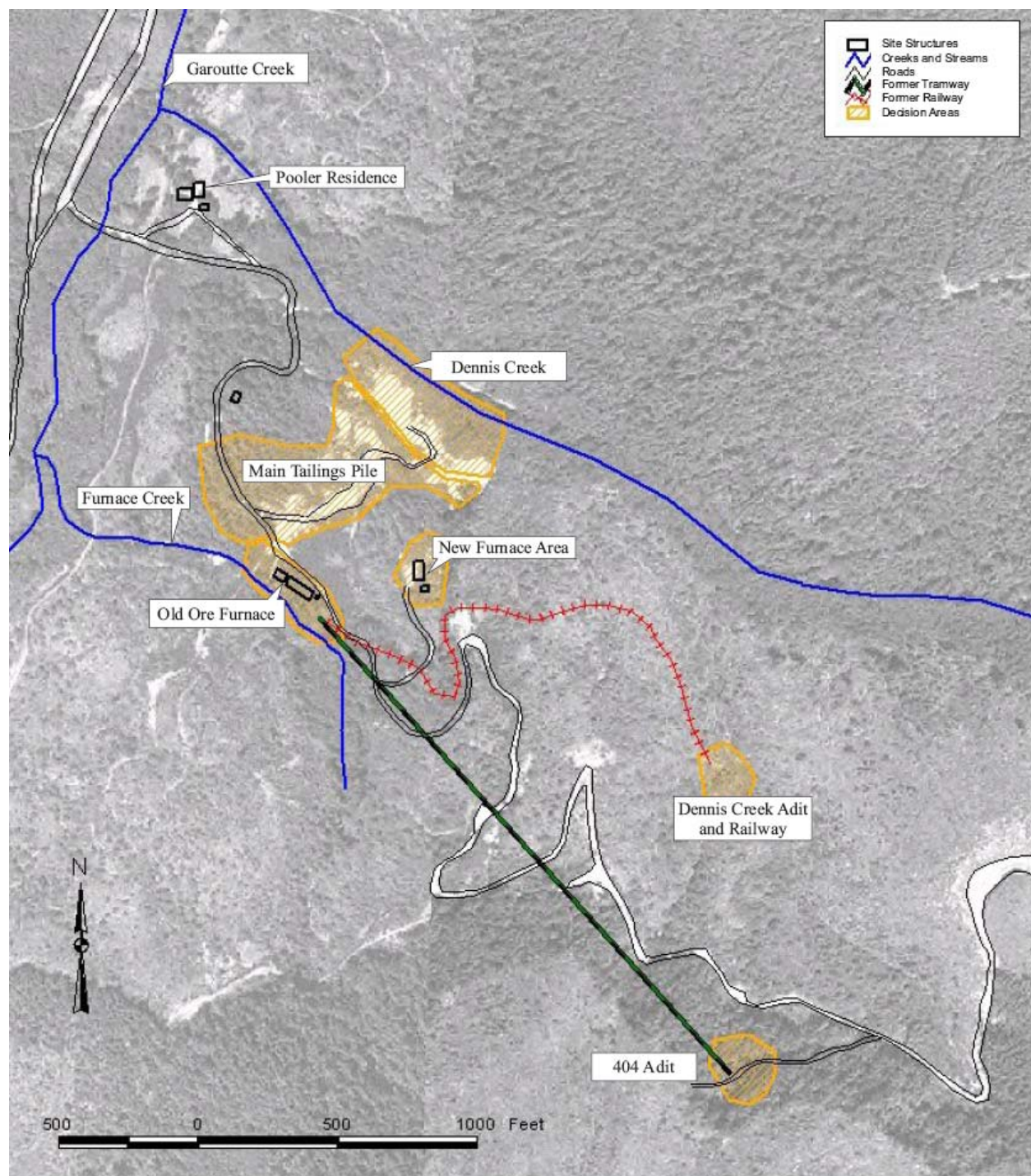
New Furnace

Figure # 6

Main Tailings Pile



**Figure 7. Black Butte Mine**



### List of Tables and Photographs:

Figure 1 – Mercury Districts in Western Oregon

Figure 2 - Geology and Historic Site Data, Black Butte Mine

Figure 3 - Black Butte Mine Area Map

Figure 4 – Photograph of Old Ore Furnace, May 2006

Figure 5 – Photograph of New Furnace, May 2006

Figure 6 – Photograph of New Tailings Pile, May 2006

Figure 7 - Black Butte Mine Map

Table 1 –Potentially Applicable or Relevant and Appropriate Requirements for Black Butte Mine

Table 2 – Total Mercury and Arsenic in Waste Rock/Tailings Samples from Removal Assessment and Site Inspection, Black Butte Mine

Table 3 – Total Mercury in Sediment (Creeks and Adit) Samples from Removal Assessment and Site Inspection, Black Butte Mine

Table 4 - Total Mercury in Surface Water (Creeks and Adit) Samples from Removal Assessment and Site Inspection, Black Butte Mine

Table 5 - Mercury in Leachate from Waste Rock/Tailings, Synthetic Precipitation Leaching Procedure, Black Butte Mine Removal Assessment

Table 6 – Total, Monomethyl and Selective Sequential Extraction Mercury Results in Waste Rock/Tailings and Sediment, Black Butte Mine Removal Assessment

Photo 7 – Water Quality Parameters in Surface Water (Creek and Adit) (YSI 556 MOS #A59664), Black Butte Mine Removal Assessment



## CONCURRENCE SHEET

### Black Butte Mine Action Memorandum

NAME	INITIALS	DATE
Kathy Parker	gmkp	4/13/2007
Chris Field		
Cliff Villa	av	4/13/2007

## Appendix C

### Site Specific Sampling Plan and Data Validation Memorandum

**SITE SPECIFIC SAMPLING PLAN**  
**Project Name: Black Butte Mine Removal Action**  
**Site ID: 10EK**

APPROVALS			
Name	Title	Signature	Date
Kathy Parker	On-Scene Coordinator (OSC)	<i>Kathy Parker</i>	8/16/2007
Michael Boykin	Emergency Response Unit (ERU) Quality Assurance Coordinator (QAC)	<i>Michael Boykin</i>	17 Aug 07
Erin Lynch	START-3 Project Manager		
Mark Woodke	START-3 Quality Assurance Officer		

This Site Specific Sampling Plan (SSSP) is prepared and used in conjunction with the Quality Assurance Plan for the Emergency Response Unit for collecting samples during this Removal Program (RP) project. Refer to the QAPP for additional details relating to the SSSP.

Additional Personnel and Affiliations involved in the project:

United States Environmental Protection Agency (EPA) OSC			
Kathy Parker	USEPA M/S: ECL-116 1200 Sixth Avenue, Seattle, WA 98101	(206) 321-3796	parker.kathy@epa.gov
ERU QAC			
Michael Boykin	USEPA M/S: ECL-116 1200 Sixth Avenue, Seattle, WA 98101	(206) 553-6362	boykin.michael@epa.gov
Ecology and Environment, Inc. (E & E), START-3 Project Manager			
Erin Lynch	Ecology and Environment, Inc. 333 SW Fifth Avenue, Suite 608 Portland, OR 97204	(503) 248-5600	elynch@ene.com
Analytical Laboratory, Project Manager			
NA			

## Physical Description and Contact Information

<b>Site Name</b>	Black Butte Mine	
<b>Site Location</b>	South end of London Road, Lane county, Oregon Section 16, Township 23 South, Range 3 West, Willamette Meridian	
	Latitude: 43°34.727 North	Longitude: 123° 04.134West
<b>Property size</b>	Acres: approximately 20 acres in the affected area	
<b>Site Contact</b>	Name: Robert Smejka 696 County Club Road, Eugene OR 97401	Phone Number: (541) 345-3330
<b>Site Owner</b>	Name: Land and Timber Company	Phone Number: NA
<b>Site Operator</b>	Name: site is not in operation	Phone Number: NA
<b>Nearest Residents</b>	Distance: Michael Pooler	Direction: west
<b>Primary land uses surrounding the site</b>	Timber	

The Data Quality Objective process will be used to determine all sample locations.

## Historical and Background Information

The section upon which the Black Butte Mine (BBM) sits is currently owned by the Land and Timber Company, which purchased it in January 1994 for timber harvesting. The BBM is located in southern Lane County, in the Coast Fork Willamette River basin, approximately fifteen miles south of Cottage Grove, Oregon. From 1927 to 1940, BBM was one of Oregon's largest producers of mercury. Motor vehicle access to the Site is restricted by a locked gate. The road leading to this gate crosses private property owned by Michael Pooler, a former BBM worker who currently lives with his wife at a home located near the entrance to the Site.

The primary features of the Site include a former mill structure containing a rotary kiln, mercury condenser, and ore storage/crushing equipment (New Furnace Area), another mill and furnace area (Old Ore Furnace), several old dilapidated buildings, a system of unimproved roads, mine adits, and piles of waste rock and mill tailings. Potential human health and environmental impacts from historic mine wastes present at the BBM Site include public health and safety risks due to mercury and arsenic in soil on the site, increased metal concentrations in surface water, and increased sediment load to surface water. Elevated mercury levels in fish found in the Cottage Grove Reservoir pose health risks when eaten. The BBM area drains to Dennis Creek and Furnace Creek. Smaller unnamed creeks drain into Dennis Creek from the area above the Main Tailings Pile. Dennis Creek borders the northeast side of the Site and flows westward. Furnace Creek, an intermittent stream, borders the southwest side of the BBM area. Furnace Creek also flows into Garoutte Creek. Furnace Creek is adjacent to the Old Ore Furnace Area and mine tailings are in contact with the creek.

Total mercury analytical results in waste rock/tailings samples collected during the 2005 Removal Assessment and the 1999 Site Investigation of Black Butte Mine ranged in concentration from 1.13 to 54,300 milligrams per kilogram (mg/kg). Total mercury concentrations in waste rock/tailings samples collected from the Main Tailings Pile and near the Old Ore Furnace ranged from 1.13 to 2,420 mg/kg. In the New Furnace area, total mercury concentrations in waste rock/tailings/soil samples ranged from 91.9 to 54,300 mg/kg. The high concentrations of mercury in the immediate area of the mill structure and furnace are likely the result of localized spillage of elemental mercury during processing activities. Synthetic Precipitation Leaching Procedure (SPLP) analyses for mercury leachate were non-detects suggesting mercury is being transported from the Black Butte Mine to surrounding creeks via erosion and not leaching.

Total mercury in sediment samples collected during the 2005 Removal Assessment from Dennis Creek, Furnace Creek, and Garoutte Creek ranged in concentration from 0.45 to 37.4 mg/kg. The total mercury concentration of 37.4 mg/kg was from a location in Furnace Creek where tailings were present in the creek.

The R9 Preliminary Remediation Goal (PRG) for residential soil of 23 mg/kg will be used as a cleanup goal for soil in areas of the site where the exposure pathway is strictly dermal contact and the previous sequential extraction procedure indicates soluble forms of mercury are present (the Old Furnace Area). For the areas where the exposure pathway is strictly dermal contact and the previous sequential extraction procedure indicates soluble forms of mercury are not present (the New Furnace Area), then the cleanup goal of 115 mg/kg will be used. The 115 mg/kg figure is derived by converting the R9 residential PRG from mercuric chloride to mercuric sulfide based on toxicity for dermal contact as calculated by Stan Smucker. The Removal Assessment data shows that in the Old Furnace area there is 43% to 47% soluble mercury present but negligible amounts in the New Furnace Area.

The background level of 10 mg/kg will be used for the clean up goal in areas where soil and sediment can be transported off-site through water or soil migration. This concentration is based on the background level of mercury in soil in uncontaminated areas in the locale.

Starting in August 2007 EPA will be performing the following tasks as part of a removal action:

- Site clearing and excavation of clean fill;
- Removal of tailings from the main tailings pile to reduce the grade of the pile;
- Removal of mercury contaminated sediment from Furnace Creek;
- Removal of mercury contaminated soil from near the Old Furnace;
- Cover mercury contaminated soil near the New Furnace with clean fill;
- Seed the tailings pile in the fall as the rains start.

There are no anticipated sampling constraints. The proposed schedule of project work follows:

Activity	Estimated Start Date	Estimated Completion Date	Comments
<b>SSSP Review/Approval</b>	July 30, 2007	August 18, 2007	
<b>Mobilize to Site / Site Removal Activities</b>	August 19, 2007	September 20, 2007	

<b>Sample Collection</b>	August 20, 2007	September 20, 2007	
<b>Laboratory Sample Receipt</b>	none	none	
<b>Laboratory Analysis</b>	none	none	
<b>Data Validation</b>	October 1, 2007	October 31, 2007	
<b>Draft Report</b>	November 30, 2007		
<b>Target Completion Date</b>	December 31, 2007		

### Conceptual Site Model

The conceptual model of contamination with respect to this sampling plan is the following:

- Mercury contaminated soil is made waterborne by the action of rain and wind transporting it to the Dennis and Furnace Creeks where it moves downstream to Cottage Grove reservoir thus contaminating sediment, invertebrates, fish and human drinking water.
- Mercury contaminated soil comes into contact with humans such as trespassers and recreational users as well as animals by direct contact as they walk on the soil at the site.

### Decision Statement

The decision to be made from this investigation is to:

- Determine where mercury-contaminated soil and sediment above the action levels are located in the decision areas;
- Determine during soil removal or covering when the soil remaining in each decision area is below the action levels and requires no further action.

### Inputs into the Decision

The following inputs to the decision are necessary to interpret the analytical results:

- Location and concentration of total mercury in soil and sediment

### Sample Collection Information

The applicable sample collection Standard Operating Procedures (SOPs) or methods will be followed and include:

1. Ecology and Environment's START3 Field Activity Logbook SOP
2. Ecology and Environment's START3 Sample Packaging and Shipping SOP
3. Ecology and Environment's START3 Sampling Equipment Decontamination SOP
4. Mercury Instrument Method for Lumex with soil attachment
5. Mercury Instrument Method for XRF and SW846 Method 6200

**Mercury in Soil** will be analyzed by XRF, either in situ or collected, air dried (at less than 60 degrees C) and analyzed in plastic bags. If the reporting limit of the XRF cannot reach 10 mg/kg, samples below the reporting limit will be analyzed as needed by Lumex with soil attachment.

**Mercury in Sediment** with visible moisture content (greater than 20%) will be analyzed by Lumex with soil attachment. If the moisture content is low, the sample will be analyzed by XRF unless it is below the XRF reporting limit.

### Decision Areas

The Decision Area boundaries for the site are:

- The New Furnace area, outside of the structures
- The Old Furnace area (not marked on map), outside of the structure
- Furnace Creek in the area near where previous high mercury results were recorded in the 2005 Removal Assessment
- The Main Tailings Pile

See maps in Figures 1 and 2.

### **Temporal Study Boundaries**

Analysis must be performed several weeks prior to snow fall this winter to complete the removal before weather interferes.

### **The Decision Rule**

The following statements describe the decision rules to apply to this investigation:

- In the Old Furnace area, the soil in the area around the furnace structure will be excavated until sample analysis with XRF shows no mercury concentrations in surface soil remain above 23 mg/kg;
- In the New Furnace area, the soil outside the structures will be covered with clean fill where sample analysis with XRF shows no surface soil levels above 115 mg/kg mercury;
- In Furnace Creek, soil and sediment will be excavated until sample analysis shows no surface soil levels remain above 10 mg/kg mercury;
- In the Main Tailings Pile, soil will be resloped or covered everywhere sample analysis shows surface soil levels are above 10 mg/kg mercury;
- If mercury above 10 mg/kg is found in soil to be used as clean fill, the soil will not be used. Only soil confirmed to contain less than 10 mg/kg mercury will be used as clean material for capping.

### **Limits on Decision Error**

The possibility exists that XRF detection limits will be higher than required to achieve accuracy at the sediment or soil action levels. In that situation the Lumex will be used for the analysis. If detection limits are still not achieved, the result will be more uncertainty about the area to clean up and more soil will be excavated or covered to account for the uncertainty.

### **Design Optimization**

The XRF will be used in situ whenever possible to achieve accurate results. Reproducibility and accuracy of in situ XRF analyses will be checked by collecting, air drying, analyzing and comparing five in situ samples at the start of sampling. Where interferences are suspected, steps will be taken to eliminate the interferences by mechanisms such as drying, grinding or sieving the samples or analyzing them using the Lumex with soil attachment.

The Lumex will be calibrated using accepted calibration criteria and verified using a second source standard. XRF results will be periodically verified using the Lumex.

### **Sampling**

All samples will be collected following applicable SOPs and methods. The XRF and Lumex for sediment will be calibrated before each day of use and checked with a second source standard. A field blank will be analyzed with each calibration to confirm the concentration of nondetection.

### **Sampling Pattern**

Grab soil samples will be collected for surface soil in areas where previous studies indicate mercury contamination exists. The sample locations will be the width of the excavator bucket apart. After contaminated soil is excavated, the new surface will be reanalyzed and excavation will continue until the action level is reached.

#### **Number of Samples**

For this removal action, a total of approximately 500 samples are expected to be analyzed.

#### **Types and Locations of Samples**

Grab soil samples will be collected from each of the DAs at the frequency and locations that best delineate the extent of contamination. This will be determined in the field by the OSC. Each sample location will be noted by global positioning system (GPS) equipment and on a site map.

#### **Sample Matrix and Target Analytes**

Sediments, soils, and tailings/waste rock will be collected for total mercury analysis. For the purpose of this sampling event it will not be necessary to differentiate between these three matrix types. If particle size is too large for accurate analyses, the samples will be ground prior to analysis. If the sample contains too much moisture for accurate analyses, the sample will be decanted and air dried prior to analysis.

Sample collection and analysis information is summarized in Tables 1 through 4.

The Sample Plan Alteration Form (a blank form is included at the end of this document) will list project discrepancies (if any) that occur between planned project activities listed in the final SSSP and actual project work

**Table 1**  
**SAMPLE INFORMATION SUMMARY**  
**Black Butte Mine**  
**Lane County, Oregon**

Project Sampling Schedule	Parameter/ Limits	Design Rationale	Sampling Design Assumptions	Sample Selection Procedures	Measurement Classification (Critical/Non Critical)	Nonstandard Method Validation
Soil and Sediment	Mercury / MDL	Determine if contaminant concentrations are greater than the action level for the DA.	Contaminant present.	At OSC direction	Critical	none

All samples will be collected during the field event.

The listed items are the decision areas.

Detection limits will be method or instrument limits for field methods.

Locations chosen based on indications from previous investigations at the site and from on-site observations.

All locations will be determined by the OSC.

**Key:**

Critical = Required to achieve project objectives or limits on decision errors.

XRF = X-Ray Fluorescence.

MDL = Method detection limits.

**Table 2**  
**Sample Analyses Summary**  
**Black Butte Mine, Lane County Oregon**

<b>Matrix</b>	<b>Location</b>	<b>Analytical Parameters/Method</b>	<b>Sample Preservation</b>	<b>Technical Holding Time</b>	<b>Sample Containers</b>
Soil	Main Tailings Pile, Old Furnace Area, New Furnace Area	Mercury / XRF instrument method and EPA Method 6200	None for In situ. Air dry for moist samples.	28 days	8 oz ziplock bag
Soil and Sediment	Furnace Creek	Mercury / Lumex with sediment attachment	None for In situ. Air dry for moist samples.	28 days	8 oz ziplock bag

Notes:

deg C = degrees Celsius

XRF = X-Ray Fluorescence

SOP = Standard Operating Procedure

**Table 3**  
**QC ANALYTICAL SUMMARY and FIELD ANALYTICAL METHODS**  
**Black Butte Mine**  
**Lane County, Oregon**

Matrix	Parameter, Method	Method Description, and Detection Limit	Total Field Samples	QC Sample Analyses			Total Field Containers	Precision of Dup	Accuracy of MS
				Duplicate	Matrix Spike	Field Blank			
Soil and Sediment	Total Mercury, Lumex sediment	Thermal Combustion Atomic Fluorescence, 50 nanograms per kilogram	100	10%	10%	NA	100	35%	70%-130%
Soil and Sediment	Total Mercury, XRF	X-Ray Fluorescence, 10 mg/kg	400	10%	NA	NA	400	35%	NA

Notes:

Total number of field samples is estimated.

No extra volume is required for soil/sediment QC samples.

QC = Quality Assurance

XRF = X-Ray Fluorescence

Dup = Duplicate Sample

**Table 4**  
**SAMPLE CODING**  
**Black Butte Mine**  
**Lane County, Oregon**

<b>Digits</b>	<b>Description</b>	<b>Code Example</b>
1,2,3,4	Site ID	10EK – Black Butte Mine
5	Decision Area	1 – Main Tailing Pile 2 – New Furnace Area 3 – Old Furnace Area 4 – Furnace Creek
6,7,8	Consecutive Sample Number	001 – First sample of DA

Figure 1 Black Butte Mine Site Map

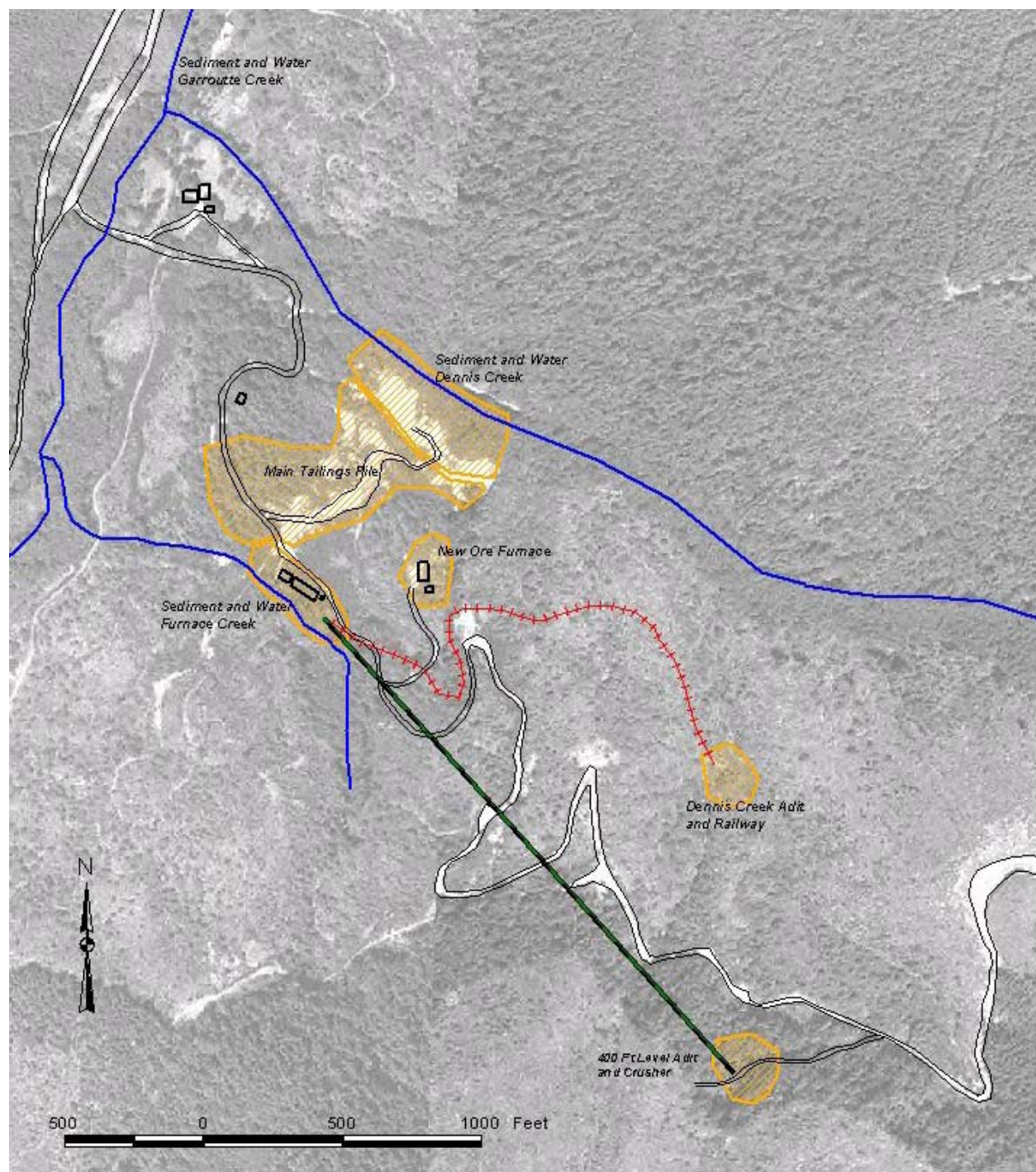
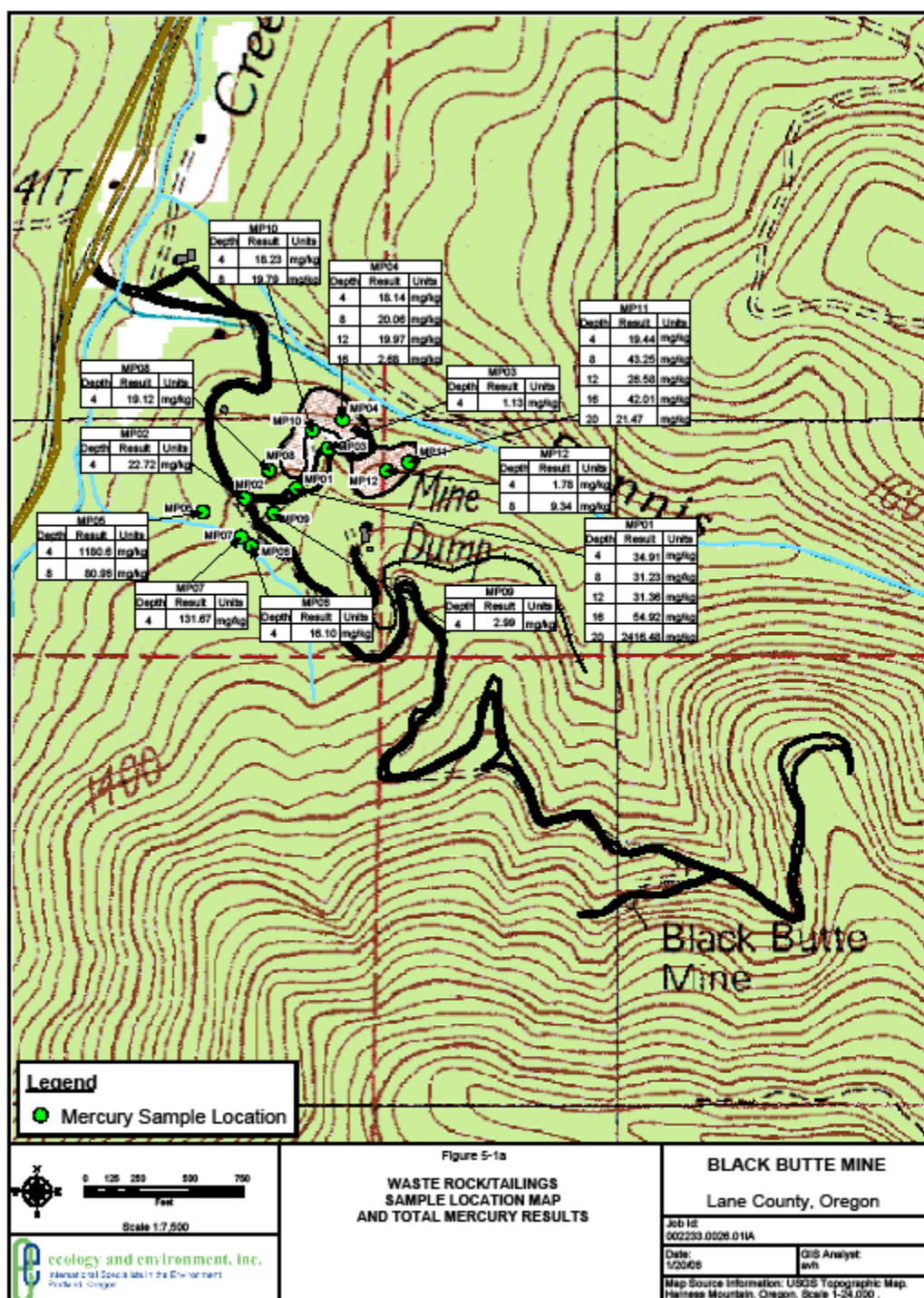


Figure 2 New Furnace Contamination Map



## MEMORANDUM

DATE: November 6, 2007

TO: Erin Lynch, Project Manager, E & E, Seattle, Washington

FROM: Mark Woodke, START-3 Chemist, E & E, Seattle, Washington

SUBJ: **Mercury Field Analysis Data Quality Assurance Review,  
Black Butte Mine Site, Cottage Grove, Oregon**

REF: TDD: 06-04-0013      PAN: 002233.0088.01SF

The data quality assurance review of soil samples collected from the Black Butte Mine site in Cottage Grove, Oregon, has been completed. Mercury analyses (Lumex SOP) were performed by START personnel on-site.

### **Data Qualifications:**

#### **1. Sample Holding Times: Satisfactory.**

The samples were maintained at temperatures less than or equal to 20°C after collection. Due to potential loss of volatile and/or metallic mercury, all mercury results are estimated (J or UJ) with an expected low bias (L) for positive results and an unknown bias (K) for non-detect results. The samples were analyzed within 24 hours of collection, therefore meeting QC criteria of less than 28 days between collection and analysis for mercury.

#### **2. Initial and Continuing Calibration: Acceptable.**

A minimum of three calibration standards and a blank were analyzed at the beginning of the analysis sequence and a minimum of one calibration standard and a blank were analyzed after every 20 samples and at the end of the sequence. The initial calibration correlation coefficients were > 0.995. Any results that exceeded the highest calibration standard were qualified as estimated quantities (J).

#### **3. Blanks: Acceptable.**

A calibration blank was analyzed for each 20 samples. There were no detections in any blanks that resulted in sample qualifications.

#### **4. Precision and Bias Determination: Not Performed.**

Samples necessary to determine precision and bias were not provided to the laboratory. All

results were flagged "PND" (Precision Not Determined) and "RND" (Recovery Not Determined), although the flags do not appear on the data sheets.

**5. Performance Evaluation Sample Analysis: Not Provided.**

Performance evaluation samples were not provided to the laboratory.

**6. Overall Assessment of Data for Use**

The overall usefulness of the data is based on the criteria outlined in the OSWER Guidance Document "Quality Assurance/Quality Control Guidance for Removal Activities, Sampling QA/QC Plan, and Data Validation Procedures" (EPA/540/G-90/004), the analytical method, and, when applicable, the Office of Emergency and Remedial Response Publication "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review". Based upon the information provided, the data are acceptable for use with the above stated data qualifications.

Data Qualifiers and Definitions

- J - The associated numerical value is an estimated quantity because the reported concentrations were less than the sample detection limits but greater than the instrument detection limits or because quality control criteria limits were not met.
- K - Unknown bias.
- L - Low bias.
- UJ - The material was analyzed for, but not detected. The reported detection limit is estimated because quality control criteria were not met.