ENGINEERING EVALUATION / COST ANALYSIS
Roba Westfall and York & Rannells Mines
Malheur National Forest, Grant County, Oregon

June 2003

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Prepared for: USDA Forest Service
Malheur National Forest

Site Location: Roba Westfall and York Rannells Mines
Malheur National Forest
Grant County, Oregon

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EXECUTIVE SUMMARY

Cascade Earth Sciences (CES) has prepared the following Engineering Evaluation/Cost Analysis (EECA) for completing a non-time-critical removal action related to mercury contamination at the abandoned Roba Westfall and York & Rannells Mines (Site) in Grant County, Oregon. The Site consists of two abandoned mercury mines located in the Malheur National Forest, approximately 20 miles southwest of John Day, Oregon. The EECA is being performed by the Forest Service under the Comprehensive Environmental Response and Liability Act cleanup authorities [42 USC 9604(a) and 7 CFR 2.60(m)] and Federal Executive Order 12580. This EECA has been prepared in accordance with the provisions of National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR 300.415(b)(4)(i). The purpose of this EECA is to select a preferred alternative to minimize or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare as outlined in 40 CFR 300.415(b)(2)(i)-(viii).

Based on the investigations conducted at the Site, surface water, sediment, groundwater and air have not been impacted by hazardous substances from the Site. However, soil and waste piles appear to be impacted by mining activities associated with the Site. Because mercury and arsenic are elevated in soil and waste piles above background concentrations and the EPA preliminary remediation goals (PRGs), streamlined risk assessments were completed to determine if human and ecological receptors are at risk due to the concentrations of metals in the soil and waste piles.

The results of the human health risk evaluation indicated that concentrations of metals in soil and waste material were not above the regulatory standard for carcinogens and noncarcinogens, and are, therefore, not likely to result in unacceptable human health risks at the Site. The results of the ecological risk assessment indicated while birds, mammals, plants and invertebrates in the vicinity of the processing areas may be at risk, their populations are unlikely to be significantly impacted because of the localized and small exposure areas.

The goal of the removal action is to achieve final cleanup of mining-related materials to acceptable levels of risk to humans and the environment. The scope of the removal action is to: achieve closure while attaining applicable or relevant and appropriate requirements (ARARs) to the extent practicable. Since the evaluation in this EECA indicates that the scope and goal of the removal action are met, no objectives for the removal action were developed and a detailed analysis of removal action alternatives was not performed.

Because processing areas represent an “attractive nuisance”, the Forest Service has elected to be conservative and remove surficial soil and waste material with elevated mercury and arsenic concentrations around processing areas. Subsurface soil and waste material (i.e., deeper than 5 feet) would not be removed because human and ecological receptors are unlikely come into contact with these areas. For removal purposes, the EPA industrial mercury PRG of 310 milligrams per kilogram will be used as a clean-up level. Based on this, approximately 20 cubic yards (CY) of material from the Roba Westfall Mine and 20 CY from the York & Rannells Mine would be excavated from around processing areas and disposed at the Subtitle C landfill in Arlington, Oregon. The total capital cost for implementing the recommended removal action is estimated to be $30,950.

1.0 INTRODUCTION

Cascade Earth Sciences (CES) has prepared the following Engineering Evaluation/Cost Analysis (EECA) for completing a non-time-critical removal action at the abandoned Roba Westfall and York & Rannells Mines (Site) in Grant County, Oregon. The EECA is being performed by the Forest Service under the Comprehensive Environmental Response and Liability Act (CERCLA) cleanup authorities [42 USC 9604(a) and 7 CFR 2.60(m)] and Federal Executive Order 12580. This EECA has been prepared in accordance with the provisions of National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR 300.415(b)(4)(i). The purpose of this EECA is to select an alternative to minimize or eliminate any release or threat of release of a hazardous substance into the environment or impact on public health and welfare as outlined in 40 CFR 300.415(b)(2)(i)-(viii). The EECA has been prepared utilizing the U.S. Environmental Protection Agency (EPA) "Guidance on Conducting Non-Time-Critical Removal Actions under CERCLA".

2.0 SITE CHARACTERIZATION

2.1 SITE DESCRIPTION AND BACKGROUND

2.1.1 Site Location and Status

The former mines that compose the Site are located approximately one mile apart in the Blue Mountain Ranger District of the Malheur National Forest (MNF). The following sections give a brief description of the site locations and an operation history of the Site. Figure 1 depicts the location of the Site in relation to the surrounding land and surface water features. The information in this section was obtained from *Quicksilver in Oregon* (Schuette, 1938 and Brooks, 1963) and *Quicksilver Deposits in Oregon* (Brooks, 1971) and the *Preliminary Assessment Reports for the Roba Westfall Mine and the York & Rannells Mine* (CES, 2001a and b). Refer to the Preliminary Assessment Reports for additional information.

- **Roba Westfall Mine:** The Roba Westfall Mine is located in the southwest ¼ of the southeast ¼ of Section 6, Township 16 South, Range 29 East of the Willamette Meridian (Figure 1). The Roba Westfall Mine encompasses an area of approximately 2 acres on National Forest System Land (NFSL) within the MNF at 44^{o}12'37" north latitude and 119^{o}16'57" west longitude. The elevation of the mine is approximately 5,260 feet above mean sea level (AMSL).

  The Roba Westfall Mine (also known as Deer Creek Prospect) is a former mercury mine, first discovered in 1947 by Lawrence Roba of Canyon City, Oregon. Little or no work was done until 1951 when claims were staked. A retort was installed and ore processing began in 1951.

  All of the ore processed from this mine was extracted above the 25-foot depth. Total production from the mine has been estimated at 9 flasks (684 pounds) and up to possibly 12 flasks of mercury. No production has occurred since 1953. According to Bureau of Land Management office electronic records, the last active claim was located September 2, 1982, by Precious Minerals Unlimited.

- **York & Rannells Mine:** The York & Rannells Mine is located in the northeast ¼ of the southwest ¼ of Section 7, Township 16 South, Range 29 East of the Willamette Meridian. The mine encompasses an area of approximately 5.5 acres on NFSL within the MNF at 44°11'49" north latitude and 119°17'14" west longitude. The mine is located at an approximate elevation of 5,640 feet AMSL.

  The initial mercury claim at the York & Rannells Mine (also known as the Broadway Prospect) was discovered about 1940 by Cecil Rannells and Homer York. Brooks' reference states 2,000 pounds of ore from the shaft was processed at the Roba Westfall retort (approximately 2 miles to the north) to generate 21 pounds of mercury in the early 1950s. In the 1960s, the claim was leased to Reeves and Farrin of Prineville, Oregon. Reeves and Farrin set up a retort, of which some of the portions remain today. Construction on the retort started in 1965 and was finished by 1968 although there are no references that address production from the mine using this retort.

2.1.2 Previous Removal Actions

No previous CERCLA or other regulatory removal actions have been conducted at the Site. According to USFS information, the mineshafts were collapsed using soil and rocks from around the former mine shafts. Previous environmental regulatory activities related to the Site are:

- *Preliminary Assessment, Roba Westfall Mine,* CES, October 2000 (CES, 2001a), and
- *Preliminary Assessment, York & Rannells Mine*, CES, October 2000 (CES, 2001b).

2.1.3 Site Physiography

The Site is located in the South Fork John Day River Watershed. The Roba Westfall Mine is located in the Murderers Creek subwatershed, and the York & Rannells Mine is located in the Deer Creek subwatershed. Additional information on surface water features in the area of the Site is presented in Section 2.1.7. The general terrain consists of hills, valleys, ridges, and mountains.

- **Roba Westfall Mine:** Topography of the Roba Westfall Mine is steep with a slope of approximately 25%. The topography generally slopes from southeast to northwest toward Beaverdam Creek. According to the USGS topographic map, Flagtail Mountain (USGS, 1990), springs and groundwater seeps appear to be the primary source for the surface water drainage features in the lower elevations of the watershed, although none are in the immediate vicinity of the Site. The nearest body of water downslope from the Roba Westfall Mine on the USGS map is Beaverdam Creek located approximately ¼ mile to the northwest. The Roba Westfall Mine is within a small drainage (approximately 230 acres) of Beaverdam Creek.

  Features observed at the Roba Westfall Mine include:
  - A former vertical shaft is located at the highest elevation in the Mine area.
  - To the west of the mineshaft is a waste rock pile. Mounds of overburden rock and soil piles surround the area. Older workings, as evidenced by bulldozed trenches below the mineshaft area, are covered with vegetation.
  - To the north of the former mine shaft, a former road connecting to FS 641 leads to the mine (Figure 2). The road may have been used to move ore from the shaft to the retort.
  - The remaining structures present on the mine are the cement foundation of the former retort, exhaust hood assembly and stacks from the retort, and various planks of wood and metal

roofing from the former building on the mine. Very little remains of the former rotary retort, and it is speculated that much of the equipment was moved to another mill in the vicinity. Only the foundation is in the original location. Other remnants are scattered about the mine.
    - A burnt ore pile was observed immediately to the southwest of the retort foundation (Figure 2).

- **York & Rannells Mine:** The topography at the York & Rannells Mine is relatively steep with a slope of approximately 25%. The Site is sloped from Flagtail Mountain in the southeast to the northwest. During the Site visits in the fall 2000 and 2002, no surface water was observed on-site. However, approximately 100 feet to the south was a small unnamed/unmapped 2-foot-wide and 6-inch-deep dry ephemeral channel, which appeared to transmit water during wetter times of the year. However, no material was observed migrating from the mine to this drainage. No other surface water drainage or water storage features were observed at the mine. The York & Rannells Mine is within the upper North Fork Deer Creek drainage area of approximately 1600 acres.

  Features observed at the York & Rannells Mine include:
    - Mounds of overburden rock and ore piles surround the area. Older workings are covered with vegetation. To the northeast of the former mine shaft, a wooden loading dock and road leading to the mill area still exist.
    - The mill area still contains a number of pieces of equipment used to process the ore, although vandals have removed many of the smaller parts from the mine. The remaining equipment, most of which has rusted and fallen over, includes a coarse ore hopper, fine ore bin, exhaust hood assembly, rotary furnace, firing hood assembly, burnt ore bin, dust collector and fan, and some condenser tubes and collection tray. Because the equipment is large, much of it remains in approximately the same position as when in operation.
    - Stairs made from railroad ties remain in the ground along where the ore delivery system and crushing system was set on the hillside. An ore pile was observed on the upper bench road. The actual point of crushing could not be determined based on the remains, although it is presumed to be in the vicinity of the lower bench road. The mill processing equipment is set on level ground at the base of the hillside.
    - Near the end of the calcine (burnt ore) soaking pit, the flat land extends approximately 50 feet and then drops sharply onto a small meadow. Vegetation was not growing on the face of the small escarpment and it appeared that the flat land extending out from the end of the calcine-soaking pit is comprised of burnt ore waste tailing.
    - A small wooden cabin is located approximately ¼ mile to the east. It did not appear that any ore or processing type activity occurred in this area. There was no evidence of a water supply well at the cabin.

2.1.4 Climate and Meteorology

Climate in Grant County is as follows:

- The climate is semi-arid and the Site lies within the northeastern Highlands Climatic Region.
- Marine influenced air movement is from the west, with much of the moisture released on the west slopes of the Cascade Mountains west of the Site, causing semi-arid conditions at the Site.
- The majority of the precipitation occurs as snow in the winter with thunderstorms providing precipitation in the summer as the air mass rises over the mountains.

Precipitation data was obtained from the Natural Resource Conservation Service (NRCS), National Water and Climate Center (NWCC) SNOTEL station 789 (Starr Ridge). The station is located approximately 10 miles east of the Site, at an elevation of approximately 5,300 feet above MSL. Data indicates the following:

- Between 1981 and 2002, the annual average precipitation was 20.9 inches with a minimum of 14.5 inches recorded in 1994 and a maximum of 29.1 inches recorded in 1993.
- Between 1989 and 2002, the average annual temperature ranged from a low of –3.3°C in December to a high of 17.6°C in July.

2.1.5 Geology

No additional information on geology is being presented in this EECA. Refer to Section 3.4 of the Preliminary Assessments for the Roba Westfall and York & Rannells Mines (CES, 2001a and b).

2.1.6 Hydrogeology

No additional information on hydrogeology is being presented in this EECA. Refer to Section 3.6 of the Preliminary Assessments for the Roba Westfall and York & Rannells Mines.

2.1.7 Hydrology

There are no reservoirs or other surface water bodies within the 15-mile downstream reach of the Site. No hydrologic studies on the streams in the area have been completed. Therefore, it is not known whether the streams are gaining or losing streams. However, given the location and geology, it is likely that the streams in the subwatersheds in the vicinity of the Site are gaining streams during the wet season (receive water) and losing streams during the dry season (groundwater recharge).

- **Roba Westfall Mine:** Perennial surface water does not occur near the mine. The nearest perennial surface water body to the Roba Westfall Mine is Murderers Creek, approximately 2.7 miles downslope to the northwest via ephemeral Beaverdam Creek. Murderers Creek eventually drains to the South Fork John Day River approximately 15 miles to the west. The John Day River System eventually joins the Columbia River, which discharges to the Pacific Ocean.

  According to USGS Flagtail Mountain map, the southernmost ephemeral reach of Beaverdam Creek comes to within ¼ mile west of the Roba Westfall Mine. However, during site visits in 2000 and 2002, no surface water was present in the apparent ephemeral creek. In addition, no channel or other surface water features were observed.

  North Fork Deer Creek, located approximately ¼ mile to the east of the Roba Westfall Mine is separated by a ridge from the mine. This creek could only be impacted by ore transportation activities from the mineshaft to the mill area via the former road in the area. North Fork Deer Creek eventually drains to the southwest approximately three miles where it joins Deer Creek, which flows west approximately 15 miles where it joins the South Fork John Day River.

- **York & Rannells Mine:** During the visits to the York & Rannells Mine for the 2000 PA and 2002 EECA, no surface water was present. The North Fork Deer Creek is approximately 4,000 feet downslope from the mine, although there are no apparent drainages directly to the creek from the mine. Approximately 100 feet to the south was a small unnamed/unmapped 2-foot-wide and 6-inch-deep dry channel, which appeared to transmit water during wetter times of the year.

2.1.8 Surrounding Land Use

2.1.8.1 Residential, Industrial, or Commercial

The Site has been designated as industrial for comparison with the EPA Region 9 Preliminary Remediation Goals (PRGs). The immediate area around the Site is part of the MNF and is utilized for recreational activities (hiking, hunting, fishing, camping, etc.), livestock grazing, and resources (mining, timber, etc.). There are no homes within a 4-mile radius of the Sites.

2.1.8.2 Identification of Sensitive Populations

Sensitive populations are defined as receptors that are located within a target distance for a particular pathway. The soil and air pathway are defined as the immediate area of the Site. There are no on-site workers, occupied structures or people who live within a 4-mile radius of the Site. Public use of the Site and vicinity is minimal, though public access records are not maintained**.** In general, land uses in this area are limited to timber harvesting, firewood cutting, recreation (hiking, camping, hunting, etc.) and some minerals prospecting.

For the groundwater pathway, the target distance has been defined as 4-miles and example targets are drinking water wells, wellhead protection areas, etc. According to the water well record database maintained by the Oregon Water Resources Department (WRD), no water wells exist within 4-miles of the Site. Therefore, the possibility of non-registered water wells located near the Site is very low. Based on this information, it can be assumed that groundwater is not used for drinking within 4-miles of the Site. For these same reasons, designated wellhead program areas not located within 4-miles of the Site.

2.1.9 Wildlife and Plant Survey

In November 2002, CES contracted with Entrix Corporation (ENTRIX) to perform a wildlife and plant species survey and habitat assessment. The information presented in this section is summarized from the *York & Rannells and Roba Westfall Mine Wildlife and Plant Species Survey and Habitat Assessment*, which is located in Appendix A.

2.1.9.1 Plant Species

The vegetation community found in the vicinity of the Site can be categorized as ponderosa pine-douglas fir forest, which occurs in much of eastern Oregon, the eastern slopes of the Cascades, and the Blue Mountains and its foothills. This community generally occurs in the driest locations supporting conifers in the Pacific Northwest. In Oregon, this community is associated with dry pumice soils. Ponderosa pine and douglas fir dominate the overstory at the Site, with occasional western larch interspersed. The understory appeared to be comprised predominately of grasses. A general list of herbaceous plant species that typically occur within ponderosa pine-douglas fir forest is located in Appendix A. Shrubs were interspersed within the understory, with snowberry being the most dominant shrub species observed. Other shrubs observed included curl-leaf mountain mahogany and western juniper. Grand fir (abies grandis) seedlings and saplings were also present in the understory.

No special-status plant species were documented during surveys. However, the following special-status plant species could potentially be found within the project area based on their range and suitable habitat being present: twin-spike moonwort, stalked moonwort, and dwarf phacelia.

2.1.9.2 Wildlife Species

The special-status animals of Oregon, and their habitat preferences are detailed in Appendix A. If the known range of a species does not overlap with the MNF it was not expected to occur. A full listing of all wildlife species observed and "expected, but not observed" during the reconnaissance survey is provided in Appendix A. In addition, the MNF provided CES with a database of sightings in the area around the Site, which is also presented in Appendix A.

The following species were documented during the survey: hairy woodpecker, northernflicker, clark's nutcracker, american crow, common raven, fox sparrow, coyote, and mule deer. No special-status animal species were observed during surveys. The following special-status animal species of concern listed could potentially be found within the project area based on sightings, their range and suitable habitat being present: western toad, northern goshawk, olive-sided flycatcher, pileated woodpecker, Eastern Oregon willow flycatcher, northern pygmy owl, yellow-breasted chat, lewis's woodpecker, mountain quail, flammulated owl, white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, great gray owl, pallid bat, silver-haired bat, bald eagle, canada lynx, american marten, pacific fisher, long-eared myotis, long-legged myotis, and yuma myotis.

2.1.9.3 Summary of Wildlife and Plant Species Survey

Based upon qualitative observations of habitat conditions upgradient and downgradient from past mining activity, habitat conditions outside of the Site do not appear to be impacted by historic mine operations. However, historical mine operations within the Site have affected the plant communities and wildlife habitat. Direct, acute mine impacts to plant communities resulted from the land clearing for roads, structures, and maintenance at the mines. In the immediate vicinity of the Site, past land clearing has reduced tree cover and plant cover in general. However, it appears likely that these areas will restore naturally over a long period of time. After re-establishment, the Site will provide habitat similar to the areas around them. None of the mine impacts currently recognized would appear to completely prevent the use of the habitats by species whose range would overlap with the Site. However, the physical disturbance at the Site has reduced the habitat quality, which would limit the number of individuals potentially supported by the available habitat.

Grasses, shrubs, and tree saplings have re-established in many of the cleared areas and atop the waste piles and areas adjacent to mining operations. However, plant re-establishment is predominately herbaceous, with very few tree saplings re-establishing. On the basis of the habitat and climate in the area, the most likely scenario to explain the low diversity and abundance of plants on the piles is the lack of soil nutrients and water.

2.1.10 Sensitive Ecosystems

2.1.10.1 Wetlands and Wildlife Breeding Areas

The following is summarized from the PA reports; see Section 3.5 for more information (CES, 2000a, 2000b). The following are "listed" on the National Wetlands Inventory (NWI) map:

- A NWI prepared by the U.S. Fish and Wildlife Service (USF&WS) identified Deer Creek as palustrine (or marsh), scrub-shrub, and seasonally flooded. The creek was mapped as palustrine to within ½ mile downslope of the Roba Westfall Mine.

- A NWI identified the creek near the York & Rannells Mine as palustrine (or marsh), scrub-shrub, and seasonally flooded. The two springs located near the head of the creek are classified as palustrine, scrub-shrub, and seasonally flooded areas (PSSC).

There are no known designated wildlife breeding areas in the vicinity of the Site.

2.1.10.2 Wild and Scenic Rivers

The South Fork of the John Day River is designated a Wild and Scenic River and is one of the most important rivers in northeast Oregon for the production of anadromous fish. Wildlife found along the river's corridor include mule deer, elk, and black bears, along with peregrine falcons and bald eagles. The Site is approximately 17 miles up stream from the confluence of the South Fork John Day River.

In addition, the ODF&W indicated that North Fork Deer Creek and Murderers Creek are designated critical habitats by the National Marine Fisheries Service, due to the threatened mid-Columbia steelhead (ODF&W, 2001a, 2001b).

2.1.10.3 Threatened And Endangered Species

The US Fish & Wildlife and the USFS was contacted and they indicated that the listed and proposed threatened and endangered (T&E) species that may be found in the area surrounding the Site are the Canada lynx, bald eagle, and mid-Columbia steelhead. The only candidate species, or species under review for listing, is the Columbia spotted frog. No T&E species or SOC were observed during the Wildlife and Plant Species Survey, see Section 2.1.9.

2.2 SOURCE, NATURE, AND EXTENT OF CONTAMINATION

This section describes the nature and extent of environmental contamination at the Site. Previous investigations have been conducted at the Site. In 1996, the USFS collected a total of eight soil/waste samples at the Site (four from Roba Westfall Mine and four from York & Rannells Mine). In 2000, CES conducted additional soil/waste material samples and prepared PAs for each mine. The result of the sampling indicated that mercury and other metals were elevated in the vicinity of the processing areas, when compared to background concentrations and EPA PRGs. Therefore, further sampling was needed to characterize the nature and extent of contamination around processing areas at the Site. As part of this EECA, CES collected a total of 62 soil and waste material samples for either XRF or laboratory analysis to determine the nature and extent of contamination at the Site. Tables 1 through 6 present the combined analytical results from the 1996 USFS sampling, 2000 PA and the 2002 EECA investigation.

2.2.1 Surface Water and Sediment

Based on the information presented in Sections 2.7.1 and the PAs (Section 9.4), there is no documented release of hazardous substances from the Site to local surface water and sediment. Therefore, additional investigation and characterization of the surface water and sediment is not warranted.

2.2.2 Groundwater

Based on the information presented in the PAs (Section 9.3), there is no documented release of hazardous substances from the Site to local groundwater. Furthermore, because groundwater is not used as drinking water in the vicinity of the Site, the groundwater exposure pathway is not complete. Therefore, additional investigation and characterization of the groundwater is not warranted.

2.2.3 Air

The most likely source of air contamination related to the Site would be a result of dust or particulate matter. Most of the particulate matter in the air would originate from the soil and waste piles that currently exist at the Site. Remediation of the Site should address any air contamination concerns. Given this, and the remote location and limited use of the Site, no further assessment into Site-specific levels of compounds in the air is recommended.

2.2.4 Soil and Waste Pile Material

Soil and waste material (i.e. waste rock, burnt ore, tailings, etc.) samples were collected and analyzed from the Site to determine the nature and extent of metallic contamination related to the mining activities and for the purposes of evaluating removal action options. During the 1996, 2000 and 2002 investigations, a total of 46 soil samples, 9 background soil samples, and 37 waste material samples were collected and analyzed for metals, pH, and/or acid-base accounting (ABAs). Metals analysis was performed either in the laboratory or in the field using a Niton™ dual source XRF. Laboratory and XRF results are shown in Tables 1 through 5. All of the samples analyzed for ABAs were positive, which indicates that acid rock drainage (ARD) from the Site is not occurring and the likelihood of ARD occurring in the future is extremely low.

To determine potential disposal options, leachate from six waste material samples using the synthetic precipitation leaching procedure (SPLP) and the toxicity characterization leaching procedure (TCLP) was analyzed for the eight Resource Conservation Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). For off-site disposal, if soil or waste material exhibits a TCLP concentration greater than the RCRA limit, it can only be disposed in a Subtitle C landfill. However, if material does not exceed the TCLP limit, it can be disposed in a Subtitle D landfill. For on-site disposal, the SPLP analysis is a more appropriate test to determine the in-situ leachability, because the SPLP analysis uses natural acidic rain as the leaching solution to mimic natural conditions at the Site. The results indicate that metals are not significantly leaching and no sample exceeded the TCLP disposal limits for any metal (Table 6).

Soil and waste material samples have been compared with the arsenic and mercury EPA Region 9 PRGs. As outlined in the 2002 PRG table, arsenic has an industrial PRG of 1.6 milligrams per kilogram (mg/kg) and mercury an industrial PRG of 310 mg/kg.

2.2.4.1 Soil

Background soil and Site soil laboratory and field XRF analysis results are presented in Table 1, 2 and 3; and sample locations are shown on Figure 2 and 3.

- **Background Soil:**
  - Nine background soil samples were collected: four around the York & Rannells Mine and five around the Roba Westfall Mine.
  - All samples were collected from 0 to 12 inches below ground surface (BGS).
  - One sample (BGS-R-1) was collected at the Roba Westfall Mine during the 2002 EECA investigation to confirm the abnormally high mercury concentration, 3,600 mg/kg, detected in RW-S-4 during the October 2000 investigation. Because BGS-R-1 was detected at 0.806 mg/kg, the October 2000 sample result is most likely due to a laboratory or field sampling error and is considered a statistical outlier and excluded from the assessment.
  - Mercury concentrations ranged from 0.11 mg/kg to 54 mg/kg, with a mean of 9.9 mg/kg.
  - Arsenic concentrations ranged from 2.0 mg/kg to 19.4 mg/kg, with a mean of 6.9 mg/kg. Because the mean concentration of arsenic in background soil was greater than the industrial PRG of 1.6 mg/kg, the mean background concentration will be used for comparison.
  - The average pH of the background soil samples was 6.5 standard units (su).

- **Roba Westfall Mine:**
  - 18 soil samples were collected, including 12 samples analyzed in the field using the XRF method. All samples were collected from 0 to 12 inches BGS.
  - Mercury and arsenic were detected above the laboratory method detection limit (MDL) in all soil samples collected. The MDL is lowest concentration that a laboratory method can detect a particular analyte.
  - Mercury concentrations ranged from 4.1 mg/kg to 2,140 mg/kg in laboratory analysis, and from below the Niton limit of detection (LOD) to 806 parts per million (ppm) in samples analyzed using the XRF.
  - Arsenic concentrations ranged from 4.0 mg/kg to 16.4 mg/kg in laboratory analysis, and were not detected above the LOD in samples analyzed using the XRF.
  - Five soil samples exceeded the industrial mercury PRG of 310 mg/kg, and only two soil samples exceeded the mean background arsenic concentration of 6.9 mg/kg.
  - Based on this, the highest mercury and arsenic concentrations in soil appear to be around the southeast corner of the D-tube retort foundation.
  - The average pH in soil samples was 6.5 su.

- **York & Rannells Mine:**
  - 28 soil samples were collected, including 18 samples analyzed in the field using the XRF method. All samples were collected from 0 to 6 inches BGS.
  - Mercury and arsenic were detected above the laboratory MDL in all soil samples collected.
  - Mercury concentrations ranged from 1.73 mg/kg to 7,300 mg/kg (collected within the condenser tube tray) in laboratory analysis, and from below the LOD to 6,605 ppm in XRF analysis.
  - Arsenic concentrations ranged from 6.2 mg/kg to 11.4 mg/kg in laboratory analysis, and were not detected above the LOD in any samples analyzed using the XRF.
  - Seven soil samples exceeded the industrial mercury PRG of 310 mg/kg, and four soil samples exceeded the mean background arsenic concentration of 6.9 mg/kg.
  - Based on this, the highest mercury and arsenic concentrations appear to be located around the condenser tubes and tray, and adjacent to the base of the rotary furnace.
  - The average pH in soil samples was 7.1 su.

<u>2.2.4.2</u> <u>Waste Material</u>

Waste material laboratory and field XRF analysis results are presented in Table 4 and 5, and sample locations are shown on Figure 2 and 3.

- **Roba Westfall Mine:**
  - 23 waste material samples were collected from the waste rock and burnt ore piles, including 14 analyzed in the field by XRF method.
  - Samples collected from the waste rock pile near the former shaft exhibit total mercury concentrations ranging from 5.07 mg/kg to 5,500 mg/kg in laboratory analysis, and from below the LOD to 3,500 ppm in XRF samples. However, with the exception of one sample (5,500 mg/kg collected at 4 inches BGS near the shaft) no surface sample collected from 0 to 12 inches BGS exceeded the industrial mercury PRG. Furthermore, the remaining three samples that did exceed the mercury PRG were collected from 5 feet BGS or deeper.
  - Arsenic concentrations collected from the waste rock pile ranged from 3.1 mg/kg to 39 mg/kg in laboratory samples, and was not detected above the LOD in XRF samples. Surface samples (collected from 0 to 12 inches BGS) did not exceed the mean background arsenic concentration. Furthermore, the remaining three samples that did exceed the mean background arsenic concentration were collected from 5 feet BGS or deeper.
  - Total mercury concentrations in samples collected from the burnt ore pile range from 3.94 mg/kg to 886 mg/kg in laboratory analysis, and from below the LOD to 215 ppm in XRF samples. Three surface samples collected from 0 to 4 inches BGS exceeded the mercury PRG; however, all subsurface samples did not exceed the mercury PRG.
  - Samples collected from the burnt ore pile exhibited concentration of total arsenic ranging from 11 mg/kg to 197 mg/kg in laboratory analysis and below the LOD in XRF samples. All laboratory samples exceeded the mean arsenic background concentration.
  - The average pH in waster material samples was 6.5 su.

- **York & Rannells Mine:**
  - 14 waste material samples were collected from waste rock, burnt ore, and ore piles, including 9 analyzed in the field by XRF method. All samples were collected from 0 to 12 inches BGS.
  - Total mercury concentrations in waste material samples ranged from 1.35 mg/kg to 480 mg/kg in laboratory analysis, and from below the LOD to 102 ppm in XRF samples.
  - Arsenic concentrations collected ranged from 2.8 mg/kg to 15 mg/kg in laboratory analysis; however, arsenic was not detected above the LOD in XRF samples.

- o No waste material samples exceeded the industrial mercury PRG; however, all five samples analyzed in the laboratory exceeded the industrial arsenic PRG.
- o The average pH in soil samples was 6.9 su.

2.2.4.3 Soil and Waste Material Summary

A summary of the extent of contamination at each mine indicates the following:

- **Roba Westfall Mine:** Soils and waste materials appear to be impacted by mining activities associated with the mine. With the exception of three samples, all samples analyzed in the laboratory exceeded the mean background arsenic concentration of 6.9 mg/kg. The mean background arsenic concentration is a more appropriate comparison because of the naturally elevated levels of arsenic in the area around the Site (e.g., all background concentrations exceeded the arsenic industrial PRG). Mercury concentrations exceeded the industrial PRG of 310 mg/kg in 12 soil and waste material samples collected. Of these, the highest concentrations were from samples collected from surficial soils adjacent to the D-tube retort foundation and from subsurface samples (below 5 feet BGS) in the waste rock pile.

- **York & Rannells Mine:** Soils and waste materials appear to be impacted by mining activities associated with the mine. Eight samples exceeded the mean background arsenic concentration of 6.9 mg/kg. Mercury concentrations exceeded the industrial mercury PRG in eight samples. Of these, the highest concentrations were from samples collected in the area around the condenser tube pipes and tray. The highest concentration of mercury detected was collected from within the fan unit by the USFS in 1996; however, the exact location and sampling methods is not known.

- Because mercury and arsenic are elevated (above background concentrations and PRGs) in areas around the Site, a streamlined risk assessment is warranted to determine human and ecological receptors are at risk due to the concentrations of metals in the soil and waste rock.

3.0 STREAMLINED RISK EVALUATION

3.1 STREAMLINED HUMAN HEALTH RISK EVALUATION

A human health risk evaluation (HHRE) is an analysis of the potential adverse health effects that could result from current or future exposures to hazardous substances released from a site, in the absence of any action to control or mitigate these releases. The objective of this assessment is to incorporate analytical data and information on potential exposure pathways gathered during the site inspection to provide a more complete baseline HHRE for the Site. The following are primary elements of the HHRE:

- **Identification of Contaminants of Concern:** Evaluation of Site data and identification of elevated concentrations of contaminants in Site media.
- **Exposure Assessment:** Identification of areas that pose human health risks under current or potential future Site uses and quantification of estimates of exposure.
- **Toxicity Assessment:** Quantification of estimates of the relationship between exposure levels and adverse effects.
- **Risk Characterization:** Development of quantitative risk estimates using potential exposure and toxicity information previously developed for the contaminants of potential concern (COPC).

3.1.1 Risk and Hazard Estimates for the Recreational Receptor

The results of the quantitative risk assessment are presented in this section. Calculations, assumptions and exposure inputs are presented in Appendix B. Since the Hazard Index (HI) was less than regulatory standard (1.0) there is no potential for adverse hazards from exposure to noncarcinogenic COPCs at the Site. Furthermore, because the excess cancer risk (ECR) was below the regulatory standard (1E-06), the risk characterization for carcinogenic effects demonstrates that the potential for unacceptable excess cancer risks at the Site is low. The following table summarized the results.

Summary of Potential Human Health Risks

SCENARIO	Excess Cancer Risk		Hazard Index	
	CTE	RME	CTE	RME
Recreational	3.E-08	8.E-07	1.E-01	7.E-01

CTM – central tendency exposure
RME – reasonable maximum exposure

3.1.1.1 Noncarcinogenic Risks Results

- Soils, Waste Rock, and Tailings: Arsenic and mercury were identified as the primary COPCs for this media. The 90 percent upper confidence limit (90_{UCL}) concentration of arsenic was used as the exposure point concentration (EPC). The Hazard Quotient (HQ) does not exceed 1.0 for any of the pathways evaluated.

- Air: Inhalation of particulates potentially contaminated with mercury and arsenic was quantified. The HQs for the RME and CTE scenarios for mercury and arsenic are negligible ranging from 5E-12 to 9E-13, respectively.

3.1.1.2 Carcinogenic Risks Results

- Soils, Waste Rock, and Tailings: The only carcinogenic constituent identified in soils, waste rock and tailings was arsenic. The 90_{UCL} concentration of arsenic was used as the EPC. The ECR did not exceed the regulatory standard of 1E-06 for any pathway of exposure and ranged from 8E-07 (RME) to 3E-08 (CTE).

- Air: Inhalation of particulates potentially contaminated with arsenic was quantified. The ECRs for the RME and CTE scenarios are negligible ranging from 3E-09 to 1E-10, respectively.

3.1.2 Human Health Risk Evaluation Summary

The conceptual human health exposure model is presented in Figure 1 of Appendix B. Of the 15 COIs identified at the Site, only arsenic and mercury were identified as COPCs. These two metals were quantitatively and qualitatively evaluated in this HHRE. Based on current and future land use, individuals who might come in contact with Site-related contaminants through recreational activities such as hunting, hiking and camping were the only potential receptors identified. The quantitative risk assessment determined that concentrations of COPCs in soil and waste material were not above the regulatory standard for carcinogens (ECR = 1E-06) and non-carcinogens (HI = 1.0), and are, therefore, not likely to result in unacceptable human health risks at the Site. Furthermore, a Site-specific human health PRG was not calculated because the Site does not pose a risk to human health under the recreational scenario.

3.2 STREAMLINED ECOLOGICAL RISK ASSESSMENT

In accordance with ODEQ guidance (ODEQ, 2001), a Screening Level Ecological Risk Assessment (ERA) was completed for the Site. The ERA is also consistent with national and regional guidance (USEPA 1992, 1997, 1998). The goal of the ERA is to provide an understanding of the potential for ecological risks due to mine-related contamination and to determine whether there is a need for more detailed ecological risk assessment. The ERA includes the following, which is included in Appendix C:

- A description of the COIs based on Site uses and data gathered during the PA and SI;
- A description of the ecology of the Site and potential ecological receptors (including rare, threatened, and endangered species) at or near the Site;
- Presentation of the conceptual ecological exposure model which provides a summary of potential and likely exposure media and pathways;
- Assessment and measurement endpoints;
- An assessment of the analytical data used in the ERA;
- An ecological risk-based screening; and
- A risk characterization to assess the potential for significant ecological effects due to Site related COIs.

Appendix C presented the problem formulation, risk assessment data, ecological risk-based screening, risk characterization, uncertainty analysis, conclusions and recommendations. The problem formulation determines the scope of the ERA and culminates in a conceptual ecological exposure model and assessment endpoints. The assessment endpoints tie the risk assessment results to risk management decisions and presents the focus of the remainder of the ERA. The Site analytical data that were used for the ERA are briefly described, and a risk-based screening was conducted, comparing the Site data to ecological risk-based screening concentrations. The results of the risk-based screening are discussed along with the uncertainties inherent in the ERA process; and, finally, conclusions and recommendations are provided regarding the potential for ecological risks to be posed by Site-related chemicals and whether further investigation or remediation is warranted for the protection of ecological receptors. Also included in Appendix C is the ODEQ ecological scoping checklist.

3.2.1 Ecological Risk Assessment Summary

The conceptual ecological exposure model (CEEM) presented in Figure 1 of Appendix C, which outlines the sources of contamination, contaminant release and transport mechanisms, impacted exposure media, and exposure routes for ecological receptor types at the site.

The highest concentrations of contaminants of potential ecological concern (COPECs) in soils are located in the vicinity of former ore handling and refining areas, and in the waste piles at the

Site. It is likely that plants and invertebrates may be at risk within these localized areas to mercury and nickel. However, while the plants and invertebrates within these localized areas may be at risk, their populations are unlikely to be significantly impacted within the vicinity of the Site because of the localized and small exposure areas. In addition, the habitat lost due to any effects on plants is also unlikely to result in significant effects to upper trophic level species (i.e. birds and mammals) due to the large amount of relatively undisturbed habitats available surrounding the mines.

Risks due to mercury and nickel in soil and waste piles were also predicted for birds and mammals. Risks due to arsenic, chromium, lead, mercury and nickel were predicted for protected bird and mammal species (i.e. bald eagle and Canada lynx). However, population level effects could only occur for these species if the receptors were to forage predominantly at the site. This is extremely unlikely given the readily available undisturbed habitat surrounding the Site. Furthermore, risks are unlikely for the protected Canada lynx and bald eagle because of its very large home range, and the resulting minimal exposure to COPECs at the site. Given the conservative nature of the exposure point concentrations, and taking into account the large feeding range and regional ecology, use of the soil ecological risk based screening concentrations (ERBSCs) as PRGs would be grossly over protective because the receptors are not expected to inhabit the Site for an extended period of time.

4.0 SITE CLEANUP CRITERIA

4.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of the CERCLA, 42 U.S.C.§9621(d), the NCP, 40 CFR Part 300 (1990), and guidance and policy issued by the EPA require that removal actions under CERCLA comply with substantive provisions of applicable or relevant and appropriate standards, requirements, criteria, or limitations (ARARs) from Federal and State environmental laws and State facility citing laws during and at the completion of the removal action. These requirements are threshold standards that any selected alternative must meet, unless an ARAR waiver is invoked.

This section identifies ARARs for the removal action activities to be conducted for the USFS at the Roba Westfall and York & Rannells Mines. The ARARs identification is a component of the "non-time-critical removal process".

As part of the EECA, these ARARs have been used to determine the design specifications and performance standards for the project. They are grouped as Federal or State of Oregon ARARs. They are identified by a statutory or regulatory citation, followed by a brief explanation of the ARAR, and whether the ARAR is applicable, or relevant and appropriate. Administrative requirements are not ARARs and thus do not apply to actions conducted entirely on-site. Administrative requirements are those that involve consultation, issuance of permits, documentation, reporting, record keeping, and enforcement. The CERCLA program has its own set of administrative procedures, which assure proper implementation of CERCLA. In accordance with Section 121(e) of CERCLA, no permits are required for the removal action.

ARARs are either "applicable" or "relevant and appropriate." Both types of requirements are mandatory under CERCLA and the NCP.

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

- **Relevant and Appropriate.** Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal or state environmental or facility citing laws that, while not "applicable" to hazardous substances, pollutants, contaminants, remedial actions, locations, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements are relevant and appropriate.

ARARs are chemical, location, or action specific:

- **Chemical Specific**. Theses requirements address chemical or physical characteristics of compounds or substances on sites. These values establish acceptable amounts or concentrations of chemicals, which may be found in or discharged to the ambient environment.

- **Location Specific**. These requirements are restrictions placed upon the concentrations of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs relate to the geographical or physical positions of sites, rather than to the nature of contaminants at sites.

- **Action Specific**. These requirements are usually technology based or activity based requirements or limitations on actions taken with respect to hazardous substances, pollutants or contaminants. A given cleanup activity will trigger an action specific requirement. Such requirements do not themselves determine the cleanup alternative, but define how chosen cleanup methods should be performed.

The list of ARARs submitted and evaluated for the Site are presented in Appendix D.

4.2 RISK-BASED AND ARAR-BASED PRGS

According to OAR 340-122-040, removal actions shall be implemented to achieve 1) acceptable risk levels as demonstrated through site-specific risk assessment for both human and ecological receptors; 2) background concentrations for naturally occurring substances; or 3) numeric soil cleanup levels specified in OAR 340-122-045 and the EPA Region 9 PRGs. Because the streamlined human health risk evaluation did not indicate that there were unacceptable risks to humans, a risk-based PRG for humans was not developed. Furthermore, the soil cleanup levels and EPA Region 9 PRGs are screening levels that were used in the risk assessment and are not considered appropriate cleanup levels. ARAR-based PRGs for surface water and sediment are not applicable, because the surface water and sediment pathways were determined to be incomplete for both human and ecological receptors.

As outlined in the streamlined ecological risk assessment, State of Oregon soil ERBSC's would be grossly overprotective of ecological receptors. Furthermore, population level effects could only occur for ecological species if the receptors were to forage predominantly at the Site. Considering localized and small exposure areas, this is unlikely. In addition, the habitat lost due to any effects on plants is also unlikely to result in significant effects to upper trophic level species due to the large amount of relatively undisturbed habitats available surrounding the mines. Based on this, risk-based PRGs for ecological receptors were not developed.

5.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

5.1 SCOPE, GOALS AND OBJECTIVES OF THE REMOVAL ACTION

The scope of the removal action is to achieve closure of the Site while attaining ARARs to the extent practicable.

The goal of the removal action for the Roba Westfall and York & Rannells Mines is to achieve final cleanup of mining-related materials to acceptable levels of risk to humans and the environment.

Since the evaluation in this EECA indicates that the scope and goal of the removal action are met, no objectives for the removal action were developed and a detailed analysis of removal action alternatives was not performed.

6.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Because unacceptable cancer and non-cancer human health impacts at the Site are not expected, and protected and non-protected ecological species are not expected to be impacted by the Site, no further environmental action is warranted at the Site. However, because processing areas represent an "attractive nuisance", the Forest Service has elected to be conservative and remove surficial soil and waste material with elevated mercury and arsenic concentrations around processing areas. Subsurface soil and waste material (i.e., deeper than 5 feet BGS) would not be removed because human and ecological receptors are unlikely to come into contact with these areas. For removal purposes, the EPA industrial mercury PRG of 310 mg/kg will be used as a clean-up level. Based on this, approximately 20 cubic yards (CY) of material from the Roba Westfall Mine and 20 CY from the York & Rannells Mine would be excavated from around processing areas. Because none of the soil and waste samples exceeded the TCLP limits for metals, technically the excavated material can be disposed in the local Subtitle D facility. However, in an effort to protect the Forest Service's liability and long-term risk, the excavated material would be disposed at the Subtitle C landfill in Arlington, Oregon. Subtitle C landfills provide an extra level of environmental assurance because these landfills are lined and have stricter monitoring requirements than Subtitle D landfills. A Niton dual source XRF would be used to generally delineate the limits of excavation, and confirmation samples will be collected to verify the areas with mercury above the PRG have been removed. In addition, miscellaneous debris (i.e., metal siding, pipes, wood, garbage, drums, etc.) would also be removed from the Site and disposed in a local Subtitle D facility. Excavated areas will be re-contoured and revegetated. Revegetation would consist of fertilizing, seeding and mulching to all disturbed areas. A certified weed free straw mulch would be applied to prevent erosion during plant establishment.

The purpose of this section is to evaluate the removal action alternative for its effectiveness, specifically how the alternative addresses the following criteria.

- **Overall protection of human health and the environment:** – since there is not a documented risk to human and ecological receptors, this alternative is protective of human health and the environment.
- **Compliance with ARARs: -** this alternative will comply with all of the ARARs listed in Appendix D.
- **Long-term effectiveness and permanence: -** backfilling and revegetating the excavated areas will provide for long-term effectiveness.
- **Reduction of toxicity, mobility, or volume through treatment: -** this alternative does not reduce the toxicity or volume of the material; however the mobility is reduced by transferring the material to a control Subtitle C landfill.
- **Short-term effectiveness:** - construction activities are expected to be completed in one week. On-site workers would be protected by following a site specific Health and Safety Plan.
- **Implementability:** - this alternative is both technically and administratively feasible and is a proven method.
- **Cost: -** Tables 7 provides the capital, indirect, operation and maintenance costs, as well as the 5 year Net Present Value (NPV) of the alternative. The NPV is estimated at $32,500.
- **State and community acceptance: -** because no risks have been identified at the Site and the proposed alternative goes above and beyond the scope of an EECA, it is expected that state agencies and the community would accept this alternative.

Since the recommended removal action alternative addresses and complies with the above evaluation criteria, CES recommends that the recommended removal action be implemented.

Prepared by: Reviewed by:

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_____________________________ _____________________________

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TABLES

Table 1. Background Soil Analytical Results - Roba Westfall and York & Rannells Mine
Malheur National Forest, Grant County, Oregon

Sample ID [1]	Sample Date	Collected By:	Sample Depth (ft)	Metals Analysis Method (Lab or XRF)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Magnesium	Manganese	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	pH (lab)
					mg/kg for laboratory results, ppm for XRF results																							su
YR-S4	10/24/2000	CES	0.5	Lab	--	0.1	2.0	--	0.6	2.3	--	18	--	55	--	<5	0.11	--	--	25	--	0.6	<0.6	--	0.39	--	171	7.1
YR-S5	10/24/2000	CES	0.5	Lab	--	0.3	5.9	--	0.6	1.3	--	33	--	43	--	<5	0.35	--	--	21	--	0.2	<0.6	--	0.41	--	101	5.9
YR-S6	10/24/2000	CES	0.5	Lab	--	<0.1	5.0	--	0.8	1.4	--	16	--	43	--	<5	0.36	--	--	17	--	0.2	<0.6	--	0.64	--	125	6.1
YR-S9	10/24/2000	CES	0.5	Lab	--	0.1	3.1	--	0.7	2.7	--	19	--	51	--	5	0.69	--	--	29	--	0.5	<0.6	--	0.60	--	159	6.9
RW-S4	10/24/2000	CES	0.25	Lab	--	<0.1	13.6	--	<0.5	0.5	--	17	--	75	--	9	3600 [3]	--	--	20	--	33	1.2	--	0.13	--	82	6.2
BGS-R-1-1'	10/29/2002	CES	1	Lab	19,300	<0.5	5.75	454	0.32	0.71	2,620	18.1	10.5	67.9	28,600	13.9	0.806	1,150	3,740	24.7	2,890	0.44	1.02	123	<0.2	40.5	153	7.83
BGS-R-1-1'	10/29/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	25,997	ND	ND	--	ND	ND	--	ND	ND	--	--	--	239	--
RW-S5	10/24/2000	CES	0.25	Lab	--	<0.1	3.3	--	<0.5	1.1	--	14	--	41	--	5	22	--	--	24	--	0.8	0.8	--	0.19	--	152	6.0
RW-S6	10/24/2000	CES	0.25	Lab	--	<0.1	3.8	--	0.2	0.8	--	25	--	54	--	5	0.7	--	--	30	--	0.3	0.9	--	0.20	--	120	6.1
RW-S8	10/24/2000	CES	0.25	Lab	--	0.3	19.4	--	<0.5	1.0	--	21	--	51	--	5	54	--	--	20	--	1.1	1.0	--	0.90	--	107	6.1
				Mean Value	19,300	0.2	6.9	454	0.5	1.3	2,620	20.1	10.5	53.4	27,299	7.2	9.9 [3]	1,150	3,740	23.4	2,890	4.1	1.0	123	0.43	40.5	141	NS

NOTES:

[1] Samples collected on 8/5/96 were analyzed by Alche Labs in Boise ID, samples collected on 10/24/00 were analyzed by ACZ Labs in Steamboat Springs, CO, samples collected on 10/29/02 were analyzed by SVL Analytical in Kellogg ID.

[2] t CaCO3/Kt = tons of calcium carbonate needed to neutralize 1000 tons of waste/soil. Negative number indicates lack of $CaCO_3$; positive value indicates excess.

[3] RW-S4 was removed from the mercury mean value because it is considered an outlier

su = standard units

mg/kg = milligrams per kilogram

ppm = parts per million

< value = analyte not detected above listed Method Detection Limit (MDL)

ND = not detected above the limits of detection (LOD) of the Niton XRF

-- = not analyzed

Table 2. Soil Analytical Results - Roba Westfall Mine
Malheur National Forest, Grant County, Oregon

Sample ID [1]	Location of Sample	Sample Date	Collected By:	Sample Depth (ft)	Metals Analysis Method (Lab or XRF)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Magnesium	Manganese	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Acid-Base Accounting: Acid Generation Potential	Acid Neutralization Potential	Acid-Base Potential	pH (lab)
						mg/kg for laboratory results, ppm for XRF results																							t CaCO3/Kt [2]			su
RW#3	D-tube retort foundation	8/5/1996	USFS	0.25	Lab	--	--	--	--	--	--	--	--	--	--	--	--	4.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RW#4	North of D-tube retort foundation	8/5/1996	USFS	0.25	Lab	--	--	--	--	--	--	--	--	--	--	--	--	54.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RW-S1	North of D-tube retort foundation	10/24/2000	CES	0.25	Lab	--	<0.1	**8.1**	--	<0.5	1.3	--	24	--	69	--	9	**910**	--	--	28	--	4.6	0.7	--	0.28	--	129	--	--	--	6.0
RW-S2	North of D-tube retort foundation	10/24/2000	CES	0.25	Lab	--	<0.1	4.2	--	<0.5	0.6	--	24	--	71	--	6	17	--	--	24	--	0.7	0.8	--	0.17	--	92	--	--	--	5.7
RW-S3	South of D-tube retort foundation	10/24/2000	CES	0.25	Lab	--	0.2	**16.4**	--	<0.5	1.0	--	23	--	73	--	38	**2,140**	--	--	25	--	2.7	1.2	--	0.49	--	221	--	--	--	7.3
RW-WS3	North of D-tube retort foundation	10/24/2000	CES	0.25	Lab	--	0.2	4.0	--	<0.5	0.4	--	22	--	79	--	<9	26	--	--	22	--	0.7	0.7	--	0.15	--	88	--	--	--	6.8
S-R-1	West of D-tube retort foundation	10/28/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	30,080	ND	79	--	ND	ND	--	ND	ND	--	--	--	214	--	--	--	--
S-R-1	West of D-tube retort foundation	10/28/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	24,691	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
S-R-2	South of D-tube retort foundation	10/28/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	27,494	ND	**413**	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
S-R-2	South of D-tube retort foundation	10/28/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	26,880	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
S-R-3	West of D-tube retort foundation	10/28/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	25,190	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
S-R-4	North of D-tube retort foundation	10/28/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	22,093	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
S-R-5	North of D-tube retort foundation	10/28/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	24,998	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	<0.3	13.8	13.8	6.65
S-R-6	South of D-tube retort foundation	10/28/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	108,953	392	261	--	ND	ND	--	ND	ND	--	--	--	1,050	--	--	--	--
S-R-7	SE edge of D-tube Retort foundation	10/28/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	33,485	ND	**806**	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
S-R-7	SE edge of D-tube Retort foundation	10/28/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	31,693	ND	**313**	--	ND	ND	--	ND	ND	--	--	--	255	--	--	--	--
S-R-7	SE edge of D-tube Retort foundation	10/28/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	28,698	ND	ND	--	ND	21990	--	ND	ND	--	--	--	ND	--	--	--	--
S-R-8	West of D-tube retort foundation	10/28/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	23,898	ND	ND	--	ND	3478	--	ND	ND	--	--	--	ND	--	--	--	--

NOTES:

[1] Samples collected on 8/5/96 were analyzed by Alche Labs in Boise ID, samples collected on 10/24/00 were analyzed by ACZ Labs in Steamboat Springs, CO, samples collected on 10/29/02 were analyzed by SVL Analytical in Kellogg ID.

[2] t CaCO3/Kt = tons of calcium carbonate needed to neutralize 1000 tons of waste/soil. Negative number indicates lack of $CaCO_3$; positive value indicates excess.

su = standard units

mg/kg = milligrams per kilogram

ppm = parts per million

< value = analyte not detected above listed Method Detection Limit (MDL)

ND = not detected above the limits of detection (LOD) of the Niton XRF

-- = not analyzed

Bold = arsenic concentration exceeds the mean background concentration of 6.9 mg/kg; mercury concentration exceeds the EPA industrial mercury PRG of 310 mg/kg.

Table 3. Soil Analytical Results - York & Rannells Mine
Malheur National Forest, Grant County, Oregon

																													Acid-Base Accounting			
Sample ID [1]	**Sample Location**	**Sample Date**	**Collected By:**	**Sample Depth (ft)**	**Metals Analysis Method (Lab or XRF)**	**Aluminum**	**Antimony**	**Arsenic**	**Barium**	**Beryllium**	**Cadmium**	**Calcium**	**Chromium**	**Cobalt**	**Copper**	**Iron**	**Lead**	**Mercury**	**Magnesium**	**Manganese**	**Nickel**	**Potassium**	**Selenium**	**Silver**	**Sodium**	**Thallium**	**Vanadium**	**Zinc**	**Acid Generation Potential**	**Acid Neutralization Potential**	**Acid-Base Potential**	**pH (lab)**
						mg/kg for laboratory results, ppm for XRF results																							**t CaCO3/Kt [2]**			**su**
Sample 1	South end of rotary furnace	8/5/1996	USFS	0.5	Lab	--	--	--	--	--	--	--	--	--	--	--	--	1.73	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sample 2	North end of rotary furnace	8/5/1996	USFS	0.5	Lab	--	--	--	--	--	--	--	--	--	--	--	--	153	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sample 3	Fan unit	8/5/1996	USFS	0.5	Lab	--	--	--	--	--	--	--	--	--	--	--	--	**7,300**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sample 4	Condenser tube tray	8/5/1996	USFS	0.5	Lab	--	--	--	--	--	--	--	--	--	--	--	--	**1,020**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
YR-S1	Condenser tubes and tray	10/24/2000	CES	0.5	Lab	--	0.2	6.2	--	0.6	1.7	--	35	--	49	--	<5	**950**	--	--	26	--	1.1	0.7	--	0.35	--	118	--	--	--	6.8
YR-S2	East of coarse ore hopper	10/24/2000	CES	0.5	Lab	--	0.3	**9.9**	--	0.6	1.4	--	41	--	49	--	6	3.44	--	--	26	--	0.3	<0.6	--	0.42	--	102	--	--	--	6.5
YR-S3	Between ore pile and processing area	10/24/2000	CES	0.5	Lab	--	0.2	**7.2**	--	0.5	1.2	--	34	--	48	--	<5	51	--	--	22	--	0.7	<0.6	--	0.40	--	80	--	--	--	7.7
YR-S8	Loading dock near dformer shaft	10/24/2000	CES	0.5	Lab	--	0.8	6.5	--	0.7	1.4	--	29	--	57	--	5	246	--	--	39	--	1.1	<0.6	--	0.60	--	106	--	--	--	7.1
WS-Y-4	East of processing area	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	27,392	ND	ND	--	ND	ND	--	ND	ND	--	--	--	188	--	--	--	--
WS-Y-5	Rotary furnace	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	25,594	ND	ND	--	ND	1,100	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-6	Condenser tubes and tray	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	35,200	ND	243	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-7	Condenser tubes and tray	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	28,979	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-8	Rotary furnace	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	53,965	ND	136	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-9	Dust collctor and fan	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	32,486	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-10-0.25'	Condenser tubes and tray	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	137,933	446	**6,605**	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-10-0.5'	Condenser tubes and tray	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	50,282	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-10-0.5'	Condenser tubes and tray	10/29/2002	CES	0.5	Lab	26,700	2.04	**9.8**	144	0.22	1.17	10,200	45	19.7	58.3	47,300	9.8	62.7	9,930	1,110	31.6	3,270	<0.4	1.35	121	<0.2	110	106	0.31	6.26	5.95	7.7
WS-Y-11	Condenser tubes and tray	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	27,597	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-12	Condenser tubes and tray	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	38,784	ND	**2,130**	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-13	Condenser tubes and tray	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	27,878	ND	73	--	ND	ND	--	ND	ND	--	--	--	364	--	--	--	--
WS-Y-14	Condenser tubes and tray	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	34,099	ND	**564**	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-15	Condenser tubes and tray	10/29/2002	CES	0.25	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	20,595	ND	210	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-16	West of processing area	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	30,592	ND	ND	--	ND	1,020	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-17	West of processing area	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	32,179	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-18	North of rotary furnace	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	43,699	ND	**1,490**	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-19	East of coarse ore hopper	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	35,686	ND	145	--	ND	1,060	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-20	North of coarse ore hopper	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	35,379	ND	135	--	ND	2,650	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-20	North of coarse ore hopper	10/29/2002	CES	0.5	Lab	25,200	2.67	**11.4**	99.9	0.27	1.64	42,000	41.9	21.2	64.4	40,900	23.2	6.15	13,200	1,200	28.6	870	1.74	0.95	152	<1.0	119	118	6.56	22.3	15.7	6.56

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[2] t CaCO3/Kt = tons of calcium carbonate needed to neutralize 1000 tons of waste/soil. Negative number indicates lack of $CaCO_3$; positive value indicates excess.

su = standard units

mg/kg = milligrams per kilogram

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< value = analyte not detected above listed Method Detection Limit (MDL)

ND = not detected above the limits of detection (LOD) of the Niton XRF

-- = not analyzed

Bold = arsenic concentration exceeds the mean background concentration of 6.9 mg/kg; mercury concentration exceeds the EPA industrial mercury PRG of 310 mg/kg.

Table 4. Waste Material Analytical Results - Roba Westfall Mine
Malheur National Forest, Grant County, Oregon

Sample ID [1]	Location of Sample	Sample Date	Collected By:	Sample Depth (ft)	Metals Analysis Method (Lab or XRF)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Magnesium	Manganese	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Acid-Base Accounting: Acid Generation Potential	Acid-Base Accounting: Acid Neutralization Potential	Acid-Base Accounting: Acid-Base Potential	pH (lab)
						mg/kg for laboratory results, ppm for XRF results																							t CaCO3/Kt [2]			su
RW#1	Burnt Ore Pile	8/5/1996	USFS	0.25	Lab	--	--	--	--	--	--	--	--	--	--	--	--	**625**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RW#2	Burnt Ore Pile	8/5/1996	USFS	0.25	Lab	--	--	--	--	--	--	--	--	--	--	--	--	**886**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
RW-WS1	Waste Rock near former shaft	10/24/2000	CES	0.25	Lab	--	<0.1	3.1	--	<0.5	0.6	--	17	--	71	--	7	**5,500**	--	--	19	--	19	0.8	--	0.16	--	82	--	--	--	6.1
RW-WS2	Burnt Ore Pile	10/24/2000	CES	0.25	Lab	--	2.5	**94.5**	--	<0.5	3.2	--	84	--	145	--	62	**660**	--	--	20	--	1.2	2.5	--	7.66	--	476	--	--	--	5.8
WS-R-1	Burnt Ore Pile	10/28/2002	CES	1.5	Lab	17,000	39.9	**197**	710	<1.0	<1.0	1,970	63.3	<3.0	86.4	113,000	213	3.94	683	135	6.9	3,030	1.6	6.6	<250	3.34	115	144	0.94	16.3	15.3	6.62
WS-R-1	Burnt Ore Pile	10/28/2002	CES	3	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	23,693	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-R-1	Burnt Ore Pile	10/28/2002	CES	7.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	28,493	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-R-2	Burnt Ore Pile	10/28/2002	CES	1	Lab	18,900	3.35	**11**	597	0.26	0.2	3,730	25.5	11.8	75.8	37,600	10.8	30.9	8,530	374	14.5	1,140	4.7	1.37	142	<0.2	77.7	89.5	0.63	11.3	10.6	6.63
WS-R-2	Burnt Ore Pile	10/28/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	35,891	ND	215	--	2,010	673	--	ND	ND	--	--	--	ND	--	--	--	--
WS-R-2	Burnt Ore Pile	10/28/2002	CES	6	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	27,597	ND	ND	--	ND	613	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-1	Waste Rock near former shaft	10/28/2002	CES	6	Lab	13,100	3.25	**18.7**	321	0.29	0.58	32,400	19.1	12.9	86	38,700	10.6	5.07	8,250	625	21.2	1,150	17.4	1.4	94	<0.2	49.2	87.7	14.4	60.7	46.3	6.45
WR-R-1	Waste Rock near former shaft	10/28/2002	CES	6	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	24,090	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-2	Waste Rock near former shaft	10/28/2002	CES	5	Lab	15,100	12	**39**	615	0.39	0.51	5,490	20.7	26.7	96.4	61,000	14.4	**3,500**	6,310	2,360	27	1,040	15.9	2.54	97	<1.0	75.3	109	0.94	14.8	13.8	7.24
WR-R-2	Waste Rock near former shaft	10/28/2002	CES	5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	63,181	ND	**590**	--	4,198	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-2	Waste Rock near former shaft	10/28/2002	CES	7	Lab	15,300	9.2	**27.6**	409	0.43	0.56	6,440	19.2	25.4	111	58,500	12.4	115	7,010	2,060	31.2	1,210	10.8	2.17	91	<0.2	61.4	110	0.94	10.8	9.82	6.97
WR-R-2	Waste Rock near former shaft	10/28/2002	CES	7	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	44,698	ND	**320**	--	3,318	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-3	Waste Rock near former shaft	10/28/2002	CES	2	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	34,586	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-4	Waste Rock near former shaft	10/28/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	28,288	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-5	Waste Rock near former shaft	10/28/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	22,694	ND	ND	--	1930	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-6	Waste Rock near former shaft	10/28/2002	CES	1.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	19,494	ND	ND	--	1680	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-7	Waste Rock near former shaft	10/28/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	31,078	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-8	Waste Rock near former shaft	10/28/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	30,694	ND	83	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-R-9	Waste Rock near former shaft	10/28/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	24,794	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--

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Bold = arsenic concentration exceeds the mean background concentration of 6.9 mg/kg; mercury concentration exceeds the EPA industrial mercury PRG of 310 mg/kg.

Table 5. Waste Material Analytical Results - York & Rannells Mine
Malheur National Forest, Grant County, Oregon

Sample ID [1]	Location of Sample	Sample Date	Collected By:	Sample Depth (ft)	Metals Analysis Method (Lab or XRF)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Mercury	Magnesium	Manganese	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Acid-Base Accounting: Acid Generation Potential	Acid-Base Accounting: Acid Neutralization Potential	Acid-Base Accounting: Acid-Base Potential	pH (lab)
						mg/kg for laboratory results, ppm for XRF results																							t CaCO3/Kt [2]			su
YR-WS1	Waste rock near former shaft	10/24/2000	CES	0.5	Lab	--	0.4	2.8	--	0.6	0.9	--	49	--	51	--	<5	95	--	--	28	--	0.5	<0.6	--	0.26	--	66	--	--	--	6.8
YR-WS2	Ore pile above processing area	10/24/2000	CES	0.5	Lab	--	0.3	**7.7**	--	0.6	1.5	--	35	--	53	--	<5	11.8	--	--	24	--	0.4	<0.6	--	0.63	--	93	--	--	--	6.9
YR-WS3	North of coarse ore hopper	10/24/2000	CES	0.5	Lab	--	0.5	**8.4**	--	0.5	1.3	--	30	--	50	--	<5	**480**	--	--	27	--	3.3	<0.6	--	0.44	--	97	--	--	--	7.3
WS-Y-1	Waste rock near former shaft	10/29/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	33,587	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-2	Waste rock near former shaft	10/29/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	35,277	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-2	Waste rock near former shaft	10/29/2002	CES	1	Lab	--	--	**10.4**	54.3	--	1.05	--	43.8	--	--	--	11.5	1.35	--	--	--	--	<1.0	<0.5	--	--	--	--	2.5	113	111	6.9
WS-Y-3	Waste rock near former shaft	10/29/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	27,776	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-21	Ore pile above processing area	10/29/2002	CES	1	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	31,590	ND	ND	--	ND	567	--	ND	ND	--	--	--	ND	--	--	--	--
WS-Y-21	Ore pile above processing area	10/29/2002	CES	1	Lab	--	--	**15**	131	--	1.25	--	46.1	--	--	--	9.41	4.36	--	--	--	--	<1.0	0.87	--	--	--	--	1.56	65.8	64.3	6.67
WR-Y-1	Burnt ore pile in processing area	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	36,787	ND	102	--	ND	2,148	--	ND	ND	--	--	--	ND	--	--	--	--
WR-Y-2	Burnt ore pile in processing area	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	39,680	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--
WR-Y-3	Burnt ore pile in processing area	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	33,894	ND	ND	--	ND	690	--	ND	ND	--	--	--	ND	--	--	--	--
WR-Y-4	Waste rock near former shaft	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	38,682	ND	ND	--	ND	14,989	--	ND	ND	--	--	--	ND	--	--	--	--
WR-Y-5	Waste rock near former shaft	10/29/2002	CES	0.5	XRF	--	ND	ND	ND	--	ND	--	ND	ND	ND	34,278	ND	ND	--	ND	ND	--	ND	ND	--	--	--	ND	--	--	--	--

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Bold = arsenic concentration exceeds the mean background concentration of 6.9 mg/kg; mercury concentration exceeds the EPA industrial mercury PRG of 310 mg/kg.

Table 6. SPLP and TCLP Analytical Results - Roba Westfall and York & Rannells Mine
Malheur National Forest, Grant County, Oregon

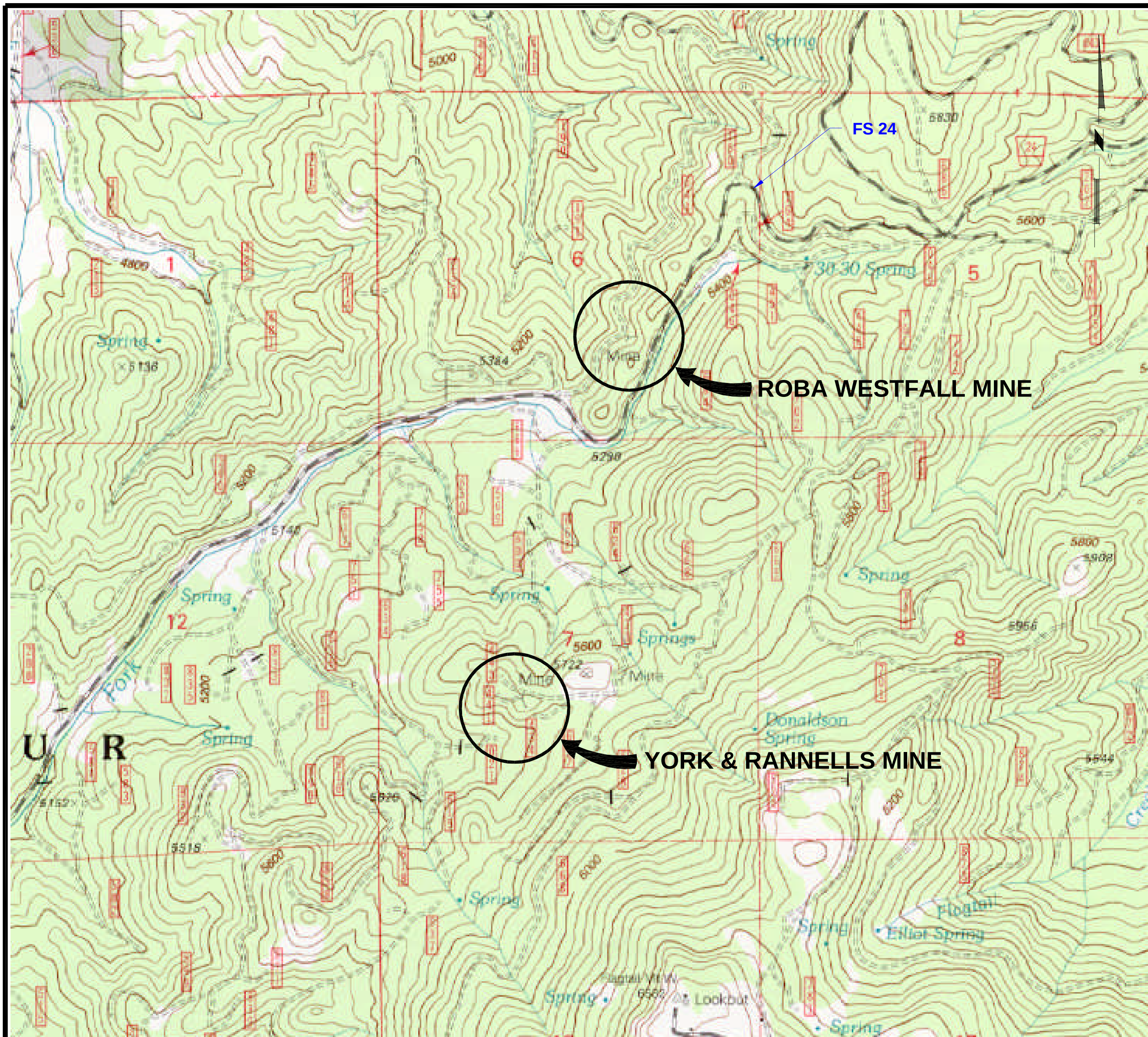
Sample ID [1]	Sample Date	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
			mg/L							
SPLP										
WS-R-1	10/28/2002	1.5	0.046	0.156	<0.002	<0.006	<0.005	0.0383	0.014	<0.005
WS-R-2	10/28/2002	1	<0.01	0.472	<0.002	<0.006	<0.005	0.0121	<0.01	<0.005
WR-R-2	10/28/2002	5	<0.01	0.376	<0.002	<0.006	<0.005	0.0187	<0.01	<0.005
WR-R-2	10/28/2002	7	<0.01	0.404	<0.002	<0.006	<0.005	0.014	<0.01	<0.005
WS-YR-10	12/29/2002	0.5	<0.01	0.736	<0.002	0.0098	<0.005	0.0713	<0.01	<0.005
WS-YR-20	12/29/2002	0.5	<0.01	0.295	<0.002	<0.006	<0.005	0.00139	<0.01	<0.005
TCLP										
WS-R-1	10/28/2002	1.5	0.02	1.91	0.0024	<0.006	0.238	0.0128	0.012	<0.005
WS-R-2	10/28/2002	1	<0.01	0.565	<0.002	<0.006	<0.005	0.0027	<0.01	<0.005
WR-R-2	10/28/2002	5	<0.01	0.422	<0.002	<0.006	<0.005	0.00543	0.011	<0.005
WR-R-2	10/28/2002	7	<0.01	0.4	<0.002	<0.006	<0.005	0.0054	<0.01	<0.005
WS-YR-10	12/29/2002	0.5	<0.01	0.393	<0.002	<0.006	<0.005	0.0213	<0.01	<0.005
WS-YR-20	12/29/2002	0.5	0.023	0.258	0.0049	<0.006	<0.005	<0.0002	<0.01	<0.005
Standards										
RCRA TCLP Disposal Limits			5	100	1	5	5	0.2	1	5

NOTES: [1] Samples were collected by CES. Analysis was conducted by SVL Analytical in Kellogg, Idaho.
mg/L = milligrams per liter
< value = analyte not detected above method detection limit (MDL)

TABLE 7. PRELIMINARY COST ESTIMATE FOR RECOMMENDED REMOVAL ACTION ALTERNATIVE

TASK	QUANTITY	UNITS	UNIT $	COST $
MOBILIZATION, BONDING & INSURANCE	1	Lump Sum	3,000	3,000
LOGISTICS	1	Lump Sum	500	500
EXCAVATION, TRANSPORT, AND DISPOSAL OF SOIL AND WASTE				
Excavation of Soil and Waste Material > 310 mg/kg	40	CY	30	1,200
Loading and Transportation of Waste to Subtitle C Facility	40	CY	50	2,000
Disposal Charge - Subtitle C Facility	60	Ton	150	9,000
CLEANUP AND DISPOSAL OF MISCELLANEOUS DEBRIS				
Load Miscellaneous Debris	1	Lump Sum	500	500
Transportation and Disposal of Debris to Subtitle D Facility	1	Lump Sum	500	500
REVEGETATION				
Backfill with scavenged fill	1	Lump Sum	750	750
Seed/Fertilization	0.5	Acre	500	250
Mulch	0.5	Acre	500	250
Subtotal Capital Costs				17,950
Design and Workplans				5,000
Construction Oversight and Niton				8,000
Subtotal Indirect Capital Costs				30,950
TOTAL CAPITAL AND INDIRECT CAPITAL COSTS				**30,950**

FIGURES

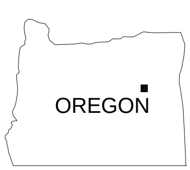


SCALE 1 INCH = 2,000 FEET

1 1/2 0 1 MILE

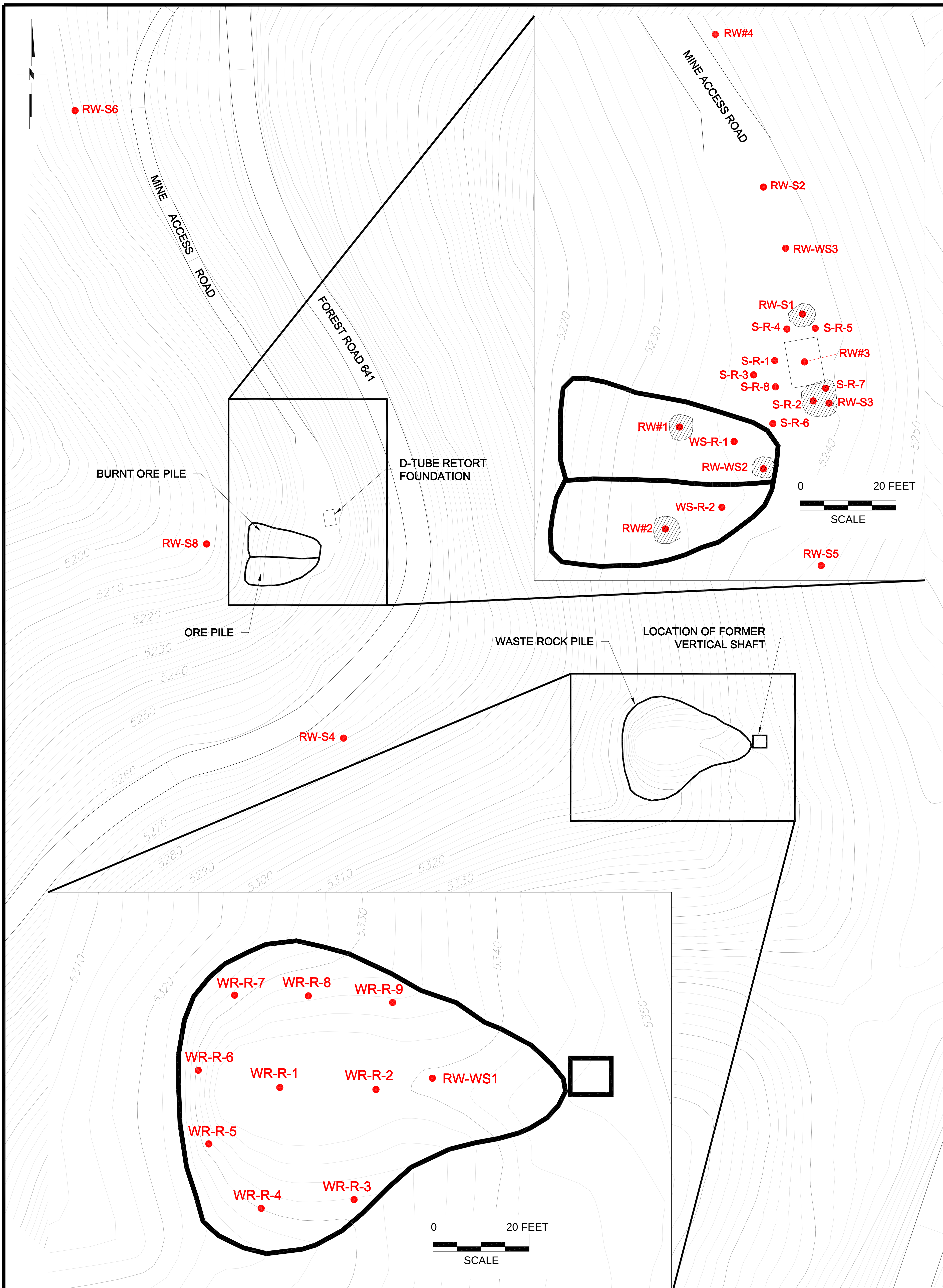
CONTOUR INTERVAL = 40 FEET

Figure 1. Site Location Map



(SOURCE: 7.5 MIN USGS TOPOGRAPHIC MAP OF FLAGTAIL MOUNTAIN, OR 1990)

PROJECT NUMBER: 2223035	ROBA WESTFALL AND YORK & RANNELLS MINES
DATE: 03-19-03	
DWG BY DGW / DWG NO: 2223035F1	ROBA - YORK EECA MALHEUR NATIONAL FOREST
PROJECT MANAGER: DGW	
REVISED:	CES CASCADE EARTH SCIENCES A Valmont Industries Company



LEGEND

MINE ACCESS ROAD — ROADS

5360 — INDEX CONTOURS

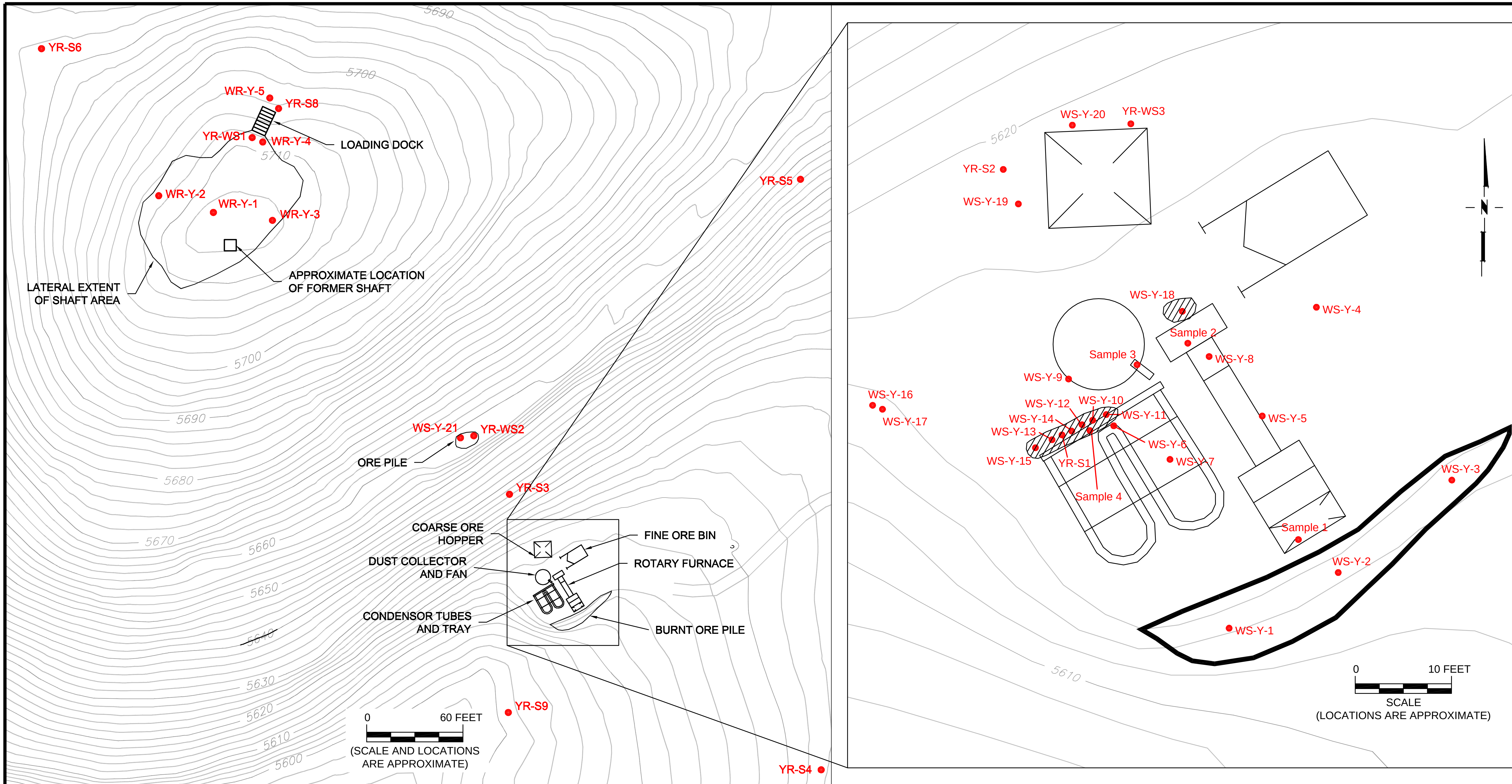
WR-R-1 — SOIL/WASTE SAMPLE LOCATION

EXCAVATION AREAS > 310 mg/kg Hg

0 60 FEET
SCALE
(LOCATIONS ARE APPROXIMATE)

Figure 2. Roba Westfall Mine Layout and Soil/Waste Sampling Locations

PROJECT NUMBER: 2223035	ROBA WESTFALL MINE
DATE: 03-19-03	
DWG BY DW/DO — DWG NO: 2223035F2.dwg	ROBA - YORK EECA MALHEUR NATIONAL FOREST
PROJECT MANAGER: DGW	
REVISED:	CES CASCADE EARTH SCIENCES A Valmont Industries Company



LEGEND

ROADS

5690 INDEX CONTOURS

YR-S3 SOIL/WASTE SAMPLE LOCATION

EXCAVATION AREAS >310 mg/kg Hg

Figure 3. York & Rannells Mine Layout and Soil/Waste Sampling Locations

PROJECT NUMBER: 2223035	DATE: 03-19-03	YORK & RANNELLS MINE
DWG BY: DO	DWG NO: 2223035F3.dwg	ROBA - YORK EECA MALHEUR NATIONAL FOREST
PROJECT MANAGER: DW	REVISED:	CES CASCADE EARTH SCIENCES A Valmont Industries Company

APPENDICES

APPENDIX A.

WILDLIFE AND PLANT SPECIES SURVEY AND HABITAT ASSESSMENT

WILDLIFE AND PLANT SPECIES SURVEY AND HABITAT ASSESSMENT
Roba Westfall and York & Rannells Mines
Malheur National Forest, Grant County, Oregon

March 2003

WILDLIFE AND PLANT SPECIES SURVEY AND HABITAT ASSESSMENT
Roba Westfall and York & Rannells Mines
Malheur National Forest, Grant County, Oregon

Principal Authors: *Allison Nabours, Wildlife Biologist*

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Jeff Fisher, Ph.D., Senior Wildlife Ecologist

Prepared for: USDA Forest Service
Malheur National Forest

Site Location: Roba Westfall and York Rannells Mines
Malheur National Forest
Grant County, Oregon

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Doc: 2223035Survey.doc
PN: 2223035
March 2003

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BACKGROUND

The Roba Westfall (Roba) and York & Rannells (York) Mines are located within the Malheur National Forest in eastern Oregon, approximately 23 miles southwest of John Day, Oregon. The York and Roba Mines are located within approximately 1 mile of one another, bisected by Forest Service Road (FR) 24, and accessed by FR roads #667 and #641, respectively. The York and Roba Mines are both within the Deer Creek watershed. Evidence of past mining activity is more apparent at the York Mine, very little equipment remains at the Roba Mine.

YORK MINE SITE

The York Mine is located at 44° 11' 48.5" N latitude; 119° 17' 21.1" W longitude, and occupies a total of approximately 5.5 acres. The York Mine is situated above and between a few unnamed tributaries of the North Fork of Deer Creek. According to the USGS topographic map, Flagtail Mountain (USGS 1990), springs and groundwater seeps appear to be the primary source for the surface water drainage features in the area. The nearest body of water to the York Mine is an unnamed tributary located ? -mile south and downslope of the mine. No other surface water drainage or water storage features were observed.

ROBA MINE SITE

The Roba Mine is located at 44°12' 36.7" N latitude; 119° 17' 1.0" W longitude, and occupies a total of approximately 2.9 acres. The Roba Mine is situated in the southernmost reach of the Beaverdam Creek. According to the USGS topographic map, Flagtail Mountain (USGS, 1990), springs and groundwater seeps appear to be the primary source for the surface water drainage features in the lower elevations of the watershed, although none are in the immediate vicinity of the mine and mill. The nearest body of water downslope from the Mine is Beaverdam Creek, which is located approximately ¼-mile northwest of the Roba Mine. No other surface water drainage or water storage features were observed.

The objectives of this study were three-fold: (1) to characterize wildlife, plant communities, and habitats, (2) to identify the presence of threatened and endangered species or their critical habitats, and (3) to characterize the potential impacts from the past mining activity on habitat conditions.

METHODOLOGY

A reconnaissance-level survey was conducted on November 11, 2002 to characterize plant communities, wildlife use, and wildlife habitat at the York and Roba Mines. Sites were surveyed by walking the entire boundaries of the Mines. Habitat types encountered during the survey were characterized primarily by dominant and subdominant plant species and categorized based on Johnson and O'Neil (2001). Plant species observed were identified and recorded to the extent possible. Due to the conditions at the time of survey (i.e., 2-4 inches of snow cover and time of year), most herbaceous plant species could not be identified. Plant taxonomy was based on the *Flora of the Pacific Northwest* (Hitchcock and Cronquist, 1990). Wildlife species were recorded if they were observed, if species vocalizations were heard, or if diagnostic field signs were found (i.e., scat, calls, tracks, or pellets). Some species that are known to occur or for which suitable habitat is present were recorded as “expected, but not observed.” Wildlife distribution, life history, and habitat requirements are based on *Atlas of Oregon Wildlife* (Csuti et al. 1997). A wildlife species list for the survey is attached as Attachment A, Table 2. In addition, the Forest Service provided a list of wildlife sightings in the areas surrounding the mines. In order to characterize the potential impacts from past mining activity, qualitative observations were made with regard to habitat conditions upgradient, downgradient, and within the area of potential impact.

Special-status species include species federally listed as endangered or threatened, federal candidate species for listing, federal species of concern, species protected by the State of Oregon as endangered or threatened, and state sensitive species.

RESULTS AND DISCUSSION

Conditions at the time of survey were dry, slightly windy, and partly to mostly cloudy, with temperatures ranging from the low 30s to mid 40s. There was approximately 2-4 inches of snow on the ground at the time of survey.

PLANT SPECIES AND COMMUNITIES IDENTIFIED IN SURVEY

The vegetation community found in the vicinity of both the York and Roba Mines can be categorized as ponderosa pine-douglas fir forest, which occurs in much of eastern Oregon, the eastern slopes of the Cascades, the Blue Mountains and its foothills, and the Okanogan Highlands in Washington State. This community generally occurs on the driest sites supporting conifers in the Pacific Northwest. In Oregon, this community is associated with dry pumice soils. In ponderosa pine communities in Oregon, average annual precipitation ranges from about 14 to 30 inches and often as snow. This community can be found at elevations ranging from 100-6,000 feet.

Ponderosa pine (pinus ponderosa) and douglas-fir (pseudotsuga menziesii) dominate the overstory at both mines, with occasional western larch (larix occidentalis) interspersed. The understory appeared to be comprised predominately of grasses. A general list of herbaceous plant species that typically occur within ponderosa pine-douglas fir forest is provided below. Shrubs were interspersed within the understory, with snowberry (symphoricarpos albus) being the most dominant shrub species observed. Other shrubs observed included curl-leaf mountain mahogany (cercocarpus ledifolius) and western juniper (juniperus occidentalis). Grand fir (abies grandis) seedlings and saplings were also present in the understory.

Ponderosa pine-douglas fir forest generally has an open to closed sodgrass undergrowth dominated by pinegrass (calamagrostis rubescens), geyer’s sedge (carex geyeri), ross’ sedge (c. rossii), long-stolon sedge (c. inops), or blue wildrye (elymus glaucus). In drier areas, undergrowth may also contain bunchgrass steppe species, such as Idaho fescue (festuca idahoensis), rough fescue (f. campestris), bluebunch wheatgrass (pseudoroegneria spicata), indian ricegrass (oryzopsis hymenoides), or needlegrasses (stipa comata, s. occidentalis).

Common exotic grasses that may appear in abundance are cheatgrass (bromus tectorum), and bulbous bluegrass (poa bulbosa). Forbs are also common associates.

No special-status plant species were documented during surveys. The following special-status plant species listed in Attachment A, Table 1 could potentially be found within the project area based on their range and suitable habitat being present: twin-spike moonwort (botrychium paradoxum), stalked moonwort (botrychium pedunculosum), and dwarf phacelia (phacelia minutissima).

WILDLIFE SPECIES AND HABITAT TYPES OBSERVATIONS

The special-status plants and animals of Oregon, and their habitat preferences are detailed in Attachment A. If the known range of a species does not overlap with the Malheur National Forest it was not expected to occur. A full listing of all wildlife species observed and "expected, but not observed" during the reconnaissance survey is provided in Attachment A, Table 2.

The ponderosa pine-douglas fir forest of the Pacific Northwest provides wildlife habitat to many species. The most conspicuous mammals include mule deer, chipmunk, and douglas squirrel. These forests provide food and breeding habitat for a number of songbirds (passerines), common examples of which include western wood-pewee, hammond's flycatcher, steller's jay, clark's nutcracker, mountain chickadee, bushtit, white-breasted nuthatch, ruby-crowned kinglet, american robin, varied thrush, yellow-rumped warbler, townsend's warbler, chipping sparrow, and dark-eyed junco. Soaring above the forests and openings within the forest are red-tailed hawk, american kestrel, and turkey vulture. Common woodpeckers include downy woodpecker and hairy woodpecker.

Common amphibians that may occur within ponderosa pine-douglas fir forest include great basin spadefoot and pacific chorus frog. Reptiles include the western skink, short-horned lizard, western fence lizard, and many species of snakes. Rubber boa, racer, striped whipsnake, gopher snake, western terrestrial garter snake, common garter snake, and western rattlesnake are all common throughout the range of the project area.

The following species were documented during the survey: hairy woodpecker, northern flicker, clark's nutcracker, american crow, common raven, fox sparrow, coyote, and mule deer. No special-status animal species were observed during surveys. The following special-status animal species of concern listed in Attachment A, Table 1 could potentially be found within the project area based on their range and suitable habitat being present: western toad, northern goshawk, olive-sided flycatcher, pileated woodpecker, Eastern Oregon willow flycatcher, northern pygmy owl, yellow-breasted chat, lewis's woodpecker, mountain quail, flammulated owl, white-headed woodpecker, black-backed woodpecker, pygmy nuthatch, great gray owl, pallid bat, silver-haired bat, canada lynx, american marten, pacific fisher, long-eared myotis, long-legged myotis, and yuma myotis.

SUMMARY

Based upon qualitative observations of habitat conditions upgradient and downgradient from past mining activity, habitat conditions outside of the immediate mine areas do not appear to be impacted by historic mine operations. However, historical mine operations within the immediate York and Roba Mines have affected the plant communities and wildlife habitat. Direct, acute mine impacts to plant communities resulted from the land clearing for roads, structures, and maintenance at the mines. Indirect, chronic impacts from potentially toxic constituents in the mines could not be determined from the survey conducted. In the immediate vicinity of the mines, past land clearing has reduced tree cover and plant cover in general. However, it appears likely that these areas will restore naturally over a long period of time. With restoration, recovery could occur sooner. After re-establishment, the mines will provide habitat similar to the areas around them. None of the mine impacts currently recognized would appear to completely prevent the use of the habitats by species whose range would overlap with the mine areas. However, the physical disturbance at the mines has reduced the habitat quality, which would limit the number of individuals potentially supported by the available habitat.

Grasses, shrubs, and tree saplings have re-established in many of the cleared areas and atop the mines ore waste piles and soil piles.   However, plant re-establishment atop the mines ore waste piles and soil piles are predominately herbaceous, with very few tree saplings re-establishing. There could be several reasons for the limited vegetation: the piles may not have had enough time to become re-established; the piles may lack important plant nutrients and organic matter; dehydration; or toxic constituents may be present within piles restricting the species diversity that could grow there.   On the basis of the habitat and climate in the area, the most likely scenario to explain the low diversity and abundance of plants on the piles is the lack of soil nutrients and water.

REFERENCES

Csuti, et al. 1997. Atlas of Oregon Wildlife: distribution, habitat, and natural history. Oregon State University Press, Corvallis, OR.

Hitchcock, C.L. and A. Cronquist. 1990. Flora of the Pacific Northwest. University of Washington Press, Seattle, WA.

Johnson, et al. 2001. Wildlife-Habitat Relationships in Oregon and Washington. Oregon State University Press, Corvallis, OR.

Attachment A.

Tables

Table 1. Special-Status Species in Oregon, and Documentation of Habitat Presence in the Roba and York Mine Sites

Scientific Name	Common Name	Federal Status	State Status	Habitat Type Preference	Habitat Present	Range
AMPHIBIANS						
Bufo boreas	Western toad		SV	Deserts, chaparral, grasslands, woodlands, and forests	X	X
Rana luteiventris	Columbia spotted frog	C		Ponds, springs, and marshes		
Rana pipiens	Northern leopard frog		SC	Marshes, wet meadows, vegetated irrigation canals, ponds, and reservoirs		
REPTILES						
Chrysemys picta	Painted turtle		SC	Lakes, ponds, marshes, and small streams		
Sceloporus graciosus graciosus	Northern sagebrush lizard	SoC		Sagebrush habitats, chaparral, juniper woodlands, and coniferous forests	X	
BIRDS						
Accipiter gentilis	Northern goshawk	SoC	SC	Coniferous forests	X	X
Athene cunicularia hypugaea	Western burrowing owl	SoC	SC	Open deserts, grasslands, fields, and pastures		
Bartramia longicauda	Upland sandpiper	SoC	SC	Nest in partially flooded meadows and grasslands		
Buteo regalis	Ferruginous hawk	SoC	SC	Grassland, desert steppe, and juniper woodlands		
Centrocercus urophasianus phaios	Western greater sage-grouse	SoC	SV	Found in areas dominated by big sagebrush		
Chlidonias niger	Black tern	SoC		Alkaline lakes, freshwater marshes, and marshy areas along rivers or ponds		
Coccyzus americanus	Yellow-billed cuckoo	SoC	SC	Thick, closed-canopy riparian forests		
Contopus cooperi (=borealis)	Olive-sided flycatcher	SoC	SV	Coniferous forests	X	X
Dolichonyx oryzivorus	Bobolink		SV	Open prairies, grasslands, wet meadows, pastures, and grain crops		
Dryocopus pileatus	Pileated woodpecker		SV	Forest habitats with large trees	X	X
Empidonax traillii adastus	Eastern Oregon willow flycatcher	SoC		Tall, brushy vegetation along stream edges, meadows, and marshes; and thickets along the edges of forest clearings	X	X
Falco peregrinus anatum	American peregrine falcon		LE	Nest in cliffs near open areas		X
Glaucidium gnoma	Northern pygmy-owl		SC	Coniferous and mixed coniferous-deciduous forests	X	X
Grus canadensis tabida	Greater sandhill crane		SV	Nest in marshes, wet meadows, grasslands, and pastures		

Scientific Name	Common Name	Federal Status	State Status	Habitat Type Preference	Habitat Present	Range
Haliaeetus leucocephalus	Bald eagle	LT	LT	Inland lakes and marshes		X
Icteria virens	Yellow-breasted chat	SoC	SC	Brushy areas and riparian woodlands along streams	X	X
Melanerpes lewis	Lewis's woodpecker	SoC	SC	Low elevations within open forests	X	X
Oreortyx pictus	Mountain quail	SoC		Open forests and woodlands	X	X
Otus flammeolus	Flammulated owl		SC	Open forests with a ponderosa pine component	X	X
Picoides albolarvatus	White-headed woodpecker	SoC	SC	Ponderosa pine or ponderosa pine-mixed conifer forests	X	X
Picoides arcticus	Black-backed woodpecker		SC	Forests dominated by lodgepole pine or ponderosa pine	X	X
Picoides tridactylus	Three-toed woodpecker		SC	Higher-elevation (above 4500 feet) forests of grand fir-lodgepole pine, lodgepole pine, or lodgepole pine mixed with other conifers		
Sitta pygmaea	Pygmy nuthatch		SC	Open coniferous woodland community types	X	X
Strix nebulosa	Great gray owl		SV	Nest in mixed coniferous, ponderosa pine, and lodgepole pine forests; and forage over open areas	X	X
Tympanuchus phasianellus columbianus	Columbian sharp-tailed grouse	SoC		Areas of low, sparse vegetation		
MAMMALS						
Antrozous pallidus pallidus	Pallid bat		SV	Open forest types	X	X
Brachylagus idahoensis	Pygmy rabbit	SoC	SV	Areas of dense Great Basin sagebrush and areas dominated by greasewood		
Corynorhinus townsendii pallescens	Pale western big-eared bat	SoC	SC	Roosts in buildings, caves, mines and bridges	X	
Gulo gulo luteus	California wolverine	SoC	LT	Open forests and alpine areas	X	
Lastonycteris noctivagans	Silver-haired bat	SoC		Older Douglas fir/ Western hemlock/ ponderosa pine forests	X	X
Lynx canadensis	Canada lynx	LT		Dense boreal forests	X	X
Martes americana	American marten		SV	Forested habitats	X	X
Martes pennanti pacifica	Pacific fisher	SoC	SC	Mature, closed-canopy coniferous forests with some deciduous component	X	X
Myotis ciliolabrum	Western small-footed myotis	SoC		Arid grasslands and desert scrub		
Myotis evotis	Long-eared myotis	SoC		Forested areas mostly along the edges	X	X
Myotis thysanodes	Fringed myotis	SoC	SV	Forested or riparian areas	X	X
Myotis volans	Long-legged myotis	SoC		Coniferous forests	X	X

Scientific Name	Common Name	Federal Status	State Status	Habitat Type Preference	Habitat Present	Range
Myotis yumanensis	Yuma myotis	SoC		Riparian, desert scrub, moist woodlands, open forests	X	X
Sorex preblei	Preble's shrew	SoC		Dense high-elevation coniferous forests	X	
MOLLUSCS						
Anodonta californiensis	California floater	SoC		Shallow areas of unpolluted perennial waters		X
VASCULAR PLANTS						
Astragalus diaphanus	South Fork John Day milk-vetch		LT	Sandy or gravelly soils on gravel bars, alluvial slopes, and overlying basaltic rocks		X
Botrychium ascendens	Upward-lobed moonwort	SoC	C	Moist western redcedar forests, grassy fields, moist meadows, and shrub or conifer dominated wetlands up to about 8,200 feet elevation		X
Botrychium crenulatum	Crenulate moonwort	SoC	C	Moist meadows, creek banks, shrub- or tree-dominated wetlands, springy spots, and wet roadside areas		X
Botrychium paradoxum	Twin-spike moonwort	SoC	C	Mostly in montane to subalpine grasslands or forb-dominated meadows, but also in various forested habitats	X	X
Botrychium pedunculosum	Stalked moonwort	SoC	C	Open habitats such as mesic to moist meadows, swales, and along roadsides; and forest habitats	X	X
Camissonia pygmaea	Dwarf evening-primrose		C	Unstable soil or gravel in steep talus, dry washes, banks and roadcuts		X
Luina serpentina	Colonial luina	SoC	LT	Open, rocky, serpentine slopes		X
Mimulus evanescens	Disappearing monkeyflower	SoC	C	Moist, heavy gravel areas within sagebrush-juniper-dominated vegetation zones		X
Phacelia minutissima	Dwarf phacelia		C	Ephemerally moist, bare-soil areas of riparian zones and meadows in sagebrush-steppe and lower montane forest	X	X
Thelypodium eucosmum	Arrow-leaf thelypody	SoC	LT	Lower canyons of Blue Mountain		X

LE	Listed Endangered
LT	Listed Threatened
C	Candidate
SoC	Species of Concern
SC	Critical
SV	Vulnerable
*	SC listing applies to winter run, SV listing applies to summer run

Source:

Oregon Natural Heritage Program, February 2001, Rare, Threatened and Endangered Plants and Animals of Oregon

Table 2. Wildlife Species Potentially Occuring at Roba and York Mine Sites

Common Name	Scientific Name
AMPHIBIANS	
Great Basin spadefoot	*Scaphiopus intermontanus*
Western toad	*Bufo boreas*
Pacific chorus frog	*Pseudacris regilla*
REPTILES	
Short-horned lizard	*Phrynosoma douglassii*
Western fence lizard	*Sceloporus occidentalis*
Western skink	*Eumeces skiltonianus*
Rubber boa	*Charina bottae*
Racer	*Coluber constrictor*
Ringneck snake	*Diadophis punctatus*
Striped whipsnake	*Masticophis taeniatus*
Gopher snake	*Pituophis melanoleucus*
Western terrestrial garter snake	*Thamnophis elegans*
Common garter snake	*Thamnophis sirtalis*
Western rattlesnake	*Crotalus viridis*
BIRDS	
Turkey vulture	*Cathartes aura*
Sharp-shinned hawk	*Accipiter striatus*
Cooper’s hawk	*Accipiter cooperii*
Northern goshawk	*Accipiter gentilis*
Red-tailed hawk	*Buteo jamaicensis*
Golden eagle	*Aquila chrysaetos*
American kestrel	*Falco sparverius*
Blue grouse	*Dendragapus obscurus*
Ruffed grouse	*Centrocercus urophasianus*
California quail	*Callipepla californica*
Mountain quail	*Oreortyx pictus*
Mourning dove	*Zenaida macroura*
Flammulated owl	*Otus flammeolus*
Western screech-owl	*Otus kennicottii*
Great horned owl	*Bubo virginianus*
Northern pygmy-owl	*Glaucidium gnoma*
Barred owl	*Strix varia*
Great gray owl	*Strix nebulosa*
Long-eared owl	*Asio otus*
Northern saw-whet owl	*Aegolius acadicus*
Common nighthawk	*Chordeiles minor*
Common poorwill	*Phalaenoptilus nuttallii*
Vaux’s swift	*Chaetura vauxi*
Black-chinned hummingbird	*Archilochus alexandri*
Calliope hummingbird	*Stellula calliope*
Rufous hummingbird	*Selasphorus rufus*

Common Name	Scientific Name
Lewis's woodpecker	*Melanerpes lewis*
Williamson's sapsucker	*Sphyrapicus thyroideus*
Red-naped sapsucker	*Sphyrapicus nuchalis*
Downy woodpecker	*Picoides pubescens*
Hairy woodpecker	***Picoides villosus***
White-headed woodpecker	*Picoides albolarvatus*
Black-backed woodpecker	*Picoides arcticus*
Northern flicker	***Colaptes auratus***
Pileated woodpecker	*Dryocopus pileatus*
Olive-sided flycatcher	*Contopus cooperi*
Western wood-pewee	*Contopus sordidulus*
Willow flycatcher	*Empidonax traillii*
Hammond's flycatcher	*Empidonax hammondii*
Dusky flycatcher	*Empidonax oberholseri*
Ash-throated flycatcher	*Myiarchus cinerascens*
Cassin's vireo	*Vireo cassinii*
Gray jay	*Perisoreus canadensis*
Steller's jay	*Cyanocitta stelleri*
Clark's nutcracker	***Nucifraga columbiana***
American crow	***Corvus brachyrhynchos***
Common raven	***Corvus corax***
Violet-green swallow	*Tachycineta thalassina*
Black-capped chickadee	*Parus atricapillus*
Mountain chickadee	*Parus gambeli*
Bushtit	*Psaltriparus minimus*
Red-breasted nuthatch	*Sitta canadensis*
White-breasted nuthatch	*Sitta carolensis*
Pygmy nuthatch	*Sitta pygmaea*
Brown creeper	*Certhia americana*
Rock wren	*Salpinctes obsoletus*
Canyon wren	*Catherpes mexicanus*
House wren	*Troglodytes aedon*
Ruby-crowned kinglet	*Regulus calendula*
Western bluebird	*Sialia mexicana*
Mountain bluebird	*Sialia currucoides*
Townsend's solitaire	*Myadestes townsendi*
American robin	*Turdus migratorius*
Varied thrush	*Ixoreus naevius*
Cedar waxwing	*Bombycilla cedrorum*
Orange-crowned warbler	*Vermivora celata*
Nashville warbler	*Vermivora ruficapilla*
Yellow-rumped warbler	*Dendroica coronata*
Black-throated gray warbler	*Dendroica nigrescens*
Townsend's warbler	*Dendroica townsendi*
Macgillivray's warbler	*Oporornis tolmiei*

Common Name	Scientific Name
Wilson’s warbler	*Wilsonia pusilla*
Yellow-breasted chat	*Icteria virens*
Western tanager	*Piranga rubra*
Green-tailed towhee	*Pipilo chlorurus*
Spotted towhee	*Pipilo maculatus*
Chipping sparrow	*Spizella passerina*
Brewer’s sparrow	*Spizella breweri*
Lark sparrow	*Chondestes grammacus*
Fox sparrow	***Passerella iliaca***
Dark-eyed junco	*Junco hyemalis*
Black-headed grosbeak	*Pheucticus melanocephalus*
Lazuli bunting	*Passerina amoena*
Brewer’s blackbird	*Euphagus cyanocephalus*
Brown-headed cowbird	*Molothrus ater*
Cassin’s finch	*Carpodacus cassinii*
House finch	*Carpodacus mexicanus*
Red crossbill	*Loxia curvirostra*
Pine siskin	*Carduelis pinus*
Evening grosbeak	*Coccothraustes vespertinus*
MAMMALS	
Masked shrew	*Sorex cinereus*
Vagrant shrew	*Sorex vagrans*
Montane shrew	*Sorex monticolus*
Coast mole	*Scapanus orarius*
California myotis	*Myotis californicus*
Western small-footed myotis	*Myotis ciliolabrum*
Yuma myotis	*Myotis yumanensis*
Little brown myotis	*Myotis lucifugus*
Long-legged myotis	*Myotis volans*
Fringed myotis	*Myotis thysanodes*
Long-eared myotis	*Myotis evotis*
Silver-haired bat	*Lasionycteris noctivagans*
Big brown bat	*Eptesicus fuscus*
Hoary bat	*Lasiurus cinereus*
Pallid bat	*Antrozous pallidus*
American pika	*Ochotona princeps*
Mountain cottontail	*Sylvilagus nuttallii*
Snowshoe hare	*Lepus americanus*
White-tailed jackrabbit	*Lepus townsendii*
Least chipmunk	*Tamias minimus*
Yellow-pine chipmunk	*Tamias amoenus*
Yellow-bellied marmot	*Marmota flaviventris*
Columbian ground squirrel	*Spermophilus columbianus*
Golden-mantled ground squirrel	*Spermophilus lateralis*
Red squirrel	*Tamiasciurus hudsonicus*

Common Name	Scientific Name
Douglas' squirrel	*Tamiasciurus douglasii*
Northern flying squirrel	*Glaucomys sabrinus*
Deer mouse	*Peromyscus maniculatus*
Bushy-tailed woodrat	*Neotoma cinerea*
Southern red-backed vole	*Clethrionomys gapperi*
Long-tailed vole	*Microtus longicaudus*
Common porcupine	*Erethizon dorsatum*
Coyote	***Canis latrans***
Red fox	*Vulpes vulpes*
Common raccoon	*Procyon lotor*
American marten	*Martes americana*
Ermine	*Mustela erminea*
Long-tailed weasel	*Mustela frenata*
American badger	*Taxidea taxus*
Western spotted skunk	*Spilogale gracilis*
Striped skunk	*Mephitis mephitis*
Mountain lion	*Felis concolor*
Bobcat	*Lynx rufus*
Elk	*Cervus elaphus*
Mule deer	***Odocoileus hemionus***
Pronghorn antelope	*Antilocapra americana*

Bolded species were observed during November 11, 2002 survey

Sources:

Csuti, et al., 1997, Atlas of Oregon Wildlife
Johnson, et al., 2001, Wildlife-Habitat Relationships in Oregon and Washington

Attachment B.

Forest Service Wildlife Sighting Report

	Common Name	Species	#Female	#Male	#Unk	Date	Observer	T	R	Sec	Nest	Comments
1	ACCIPITER, UNKNOWN				1	11/4/1997	K.BROWN	16S	29E	16NENENE		11:00, HAD JUST CAUGHT A RABBIT AND FLEW ACROSS VALLEY. SAW TWO HOURS LATER PULLING FUR FROM RABBIT.
2	ACCIPITER, UNKNOWN				1	8/23/2001	J.SHAFER	16S	29E	34SW		SHARP-SHINNED OR COOPERS? SOARING IN DRAW ALONG FS 31 ~1/4 MILE NORTH OF 451/31 JCT. MAY BE IMMATURE: UNSTEADY IN LIFT.
3	AMERICAN KESTREL	FALCO SPARVERIUS		2		9/4/1999	B.MILLER-SOHR	16S	29E	18 SENE		TWO SEEN IN VICINITY OF LOOKOUT THROUGHOUT THE DAY.
4	AMERICAN KESTREL	FALCO SPARVERIUS	1	1		4/30/1996	ANNE FROST-BIO TECH	16S	29E	22NENE	YES	F.S. RD. 24 N. NEST IS 100' W. OF THE 24 RD. NEAR ITS JUNCTION WITH CO. RD. 63 ACROSS CK. IN BROKEN-TOP PIPO.
5	AMERICAN ROBIN				1	5/6/1997	K. HAINES	16S	29E	9SENW		RD. 2400822 WICKIUP CREEK
6	ANTELOPE	ANTILOCAPRA AMERICANA			4	5/2/1991	EMERY SWAN - RANGE	16S	29E	5		Wickiup Cr. near 30-30 summit.
7	BADGER	TAXIDEA TAXUS			1	8/10/1990	EMERY SWAN - RANGE	16S	29E	29 SE NE		S. of Izee Hwy., edge of meadow.
8	BALD EAGLE	HALIAEETUS LEUCOCEPHALUS			1	5/1/1991	ANNE FROST - BIO AID	16S	29E	28 NW NW		Being chased by Red Tail W. of Izee Rd., W. of C. S. road 594.
9	BALD EAGLE	HALIAEETUS LEUCOCEPHALUS			1	8/20/1991	ANNE FROST - BIO AID	16S	29E	19		Hunting in hay field n. side of co. rd.
10	BALD EAGLE	HALIAEETUS LEUCOCEPHALUS			1	1/24/1992	GLEN POWELL-SALES AD	16S	29E	12		Feeding on carcas.
11	BALD EAGLE	HALIAEETUS LEUCOCEPHALUS			1	6/2/1992	ANNE FROST - BIO AID	16S	29E	21 SE SW		Perched on small snag in pond on norht side of Izee, W. of 24.
12	BALD EAGLE	HALIAEETUS LEUCOCEPHALUS			1	11/30/1995	ANNE FROST - BIO TEC	16S	29E	4NENW		PERCHED ON TREE N. OF 24 RD., E. OF ITS JUNCTION WITH THE 754.
13	BALD EAGLE	HALIAEETUS LEUCOCEPHALUS			1	12/14/1995	JIM JOHNSON - SALES	16S	29E	13NW		IZEE HWY. AT 662 ROAD PERCHED IN TREE.
14	BALD EAGLE	HALIAEETUS LEUCOCEPHALUS			1	10/30/1997	A.FROST	16S	29E	14 NWSE		PERCHED ALONG SEASONAL STREAM, SOUTH OF FS 662, .5 MILES WEST OF COUNTY ROAD 63
15	BALD EAGLE	HALIAEETUS LEUCOCEPHALUS			2	5/15/1993	WALT COOPER - LOGGER	16S	29E	26NE		TWO BIRDS OBSERVED ALONG THE 24 RD. BETWEEN MILE POST 13 AND 14.
16	BARRED OWL	STRIX VARIA			1	9/15/1990	K.HAINES	16S	29E	07 S 1/2		PHOTO TAKEN BY MINER, ROBA MINE VICINITY OFF 24 ROAD. PICTURE POOR. SHOWN TO KAREN HAINES IN FALL OF 1990 OR 1991.
17	BEAVER				1	7/29/1997	B.MILLER-SOHR	16S	29E	23NENW		ALONG IZEE HIWAY ,.1 MILE EAST OF 24 RD. SWIMMING UP STREAM
18	BEAVER				1	8/1/1997	B.MILLER-SOHR	16S	29E	23NENW		SEEN SWIMMING UP STREAM, SILIVES RIVER
19	BELTED KINGFISHER	CERYLE ALCYON			1	6/22/1994	KIM BROWN, B. STOVER	16S	29E	12		UPPER SILVIES RIVER .5 M W OF BEAR VALLEY GUARD STATION JUST OFF IZEE HWY
20	BELTED KINGFISHER	CERYLE ALCYON		1		4/26/1994	ANNE FROST	16S	29E	22		SNOW SHOE PONDS
21	BLACK BEAR	URSUS AMERICANUS			1	6/4/1996	ANNE FROST-BIO TECH	16S	29E	20NESW	NO	ALONG SNOWSHOE CREEK.
22	BLACK BEAR	URSUS AMERICANUS			1	6/20/1996	JOE ROBSON - RANGE	16S	29E	5NW		RAN ACROSS 24 ROAD.
23	BLACK-BACKED WOODPECKER	PICOIDES ARCTICUS	1			7/8/1991	ANNE FROST - BIO AID	16S	29E	9 NW NW		Foraging in wooded area on N.W. end of unit 17 of wickiup T.S.
24	BLACK-BACKED WOODPECKER	PICOIDES ARCTICUS	1			6/13/1996	ANNE FROST-BIO TECH.	16S	29E	4NWNE		S. OF THE 24 RD. AND W. OF THE 756 RD. ALONG WICKIUP CK.
25	BLUE GROUSE	DENDRAGAPUS OBSCURUS	1		5	7/8/1993	MIKE FEIGER-BIO TECH	16S	29E	5 NW NW		1 ADULT, 5 YOUNG.
26	CANADA GOOSE	BRANTA CANADENSIS			6	4/19/1991	JIM SOUPIR-STAND IMP	16S	29E	22		Crossing road between ponds/creek.
27	CANADA GOOSE	BRANTA CANADENSIS			6	4/29/1991	JIM SOUPIR-STAND IMP	16S	29E	22		Crossing road between ponds/creek.
28	CANADA GOOSE	BRANTA CANADENSIS	1	1		4/22/1996	MIKE FEIGER-BIO TECH	16S	29E	14NWNE		MEADOW N. OF DEER CREEK GUARD STATION.

	Common Name	Species	#Female	#Male	#Unk	Date	Observer	T	R	Sec	Nest	Comments
29	CASSIN'S FINCH	CARPODACUS CASSINII			1	10/16/1997	K.HAINES,C.CRIST	16S	29E	17 NE		20-30 FORAGING ALONG RIDGE EAST OF FLAGTAIL LOOKOUT
30	CHIPPING SPARROW	SPIZELLA PASSERINA			1	7/11/1994	KAREN HAINES-BIO	16S	29E	12,7,18		
31	CHIPPING SPARROW	SPIZELLA PASSERINA			2	6/27/1994	KAREN HAINES-BIO	16S	29E	4,9		
32	CHIPPING SPARROW	SPIZELLA PASSERINA			3	5/14/1994	KAREN HAINES-BIO	16S	29E	19,20		
33	CHIPPING SPARROW	SPIZELLA PASSERINA			4	5/13/1994	KAREN HAINES-BIO	16S	29E	19,20		
34	CLARK'S NUTCRACKER	NUCIFRAGA COLUMBIANA			1	4/6/1995	ANNE FROST-BIO TECH	16S	29E	24NWSE		F.S. RD. 24 AT ASPEN EXCLOSURE ON E. SIDE OF ROAD.
35	COMMON MERGANSER	MERGUS MERGANSER			2	4/14/1993	ANNE FROST-BIO AID	16S	29E	15 SE SE		On wickiup ck. 150 yds. west of 24 rd. near its intersection with co. rd. 63.
36	COMMON MERGANSER	MERGUS MERGANSER	1	2		4/21/1994	ANNE FROST-BIO TECH	16S	29E	23NWNW		IN POND W. OF F.S. RD. 24 AT ITS JCT. WITH CO. RD. 63.
37	COMMON RAVEN	CORVUS CORAX			2	10/16/1997	K.HAINES, C.CRIST	16S	29E	16		FLAGTAIL VICINITY
38	COOPER'S HAWK	ACCIPITER COOPERII			1	6/15/1993	MARK PENNINGER-BIO	16S	29E	10 NE SW		FLEW ACROSS 24 RD., HEADING EAST, BY RANGE INTERPRTIVE SIGN.
39	COOPER'S HAWK	ACCIPITER COOPERII			1	8/3/1993	ANNE FROST-BIO TECH.	16S	29E	15 NENW		FLYING ACROSS F.S. RD. 31, 5 MILES SOUTH OF CO. RD. 63.
40	COOPER'S HAWK	ACCIPITER COOPERII			1	9/10/1994	M. PENNIGER-BIO	16S	29E	18NENENE		IN OLD GROWTH BLOCK 221
41	COOPER'S HAWK	ACCIPITER COOPERII			1	9/4/1999	B.MILLER-SOHR	16S	29E	18 SENE		HUNTING RODENTS NEAR LOOKOUT; PERCHED SEVERAL TIMES.
42	COOPER'S HAWK	ACCIPITER COOPERII			3	7/6/1993	ANNE FROST-BIO TECH	16S	29E	32SENENE	YES	NEST ON NW SIDE OF FS ROAD 043. RECORDED IN NEST BOOK.
43	COOPER'S HAWK	ACCIPITER COOPERII	1		1	7/15/1994	KAREN HAINES - BIO	16S	29E	31NENE	YES	HWY. 395 TO CO. RD. 63. GO 14-15 MI TO GRAVEL PIT ON N. SIDE PAST 901 RD. CROSS TO S. SIDE OF 63. WALK UP SKID TRAIL INTO BIG DRAINAGE HEADING E. TAKE SE FORK FOR 1600'. GO 210 DEG 50 YDS.
44	COOPER'S HAWK	ACCIPITER COOPERII	1		2	7/6/1993	FROST/FEIGER-BIO TEC	16S	29E	32NENE	YES	CO. RD. 63 TO F.S. RD. 014 TO 043. DRIVE .35MI. ON 043. NEST IS 320 DEG, 100' DOWN SLOPE IN FIR STAND.
45	COOPER'S HAWK	ACCIPITER COOPERII	1	1	1	6/1/1995	BOB MILES - PLANNER	16S	29E	24NESW	YES	24 RD. S. TO 011. GO .2 MI. FROM 011 ON 24 RD. TO ASPEN ENCLOSURE. WALK 200 DEG. THROUGH WET MEADOW. NEST IS 30' FROM WATER'S EDGE.
46	COOPER'S HAWK	ACCIPITER COOPERII	1	1	2	6/21/1995	SKYLAR RICKABAUGH	16S	29E	30NWSE	YES	FOLLOW DIRECTIONS TO G.H. NEST 52. AT END OF RD. 743 IS A Y JUCT. TAKE RIGHT SIDE & GO TO TOP OF DRAW. IN MIDDLE OF SADDLE IS LG. MISTLETOED PSME. NEST IN TOP MISTLETOE.
47	COUGAR	FELIS CONCOLOR			1	6/14/1996	STEPHANI CLAUGHTON	16S	29E	6		SAW YOUNG CAT ALONG 191 ROAD AND SAW TRACK OF LARGE CAT.
48	DOWNY WOODPECKER		1	2		4/28/1997	A. FROST	16S	29E	16NESW		ONE WAS CHASING A PAIR IN DOG 222
49	DOWNY WOODPECKER	PICOIDES PUBESCENS	1			7/12/1994	A. FROST, J. EDIGER	16S	29E	24	YES	FEEDING YOUNG IN ASPEN CAVITY N. OF RD 011. SE NE
50	ELK	CERVUS ELAPHUS			50	6/22/1993	CURT QUAL - SALES AD	16S	29E			IN CORRAL II T.S. UNIT 31.
51	ELK	CERVUS ELAPHUS		1		6/15/1999	B.MILLER-SOHR	16S	29E	11 NENW		BUTTON BULL ALL BY HIMSELF, SWAMP CREEK.
52	FLAMMULATED OWL	OTUS FLAMMEOLUS			2	4/6/1996	ANNE FROST-BIO TECH.	16S	29E	12NESE		E. OF B.V. GUARD STATION 300' UPSLOPE FROM HORSE BARN. HEARD CALLING.
53	FLYING SQUIRREL	GLAUCOMYS SABRINUS			1	10/15/1991	RANDY SIMRELL-MARK.	16S	29E	20-21		
54	GOLDEN EAGLE'	AQUILA CHRYSAETOS			2	9/4/1999	B.MILLER-SOHR	16S	29E	18 SENE		2 ADULTS SOARING AND PLAYING AROUND FLAGTAIL LOOKOUT AREA. INTERACTED WITH SINGLE TURKEY VULTURE.
55	GREAT BLUE HERON				1	9/5/1997	A.FROST	16S	29E	22SENW		WADING IN SNOW SHOE PONDS NEAR CO.RD.63 AND 24 RD.

	Common Name	Species	#Female	#Male	#Unk	Date	Observer	T	R	Sec	Nest	Comments
56	GREAT BLUE HERON	ADREA HERODIAS			1	12/29/1992	ANNE FROST - BIO AID	16S	29E	22		Fishing in Sproul springs, .4 mile east of F.S. rd. 31.
57	GREAT GRAY OWL	STRIX NEBULOSA			1	5/25/1993	JENNIFER BARKER-BOT	16S	29E	7 NE NE		FLEW TO TREE, ROOSTED FOR A MINUTE, THEN FLEW UPSTREAM.
58	GREAT GRAY OWL	STRIX NEBULOSA			1	10/29/1997	K.RUTHERFORD	16S	29E	11 SESE		HUNTING IN MEADOW, 0.1MILE UP COLD CREEK
59	GREAT HORNED OWL	BUBO VIRGINIANUS			1	9/12/1990	KEN MEYER - FISH	16S	29E	20 NW NW		
60	GREAT HORNED OWL	BUBO VIRGINIANUS			1	6/5/1998	Z.NAPKORA	16S	29E	06 SWSW		NF DEER CREEK, DOWNSTREAM OF 641 ROAD INTERSECTION
61	GREEN-WINGED TEAL	ANAS CRECCA	2	3		4/12/1994	ANNE FROST-BIO TECH	16S	29E	22 SWNE	NO	SNOWSHOE PONDS N. OF CO. RD. 63
62	HAIRY WOODPECKER	PICOIDES VILLOSUS			1	10/3/1987	RAY ROMERO - BIO.	16S	29E	15 SW NE		Feeding on down tree trunk, (log), along creek.
63	HAIRY WOODPECKER	PICOIDES VILLOSUS			1	10/10/1987	R.ROMERO	16S	29E	15 SWNE		FEEDING ON DOWN LOGS ALONG CREEK
64	HAIRY WOODPECKER	PICOIDES VILLOSUS			1	4/28/1997	A.FROST -BIOTECH	16S	29E	17NWSW		IN WICKIUP DOG 222
65	HAIRY WOODPECKER	PICOIDES VILLOSUS			2	10/16/1997	K.HAINES, C.CRIST	16S	29E	17 NE		D.O.G. 222, FLAGTAIL
66	HAIRY WOODPECKER	PICOIDES VILLOSUS		1		4/6/1995	ANNE FROST-BIO TECH	16S	29E	24NESW		ON W. SIDE OF 24 RD. ACROSS FROM ASPEN EXCLOSURE.
67	LINCON'S SPARROW	MELOSPIZA LINCOLNII	1	1		5/12/1994	ANNE FROST	16S	29E	33		N OF 3190 RD, 1/4 M W OF FS RD 24 ON SCOTTY CR.
68	MALLARD	ANAS PLATYRHYNCHOS	1	3		4/26/1994	ANNE FROST	16S	29E	22		SNOWSHOE PONDS
69	MERLIN	FALCO COLUMBARIUS			1	10/3/1987	RAY ROMERO - BIO.	16S	29E	11 NE SW		Flying down slope rapidly.
70	MOUNTAIN GOAT	OREAMNOS AMERICANUS			1	8/23/1993	BOB BLACK - LOOKOUT	16S	29E	18 NESW		SOUTH OF FLAGTAIL LOOKOUT TOWER ON FLAGTAIL MT. CONFIMRED BY BIO.
71	MULE DEER	ODOCOILEUS HEMIONUS	2		1	6/21/1993	M.FEIGER/M.PENNINGER	16S	29E	30		510 RD. OF IZEE HWY.
72	NORTHERN FLICKER	COLAPTES AURATUS			1	5/27/1988	RAY ROMERO - BIO.	16S	29E	13 NE NE		In flight.
73	NORTHERN FLICKER	COLAPTES AURATUS			1	4/28/1997	A.FROST - BIO TECH	16S	29E	16NW MID		IN DOG 222
74	NORTHERN GOSHAWK				1	3/5/1997	B. MILLER-SOHR	16S	29E	15SENW		SEEN FROM HELICOPTER, FLYING AT JUNCTION OF 24RD. AND 889RD.
75	NORTHERN GOSHAWK				1	4/5/1997	R. SIMRELL	16S	29E	23NWNW		ABOUT 200 YARDS SOUTH OF CO. RD.63 AND FS.RD. 24 JUNCTION ON THE 24 RD.
76	NORTHERN GOSHAWK				1	7/8/1997	B.MILLER-SOHR	16S	29E	22NWSW		FLEW ACROSS IZEE HIWAY FROM SNOWSHOE POND
77	NORTHERN GOSHAWK	ACCIPITER GENTILIS				6/22/1993	MARK PENNINGER-BIO	16S	29E	30NESESE	YES	CO. RD. 63 TO F.S. RD. 901. DRIVE .3MI. ON 63 PAST THE 901 TO GRAVEL PULLOUT ON NORTH SIDE OF ROAD. NEST TREE IS 100 YDS. DOWNSLOPE IN CREEK BOTTOM. FLAGGED WITH GREEN & BLACK RIBBON.
78	NORTHERN GOSHAWK	ACCIPITER GENTILIS			1	6/1/1993	JENNIFER BARKER-BOT	16S	29E	19 NE SW		POSSIBLE NEST IN AREA??
79	NORTHERN GOSHAWK	ACCIPITER GENTILIS			1	6/6/1993	JILL OERTLEY-BIO	16S	29E	19 NE		FLYING ACROSS F.S. RD. 594.
80	NORTHERN GOSHAWK	ACCIPITER GENTILIS			1	9/8/1993	JEFF JENKINS -LAYOUT	16S	29E	23		FLYING ACROSS CO. RD. 63 AT JCT. WITH F.S. RD. 24.
81	NORTHERN GOSHAWK	ACCIPITER GENTILIS			1	6/18/1996	ANNE FROST - BIO TEC	16S	29E	12NENE	YES	CO. RD. 63 TO F.S. RD. 2195. DRIVE 2195 PAST ITS JCT. WITH 590. STOP .3 MI. PAST THE 590 AT FLAGGED BITTERCHERRY ON E. SIDE. AT 160 DEG. WALK DOWN DRAW 147 PACES (600') TO SIGNED 36" PIPO.

	Common Name	Species	#Female	#Male	#Unk	Date	Observer	T	R	Sec	Nest	Comments
82	NORTHERN GOSHAWK	ACCIPITER GENTILIS			1	8/9/1996	RICHARD FINDLEY-SILV	16S	29E	19NWNW		FLEW ACROSS 514 ROAD JUST E. OF 556 ROAD.
83	NORTHERN GOSHAWK	ACCIPITER GENTILIS			1	11/20/2001	K.HAINES	16S	29E	34SWSW		SE END OF HOG CREEK ALONG 3100-382 APPROX. 1 MILE SOUTH OF 31 JCT.
84	NORTHERN GOSHAWK	ACCIPITER GENTILIS			1	11/22/2001	K.HAINES	16S	29E	12SENW		NW OF BEAR VALLEY WORK CENTER. IN PIPO DOMINATED STAND, PERCHED IN SNAG. BACK TURNING FROM BROWN TO GRAY. SWAMP CREEK NEST NEARBY.
85	NORTHERN GOSHAWK	ACCIPITER GENTILIS			1	9/4/1999	B.MILLER-SOHR	16S	29E	13 NWSW		IZEE HWY WEST OF BVWC, FLYING EAST JUST BELOW TREETOP LEVEL, FOLLOWING STREAM COURSE.
86	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1			7/13/1994	ANNE FROST-BIO TECH	16S	29E	24		FLYING W ACROSS 24 RD ACROSS FROM ASPEN ENCLOSURE
87	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1		1	5/19/1996	SKYLAR RICKABAUGH	16S	29E	25NESW	YES	29" LAOC ALONG ROAD EDGE JUST 10M BEFORE YOU GET TO NEST 0016. N.E. OF 0016.
88	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1		2	6/30/1994	SKYLAR RICKABAUGH	16S	29E	21NWNE	YES	CO. RD. 63 PAST F.S. RD. 24 TO 1ST. RD. ON N. SIDE OF 63. IT GOES ACROSS SNOWSHOE CK. MEADOW. FOLLOW RD. 645. NEST IS .5 MI. N.W. PAST CATTLEGUARD 100' DUE E. OF RD.IN DRAW.
89	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1		2	5/30/1995	SKYLAR RICKABAUGH	16S	29E	21NWNE	YES	CO. RD. 63 TO F.S. RD. 645. FROM 721 JCT. CONTINUE ON 645 .7 MI. ON W. SIDE IS STEEP CUT-BANK W/STUMP. FROM TOP OF BANK GO 260 DEG. OVER TOP & DOWN TO RD. & BOTTOM OF DRAW. LOOK 180 DEG. 100' TO FIR.
90	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1		3	6/19/1994	SONYA DAW - O.S.U.	16S	29E	30NESW	YES	CO. RD. 63 TO F.S. RD. 901. GO 2/3 MI. PAST 901 TO GRAVEL PIT. WALK N. DOWN SLOPE TO RD. 537 & GO TO 743. WALK N ON 743 425M TO JCT OF OLD RD GOING OFF AT 35 DEG ANGLE. GO 320 DEG ALONG DRAW FOR 105M.
91	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1	1	1	7/7/1992	KATHY CUSHMAN-BIO TE	16S	29E	9NWSE	YES	24 RD. N. TO 822 RD. ON 822 GO 1.2 MI.. AT FLAG ON SMALL SNAG, GO 200' N. TOWARDS CK.. NEST IS IN 36" D. FIR AND SIGNED.
92	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1	1	1	6/23/1994	KAREN HAINES - BIO	16S	29E	9NENW	YES	24 RD. N. TO 805 TO 815. DRIVE 815 .35 MI. TO G&B FLAG ON S.W. SIDE OF RD. WALK UPHILL @ 230 DEG. FOR 90 PACES & DROP DOWN OTHER SIDE TO SHALLOW DRAW. NEST ON NE EDGE OF DRAW.
93	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1	1	2	6/8/1993	SONYA DAW - O.S.U.	16S	29E	25NESW	YES	F.S. RD. 24 S. TO 048. TURN ON 048 & MAKE QUICK LEFT WHERE IT PARTS FROM 050 (NO SIGN. BIG PIPO W/ALUMINUM TAG). GO .5 MI. TO JUST BEFORE CK. CROSSING. WALK 1/2 MI. UP 048. NEST ON E. SIDE OF RD.
94	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1	1	2	8/16/1993	S. DAW/C. SCHELZ-OSU	16S	29E	25NESW	YES	24 RD. S. TO 048 RD. TURN ONTO 050 AND MAKE QUICK LEFT ONTO 048. NO SIGN AT THIS JCT. GO .5 MI. TO CK. CROSSING. WALK 048 1/2 MI. NEST TREE E. OF RD. BETWEEN RD. & DRAW IN 59" PIPO.
95	NORTHERN GOSHAWK	ACCIPITER GENTILIS	1	1	3	4/25/1996	SKYLAR RICKABAUGH	16S	29E	29SWSW	YES	CO. RD. 63. ACROSS FROM RD.901 IS LGE TURNOUT. GATE ON S. SIDE OF 63. GO 170 DEG 180 PAC. TO SMALL MEADOW W/2-TRACK IN IT. CROSS MEAD 65 PAC. TO LG. LOG ON SW SIDE OF OPENING. 3 LG TREES AT MEAD EDGE
96	OSPREY	PANDION HALIAETUS			1	6/30/1993	MIKE FEIGER-BIO TECH	16S	29E	23 NW NW		NEAR THE CROSSING OF THE 24 RD. AND THE CO. 63 RD. FLEW ALONG THE SILVIES RIVER.
97	OSPREY	PANDION HALIAETUS			1	7/13/1994	ANNE FROST-BIO TECH	16S	29E	23		FLYING ALONG SILVIES RIVER AT JCT 24 RD AND CO RD 63
98	OSPREY	PANDION HALIAETUS			1	9/12/1996	KIM BROWN-FISH TECH.	16S	29E	22NE		SITTING ON SNAG IN CHECK DAM POOL IN SNOWSHOE POND.
99	OSPREY	PANDION HALIAETUS			2	4/30/1996	KAREN HAINES-BIO	16S	29E	12SW		APPROX. 1/2 MI. WEST OF B.V. GUARD STA. SOARING OVER SILVIES RIVER.
100	OSPREY	PANDION HALIAETUS	1	1		5/16/1991	ANNE FROST - BIO AID	16S	29E	7 SW NW		Fishing Silvies river and building nest on river.
101	PILEATED WOODPECKER				1	5/6/1997	K. HAINES	16S	29E	9SENW		ROAD 2400822, WICKIUP CREEK
102	PILEATED WOODPECKER				1	8/20/1997	B.MILLER-SOHR	16S	29E	11SESE		COLD CREEK, FLEW TO PP TO FORAGE

	Common Name	Species	#Female	#Male	#Unk	Date	Observer	T	R	Sec	Nest	Comments
103	PILEATED WOODPECKER				1	9/20/1997	B.MILLER-SOHR	16S	29E	8SW		FLYING EAST TO WEST OVER SADDLE ALONG 701 RD. AT 524 JUNCTION
104	PILEATED WOODPECKER			1		4/28/1997	A.FROST	16S	29E	16NESW		DOG 222 WICKIUP
105	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	5/5/1987	C.PINTO,R.ROMERO	16S	29E	07 NWSE		DRUMMING. HEARD IN LARGE TIMBER.
106	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	10/3/1987	RAY ROMERO - BIO.	16S	29E	14 NW NW		Knocking on large Douglas-fir tree trunk.
107	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	10/10/1987	R.ROMERO	16S	29E	14 NWNW		DRUMMING ON LARGE DOUGLAS FIR TRUNK
108	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	7/9/1988	CHUCK ROBERTS - SSTS	16S	29E	30 SW SW		In snag.
109	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	4/22/1993	ANNE FROST-BIO AID	16S	29E	24SENE		Heard Pileated west of F.S. road 555 in N.E. portion of dedicated old growth unit 8.
110	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	6/3/1993	SONYA DAW-O.S.U.	16S	29E	34 SW NE		EAST OF HOG CREEK
111	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	7/16/1993	KAREN HAINES-B.S.U.	16S	29E	8 SE		HEARD CALLING IN D.O.G. 222.
112	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	5/6/1994	K. HAINES	16S	29E	19		SW 1/4
113	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	8/29/1996	JENNIFER BARKER-FISH	16S	29E	17NWNE		SEEN AT CLOSE RANGE.
114	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	10/20/1997	K.BROWN	16S	29E	14 NENW		FEEDING ON DEAD PIPO? NEAR STOCK POND
115	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	10/20/1997	K.BROWN	16S	29E	20 NENE		WAS FLYING TO AVOID ME. FEEDING ON DEAD FIR.
116	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	10/21/1997	A.FROST	16S	29E	01 SESE		SOUTH OF 578 ROAD NEAR JUNCTION WITH 2195.
117	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	6/17/1998	K.KINCAID, C.QUAL	16S	29E	31		NORTH OF HWY 63, ROAD 509
118	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			1	11/22/2001	K.HAINES	16S	29E	12SENW		NW OF BEAR VALLEY WORK CENTER.
119	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			2	4/21/1994	BILL STOVER-FISH BIO	16S	29E	7NESW		ROBA UNIT 13 UPROAD 2400-667 IN VICINITY OF F.S. RD. 569 W. OF THE ROAD SYSTEM.
120	PILEATED WOODPECKER	DRYOCOPUS PILEATUS			2	9/3/1996	JENNIFER BARKER-FISH	16S	29E	8SWSE		
121	PILEATED WOODPECKER	DRYOCOPUS PILEATUS		1		8/26/1989	D.RAWSON	16S	29E	15 SW		Flag timber sale 1/4 mile from 24Rd.
122	PILEATED WOODPECKER	DRYOCOPUS PILEATUS		1		6/9/1993	ANNE FROST-BIO TECH	16S	29E	30 SE SE		200 YDS. NORTH OF TAMARACK CRK. FORAGING ON LOW RIDGE.
123	PILEATED WOODPECKER	DRYOCOPUS PILEATUS	1			4/22/1993	ANNE FROST-BIO AID	16S	29E	24 NESW		Drumming on snag 300 yds. south of F.S. road 550 in dedicated old growth stand no. 8.
124	PRAIRIE FALCON				1	4/5/1997	J. WAY	16S	29E			MILEPOST 3 ON 24 ROAD
125	PRONGHORN	ANTILOCAPRA AMERICANA		1		6/28/2001	B.MILLER-SOHR	16S	29E	09 CTR		CROSSED ROAD EAST TO WEST. FLAGTAIL CREEK JUST SOUTH OF NEW BUCK AND POLE FENCE ALONG 814 ROAD.
126	RED CROSSBILL	LOXIA CURVIROSTRA	1	2		7/26/1992	MARK PENNINGER - BIO	16S	29E	36		Drinking water from puddle in rd. 998.
127	RED TAILED HAWK				2	6/2/1997	J.SHAFER	16S	29E	6SWSW		PERCHED OR FLYING AT JUNCTION OF 24 RD. AND 252 RD.
128	RED TAILED HAWK	BUTEO JAMAICENSIS			1	4/29/1997	J. WAY, S.RIGGINS	16S	29E	23NE		SOUTH OF FORTRESS ON ROAD 24
129	RED-BREASTED NUTHATCH	SITTA CANADENSIS			3	10/16/1997	K.HAINES, C.CRIST	16S	29E	17 NE		D.O.G. 222, FLAGTAIL
130	RED-NAPED SAPSUCKER			1		4/28/1997	A.FROST	16S	29E	8SWNW		IN DOG 222

	Common Name	Species	#Female	#Male	#Unk	Date	Observer	T	R	Sec	Nest	Comments
131	RED-TAILED HAWK	BUTEO JAMAICENSIS			1	3/25/1993	ANNE FROST - BIO AID	16S	29E	28NENW		Light morph Red-tailed hawk perched 150' N. of Co.Rd. 63 in Ponderosa Pine .1 mile E. of F.S. Rd. 594.
132	RED-TAILED HAWK	BUTEO JAMAICENSIS			1	6/8/1993	SONYA DAW - OSU	16S	29E	25NWNE	YES	F.S. RD. 24 TO 050. TRAVEL ALONG 050 .6 MI. WALK 72 DEG. DOWN HILL 60' TO EDGE OF SHALLOW DRAINAGE. NEST TREE IS 30" PIPO AND SPARSELY LIMBED.
133	RED-TAILED HAWK	BUTEO JAMAICENSIS			2	3/15/1993	ANNE FROST - BIO AID	16S	29E	22SENE		Perched 300 yds. south of Co. rd. 63, 1/4 mile west of F.S. rd. 24.
134	RED-TAILED HAWK	BUTEO JAMAICENSIS			2	7/1/1993	SONYA DAW - O.S.U.	16S	29E	27SESW	YES	WALK S.W. OF RD. 331, APPROX., 150 YDS. S. OF THE 331/369 JCT. WHERE THE N. SIDE OF THE ROAD HAS A STEEP CUTOUT BANK. WALK 100 YDS. NEST TREE IS A 36" P. PINE THAT LEANS TO THE NORTH.
135	RED-TAILED HAWK	BUTEO JAMAICENSIS	1	1		6/23/1994	KAREN HAINES - BIO	16S	29E	9SWSW	YES	24 RD. TO 822 TO 870. GO .2?MI. ALONG 870. LOOK E. TO NEST. NEST IN 38" LARCH W/DEAD TOP. NEST STAND SURROUNDED BY MEADOW.
136	RED-TAILED HAWK	BUTEO JAMAICENSIS	1	1	2	6/19/1996	ANNE FROST-BIO TECH	16S	29E	2SWNE	YES	CO. RD. 63 TO F.S. RD. 2195 TO 086 (NO SIGN) WHICH IS THE 1ST RD TO THE W. AFTER 2ND CATTLE GUARD. DRIVE 086 .4 MI. NEST IS S. UP HARVESTED DRAW 100' ON W EDGE AT BOTTOM OF SLOPE.
137	RING-NECKED DUCK	AYTHYA COLLARIS	1	3		6/16/1993	MIKE FEIGER-BIO TECH	16S	29E	22 SW NE		SILVIES RIVER IN " PONDS " ABOVE 24 RD.;GRANT 63 CROSSING.
138	ROCKY MOUNTAIN ELK					7/29/1997	B.MILLER-SOHR	16S	29E	18NWSE		MOVING ACROSS OPENING DURING A STORM
139	SANDHILL CRANE			1		4/29/1997	J. WAY-BIO AIDE	16S	29E	23NWNW		FOREST RD. 24
140	SANDHILL CRANE	GRUS CANADENSIS			1	10/8/1996	S. RIGGINS/J.WAY-KV	16S	29E	22		FLYING ACROSS SNOWSHOE PONDS.
141	SANDHILL CRANE	GRUS CANADENSIS			3	7/19/1994	SUE DANVER	16S	29E	24		ON E SIDE OF 24 RD S OF ASPEN EXCLOSURE, 50 YDS
142	SHARP-SHINNED HAWK	ACCIPITER STRIATUS			1	7/28/1994	ANNE FROST	16S	29E	36		HUNTING NEAR ROAD 071 AND 354. SE NW
143	SHARP-SHINNED HAWK	ACCIPITER STRIATUS			1	8/17/1994	S. DANVER	16S	29E	34		NW NE.
144	SHARP-SHINNED HAWK	ACCIPITER STRIATUS			1	8/23/1995	KAREN HAINES - BIO	16S	29E	13SWNW		SEEN ON IZEE HWY., APPROX. 0.1 MI. E. OF 662 RD. FLYING NORTH.
145	SHARP-SHINNED HAWK	ACCIPITER STRIATUS			1	6/15/1999	B.MILLER-SOHR	16S	29E	11 SWNW		SWAMP CREEK - FLYING EAST DOWN DRAINAGE.
146	SHARP-SHINNED HAWK	ACCIPITER STRIATUS		1		8/11/1995	MIKE MCGRATH,O.S.U.	16S	29E	12SE		FLEW IN AND PERCHED AT BEAR VALLEY WORK CENTER.
147	STELLER'S JAY	CYANOCITTA STELLERI			1	10/16/1997	K.HAINES, C.CRIST	16S	29E	17 SW		
148	SWAINSON'S HAWK	BUTEO SWAINSONI			1	11/16/1993	BILL STOVER/FISH BIO	16S	29E	23NWNE		FLYING WEST AT THE JCT. OF CO. RD. 63 AND F.S. RD. 24.
149	TURKEY VULTURE				2	7/30/1997	B.MILLER-SOHR	16S	29E	NWSE		SOARING AROUND LOOK OUT,PERCHING ON THE OLD LOOKOUT,FLAGTAIL LOOKOUT
150	TURKEY VULTURE	CATHARTES AURA			1	9/4/1999	B.MILLER-SOHR	16S	29E	18 SENE		SOARING WITH A PAIR OF GOLDEN EAGLES, USING UPDRAFTS. FLAGTAIL LOOKOUT.
151	UNKNOWN RAPTOR						ANNE FROST - BIO TEC	16S	29E	25NENENE	YES	TREE SIGNED BUT NO NEST VISIBLE. F.S. RD. 24 TO 050 TO 048. TRAVEL ALONG 048 .2 MI. TREE IS 10' N. AND IS 28" PIPO.
152	UNKNOWN RAPTOR					7/1/1981	ALVAVADO	16S	29E	30SWSWSE	YES	CO. RD. 63, 1 MI. BEFORE F.S. SIGN, THERE IS A GRAVEL PILE. WALK 200' N. TO CULVERT. FROM CULVERT GO DOWNHILL. FOLLOW SMALL STREAM TO LARGER CK. NEST IS ON N. SIDE OF CK., 100' S.W. OF JCT. OF CKS.
153	UNKNOWN RAPTOR					7/5/1991	ANNE FROST - BIO TEC	16S	29E	4SENE	YES	24 RD. N. TO RD. 756. GO .2 MI. TO RD. 191 (NO RD. SIGN). GO E. UNTIL 191 MEETS FENCE. GO ACROSS FENCE S. UPHILL THROUGH DRAW, APPROX 250'. NEST E. 75' ON LOW HILL IN LARCH.

	Common Name	Species	#Female	#Male	#Unk	Date	Observer	T	R	Sec	Nest	Comments
154	UNKNOWN RAPTOR					5/24/1994	FEIGER/FROST-BIO TEC	16S	29E	32NWNE	YES	24 RD. S. TO 3190 TO 1ST CATTLEGUARD. WALK N. ALONG FENCE TO EAST/WEST CROSS FENCE. WALK N.W. ALONG CROSS FENCE TO SHARP CURVE N. NEST IS 200' N.E. IN SMALL STAND OF YOUNG FIR.
155	UNKNOWN RAPTOR					8/4/1995	BILL PROPHET-MARKING	16S	29E	24NENE	YES	24RD. S. TO 865 TO 056 TO END. AT LANDING, FOLLOW SMALL DRAW/SKID RD. 100 YDS. NEST IS ON R. SIDE NEAR EDGE OF SKID RD. IN CLUMP OF PIPO REGEN.
156	UNKNOWN RAPTOR		0	0	0	6/9/1993	ANNE FROST	16S	29E	30SWSWSE	YES	NEST FIRST FOUND BY ALVARADO IN AUG 1982. NEST #37, NEAR NEST #26 THAT WAS ACTIVE IN 1993. This nest likely belonged to a goshawk based on proximity to nest #26, and the size of the nest.
157	WESTERN SCREECH OWL	OTUS KENNICOTTII			1	10/21/1997	A.FROST	16S	29E	01 NWSE		IN ASPEN STAND NORTH OF 578 ROAD NEAR JUNCTION WITH 886
158	WHITE-HEADED WOODPECKER	PICOIDES ALBOLARVATUS			1	8/2/1994	SUE DANVER	16S	29E	36		CENTER
159	WHITE-HEADED WOODPECKER	PICOIDES ALBOLARVATUS			1	12/17/1997	K.HAINES	16S	29E	12 SENE		FORAGING IN PONDEROSA PINE NEAR ROAD 2195
160	WHITE-HEADED WOODPECKER	PICOIDES ALBOLARVATUS			1	12/17/1997	K.HAINES	16S	29E	12SWSWSW		FORAGING BY COUNTY ROAD 63
161	WILD TURKEY	MELEAGRIS GALLOPAVO			9	9/25/2001	C.KRANICH	16S	29E	4		24 ROAD, WICKIUP CREEK, IN MEADOW NEAR ASPEN EXCLOSURES
162	WILD TURKEY	MELEAGRIS GALLOPAVO	1			11/4/1991	RANDY SIMRELL	16S	29E	33		In Doug fir tree.
163	WILD TURKEY	MELEAGRIS GALLOPAVO	1			4/22/1996	MIKE FEIGER-BIO TECH	16S	29E	17SWSW		ON ROAD 361.
164	WILLIAMSON'S SAPSUCKER		1			5/6/1997	K. HAINES	16S	29E	9SENW		ROAD2400822 WICKIUP CREEK ,DRUMMING ON A SNAG BY ROAD
165	WILLIAMSON'S SAPSUCKER	SPHYRAPICUS THYROIDEUS			1	10/10/1987	R.ROMERO	16S	29E	15 SWNE		FEEDING ON DOUGLAS FIR TREE TRUNK ALONG CREEK
166	WILLIAMSON'S SAPSUCKER	SPHYRAPICUS THYROIDEUS		1		4/28/1997	A.FROST BIO TECH	16S	29E	17NWNE		IN WICKIUP DOG222
167	WILLIAMSON'S SAPSUCKER	SPHYRAPICUS THYROIDEUS	1	1		4/22/1993	ANNE FROST-BIO AID	16S	29E	24NWNE		Foraging along Dead Injun Creek S.E. of F.S. road 549.
168	WILLIAMSON'S SAPSUCKER	SPHYRAPICUS THYROIDEUS	1	1		7/8/1993	MIKE FEIGER-BIO TECH	16S	29E	5 SW NW		NEST TREE FOUND BOTH ADULTS FEEDING.
169	WILLIAMSON'S SAPSUCKER	SPHYRAPICUS THYROIDEUS	1	1		5/11/1994	ANNE FROST	16S	29E	29		AT N END OF SCOTTY UNIT 78 FORAGING IN ASPEN

APPENDIX B.

STREAMLINED HUMAN HEALTH RISK EVALUATION

HUMAN HEALTH RISK EVALUATION

ROBA WESTFALL AND YORK & RANNELLS MINE
Malheur National Forest
Grant County, Oregon

Prepared For

USDA Forest Service
Malheur National Forest

on behalf of

Cascade Earth Sciences
7150 Supra Drive SW
Albany, Oregon 97321

March 2003

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1.0 INTRODUCTION

Potential human health risks associated with mining related constituents at the Roba Westfall and York & Rannells Mines (Site) located in the Malheur National Forest were assessed as part of this streamlined risk evaluation.

A human health risk evaluation (HHRE) is an analysis of the potential adverse health effects that could result from current or future exposures to hazardous substances released from a site, in the absence of any action to control or mitigate these releases. The objective of this assessment is to incorporate analytical data and information on potential exposure pathways gathered during the remedial investigation to provide a more complete baseline HHRE for the Site. The following are primary elements of the HHRE:

- **Identification of Contaminants of Concern:** Evaluation of site data and identification of elevated concentrations of contaminants in site media.
- **Exposure Assessment:** Identification of areas that pose human health risks under current or potential future site uses and quantification of estimates of exposure.
- **Toxicity Assessment:** Quantification of estimates of the relationship between exposure levels and adverse effects.
- **Risk Characterization:** Development of quantitative risk estimates using potential exposure and toxicity information previously developed for the contaminants of potential concern (COPCs).

2.0 HAZARD IDENTIFICATION AND SELECTION OF COPCS

This section presents the rationale for the selection of the contaminants of potential concern (COPCs). All data collected during the site investigations were screened using the Oregon Department of Environmental Quality (ODEQ) screening protocol (Guidance for Conduct of Deterministic Risk Assessments, ODEQ December 1998). Fifteen metals were identified as Chemical of Interest (COIs) for the Site (aluminum, antimony, arsenic, cadmium, chromium, cobalt, copper, iron, lead, mercury, nickel, silver, thallium, vanadium and zinc). DEQ guidance allows for prescreening of COIs. Chemical contaminants were initially screened based on the following criteria:

- **Frequency of Detection:** COIs that were detected in less than 5% of the samples site-wide were not selected as COPCs. A number of chemicals in soil, sediment and groundwater were deleted on the basis of this criterion.
- **Background Concentrations:** Naturally occurring chemicals occurring at concentrations less than background are not selected as COPCs.

Several chemicals were eliminated from further consideration based on this prescreening. Table A-1 in Attachment A presents the results of the prescreening.

Exposure point concentrations of the remaining COIs were screened against Region IX Preliminary Remediation Goals (PRGs). In addition to individual screening, ODEQ requires consideration of multiple chemical COPCs. Industrial PRGs were selected as the most appropriate screening criteria for soils.

Datasets for the Roba Westfall and York & Rannells Mines were combined for purposes of screening and risk evaluation. Table A-2 in Attachment A presents the results of the chemical screening. Arsenic was identified as an individual and a multiple chemical COPC in soil. Per ODEQ guidance constituents for which no PRG exists are retained for the risk evaluation. Mercury was identified as a COPC due to a lack of PRG in for soil.

3.0 EXPOSURE ASSESSMENT

Assessing the exposure at a given site includes the identification of potentially exposed populations, the development of exposure pathways, and the calculation of exposure point concentrations and chronic daily intakes.

3.1 Potentially Exposed Populations

There are no onsite workers, occupied structures or people who live within a 4-mile radius of the Site. Public use of the Site and vicinity is most likely minimal, though public access records are not maintained**.** Access is currently not restricted by fencing, nor were any "No Trespassing" signs noted. Impacts to ecological receptors are addressed in the ecological risk assessment. In general, land uses in this area are limited to cattle grazing, limited timber harvesting, firewood cutting, and recreation (hiking, camping, hunting, etc).

The Site is not currently occupied on a regular basis and may never be occupied for extensive periods. Therefore, the risk of long-term exposure to contaminants at the sites is considered low. However, the ingestion, dermal contact and air exposure pathways are considered complete, because hikers, hunters, and campers still have the potential to access the Site.

3.2 Identification of Potential Exposures

This section evaluates potential pathways for human exposures to the identified COPCs. In general, an exposure pathway consists of four elements: a source of chemical release into the environment, an environmental medium for transport of the chemical (e.g. air, groundwater or soil), a point of potential human exposure (exposure point) and a route of exposure of the chemical into the body (e.g. breathing, eating, drinking or skin contact). The conceptual site model is presented as Figure 1.

3.3 Current and Potential Future Receptors

The site is not currently occupied, nor is it expected to be occupied or developed in the near future. While access is practically limited the site is physically accessible. The only likely current and future receptors identified for the site are hikers, campers and hunters.

3.4 Exposure Scenarios

Exposures to COPCs were evaluated for all complete pathways for which there was a receptor. These pathways were determined to be inhalation of particulates, dermal contact, and incidental ingestion of surface soils, and dermal contact and incidental ingestion of surface water and sediments by current and future recreational receptors.

3.5 Exposure Assumptions

Recreational exposure assumptions for the Site are the same as those used for the evaluation of the Paragon Mine Complex. the Upper Tenmile Creek Mining Area Superfund site in the *Draft Preliminary Human Health Risk Assessment for the Upper Tenmile Creek Mining Area Superfund Site* (CDM, 2000b), the Nonpariel Mine Tailings Site, and the Spring Creek Mine Tailings Site. These sites are similar in many respects.

Exposure assumptions include factors such as body weight, averaging time, exposure frequency, exposure duration, and chemical bioavailability. Separate assumptions are made for both central tendency exposure (CTE) and reasonable maximum exposure (RME). In general, CTE represents a less conservative model of the site risk, using exposure factors (e.g. duration, frequency, length, etc.) that are more indicative of the average recreational user rather than a maximally exposed user. General exposure assumptions are:

- Body Weight. The value of 70 kilograms (kg) is representative of the mean weight of men and women between the ages of 18 and 75. A value of 15 kg represents the mean weight of children between the ages of 0 and 6 years. The values are used for both RME and CTE.
- Averaging Time. Represents the period over which intake is averaged. For noncarcinogenic chemicals, intakes are averaged over the exposure duration (exposure duration (years) * 365 days). For carcinogens, intake calculations average the total cumulative dose over a lifetime (70 years * 365 days/year).
- Exposure duration. The exposure duration is the number of years over which the exposure may occur. For RME, recreational visitors to the site are assumed to have an exposure duration of 24 years for adults and 6 years for children.
  For CTE, the exposures are 7 and 2 years, respectively.
- Exposure Frequency. Exposure frequency is the number of days per year that an individual participates in a particular activity. For the recreational scenario, exposures to soil, solid waste, and air were based on regional information on hiking, hunting, or other land-based activities and were 26 days per year for RME and 13 days per year for CTE.
- Chemical Bioavailability.
  Arsenic in soil, tailings, dust, and sediment is assumed to have an oral bioavailability of 80%. Mercury in soils and tailings are assumed to have a relative oral bioavailability of 100 %.

- Pathway-specific exposure assumptions are:

  - Soil Ingestion. The CTE scenario soil ingestion rate for recreational exposure is 50 milligrams per day (mg/day) for adults and 100 mg/day for children. The RME scenario soil ingestion rate is 100 mg/day for adults and 200 mg/day for children.
  - Inhalation of Fugitive Dust. Inhalation rates for adult recreational users are 2.1 cubic meters per hour (m3/hr) for the CTE scenario and 3.9 m3/hr for the RME scenario. For children, the rates are 2 m3/hr and 2.3 m3/hr for CTE and RME scenarios, respectively.

3.6 Exposure Point Concentrations

An exposure point concentration (EPC) is needed to calculate the Average Daily Dose (ADD) of a contaminant. Generally, the exposure point concentration is not the maximum concentration detected at the site because, in most situations, it is not reasonable to assume long-term contact with the maximum concentration. Average concentrations are used because toxicity criteria are based on lifetime average exposures, and an average concentration is most representative of the concentration contacted over time, based on the assumption that an exposed individual moves randomly across an exposure area. The equations used to calculate the EPC and ADD are found in EPA, 1997.

All calculations are presented in Attachment B. While presented individually in the equations, USEPA Region X allows for the calculation of Summary Intake Factors (Intake Factors). Intake Factors represent the sum lifetime exposure to contaminated soil, water or air through the pathway. Where the data set is greater than ten, statistical analysis and calculation of the 90 percent upper confidence level on the mean can be used as the EPC assuming that a normal distribution of the data can be demonstrated. The 90 percent upper confidence level of the mean (90% UCL_{mean}) is a conservative estimate of mean chemical concentration and is specified in Oregon's Revised Clean Up Rules OAR 340-122-084.

There are several methods by which the normality of a data set can be tested. EPA has recommended the use of the W test (Shapiro and Wilkes 1965) or D'Agostino's Test. Both of these methods can be used to test whether the data differ significantly from a normal distribution. It cannot determine whether the data are normally distributed, but rather whether a normal distribution can be assumed. The W test is recommended for data sets with 50 or fewer samples; D'Agostino's for data sets great than 50. Environmental data sets are often asymmetrical and frequently positively skewed. Transforming the raw data points by taking the natural log of each concentration can normalize the data set.

The logarithmically transformed data set can be tested for normality in several ways. If the W test or D'Agostino's test indicates that the assumption of normality is valid, the 90 UCL on the mean is calculated using Land's Method (Gilbert, R. O., Statistical Methods for Environmental Pollution Monitoring, 1987). For data sets wherein neither a normal nor a lognormal distribution could be demonstrated, a Z calculation adjusted for skewness was used to determine the 90UCL calculation. (EPA 1997).

The EPCs for the soil COPCs are presented in Table 3-1 along with the basis for their selection.

Table 3-1 Exposure Point Concentrations

COPC	N	Maximum	90 UCL	Comments
SOIL (mg/kg)				
Arsenic	19	9.45E+01	5.43E+00	Z_{adj}
Mercury	43	7.30E+03	4.53E+01	Z_{adj}

4.0 TOXICITY ASSESSMENT

The purpose of the toxicity assessment is to present the toxicity data for the COPCs. Toxicity is defined as the ability of a chemical to induce adverse effects at some dosage in biological systems. The purpose of the toxicity assessment is twofold:

- To identify the cancer and non-cancer effects that may arise from direct or indirect exposure of humans to the COPCs ; and,
- To provide an estimate of the quantitative relationship between the magnitude and duration of exposure, and the probability or severity of adverse effects.

4.1 Toxicity Values

Toxicity values are used to quantitatively describe the relationship between the extent of exposure to a COPC and the potential increased likelihood or severity of adverse effects. The sources used to obtain toxicity information and methods for deriving toxicity criteria and estimated potential adverse effects are presented below.

The following EPA sources have been used to obtain toxicity values for most of the COPCs.

- Integrated Risk Information System (IRIS) computer database (EPA).
- Health Effects Assessment Summary Table (HEAST) (EPA, 1997).

4.1.1 Categorization of Chemicals as Carcinogens or Non-carcinogens

Both cancer and non-cancer health effects were quantitatively evaluated. The endpoints for these two different types of effects are assessed differently because the mechanisms by which chemicals cause cancer are assumed to be fundamentally different from the processes that cause non-carcinogenic effects. The principal difference reflects the assumption that non-carcinogenic effects are assumed to exhibit a threshold dose below which no adverse effects occur, where EPA assumes no such threshold exists for carcinogenic effects. Because exposure to some chemicals may result in both carcinogenic and non-carcinogenic effect, both endpoints associated with a COPC were evaluated quantitatively when sufficient toxicity data are available.

4.1.2 Potential Adverse Noncarcinogenic Health Effects

Reference doses (RfDs) are critical toxicity factors for chemicals that exhibit adverse noncarcinogenic health effects. An RfD represents an estimated intake rate that is unlikely to produce measurable adverse effects over a lifetime of exposure (USEPA, 1989a). RfDs are determined by the USEPA RfD Work Group or from the health effects assessment documents developed by the USEPA Office of Research and Development. USEPA-established RfDs have been verified by a USEPA-directed peer review of available information.

An RfD assumes a threshold for adverse noncarcinogenic effects; doses or exposures below this threshold are considered unlikely to cause adverse health effects. An RfD is expressed in units of mg/kg-day. RfDs are route-specific; that is, RfDs may differ for ingestion, inhalation or other routes of exposure. RfDs are derived using uncertainty factors (UFs) and modifying factors (MFs). The UFs reflect scientific judgment regarding the data used to estimate an RfD. A UF of 10 is usually used to account for variation in human sensitivity among populations. An additional 10-fold factor is used to account for each of the uncertainties assumed when extrapolating from animal data to humans, when extrapolating from a lowest-observed adverse effect level (LOAEL) to a no-observed-adverse-effect-level (NOAEL) and when extrapolating from subchronic to chronic exposure. To reflect professional assessment of the uncertainties of the study and the database not explicitly addressed by the above UFs, an additional UF or MF ranging from >0 to 10 can be applied. The default value for MF is 10. The Critical Toxicity Factors for the non-carcinogenic COPCs are presented in Table 4-1.

Table 4-1 Critical Toxicity Values for the Noncarcinogenic COPCs

		Chronic RfD (mg/kg-day)			
Contaminant	**CAS Number**	**Oral**	**Inhalation**	**Confidence in RfD**	**Endpoint**
Arsenic	7440-38-2	3.00E-04		medium	skin/vascular
Mercury	7487-94-7	3.00E-04	8.60E-05	medium	neuro

4.1.3 Potential Carcinogenic Effects

EPA has recently adopted new guidelines for evaluating the carcinogenicity of chemicals. The 1986 guidelines established five Weight of Evidence (WOE) categories for carcinogens: Groups A,B,C,D,and E with two subcategories of Group B—B1 and B2. The group designation was based on the presence of tumors and the assumption that carcinogenicity by one pathway (ingestion) meant that the chemical was carcinogenic for all pathways (inhalation, dermal). These guidelines placed each carcinogenic chemical into one of the following categories.

- **Group A -** human carcinogen: sufficient evidence from epidemiological studies to support a causal association between exposure and cancer in humans.
- **Group B1 -** probably human carcinogen: limited evidence of carcinogenicity in humans from epidemiological studies, but sufficient evidence of carcinogenicity from animal studies.
- **Group B2 -** probably human carcinogen: inadequate evidence of carcinogenicity in humans, but sufficient evidence of carcinogenicity from animal studies.
- **Group C -** possible human carcinogen: limited evidence of carcinogenicity from animal studies.
- **Group D -** not classifiable as to human carcinogenicity: inadequate database of carcinogenicity evidence on which to base a conclusion.
- **Group E -** no evidence of carcinogenicity in humans: no evidence of carcinogenic response in at least two adequate animal tests (in different species) or both adequate epidemiological and adequate animal studies.

The newer 1999 draft EPA Cancer Guidelines emphasizes the weighing of all evidence in reaching conclusions about the potential for a chemical to induce cancer. Evidence to be considered includes tumor findings in humans and laboratory animals, a chemical's physical and chemical parameters, its structure-activity relationship to other potentially carcinogenic chemicals and it behavior in studies of the carcinogenic process. The WOE descriptor proposed by the draft 1999 guidance addresses not only the likelihood of human carcinogenic effects of the chemical, "but also the conditions under which such effects may be expressed to the extent that these are revealed in the toxicological and other biologically important features". That being said, the 1999 narratives do not reflect and are not intended to merely substitute for the Cancer Groups developed in the 1986 guidance.

The newer guidance document is designed to enable scientific evaluation of the evidence. Evaluating information regarding structural activity relationships or the likelihood of carcinogenic effect based on chemical physical parameters is generally beyond the ken of most lay groups. According to the 1999 Guidance it is envisioned that chemicals may be deemed carcinogenic under certain conditions and noncarcinogenic under others.

The new cancer guidance reflects a new understanding of carcinogens in that mode and mechanism of action are an important aspect. Under the new guidelines, a chemical's potential for carcinogenicity will be qualified under those conditions. While it was once assumed that a chemical known or suspected to cause cancer by one route of exposure (inhalation for example), would be carcinogenic irrespective of any route of exposure, the new guidance will reflect that route-of-exposure could make a difference and will regulate and evaluate carcinogens accordingly. In all likelihood, studies to support the new cancer risk assessment will be looking at modes and mechanisms of action with a focus on child health.

Only a few chemicals have been reevaluated in light of the new cancer guidelines, none of them site related COPCs. Also, guidance as to how to effectively present this information within the context of the risk assessment does not yet exist (Personal communication, Marcia Bailey, EPA). Therefore the information presented on carcinogens will be consistent with current risk assessment guidance as presented in RAGS and information published in IRIS.

Once a chemical is qualitatively classified as a potential human carcinogen (A, B1, B2 or C), the weight of evidence approach is no longer used to develop the cancer slope factor (CSF), which is a quantitative estimate of carcinogenic potency. Tumorgenic responses, both benign and malignant, from the species found to be most sensitive are generally used. For CSF designation, studies with no response are ignored. Most CSFs are derived by using the upper 95 percent confidence limit on the slope (95% UCL) of the dose-response curve obtained from a linearized multistage model of animal data. A CSF is expressed as the inverse of milligrams of chemical per kilogram of body weight per day ([mg/kg-day]-1). When animal studies are used to estimate CSFs, some adjustments (i.e. uncertainty factors) are used by the USEPA to account for differences between animal species and humans.

The CSF provides a theoretical estimate of an upper-bound excess lifetime cancer risk (ELCR) associated with exposure to a carcinogen. In general, however, it is conservatively believed that there is approximately a 5 per cent chance that an exposure response could be greater than the estimated value. This approach is considered conservative and may overestimate the actual risk a chemical poses to human receptors. Critical Toxicity Data for the carcinogenic COPCs are presented in Table 4-2.

Table 4-2 Critical Toxicity Values for the Carcinogenic COPCs.

Contaminant	CAS Number	Slope Factor (mg/kg/day)-1 Oral	Inhalation	Weight of Evidence Classification Ingestion/Inhalation	Type of cancer Ingestion/ Inhalation	Basis of Slope Factor oral/inhalation
Arsenic	7440-38-2	1.5E+00	1.5E+01	**A**	skin	Epidemiologic Studies

5.0 RISK CHARACTERIZATION

Because the database represents worst case conditions and the quantitative risk assessment assumes that the recreational user would spend all of his/her time (26 days per year) on site in the most contaminated location, the results are useful for determining an upper range of risks and hazards for the site, but are likely to overestimate any actual or potential risks or hazards that may exist.

5.1 Estimation Of Carcinogenic Risk

Carcinogenic risk is estimated as the probability that a compound will produce a carcinogenic effect. The excess lifetime carcinogenic risk is the incremental increase in the probability of developing cancer compared to the background incremental probability of developing cancer with no exposure to site contaminants. A risk of 1×10^{-6}, for example, represents the probability that one person in one million exposed to a carcinogen over a lifetime (70 years) will develop cancer. Estimates of carcinogenic risk using the slope factors developed by USEPA are generally upper-bound estimates; actual risks from exposures to chemical constituents at the mining sites would likely be lower than the risks estimated herein.

For estimating carcinogenic risk from exposure to more than one carcinogenic chemical from a single exposure route, risks from each individual chemical are summed to estimate total cancer risk through a single route.

5.2 Estimation Of Noncarcinogenic Hazard

Noncarcinogenic hazard is estimated as the ratio of the noncarcinogenic chemical intake (CI) of a compound through a specific exposure route to the chronic (or subchronic) reference dose (RfD) for that exposure route. For example, intakes from the ingestion route are compared to oral RfDs. The CI is calculated by multiplying the chemical concentration in a given media by the media specific intake factor for the specific exposure pathway.

The CI divided by the RfD for an individual chemical is termed the hazard quotient (HQ). HQs greater than 1 indicate the potential for adverse health effects because the intake exceeds the RfD (USEPA, 1986b). An HQ is calculated for each chemical that elicits a noncarcinogenic health effect if an RfD is available for the chemical and exposure route. The sum of all individual chemical-specific HQs is termed the hazard index (HI) and is calculated under each exposure pathway. :

The HI considers exposure to a mixture of chemicals having noncarcinogenic effects based on the assumption that the effects of chemical mixtures are additive (USEPA, 1986b). An HI greater than 1 indicates the potential for adverse noncarcinogenic effects.

5.3 Risk and Hazard Estimates for the Recreational Receptor.

The results of the quantitative risk assessment are presented in this section. Calculations, assumptions and exposure inputs are presented in Attachment A. HI estimates indicate no potential for adverse hazards from exposure to noncarcinogenic COPCs at the site. The risk characterization for carcinogenic effects demonstrates that the potential for unacceptable excess cancer risks at the Site does not exceed the regulatory standard of 1E-06. The following table summarized the results.

Table 5-1. Summary of Potential Human Health Effects

SCENARIO	Excess Cancer Risk		Hazard Index	
	CTE	RME	CTE	RME
Recreational	9.E-09	2.E-07	4.E-03	2.E-02

5.3.1 Noncarcinogenic Risks

- Soils, Waste Rock, and Tailings: Arsenic and mercury were identified as the primary COPCs for this media. The 90_{UCL} concentrations of arsenic and mercury were used as the EPCs. The HQs did not exceed the regulatory standards of 1.0 for any of the pathways evaluated.

- Air: Inhalation of particulates potentially contaminated with mercury and arsenic was quantified. The HQs for the RME and CTE scenarios for Mercury are negligible ranging from 2E-13 to 3E-14, respectively.

5.3.2 Carcinogenic Risks

- Soils, Waste Rock, and Tailings: The only carcinogenic constituent identified in soils, waste rock and tailings was arsenic. The 90_{UCL} concentration of arsenic was used as the EPC. The Excess Cancer Risk (ECR) did not exceed the regulatory standard of 1E-06 for any pathway of exposure and ranged from 2E-07(RME) to 9E-09 (CTE).

- Air: Inhalation of particulates potentially contaminated with arsenic was quantified. The ECRs for the RME and CTE scenarios are negligible ranging from 7E-10 to 3E-11, respectively.

The risk characterization for potential carcinogenic effects demonstrates that the potential for unacceptable excess cancer risks at the Site is low.

6.0 SUMMARY OF RISKS

Of the fifteen COIs identified at the, only arsenic and mercury were identified as COPCs. These two constituents were quantitatively and qualitatively evaluated in this risk evaluation document. Based on current and future land use, individuals who might come in contact with site related contaminants through recreational activities such as hunting, hiking and camping were the only potential receptors identified. The quantitative risk evaluation determined that the potential for carcinogenic and non-carcinogenic human health impacts from site related contaminants at the Site was low.

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FIGURES

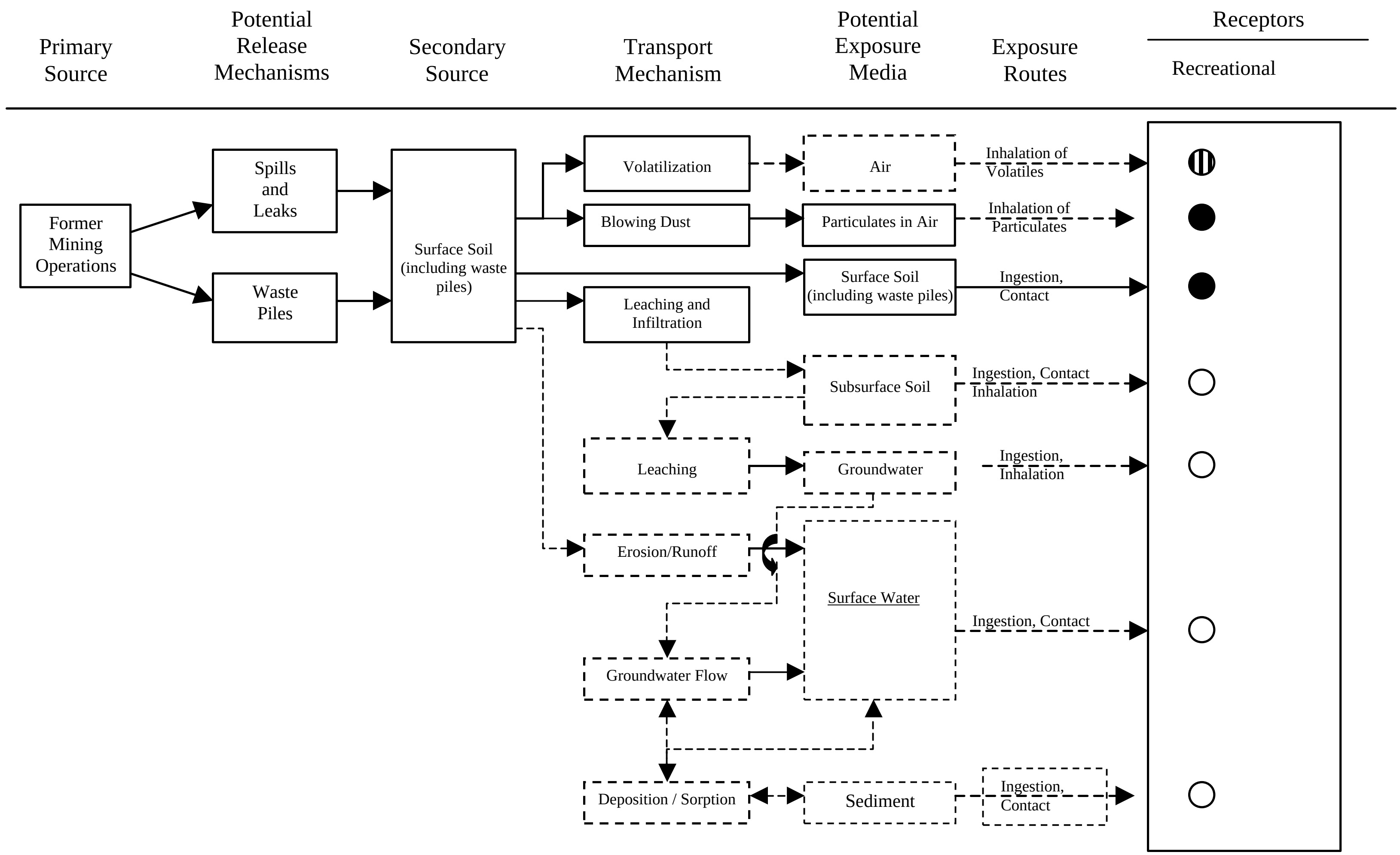

Figure 1. Conceptual Human Health Exposure Model

Legend

Symbol	Meaning
●	Complete and potentially significant exposure
◍	Potentially Complete but insignificant exposure (not to be quantified)
○	Incomplete Exposure (not to be quantified)
– –	Insignificant or Incomplete Pathway or Medium
——	Complete and/or Significant Pathway or Medium

PROJECT NUMBER: 2223035	**ENGINEERING EVALUATION / COST ANALYSIS – ROBA / YORK MINES**
DATE: March 2003	
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ATTACHMENT A

PRESCREENING RESULTS

Table A-1 Chemicals of Interest - Prescreening					
	Units	Nutrient?	Background	Max detected	Retain?
Al	mg/Kg	no	19,300	26,700	YES
Antimony		no	1	3	YES
As	mg/Kg	no	19.4	95	YES
Barium	mg/Kg	no	454	144	no
Be	mg/Kg	no	0.8	1	no
Calcium	mg/kg	YES			no
Cd	mg/Kg	no	2.7	3	YES
Cr	mg/Kg	no	33	84	YES
Cobalt	mg/Kg	no	10.5	21	YES
Cu	mg/Kg	no	75	145	YES
Fe	mg/Kg	no	28,600	137,933	YES
Pb	mg/Kg	no	13.9	446	YES
Magnesium	mg/kg	YES			no
Mn	mg/Kg	no	3740	1,155	no
Hg	mg/Kg	no	9.9	7,300	YES
Ni	mg/Kg	no	30	14,989	YES
Potassium	mg/kg	YES			no
Selenium	mg/Kg	no	33	19	no
Silver	mg/Kg	no	1.2	3	YES
Sodium	mg/kg	YES			no
Thallium	mg/Kg	no	0.9	8	YES
Vanadium	mg/Kg	no	40.5	119	YES
Zn	mg/Kg	no	239	1,050	YES

Table A-2 Chemical Screening   York-Roba Mines

Parameters	CAS #	Cancer/ Noncancer	Exposure Point Concentration Ci	USEPA Region 9 Indust. Soil PRGi	Individual COI Risk Ratio Ri=Ci/PRGi	Considered COI Based on Bi>Ci and Ri>1 or no PRGi	Multiple COIs Ri/RTotal	1/N	Multiple COPC in SOIL
Al	7429-9-0-5	nc	2.7E+04	1.00E+05	2.67E-01	no	6.99E-02	7.14E-02	no
Antimony	7440-36-0	nc	4.4E+00	4.09E+02	1.08E-02	no	2.82E-03	7.14E-02	no
As	7440-38-2	ca	5.4E+00	1.59E+00	3.42E+00	**yes**	8.94E-01	7.14E-02	**yes**
Cd	7440439	nc	1.7E+00	4.51E+02	3.83E-03	no	1.00E-03	7.14E-02	no
Cr	16065831	ca	3.8E+01	1.00E+05	3.77E-04	no	9.86E-05	7.14E-02	no
Cobalt	7440484	nc	2.1E+01	1.92E+03	1.10E-02	no	2.89E-03	7.14E-02	no
Cu	7440508	nc	5.6E+00	4.09E+04	1.36E-04	no	3.56E-05	7.14E-02	no
Fe	7439-89-6	nc	6.9E+02	1.00E+05	6.85E-03	no	1.79E-03	7.14E-02	no
Pb	7439921	nc	1.1E+01	7.50E+02	1.40E-02	no	3.67E-03	7.14E-02	no
Hg	7439-97-6	nc	4.5E+01			**yes**			
Ni	7440020	nc	1.1E+02	2.04E+04	5.57E-03	no	1.46E-03	7.14E-02	no
Silver	7440224	nc	4.4E+00	5.11E+03	8.59E-04	no	2.25E-04	7.14E-02	no
Thallium	7440-28-0	nc	4.4E+00	6.75E+01	6.59E-02	no	1.73E-02	7.14E-02	no
Vanadium	7440-62-2	nc	1.2E+02	7.15E+03	1.66E-02	no	4.35E-03	7.14E-02	no
Zn	7440666	nc	1.4E+01	1.00E+05	1.35E-04	no	3.54E-05	7.14E-02	no

c = carcinogen
nc= noncarcinogen
COI = chemical of interest
mg/kg = milligrams per kilogram
PRG = Preliminary Remediation Goal

Sum of Risk Ratios (RTotal)   3.82E+00
Number of COIs (N)   14

Table A-3 COPCs for the York-Roba Mines

	NO PRG	**Individual**	**Multiple**
Arsenic		x	x
Mercury	x		

ATTACHMENT B

RISK CALCULATIONS

TABLE B -1 SUMMARY OF EXPOSURE FACTORS

	Recreational			
	Child		Adult	
Exposure Factors	**CTE**	**RME**	**CTE**	**RME**
Body Weight (kg)	15	15	70	70
Exposure Frequency (d/yr) soil	13	26	13	26
Exposure Frequency (d/yr) sediment	10	40	10	40
Event time (hrs/event) surface water	2	2	2	2
Event time (hrs/event) soil	2	2	5	5
Event Frequency (events/d)	1	1	1	1
Exposure Duration (yr)	2	6	7	24
Averaging Time (d)				
carcinogens	25550	25550	25550	25550
noncarcinogens	730	2190	2555	8760
Intake Factors				
Ingestion of soil (mg/d)	100	200	50	100
Exposed skin surface area cm2)	6600	7300	18000	22000
Inhalation rate (m3/hr)	2	2.3	2.1	3.9
Dermal absorption factor				
volatile vp> 12000 Pa	0.0005	0.0005	0.0005	0.0005
volatile vp< 12000 Pa	0.03	0.03	0.03	0.03
semivolatiles	0.1	0.1	0.1	0.1
inorganics	0.01	0.01	0.01	0.01
Soil Adherence Factor (mg/cm2-event)	0.08	0.08	0.08	0.08
PEF (mg3/kg)	1.32E+09	1.32E+09	1.32E+09	1.32E+09

TABLE B-2 Critical Toxicity Data for Noncarcinogenic COPCs

Contaminant	CAS Number	Chronic RfD (mg/kg-day) Oral	Chronic RfD (mg/kg-day) Inhalation	Confidence in RfD	Endpoint
Arsenic	7440-38-2	3.00E-04		med	skin/vascular
Mercury	7487-94-7	3.00E-04	8.60E-05	med	neuro

TABLE B-3 Critical Toxicity Data for Carcinogenic COPCs

Contaminant	CAS Number	Slope Factor (mg/kg/day)-1 Oral	Slope Factor (mg/kg/day)-1 Inhalation	Weight of Evidence Classification Ingestion/Inhalation	Type of cancer Ingestion/ Inhalation	Basis of Slope Factor oral/inhalation
Arsenic	7440-38-2	1.5E+00	1.5E+01	**A**[1]	skin	epi studies

TABLE B-4 Exposure Point Concentrations

COPC	N	Maximum	90 UCL	Comments
SOIL (mg/kg)				
Arsenic	19	9.45E+01	5.43E+00	Z_{adj}
Mercury	43	7.30E+03	4.53E+01	Z_{adj}

TABLE B-5 INTAKE CALCULATIONS

SCENARIO	Carcinogen		Noncarcinogen	
	CTE	RME	CTE	RME
Recreational				
	Soil-surface			
Ingestion	7.8E-10	9.7E-09	2.2E-08	8.8E-08
Inhalation of particulates	4.69E-13	1.01E-11	8.65E-12	4.86E-11
Dermal	2.45E-01	1.60E+00	2.45E+00	4.66E+00

TABLE B-6 NonCancer COPCs Calculation of dermal intakes

DERMAL Dasoil			Adherence Factors		DA Values	
CHEMICAL	DAF	CF	Rec -CTE	Rec-RME	Rec-CTE	Rec RME
Arsenic	0.03	0.000001	8.00E-02	3.00E-01	2.40E-09	9.00E-09
Mercury	0.01	0.000001	8.00E-02	3.00E-01	8.00E-10	3.00E-09

TABLE B-7 Cancer COPCs Calculation of dermal intakes

DERMAL Dasoil			Adherence Factors		DA Values	
CHEMICAL	DAF	CF	Rec -CTE	Rec-RME	Rec-CTE	Rec RME
Arsenic	0.03	0.000001	8.00E-02	3.00E-01	2.40E-09	9.00E-09

TABLE B-8 RECREATIONAL SCENARIO --NONCARCINOGENS

Route of Exposure	COPC	EPC mg/kg	Intake mg/kg-d		RFD_o mg/kg/day	RFD_i mg/kg/day	Hazard Quotient	
Soil			CTE	RME			CTE	RME
Ingestion	Arsenic	4.35E+00	2.19E-08	8.76E-08	3.00E-04		3.17E-04	1.27E-03
	Mercury	4.53E+01	2.19E-08	8.76E-08	3.00E-04		3.31E-03	1.32E-02
dermal	Arsenic	4.35E+00	5.89E-09	3.73E-09	3.00E-04		8.53E-05	5.41E-05
	Mercury	4.53E+01	1.96E-09	1.40E-08	3.00E-04		2.96E-04	2.11E-03
Inhalation of particulates	Mercury	3.62E+01	8.65E-12	4.86E-11		8.60E-05	2.7E-14	1.5E-13
						Sum	**4.0E-03**	**1.7E-02**

Where,
COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
RfDo = Oral noncancer reference dose
RfDi = Inhalation noncancer reference dose

TABLE B-9 RECREATIONAL SCENARIO - CARCINOGENS

Route of Exposure	COPC	EPC mg/kg	Intake mg/kg-d		Sfo mg/kg/day	SFi mg/kg/day	EXCESS CANCER RISK	
Soil			CTE	RME			CTE	RME
Ingestion	Arsenic	4.35E+00	7.77E-10	9.69E-09	1.50E+00		5.07E-09	6.32E-08
dermal	Arsenic	4.35E+00	5.89E-10	1.44E-08	1.50E+00		3.84E-09	9.39E-08
Inhalation of particulates	Arsenic	4.35E+00	4.69E-13	1.01E-11		1.50E+01	3.06E-11	6.59E-10
						Sum	**9.E-09**	**2.E-07**

Where,
COPC = Chemical of Potential Concern
EPC = Exposure Point Concentration
RfDo = Oral noncancer reference dose
RfDi = Inhalation noncancer reference dose

Table B-10 Summary of Risks to Recreational Receptor

SCENARIO	Excess Cancer Risk		Hazard Index	
	CTE	RME	CTE	RME
Recreational Scenario	9.E-09	2.E-07	4.E-03	2.E-02

Where,
ECR = Excess Cancer Risk (carcinogens)
HI = Hazard Index (Non-carcinogens)

APPENDIX C.

STREAMLINED ECOLOGICAL RISK EVALUATION

ECOLOGICAL RISK ASSESSMENT

ROBA WESTFALL AND YORK & RANNELLS MINES
Malheur National Forest
Grant County, Oregon

Prepared For

USDA Forest Service
Mahleur National Forest

on behalf of

Cascade Earth Sciences
7150 Supra Drive SW
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March 2003

TAS PROJECT NO: TAS03001

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ACRONYMS

CEEM	conceptual ecological exposure model
CES	Cascade Earth Sciences
COI	chemical of interest
COPEC	chemical of potential ecological concern
ODEQ	Oregon Department of Environmental Quality
ERA	ecological risk assessment
ERBSC	ecological risk-based screening concentration
PA	Preliminary Assessment
PRG	Preliminary Remediation Goals
SI	Site Inspection
SOC	species of concern
T&E	threatened and endangered
TAS	Technical Assessment Services
90_{UCL}	90^{th} percentile upper confidence limit on the arithmetic mean
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

In accordance with Oregon Department of Environmental Quality (ODEQ) guidance (ODEQ, 2001), Technical Assessment Services, Inc. (TAS) has prepared an Ecological Screening Level Risk Assessment (ERA) for the York & Rannells and Roba Westfall Mines (Site) in the Malheur National Forest. The Site is located approximately 23 miles southwest of John Day in Eastern Oregon. This ERA was completed as part of the Engineering Evaluation/Cost Analysis (EECA) being conducted for the Site by Cascade Earth Sciences (CES). The ERA is also generally consistent with national and regional guidance (USEPA 1992, 1997, 1998). The goal of the ERA is to provide an understanding of the potential for ecological risks due to mine-related contamination and to determine whether there is a need for more detailed ecological risk assessment. This report consists of:

- A description of the contaminants of interest (COIs) based on Site uses and data gathered during previous Site investigations;
- A description of the ecology of the Site and potential ecological receptors (including rare, threatened, and endangered species) at or near the Site;
- Presentation of the conceptual ecological exposure model which provides a summary of potential and likely exposure media and pathways;
- Assessment and measurement endpoints
- An assessment of the analytical data used in the ERA;
- An ecological risk-based screening; and
- A risk characterization to assess the potential for significant ecological effects due to Site related COIs.

An ODEQ ecological scoping checklist was completed and is provided in Attachment A.

Problem formulation determines the scope of the ERA and culminates in a conceptual ecological exposure model and assessment endpoints. The assessment endpoints tie the risk assessment results to risk management decisions and present the focus of the remainder of the ERA. The Site analytical data that were used for the ERA are briefly described, and a risk-based screening is conducted, comparing the Site data to ecological risk-based screening concentrations. The results of the risk-based screening are discussed along with the uncertainties inherent in the ERA process, and finally, conclusions and recommendations are provided regarding the potential for ecological risks to be posed by Site-related chemicals and whether further investigation or remediation is warranted for the protection of ecological receptors.

2.0 PROBLEM FORMULATION

The scope of an ERA is defined through the "Problem Formulation" step that describes physical and chemical characteristics of the Site and the important ecological habitats, plants, invertebrates, fish, and wildlife that exist there. This information is utilized to identify the COIs and the ecological receptors of concern, and to develop a conceptual ecological exposure model (CEEM) that depicts the expected fate and transport of chemicals at the Site, the potential exposure media, and likely exposure pathways for ecological receptors of concern. The problem formulation concludes with identification of the ecological endpoints that delineate the focus (i.e., objectives) of the remainder of the ERA. Generally problem formulation includes Site description and summary of previous investigations. Because extensive versions of these have been provided in the engineering evaluation, they are not repeated here.

2.1 Ecological Stressors

Ecological receptors may be affected through exposure to chemicals (i.e., toxicity), physical (i.e., destruction of habitat), and biological (i.e., viruses and bacteria) stressors. While biological stressors may affect ecological receptors, they are more frequently associated with waste food or human waste and in areas where wildlife congregate in large numbers. Because the remote nature of the Site limits the human presence at the Site, waste food and human wastes do not pose a threat to ecological receptors. Ecological receptors are also unlikely to congregate in the vicinity of the Site in numbers that could result in significant biological infection or passage of wildlife diseases because of the lack of suitable habitat. Thus, biological stressors are unlikely to be a significant factor at this Site and are not considered further.

Past physical disturbances include the development of the mines and supporting buildings, and mining activities. Evidence of past mining activity is more apparent at the York & Rannells Mine as very little equipment remains at the Roba Westfall Mine. Because the mines have been abandoned, current physical disturbance is limited to consistent low volume automobile traffic on Forest Road 42 (FR42), an occasional automobile that is driven through the Site on gravel roads, and possibly a rare recreational walk-through by persons interested in the old mining Sites. Given the relatively remote nature of the Site within Malheur National Forest, the ecological impacts of current physical disturbances are limited.

Given the Site includes two mines, the primary chemicals of interest are metals. Based on preliminary screening using the Oregon DEQs benchmark screening values, thirteen metals were identified as Chemicals of Potential Ecological Concern (COPECs). These metals are: aluminum, arsenic, barium, chromium (total), cobalt, iron, lead, magnesium, mercury, nickel, thallium, vanadium, and zinc.

2.2 Ecological Setting

The regional, Site-specific ecology, sensitive environments, and threatened and endangered species likely to inhabit the area are described in the main portion of the EECA document and are not repeated in this report. Other than threatened and endangered species that must be considered on an individual level, a particular species must be potentially present on or utilize the Site in numbers adequate to allow an exposure level that may result in effects to the species' population. Such significant exposure to Site-related contaminants of ecological interest will only occur for those species known or likely to use the contaminated areas on a regular basis and in high numbers.

2.3 Conceptual Ecological Exposure Model

The conceptual ecological exposure model depicts the sources of contamination, contaminant release and transport mechanisms, impacted exposure media, and exposure routes for ecological receptor types at the Site. The primary source of COIs are the mines. However, chemicals may also have been used to extract metals from the ore. The COIs were brought to the surface via mining. The mine waste was placed in large piles and to some extent, spread across the Site. Once in waste piles or spilled onto surface soils, rain and melting snowfall may have resulted in leaching of the COIs to subsurface soil. Finally, some metals may bioaccumulate in plant or animal tissues and then be transported up the food chain.

Based on previous investigations and current understanding of Site conditions, the potentially contaminated exposure media for ecological receptors only includes: waste piles and surface soil in the vicinity of the mines.

Given the limited area of the Site compared to the abundance of high quality surrounding habitat, it is unlikely that terrestrial ecological receptors will be affected at the population level. An overview of the potential and significant COI transport pathways and likely fate, potential exposure media, and significantly exposed ecological receptor types are depicted graphically in Figure 1.

2.4 Ecological Endpoints

Ecological endpoints represent the characteristics of the Site ecology that may be adversely affected by Site-related chemicals and therefore, require evaluation in the ERA. Regulatory guidance suggests two types of endpoints: assessment and measurement (USEPA 1998). Assessment endpoints are qualitative or quantitative expressions of the environmental values to be protected and, therefore, assessed in the ERA. As such, assessment endpoints link the ecological risk assessment and risk management processes by highlighting ecological aspects that are of concern to risk managers. Measurement endpoints are characteristics of the Site, selected ecological receptors, or ecosystem that are measured through monitoring or sampling activities, and then related qualitatively or quantitatively to the selected assessment endpoint(s).

2.4.1 Assessment Endpoints

Within a screening level ERA, assessment endpoints are generalized to reflect the risk-based screening process and protective ecological risk-based screening concentrations (ERBSCs). The assessment endpoints for this ERA only includes: the protection of protected and non-protected plants, invertebrates, birds, and mammals from adverse effects due to COIs in soil and waste piles at the Site.

2.4.2 Measurement Endpoints

Measurement endpoints are used to evaluate the response of the indicator communities/species when exposed to a stressor (USEPA 1998). Generally, they are measurable ecological characteristics and define what samples and/or data will be collected to address the assessment endpoints. For this ERA, the measurement endpoints are comprised of the following:

- Measured concentrations of COIs in soil, waste piles, surface water, and sediment; and
- Readily available ecological risk-based screening concentrations (ERBSCs) available from ODEQ guidance or readily available in published literature.

3.0 RISK ASSESSMENT DATA

The data to be used in the ecological risk-based screening are from soil and waste piles collected during the preliminary assessment (CES, 2001) and the EECA investigation. These samples were analyzed primarily for metals, pH, and acid generation potential. Standard laboratory quality control procedures were used and analytical results were quality assured by the laboratory. The analytical data are considered good quality and useable for the ERA.

Overall, the data were collected from locations that are likely to overestimate the concentrations found within potential ecological exposure areas because samples were located to represent the areas of highest COI concentrations. Soil and waste pile sampling locations are likely to well represent concentrations of COIs at the Site.

4.0 ECOLOGICAL RISK-BASED SCREENING

Ecological risk-based screening begins with a list of COIs in the media of concern. Then an initial screening of the COIs is conducted, removing chemicals from further consideration if they are essential elements, have a frequency of detection less than 5 percent, or a concentration less than background concentrations (for metals). This initial screening is followed by an ecological risk-based screening with consideration of exposure to multiple media.

4.1 Initial Screening

4.1.1 Essential Nutrient Screening

None of the COIs were essential nutrients. Therefore, all COIs were retained for further screening.

4.1.2 Frequency of Detection Screening

Generally COIs detected in less than 5% of the samples can be eliminated from further consideration; however, none of the COIs were eliminated on the basis of frequency of detection.

4.1.3 Background Concentration Screening

Background screening is allowed only for inorganic chemicals. With the exception of aluminum and zinc, background concentrations of COIs in soil were determined in 9 samples collected during the PA and EECA. Maximum concentrations of all constituents were used to determine background values. One-half the analytical reporting limit was used in these calculations when a particular result was listed as not detected. Those COIs with maximum concentrations exceeding background concentrations in these media are shown in Table 1

4.1.4 Analytical Reporting Limit Screening

The maximum reporting limit of each COI was compared to its lowest respective medium-specific ERBSC listed in Table 1. If the maximum reporting limit was greater than the lowest ERBSC, then that COI was included for further consideration.

Tables 1 provide a summary of the initial screening procedures and lists the COIs that were retained for further assessment. Antimony, beryllium, cadmium, copper, manganese, selenium and silver were screened from further assessment in surface soil and waste piles.

4.2 Risk-Based Screening

Ecological risk-based screening includes defining exposure point concentrations (EPCs) for each COI in each potential exposure medium, and comparing them to selected ERBSC. The result is a list of Site-related chemicals with the potential to pose risks to ecological receptors at the Site.

4.2.1 Ecological Risk-Based Screening Concentrations

Generally, the ERBSCs used in the risk-based screening were screening level values (SLVs) provided by the ODEQ (ODEQ, 2001) except for those metals for which Site-specific background concentrations were calculated. Because screening values were lower than background concentrations, the arithmetic average or 90_{UCL} background concentration, whichever was higher, was substituted as the screening value.

4.2.2 Exposure Point Concentrations

The maximum detected concentrations in soil and waste were used in the risk-based screening for terrestrial plants, terrestrial invertebrates, and benthic invertebrates. For other receptors the lower of the 90_{UCL} or maximum concentrations were calculated. One-half the analytical reporting limit was used in these calculations when a particular result was listed as not detected. These exposure point concentrations (EPCs) are shown in Table 2.

4.2.3 Ecological Risk-Based Screening

The EPCs were compared to the ERBSCs to calculate chemical-specific risk ratios (R_{ij}), the analytical reporting limits were checked for adequacy, and each COI was examined to determine whether it contributed an inordinate amount to the overall risk (R_j; the sum of the chemical-specific risk ratios). The results of the ecological risk-based screening are presented in Tables 3. Risk ratios or overall risk greater than 1.5 indicates a potential risk for protected (i.e., federally threatened or endangered) and benthic ecological receptors, while the risk ratio must be 5.5 or greater to indicate a potential risk for non-protected receptors. The COIs for which potential ecological risks are indicated become the chemicals of potential ecological concern (COPECs) for the Site. The predicted risks for these COPECs are discussed further in the risk characterization section to determine whether additional ecological assessment or remedial action seems warranted at the Site.

5.0 RISK CHARACTERIZATION

Risk characterization includes risk description and uncertainty analysis. Risk description involves examining the predicted risks to determine whether they are likely, or artifacts of the risk assessment process. The uncertainty analysis lists the common uncertainties associated with ecological risk-based screening and assesses whether they are likely to over- or underestimate the potential for ecological risks to be realized at the Site.

5.1 Risk Description

As noted above arsenic, chromium, lead, mercury and nickel were calculated to be COPECs for the Site. The risk ratios for arsenic, chromium, and lead exceeded acceptable levels for protected bird species only. Acceptable risk ratios for all nonprotected ecological receptors and protected birds and mammals (the Bald Eagle and Canadian Lynx) were exceeded for mercury and nickel. Since sampling occurred in areas of expected highest concentrations, including waste piles, the resulting EPCs calculated for the site represent conservative high-end estimates. Due to the disturbed nature of the Site, lack of abundant food sources, the proximity of more suitable habitat, and the large range of these species, Site use by the Bald Eagle and Canadian lynx are expected to be minimal.

5.2 Uncertainty Analysis

The primary uncertainties associated with this ecological risk-based screening and their impact on the prediction of the potential for ecological risks are discussed below. This information is combined with that provided above in the risk description section to provide conclusions and recommendations regarding ecological risks and the need for further investigation.

Overall, the data used in this ERA conservatively represent the important areas of exposure. Thus, the predicted risks likely overestimate actual risks at the Site.

The use of maximum detected concentration or 90_{UCL} as the EPC is a conservative approach that is purposefully designed to result in some overestimation of the potential for ecological risks. Because of this, the risks predicted in Table 3 are likely to overestimate actual ecological risks at the Site.

The use of a bioaccumulation screening is a conservative measure used to assess the potential for risks posed to upper trophic level ecological receptors when appropriate ERBSCS are missing.

Within this ERA, predictions are made regarding the significance of ecological exposures under current conditions at the Site. Overall, the risk-based screening is designed to overestimate the potential for ecological risks.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The highest concentrations of COPECs in soils are located in the vicinity of former ore handling and refining areas, and in the waste piles at the Site. It is likely that plants and invertebrates may be at risk within these localized areas. However, while the plants and invertebrates within these localized areas may be at risk, their populations are unlikely to be significantly impacted within the vicinity of the mine because of the localized and small exposure areas. In addition, the habitat lost due to any effects on plants is also unlikely to result in significant effects to upper trophic level species (i.e. birds and mammals) due to the large amount of relatively undisturbed habitats available surrounding the mines.

Risks due to COPECs in soil and waste piles were also predicted for birds and mammals. Population level effects could only occur for these species if the receptors were to forage predominantly at the site. This is unlikely given the readily available uncontaminated habitat surrounding the Site. Risks are unlikely for the protected lynx and bald eagle because of its very large home range, and the resulting minimal exposure to COPECs at the site. Given the conservative nature of the EPCs and taking into account feeding range and regional ecology, use of the soil ERBSCs as preliminary remediation goals (PRGs) would be overly protective. Therefore, other PRGs such as protective human health risk-based PRGs or technology/ feasibility-based concentrations that would result in lower COPEC concentrations in surface soil or waste piles are acceptable and will further decrease the potential for risks to terrestrial ecological receptors.

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FIGURES

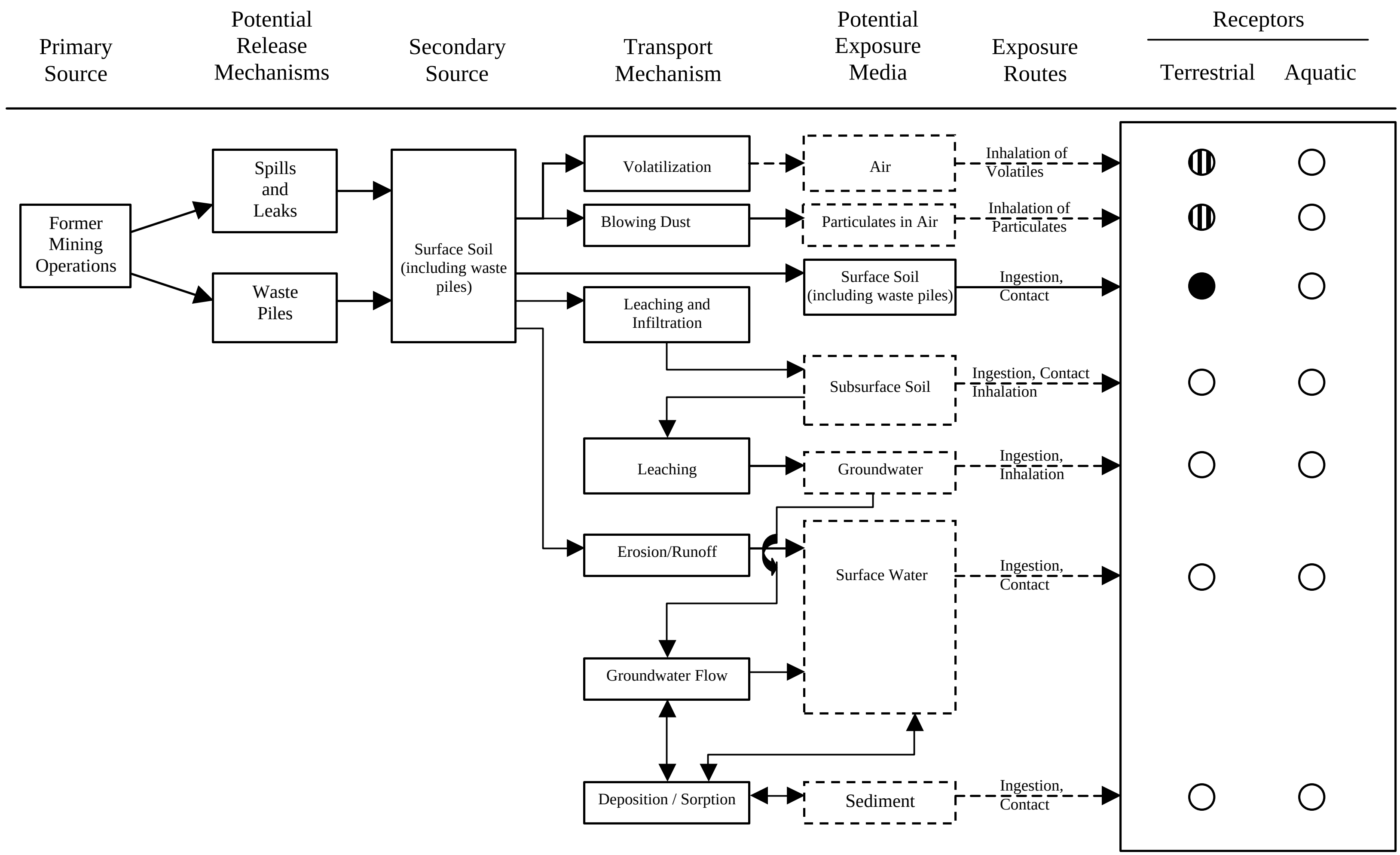

Figure 1. Conceptual Ecological Exposure Model

Legend

- ● Complete and potentially significant exposure
- ◍ Potentially Complete but insignificant exposure (not to be quantified)
- ○ Incomplete Exposure (not to be quantified)
- - - Insignificant or Incomplete Pathway or Medium
- —— Complete and/or Significant Pathway or Medium

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TABLES

Table 1 COI Prescreening
Roba Westfall - York Rannells Mines

Chemical Of Interest	Number of Analyses	Number of Detections	Frequency of Detection	Minimum Detected Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)	90% Upper Confidence Limit (mg/kg)	Exposure Point Concentration (mg/kg)	Minimum Reporting Limit (mg/kg)	Maximum Reporting Limit (mg/kg)
Metals									
Aluminum	2	2	100%	2.52E+04	2.67E+04		2.67E+04	NA	NA
Antimony	19	15	79%	1.00E-01	2.67E+00	9.7E-01	9.66E-01	NA	NA
Arsenic	19	19	100%	2.00E+00	9.45E+01	2.1E+01	2.06E+01	NA	NA
Barium	2	2	100%	9.99E+01	1.44E+02		1.44E+02	NA	NA
Beryllium	19	13	68%	2.20E-01	8.00E-01	5.2E-01	5.21E-01	NA	NA
Cadmium	19	19	100%	4.00E-01	3.20E+00	1.7E+00	1.73E+00	NA	NA
Chromium (total)	19	19	100%	1.60E+01	8.40E+01	3.8E+01	3.77E+01	NA	NA
Cobalt	2	2	100%	1.97E+01	2.12E+01		2.12E+01	NA	NA
Copper	19	19	100%	4.30E+01	1.45E+02	7.1E+01	7.13E+01	NA	NA
Iron	34	34	100%	2.06E+04	1.38E+05	4.2E+04	4.23E+04	NA	NA
Lead	21	12	57%	2.50E-01	4.46E+02	9.6E+01	9.56E+01	NA	NA
Magnesium	2	2	100%	9.93E+03	1.32E+04		1.32E+04	NA	NA
Manganese	2	2	100%	1.11E+03	1.20E+03		1.20E+03	NA	NA
Mercury	43	43	100%	1.10E-01	7.30E+03	1.2E+03	1.16E+03	NA	NA
Nickel	27	27	100%	1.70E+01	1.50E+04	2.1E+03	2.09E+03	NA	NA
Selenium	19	18	95%	2.00E-01	1.90E+01	3.2E+00	3.20E+00	NA	NA
Silver	19	9	47%	3.00E-01	2.50E+00	8.8E-01	8.78E-01	NA	NA
Thallium	19	17	89%	1.00E-01	7.66E+00	1.5E+00	1.53E+00	NA	NA
Vanadium	2	2	100%	1.10E+02	1.19E+02		1.19E+02	NA	NA
Zinc	24	24	100%	6.60E+01	1.05E+03	2.7E+02	2.67E+02	NA	NA

Notes:
kg = kilograms
L = liters
mg = milligrams

Table 1 COI Prescreening
Roba Westfall - York Rannells Mines

Chemical Of Interest	Minimum Soil Ecological Risk-Based Screening Concentration (mg/kg)	Background Concentration (mg/kg)	Exceeds 5% Frequency of Detection?	Exceeds Background?	Maximum Detection Limit Too High?	Include in Risk-Based Screening?
Metals						
Aluminum	5.00E+01	19300	Yes	**Yes**	No	**Yes**
Antimony	5.00E+00	0.5	Yes	**Yes**	No	No
Arsenic	1.00E+01	19.4	Yes	**Yes**	No	**Yes**
Barium	8.50E+01	454	Yes	No	No	No
Beryllium	1.00E+01	0.8	Yes	No	No	No
Cadmium	4.00E+00	2.7	Yes	No	No	No
Chromium (total)	4.00E-01	33	Yes	**Yes**	No	**Yes**
Cobalt		10.5	Yes	**Yes**		**Yes**
Copper	5.00E+01	75	Yes	No	No	No
Iron	1.00E+01	28600	Yes	**Yes**	No	**Yes**
Lead	1.60E+01	13.9	Yes	**Yes**	No	**Yes**
Magnesium		1150	Yes	**Yes**		**Yes**
Manganese	1.00E+02	3740	Yes	No	No	No
Mercury	1.00E-01	54	Yes	**Yes**	No	**Yes**
Nickel	3.00E+01	30	Yes	**Yes**	No	**Yes**
Selenium	1.00E+00	33	Yes	No	No	No
Silver	2.00E+00	1.2	Yes	No	No	No
Thallium	1.00E+00	0.9	Yes	**Yes**	No	**Yes**
Vanadium	2.00E+00	40.5	Yes	**Yes**	No	**Yes**
Zinc	5.00E+01	160.4735903	Yes	**Yes**	No	**Yes**

Notes:
kg = kilograms
L = liters
mg = milligrams

TABLE 2
Exposure Point Concentration
Roba Westfall - York Rannells Mines

Chemical of Interest	Maximum Detected Surface Soil Concentration (mg/Kg)	90UCL Surface Soil Concentration (mg/kg)	Surface Soil Exposure Point Concentration (mg/kg)
Metals			
Aluminum	2.67E+04		2.67E+04
Antimony	NOT A COPEC	NOT A COPEC	NOT A COPEC
Arsenic	9.45E+01	9.3E+00	9.28E+00
Barium	1.44E+02		1.44E+02
Beryllium	NOT A COPEC	NOT A COPEC	NOT A COPEC
Cadmium	NOT A COPEC	NOT A COPEC	NOT A COPEC
Chromium (total)	8.40E+01	3.8E+01	3.77E+01
Cobalt	2.12E+01		2.12E+01
Copper	NOT A COPEC	NOT A COPEC	NOT A COPEC
Iron	1.38E+05	7.4E+02	7.41E+02
Lead	4.46E+02	1.2E+01	1.18E+01
Magnesium	1.32E+04		1.32E+04
Manganese	NOT A COPEC	NOT A COPEC	NOT A COPEC
Mercury	7.30E+03	4.87E+01	4.87E+01
Nickel	1.50E+04	2.7E+02	2.66E+02
Selenium	NOT A COPEC	NOT A COPEC	NOT A COPEC
Silver	NOT A COPEC	NOT A COPEC	NOT A COPEC
Thallium	7.66E+00	4.7E+00	4.68E+00
Vanadium	1.19E+02		1.19E+02
Zinc	1.05E+03	3.0E+01	2.98E+01

Notes:
kg = kilograms
L = liters
mg = milligrams

TABLE 3 Ecological Risk Based Screening
Roba Westfall - York Rannells Mines

Chemical of Interest (COI) (a)	Maximum Detected Concentration (mg/kg)	Soil Exposure Point Concentration (mg/kg)	Maximum Sample Reporting Limit (mg/kg)	Freshwater Risk-Based Screening Value for Plants (mg/kg)	Freshwater Risk-Based Screening Value for Invertebrates (mg/kg)	Freshwater Risk-Based Screening Value for Birds (mg/kg)	Freshwater Risk-Based Screening Value for Mammals (mg/kg)	Risk Ratio for Plants (Rij) (b)	Risk Ratio for Invertebrates (Rij) (b)	Risk Ratio for Birds (Rij) (b)	Risk Ratio for Mammals (Rij) (b)	Bioaccumulator? (c)
Metals												
Aluminum	2.67E+04	2.67E+04	Not applicable	19300.00	19300.00	19300.00	19300.00	1.38	1.38	1.38	1.38	No
Arsenic	9.45E+01	2.06E+01	Not applicable	10.00	60.00	10.00	29.00	2.06	0.34	2.06	0.71	Not Required
Barium	1.44E+02	1.44E+02	Not applicable	500.00	3000.00	454.00	638.00	0.29	0.05	0.32	0.23	Not Required
Chromium	8.40E+01	3.8E+01	Not applicable	20.10	20.10	20.10	410.00	1.87	1.87	1.87	0.09	No
Cobalt	2.12E+01	2.1E+01	Not applicable	20.00	1000.00	No Data	150.00	1.06	0.02		0.14	not required
Iron	1.38E+05	4.2E+04	Not applicable	27300.00	27300.00	No Data	No Data	1.55	1.55			not required
Lead	4.46E+02	9.6E+01	Not applicable	50.00	500.00	16.00	4000.00	1.91	0.19	5.98	0.02	**yes**
Magnesium	1.32E+04	1.3E+04	Not applicable	No Data	No Data	No Data	No Data					not required
Mercury	7.30E+03	1.2E+03	Not applicable	9.90	9.90	9.90	73.00	117.17	117.17	117.17	15.89	**yes**
Nickel	1.50E+04	2.1E+03	Not Applicable	30.00	200.00	320.00	625.00	69.83	10.47	6.55	3.35	Not Required
Thallium	7.66E+00	1.5E+00	Not applicable	1.00	1.00	1.00	1.00	1.53	1.53		1.53	Not Required
Vanadium	1.19E+02	1.2E+02	Not applicable	2.00	No Data	47.00	25.00	0.77		0.03	0.06	No
Zinc	1.05E+03	2.7E+02	Not Applicable	141.00	200.00	141.00	20000.00	0.84	0.60	0.84	0.01	Not Required

Plants	Invertebrates	Birds	Mammals	
2.E+02	1.E+02	1.E+02	2.E+01	:Sum of Rij (Rj)
1.1E+01	1.0E+01	8.0E+00	1.0E+01	:Number of COIs (Nij)
9.09E-02	1.00E-01	1.25E-01	1.00E-01	:1/Nij

Notes:
L = liters
mg = milligrams
Unknown = Chemical was detected, but no screening criteria are available.
Bold indicates chemicals of potential concern that may require further assessment at the site.

(a) Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
(b) The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
(c) As listed in the Draft Sediment Evaluation Guidance (ODEQ, 2002). Bioaccumulation screening not required when a bird and mammal screening value are available.

(d) The COI is considered a COPEC if:
1) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected)
2) The Chemical of Interest is a bioaccumulator
3) No SLV or bioaccumulation vaule is available.
4) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

TABLE 3 Ecological Risk Based Screening
Roba Westfall - York Rannells Mines

Chemical of Interest (COI) (a)	Risks Posed to Non-Protected Plants (Rij>5) (d)	Risks Posed to Non-Protected Invertebrates (Rij>5) (d)	Risks Posed to Protected Birds (Rij>1) (d)	Risks Posed to Non-Protected Birds (Rij>5) (d)	Risks Posed to Protected Mammals (Rij>1) (d)	Risks Posed to Non-Protected Mammals (Rij>5) (d)
Metals						
Aluminum	No	No	No	No	No	No
Arsenic	No	No	**Yes**	No	No	No
Barium	No	No	No	No	No	No
Chromium	No	No	**Yes**	No	No	No
Cobalt	No	No	No	No	No	No
Iron	No	No	No	No	No	No
Lead	No	No	**Yes**	No	No	No
Magnesium	Not Calculated	Not Calculated	No	No	No	No
Mercury	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Nickel	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No
Thallium	No	No	No	No	**Yes**	No
Vanadium	No	Not Calculated	No	No	No	No
Zinc	No	No	No	No	No	No

Notes:
L = liters
mg = milligrams
Unknown = Chemical was detected, but no screening criteria are available.
Bold indicates chemicals of potential concern that may require further assessment at the site.

(a) Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
(b) The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
(c) As listed in the Draft Sediment Evaluation Guidance (ODEQ, 2002 Bioaccumulation screening not required when a bird and mammal screening value are available.

(d) The COI is considered a COPEC if:
1) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected)
2) The Chemical of Interest is a bioaccumulator
3) No SLV or bioaccumulation vaule is available.
4) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

TABLE 3 Ecological Risk Based Screening
Roba Westfall - York Rannells Mines

Chemical of Interest (COI) (a)	Risks Posed to Protected Species Due to Multiple Contaminants (Rij/Rj > 1/Nij)		Risks Posed to Non-Protected Species Due to Multiple Contaminants $(R_{ij}/R_j > 5/N_{ij})$				Risks Posed to Protected Species		Risks Posed to Non-Protected Species			
	Birds	**Mammals**	**Plants**	**Invertebrates**	**Birds**	**Mammals**	**Birds**	**Mammals**	**Plants**	**Invertebrates**	**Birds**	**Mammals**
Metals												
Aluminum	No	No	No	No	No	No	No	No	No	No	No	No
Arsenic	No	No	No	No	No	No	**Yes**	No	No	No	No	No
Barium	No	No	No	No	No	No	No	No	No	No	No	No
Chromium	No	No	No	No	No	No	**Yes**	No	No	No	No	No
Cobalt	No	No	No	No	No	No	No	No	No	No	No	No
Iron	No	No	No	No	No	No	No	No	No	No	No	No
Lead	No	No	No	No	No	No	**Yes**	No	No	No	No	No
Magnesium	No	No	No	No	No	No	No	No	Unknown	Unknown	No	No
Mercury	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Nickel	No	**Yes**	No	No	No	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No
Thallium	No	No	No	No	No	No	No	**Yes**	No	No	No	No
Vanadium	No	No	No	No	No	No	No	No	No	Unknown	No	No
Zinc	No	No	No	No	No	No	No	No	No	No	No	No

Notes:
L = liters
mg = milligrams
Unknown = Chemical was detected, but no screening criteria are available.
Bold indicates chemicals of potential concern that may require further assessment at the site.

(a) Chemicals remaining following the frequency of detection, essential nutrient, and background concentrations screening procedures.
(b) The risk ratio is the exposure point concentration divided by the Screening Level Values (SLV).
(c) As listed in the Draft Sediment Evaluation Guidance (ODEQ, 2002). Bioaccumulation screening not required when a bird and mammal screening value are available.

(d) The COI is considered a COPEC if:
1) The risk ratio (Rij) is greater than 5 (non-protected) or 1 (protected)
2) The Chemical of Interest is a bioaccumulator
3) No SLV or bioaccumulation vaule is available.
4) Not Calculated = Risk was not calculated for analytes with no screening criteria or bioaccumulation data.

ATTACHMENT A

ECOLOGICAL SCOPING CHECKLIST

Ecological Scoping Checklist

Site Name	York / Roba Mines
Date of Site Visit	October 23, 2002
Site Location	Grant County, Oregon
Site Visit Conducted by	Dustin G. Wasley

Part ❶

CONTAMINANTS OF INTEREST **Types, Classes, Or Specific Hazardous Substances‡** **Known Or Suspected**	**On-site**	**Adjacent to or in locality of the facility†**
Mining related metals	Yes	Yes

‡ As defined by OAR 340-122-115(34) † As defined by OAR 340-122-115(38)

Part ❷

OBSERVED IMPACTS ASSOCIATED WITH THE SITE	**Finding**
Onsite vegetation (**N**one, **L**imited, **E**xtensive)	L
Vegetation in the locality of the Site (**N**one, **L**imited, **E**xtensive)	L
Onsite wildlife such as macroinvertebrates, reptiles, amphibians, birds, mammals, other (**N**one, **L**imited, **E**xtensive)	L
Wildlife such as macroinvertebrates, reptiles, amphibians, birds, mammals, other in the locality of the Site (**N**one, **L**imited, **E**xtensive)	L
Other readily observable impacts (**N**one, **D**iscuss below)	D

Discussion:

The on-site vegetation is limited on mining waste piles and in some areas of the site, primarily adjacent to mining process buildings.

Ecological Scoping Checklist (cont’d)
Part ❸

SPECIFIC EVALUATION OF ECOLOGICAL RECEPTORS / HABITAT	Finding
Terrestrial – Wooded	
Percentage of Site that is wooded	40
Dominant vegetation type (**E**vergreen, **D**eciduous, **M**ixed)	E
Prominent tree size at breast height, i.e., four feet (<6”, 6” to 12”, >12”)	6” to 12”
Evidence / observation of wildlife (**Ma**croinvertebrates, **R**eptiles, **A**mphibians, **B**irds, **M**ammals, **O**ther)	B, M
Terrestrial – Natural Scrub/Shrub/Grasses	
Percentage of Site that is scrub/shrub/Grass	25
Dominant vegetation type (**Sc**rub, **Sh**rub, **G**rasses, **O**ther)	G, Sh
Prominent height of vegetation (<2’, 2’ to 5’, >5’)	<2’
Density of vegetation (**D**ense, **P**atchy, **S**parse)	S
Evidence / observation of wildlife (**Ma**croinvertebrates, **R**eptiles, **A**mphibians, **B**irds, **M**ammals, **O**ther)	B, M
Terrestrial – Ruderal	
Percentage of Site that is ruderal	30
Dominant vegetation type (**L**andscaped, **A**griculture, **B**are ground)	B
Prominent height of vegetation (0’, >0’ to <2’, 2’ to 5’, >5’)	<2’
Density of vegetation (**D**ense, **P**atchy, **S**parse)	P
Evidence / observation of wildlife (**Ma**croinvertebrates, **R**eptiles, **A**mphibians, **B**irds, **M**ammals, **O**ther)	B, M
Aquatic – Non-flowing (lentic)	
Percentage of Site that is covered by lakes or ponds	0
Type of water bodies (**L**akes, **P**onds, **V**ernal pools, **I**mpoundments, **Lag**oon, **R**eservoir, **C**anal)	NA
Size (acres), average depth (feet), trophic status of water bodies	NA
Source water (**R**iver, **St**ream, **G**roundwater, **I**ndustrial discharge, **Su**rface water runoff)	NA
Water discharge point (**N**one, **R**iver, **St**ream, **G**roundwater, **W**etlands impoundment)	NA
Nature of bottom (**M**uddy, **R**ocky, **S**and, **C**oncrete, **O**ther)	NA
Vegetation present (**S**ubmerged, **E**mergent, **F**loating)	NA
Obvious wetlands present (**Y**es / **N**o)	NA
Evidence / observation of wildlife (**M**acroinvertebrates, **R**eptiles, **A**mphibians, **B**irds, **M**ammals, **O**ther)	NA

Aquatic - Flowing (lotic)	
Percentage of Site that is covered by rivers, streams (brooks, creeks), intermittent streams, dry wash, arroyo, ditches, or channel waterway	NA
Type of water bodies (**R**ivers, **St**reams, **I**ntermittent Streams, Dry **W**ash, **A**rroyo, **D**itches, **C**hannel waterway)	NA
Size (acres), average depth (feet), approximate flow rate (cfs) of water bodies	NA
Bank environment (cover: **V**egetated, **B**are / slope: **S**teep, **G**radual / height (in feet))	NA
Source water (**R**iver, **St**ream, **G**roundwater, **I**ndustrial discharge, **Su**rface water runoff)	NA
Tidal influence (**Y**es / **N**o)	NA
Water discharge point (**N**one, **R**iver, **St**ream, **G**roundwater, **W**etlands impoundment)	NA
Nature of bottom (**M**uddy, **R**ocky, **S**and, **C**oncrete, **O**ther)	NA
Vegetation present (**S**ubmerged, **E**mergent, **F**loating)	NA
Obvious wetlands present (**Y**es / **N**o)	NA
Evidence / observation of wildlife (**Ma**croinvertebrates, **R**eptiles, **A**mphibians, **B**irds, **M**ammals, **F**ish, **O**ther)	NA
Aquatic – Wetlands	
Obvious or designated wetlands present (**Y**es / **N**o)	NA
Wetlands suspected at Site is/has (**A**djacent to water body, in **F**loodplain, **S**tanding water, **D**ark wet soils, **M**ud cracks, **D**ebris line, **W**ater marks)	NA
Vegetation present (**S**ubmerged, **E**mergent, **Sc**rub/shrub, **W**ooded)	NA
Size (acres) and depth (feet) of suspected wetlands	NA
Source water (**R**iver, **St**ream, **G**roundwater, **I**ndustrial discharge, **Su**rface water runoff)	NA
Water discharge point (**N**one, **R**iver, **St**ream, **G**roundwater, **I**mpoundment)	NA
Tidal influence (**Y**es / **N**o)	NA
Evidence / observation of wildlife (**Ma**croinvertebrates, **R**eptiles, **A**mphibians, **B**irds, **M**ammals, **O**ther)	NA

Part ❹

ECOLOGICALLY IMPORTANT SPECIES / HABITATS OBSERVED
None

ATTACHMENT 1
Evaluation of Receptor-Pathway Interactions

EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS	Y	N	U
Are hazardous substances present or potentially present in surface waters? **AND** **Are ecologically important species or habitats present?** **AND** **Could hazardous substances reach these receptors via surface water?**		X X X	
When answering the above questions, consider the following: • Known or suspected presence of hazardous substances in surface waters. • Ability of hazardous substances to migrate to surface waters. • Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters. Aquatic receptors may be exposed through osmotic exchange, respiration or ventilation of surface waters. • Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters. • Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.			
Are hazardous substances present or potentially present in groundwater? **AND** **Are ecologically important species or habitats present?** **AND** **Could hazardous substances reach these receptors via groundwater?**		X X X	
When answering the above questions, consider the following: • Known or suspected presence of hazardous substances in groundwater. • Ability of hazardous substances to migrate to groundwater. • Potential for hazardous substances to migrate via groundwater and discharge into habitats and/or surface waters. • Contaminants may be taken-up by terrestrial and rooted aquatic plants whose roots are in contact with groundwater present within the root zone (~1m depth). • Terrestrial wildlife receptors generally will not contact groundwater unless it is discharged to the surface.			

“Y” = yes; “N” = No, “U” = Unknown (counts as a “Y”)

ATTACHMENT 1
Evaluation of Receptor-Pathway Interactions (cont'd)

EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS	Y	N	U
Are hazardous substances present or potentially present in sediments? **AND** **Are ecologically important species or habitats present?** **AND** **Could hazardous substances reach these receptors via contact with sediments?**		X X X	
When answering the above questions, consider the following: • Known or suspected presence of hazardous substances in sediment. • Ability of hazardous substances to leach or erode from surface soils and be carried into sediment via surface runoff. • Potential for contaminated groundwater to upwell through, and deposit contaminants in, sediments. • If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods. Aquatic receptors may be directly exposed to sediments or may be exposed through osmotic exchange, respiration or ventilation of sediment pore waters. • Terrestrial plants may be exposed to sediment in an area that is only periodically inundated with water. • If sediments are present in an area that is only periodically inundated with water, terrestrial species may have direct access to sediments for the purposes of incidental ingestion. Aquatic receptors may regularly or incidentally ingest sediment while foraging.			
Are hazardous substances present or potentially present in prey or food items of ecologically important receptors? **AND** **Are ecologically important species or habitats present?** **AND** **Could hazardous substances reach these receptors via consumption of food items?**	 X		X X
When answering the above questions, consider the following: • Higher trophic level terrestrial and aquatic consumers and predators may be exposed through consumption of contaminated food sources. • In general, organic contaminants with log K_{ow} > 3.5 may accumulate in terrestrial mammals and those with a log K_{ow} > 5 may accumulate in aquatic vertebrates.			

"Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

ATTACHMENT 1
Evaluation of Receptor-Pathway Interactions (cont'd)

EVALUATION OF RECEPTOR-PATHWAY INTERACTIONS	Y	N	U
Are hazardous substances present or potentially present in surficial soils? **AND** **Are ecologically important species or habitats present?** **AND** **Could hazardous substances reach these receptors via incidental ingestion of or dermal contact with surficial soils?**	X X X		
When answering the above questions, consider the following: • Known or suspected presence of hazardous substances in surficial (~1m depth) soils. • Ability of hazardous substances to migrate to surficial soils. • Significant exposure via dermal contact would generally be limited to organic contaminants that are lipophilic and can cross epidermal barriers. • Exposure of terrestrial plants to contaminants present in particulates depoSited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash). • Contaminants in bulk soil may partition into soil solution, making them available to roots. • Incidental ingestion of contaminated soil could occur while animals grub for food resident in the soil, feed on plant matter covered with contaminated soil or while grooming themselves clean of soil.			
Are hazardous substances present or potentially present in subsurface soils? **AND** **Are ecologically important species or habitats present?** **AND** **Could hazardous substances reach these receptors via vapors or fugitive dust carried in surface air or confined in burrows?**	X	 X X	
When answering the above questions, consider the following: • Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant > 10^{-5} atm-m^3/mol and molecular weight < 200 g/mol). • Exposure via inhalation is most important to organisms that burrow in contaminated soils, given the limited amounts of air present to dilute vapors and an absence of air movement to disperse gases. • Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that could be exposed to dust disturbed by their foraging or burrowing activities or by wind movement. • Foliar uptake of organic vapors would be limited to those contaminants with relatively high vapor pressures. • Exposure of terrestrial plants to contaminants present in particulates depoSited on leaf and stem surfaces.			

"Y" = yes; "N" = No, "U" = Unknown (counts as a "Y")

APPENDIX D.

APPLICABLE AND RELEVANT AND APPROPRIATE REQUIREMENTS

Table 1
Chemical-Specific Applicable or Relevant and Appropriate Requirements
Roba Westfall – York & Rannells Mines, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
Safe Drinking Water Act	40 USC § 300		
National Primary Drinking Water Regulations	40 CFR Part 141	Establishes health-based standards, maximum contaminant levels (MCLs), for public water systems.	Not an ARAR, groundwater has been eliminated from the removal action.
National Secondary Drinking Water Regulations	40 CFR Part 143	Establishes aesthetic standards (secondary MCLs) for public water systems.	Not an ARAR, these are not enforceable standards and are outside scope of removal action.
Clean Water Act	33 USC §§ 1251-1387		
National Ambient Water Quality Criteria	40 CFR Part 131	Sets criteria for water quality based on toxicity to aquatic organisms and human health.	Not an ARAR since the State of Oregon has been delegated this program.
Clean Air Act	40 USC § 7409		
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Establishes air quality levels that protect public health.	Not an ARAR – only "major" sources are subject to requirements related to NAAQS, defer to state regulation of fugitive dust emissions.
Resource Conservation and Recovery Act	40 USC § 7601		
Lists of Hazardous Wastes	40 CFR Part 261, Subpart D and C	Defines those solids wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	Not an ARAR – mine waste is not a listed hazardous waste, Bevill exempt. Even if TCLP testing confirmed a characteristic waste (Subpart C), it is still exempt. Parts of the RCRA regulations may be relevant and appropriate, however, and are discussed under action-specific requirements.

Table 1
Chemical-Specific Applicable or Relevant and Appropriate Requirements
Roba Westfall – York & Rannells Mines, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
STATE OF OREGON			
Hazardous Substance Remedial Action Rules	OAR 340-122-84 and 1-115	Establishes DEQ Guidelines for assessing human health and ecological risk assessments on potential adverse affects from contamination according to DEQ risk guidelines and levels.	Relevant and Appropriate Requirement
Preliminary Remediation Goals (PRGs) for soil and water	US Environmental Protection Agency (EPA) Region 9	Preliminary Remediation Goals (PRGs) are tools for evaluating and cleaning up contaminated sites. They are risk-based concentrations that are intended to assist risk assessors and others in initial screening-level evaluations of environmental measurements. The PRGs contained in the Region 9 PRG Table are generic; they are calculated without site specific information. However, they may be re-calculated using site specific data. PRGs should be viewed as Agency guidelines, not legally enforceable standards. They are used for site "screening" and as initial cleanup goals if applicable.	Relevant and Appropriate Requirement
Hazardous Substance Occupational Exposure	OAR 437	Establishes OR-OSHA Permissible Exposure Limits (PELs). OR-OSHA exposure limits mirror the federal chemical specific limits (refer to NIOSH Pocket Guide to Chemical Hazards for details on individual chemicals)	Relevant and Appropriate Requirement
Numeric Soil Cleanup Levels for Motor Fuel and Heating Oil	OAR 340-122-305 through 360	Establish cleanup standards for contamination of soil by motor fuel and heating oil.	To Be Considered at Former Oil Tank Station
Oregon Soil Cleanup Rules for Simple Sites	OAR 340-122-045 and 046	Establishes DEQ rules for streamlined cleanup processes and numerical cleanup standards at simple sites.	To Be Considered
State of Oregon is authorized by the USEPA to implement the Clean Water Act in Oregon	Clean Water Act – FWQC 40 CFR	Establishes acceptable contaminant levels for ingestion of aquatic organisms and for intake by aquatic organisms in surface water.	Applicable Requirement
Asbestos Removal	OAR 340-32-5620 through 5650	Establish DEQ requirements for licensing and certification for asbestos workers. All workers who handle asbestos-containing materials must meet certain training, licensing and certification requirements.	Relevant and Appropriate Requirement

Table 2
Location-Specific Applicable or Relevant and Appropriate Requirements
Roba Westfall – York & Rannells Mines, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
Resource Conservation and Recovery Act	40 USC § 7601		
Hazardous and Solid Waste Regulations	40 CFR Part 264.18	Location standards and restrictions for hazardous waste treatment, storage, and disposal (TSD) facilities.	Relevant and Appropriate Requirement
	40 CFR §§ 257.3-1 through 257.3-4	Location standards and restrictions for municipal solid waste (MSW) facilities.	Relevant and Appropriate Requirement
National Historic Preservation Act	16 USC § 470; 36 CFR Part 800 40 CFR 6.301(b)	Requires Federal Agencies to take into account the effect of any Federally assisted undertaking or licensing on any property with historic, architectural, archeological, or cultural value that is included in or eligible for inclusion in the National Register of Historic Places.	Applicable Requirement
Archeological and Historic Preservation Act	16 USC § 469 40 CFR 6.301(c)	Establishes procedures to provide for preservation of significant scientific, prehistoric, historic, and archeological data that might be destroyed through alteration of terrain as a result of a Federal construction project or a Federally licensed activity or program.	Applicable Requirement
Protection of Wetlands Executive Order No. 11990	40 CFR Part 6; Appendix A, 40 CFR 6.302(a)	Avoid adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction in wetlands if a practicable alternative exists.	Applicable Requirement
Dredge and Fill Regulations	33 USC § 1344, 33 CFR 323.1 et. seq.	Prohibits discharge of dredged or fill material into waters of the United States without a permit	Relevant and Appropriate Requirement
Fish and Wildlife Coordination Act	16 USC Chapter 49, §§ 2901-2912; 40 CFR 6.302(g)	Requires consultation when Federal department or agency proposes or authorizes any modification of any stream or other water body to assure adequate protection of fish and wildlife resources.	Not an ARAR – no stream modification is contemplated for this removal action.

Table 2
Location-Specific Applicable or Relevant and Appropriate Requirements
Roba Westfall – York & Rannells Mines, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL (cont.)			
Floodplain Management Executive Order No. 11988	40 CFR Part 6, Appendix A 40 CFR 6.302(b)	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid the adverse impacts associated with direct and indirect development of a floodplain to the extent possible.	Applicable Requirement
Endangered Species Act	16 USC §§ 1531-1543; 40 CFR 6.302 (h); 50 CFR Part 402	Activities may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat.	Applicable Requirement
Bald Eagle Protection Act	16 USC §§ 668 et seq.	Requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald or golden eagle.	Applicable Requirement
Migratory Bird Treaty Act	16 USC §§ 703 et seq.	Establishes federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	Applicable Requirement

Table 3
Action-Specific Applicable or Relevant and Appropriate Requirements
Roba Westfall – York & Rannells Mines, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL			
Clean Water Act	33 USC § 1342		
National Pollutant Discharge Elimination System	40 CFR Part 122.26	In general, Part 122 provides permit requirements for the discharge of pollutants from any point source into waters of the United States. Part 122.26 requires permits for storm-water discharges.	Applicable Requirement
Surface Mining Control and Reclamation Act	30 USC §§ 1201-1328	Performance standards for surface mining activities.	Relevant and Appropriate Requirement
Hazardous Materials Transportation Act	49 USC §§ 1801-1813 49 CFR Parts 10, 171-177	Regulates transportation of hazardous materials.	Applicable Requirement
Resource Conservation and Recovery Act	46 USC § 7601		
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TSD) Facilities	40 CFR Part 264.13.14	Requirements for proper handling, treatment, storage, and disposal of hazardous wastes.	Applicable Requirement
Land Disposal Restrictions (LDRs)	40 CFR Part 268	LDRs place specific restrictions (conc. or trmt) on RCRA hazardous wastes prior to their placement in a land disposal unit. Relevant and appropriate LDR requirements will be met if any material accumulations are treated *ex situ*.	Applicable Requirement
Disposal of Solid Waste	RCRA 42 U.S.C. § 6901 *et seq*; 40 CFR 257	Facility or practices in floodplains will not restrict flow of basic flood, reduce the temporary water storage capacity of the floodplain or otherwise result in a wash-out of solid waste.	Applicable Requirement
Closure Requirements	RCRA/HWMA 40 CFR & 264, Subpart G	Closure of hazardous waste repositories must meet protective standards. Regulations to minimize contaminant migration, provide leachate collection and prevent contaminant exposure will be met.	Applicable Requirement

Table 3
Action-Specific Applicable or Relevant and Appropriate Requirements
Roba Westfall – York & Rannells Mines, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
FEDERAL (cont.)			
Landfill Design and Construction	RCRA/HWMA 40 CFR & 264, Subpart N	Hazardous waste landfills must meet minimum design standards. Protectiveness will be achieved through capping and institutional controls.	Applicable Requirement
Ground Water Monitoring	RCRA/HWMA 40 CFR & 264, Subpart F 40 CFR & 264, Subpart X	Establishes standards for detection and compliance monitoring. Site wide monitoring will accommodate specific ground water monitoring requirements.	Relevant and Appropriate Requirement
Occupational Exposure to Asbestos	29 CFR Parts 1910 and 1926.	Establishes OSHA requirements for asbestos-related work in the construction and demolition industry. Requirements on exposure limits, work practices and engineering controls to provide worker safety in handling, removal, disposal, or other workplace exposure to asbestos.	Relevant and Appropriate Requirement

Table 3
Action-Specific Applicable or Relevant and Appropriate Requirements
Roba Westfall – York & Rannells Mines, Oregon

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/Relevant and Appropriate?
STATE OF OREGON			
Fugitive Dust Emissions	40 CFR Section 50.6	Establishes standards for PM-10	Applicable Requirement
Asbestos Removal	OAR 340-32-5620 through 5650	Establish DEQ requirements for licensing and certification for asbestos workers. All workers who handle asbestos-containing materials must meet certain training, licensing and certification requirements.	Relevant and Appropriate Requirement
	OAR 340-33-010 through 100	Establish DEQ requirements for handling asbestos-containing materials. Handling, removing, transporting and disposing of asbestos material in a manner that prevents it from becoming friable and releasing asbestos fibers.	Relevant and Appropriate Requirement