UPPER ARKANSAS RIVER BASIN
NATURAL RESOURCE DAMAGE ASSESSMENT

PRELIMINARY ESTIMATE OF DAMAGES

Prepared For:

US Fish and Wildlife Service, US Department of Interior
Bureau of Land Management, US Department of Interior
Bureau of Reclamation, US Department of Interior
Colorado Attorney General's Office
Colorado Department of Natural Resources
Colorado Department of Public Health and Environment

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1.0 INTRODUCTION

Under Federal law, designated Federal and state agencies are authorized to act as Trustees of natural resources on behalf of the public. In this role, Trustees assess and recover damages resulting from injuries to natural resources due to hazardous substance releases, and use these recovered damages to plan and implement actions to restore, replace, rehabilitate, or acquire the equivalent of injured natural resources (hereafter referred to as restoration).

A Trustee Council has been formed to assess natural resource injuries resulting from releases of hazardous substances at and from California Gulch and its tributaries. This Council consists of the U.S. Fish and Wildlife Service, the Bureau of Land Management, and the Bureau of Reclamation on behalf of the U.S. Department of the Interior (DOI) and the Colorado Attorney General's Office, Colorado Department of Public Health and Environment, and Department of Natural Resources on behalf of the State of Colorado. The U.S. Environmental Protection Agency (EPA) has been investigating the sources, nature, and magnitude of metals pollution within and emanating from the National Priorities List (NPL) Site and has been working with potentially responsible parties (PRPs) to develop and implement response actions on the NPL site. Pursuant to relevant regulations, any restoration plan selected by the Trustees will consider the results of any actual or planned response actions.[1]

This Preliminary Estimate of Damages (PED) was developed to assist the Trustees in their natural resource damage assessment efforts. PEDs provide a rapid review of readily available information focused on resources for which Federal or State agencies and/or Indian tribes may assert trusteeship. The primary purpose of a PED is to ensure that the scientific investigations and valuation methodologies to be used in the Natural Resource Damage Assessment (NRDA) are reasonable as required by relevant regulations. PEDs inform Trustee efforts (and potential settlement discussions with Responsible Parties) by providing preliminary estimates, as readily available information allows, of the magnitude of natural resource injuries and the associated cost of actions needed to restore, replace, rehabilitate, or acquire the equivalent of injured natural resources.[2] In addition, PEDs can help identify key data gaps that may need to be filled as part of future assessment activities.

[1] See 43 CFR 11.82(d)(4).

[2] See 43 CFR 11.25(e).

1.1 LOCATION AND DESCRIPTION OF THE UPPER ARKANSAS RIVER BASIN

The Arkansas River (River) originates in the alpine and sub-alpine basins of the Mosquito and Sawatch Ranges above Leadville in Central Colorado. Its headwaters emanate largely from winter snowpack and become confluent just outside of Leadville at 10,100 feet (3,100 m) elevation to form the River mainstem. From there, the River flows through a valley flanked by the Mosquito and Sawatch Ranges from which it receives tributary flow from numerous low-order perennial and intermittent drainages (Figure 1-1).

Near Leadville, the River meanders through a broad mountain valley, creating significant wetland and floodplain meadow acreage. Predominant land uses include irrigated pasture and haying operations, livestock production, recreation, and residential development. Approximately 12 miles (19 km) downstream from Leadville, the River becomes entrenched in a canyon setting formed by the convergence of the Mosquito and Sawatch ranges, resulting in a narrow floodplain. The River descends through montane and transition life zones, flowing through deep canyons between Buena Vista and Cañon City. Ultimately, the River drains some 28,000 square miles (75,600 km^2) and empties into Pueblo Reservoir more than 160 miles (267 km) distant from and 7,000 feet (2,100 m) below its alpine origins before continuing to eastern Colorado and Nebraska.

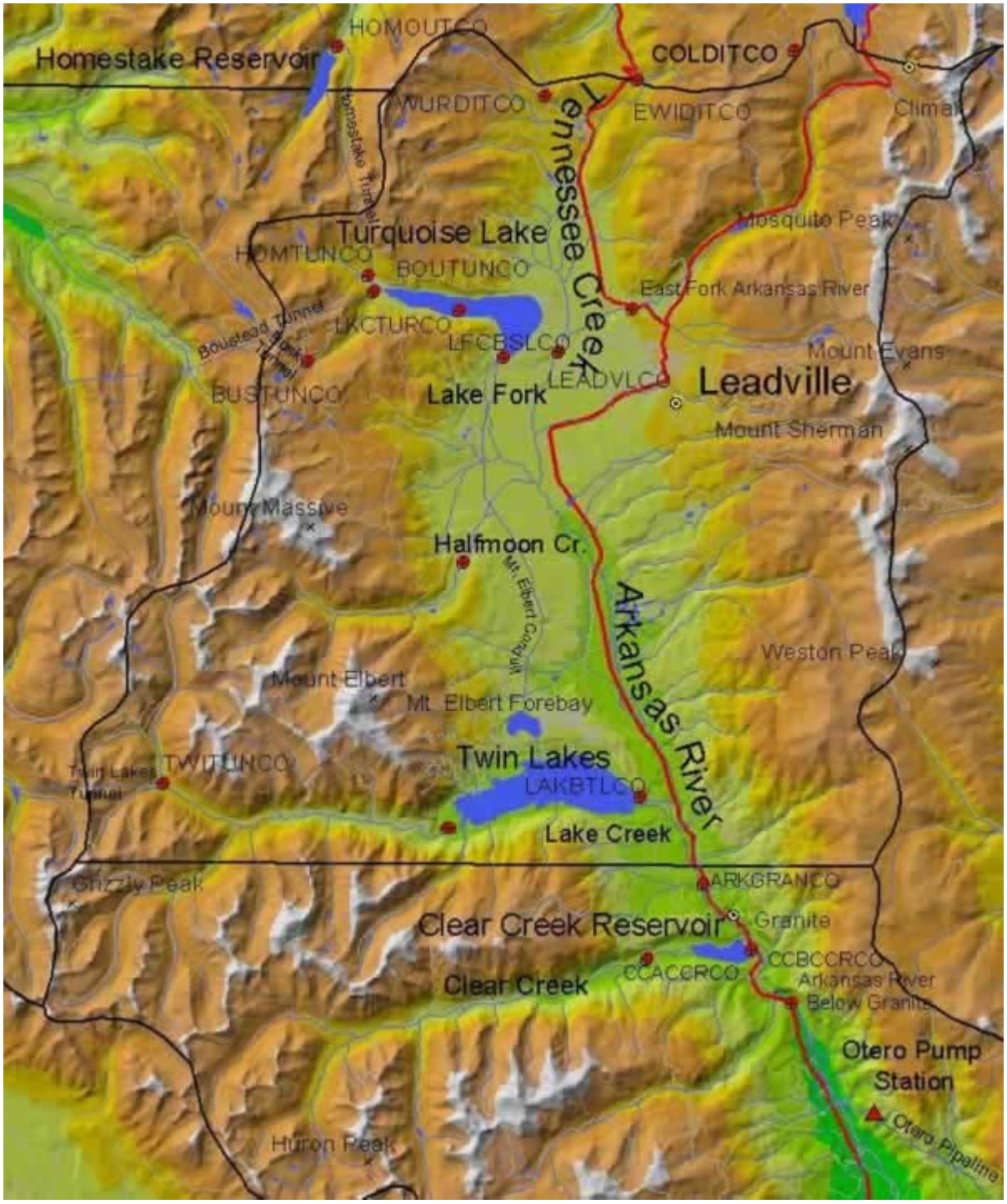
Several perennial and ephemeral drainages including Stray Horse, Oregon, Georgia, California and Evans Gulches drain an 18 1/2 square mile (48 km^2) watershed into the Arkansas River southwest of Leadville. Most of these drainages are included in the NPL Study Area identified in a 1994 Consent Decree entered into by the EPA, State of Colorado and certain mining companies.

1.2 OVERVIEW OF MINING ACTIVITY

Multiple mining methods were used in the Leadville mining district, as targeted ores changed. Mining activity also took place in many different locations throughout the district (Figure 1-2). As mining progressed from oxide down into sulfide ores, changes in the style of mining and mineral processing means occurred. Each style and ore has characteristic waste material and resulting pollution effects.

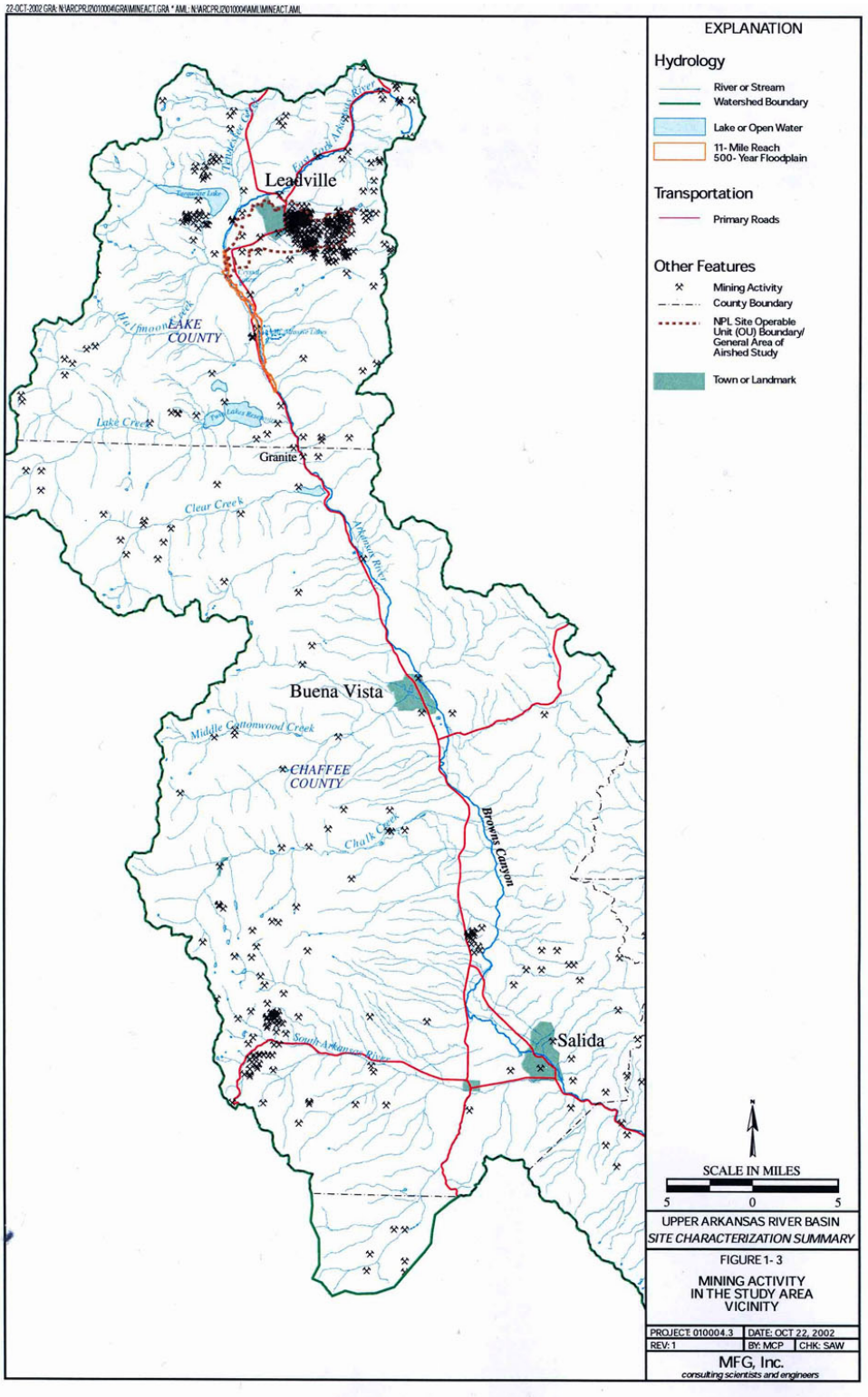
The first mining in the district, in oxide ores, was conducted by placer methods. Gold was recovered from stream placers while other material was removed from colluvium that lay down slope from exposed mineralization. Hydraulic mining was used to dislodge at least some material from the placer deposits. Hydraulic mining of oxide ores disturbed and/or removed significant amounts of surficial sediments. Heavy minerals, including gold, were segregated from the sediments using gravity methods to recover visible gold, and the waste sediment was sluiced aside. Waste sediment from these ores consisted of quartz and minor amounts of other refractory silicate minerals, stable (inert) iron hydroxides, and clay. These wastes may have presented problems for aquatic habitat and biota due, for example, to smothering of eggs or loss of substrate habitat due to sediment cover. However, these wastes, by and large, would neither leach metals nor produce acid drainage.

Figure 1-1
Upper Arkansas River Basin



Source: USGS 2005.

Figure 1-2



Source: SCR 2002.

The nature of sediment injury during this period is not well quantified. If the current conditions are any indication, the Arkansas River, which is a high gradient stream with significant sediment-carrying capacity, may not have had significant sediment problems in the early days of mining, as the stream is sediment-poor. Increased sediment might have improved aquatic habitat, especially for species that require fine sediment.

With the advent of sulfide mining, hard rock ores initially were crushed using stamp mills then placed in jigs to produce mineral concentrates. Such concentrates could have included sphalerite (zinc concentrate), galena (lead concentrate) or any of several copper mineral concentrates. Waste tails from these jigged ores would have included all of the above metals plus iron sulfides. Surface waters would have become contaminated by acid drainage that would have included dissolved toxic metals that are the subject of the CERCLA cleanup today.

During the later stages of sulfide mining, mineral concentrates were produced by flotation. Flotation tails would have been finer grained than jig tails, but the metal content and the tendency to form acid drainage would have been similar. Overall, tailings that were released from oxide ore processes, which were mined by placer methods, would have produced problems from sediment deposition, but not from dissolved metals or acid drainage. Tailings that were released from sulfide ore processing, whether produced by jigging or flotation, could have produced sediment problems, along with problems with dissolved metals and acid drainage.

The Yak tunnel has been a significant channel for contamination to California Gulch. Construction of the initial portion of the Yak tunnel began in 1895 to dewater mines by drainage to the California Gulch. Several expansions to the tunnel increased its length, with a final length by 1923 of over four miles and an estimated void space of 55 to 74 million cubic feet. The Yak tunnel was a primary focus of studies and cleanup activities between 1989 and 1994. Prior to construction of the Yak Water Treatment Plant, the tunnel discharged about 210 tons of metals each year into California Gulch, which drains into the Arkansas River.

1.3 INTEGRATION OF NRDAR PROCESS WITH USEPA SUPERFUND EFFORTS

Under natural resource damage regulations, damages recoverable by the Trustees include the cost of restoration. Damages also may include, at the discretion of the Trustees, the compensable value of all or a portion of the value of the services lost to the public for the time period from the release of hazardous substances until the attainment of such restoration to baseline conditions (often referred to as "interim loss").[3] This focus is related to, but different from EPA's and States' response programs which focuses instead on reduction of risks posed by releases and threatened releases of hazardous substances. Analyses undertaken by Trustees as part of the natural resource damage assessment process mandated in the CERCLA statute take into account the improvements to natural resources and affected services back toward baseline by remedial response actions, and therefore are complementary rather than duplicative.

[3] As specified in the DOI natural resource damage regulations, Trustees' claims for natural resource damages may include additional components not identified in this discussion (e.g., the costs of emergency restoration efforts, the reasonable and necessary costs of the assessment, and interest on the amounts recoverable).

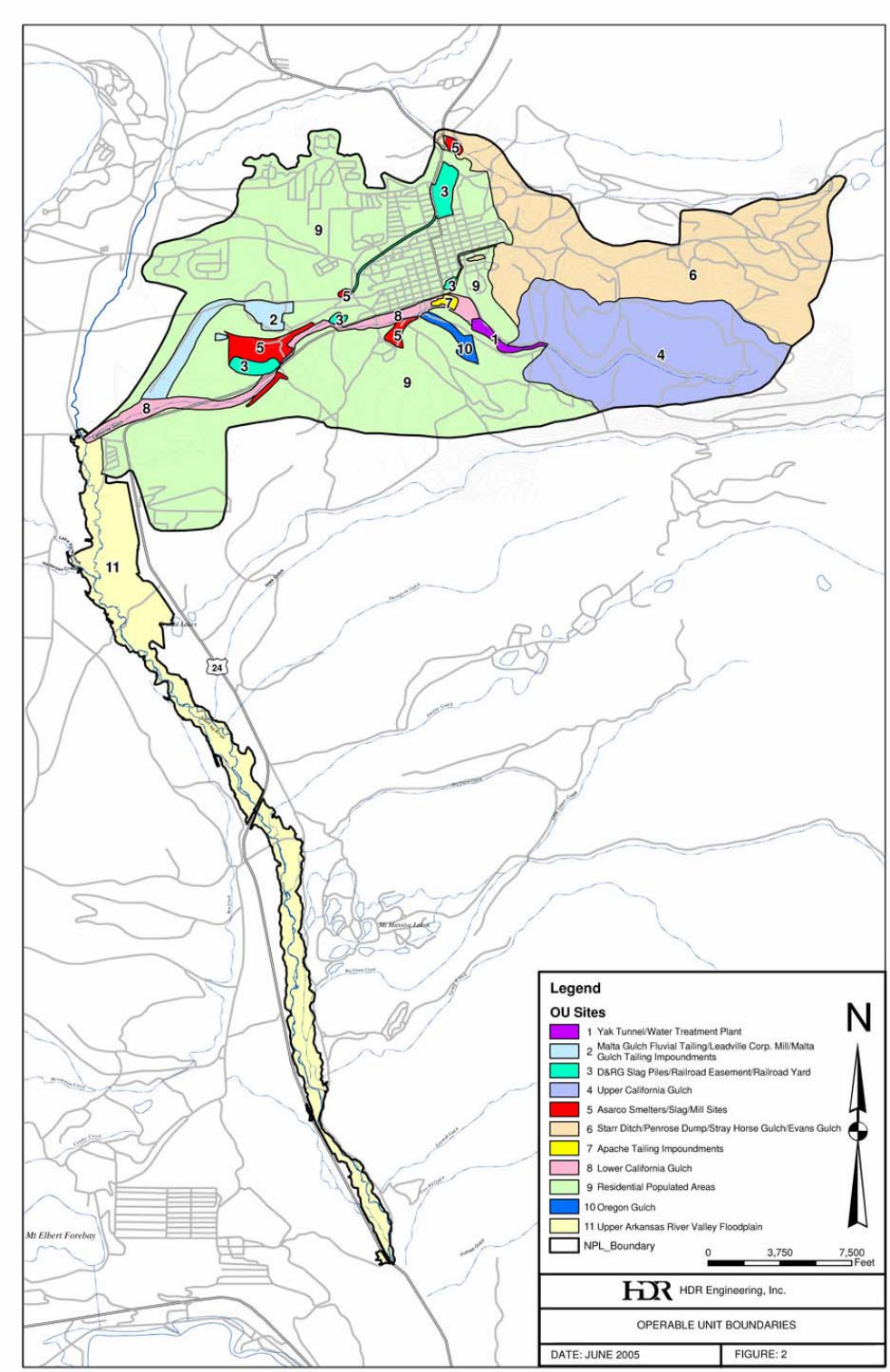
The California Gulch Superfund Site is located within the Upper Arkansas River Basin 100 miles southwest of Denver, Colorado. It was placed on the NPL in 1983, and covers 16.5 square miles affected by mining in the California Gulch watershed that drains to the Arkansas River.[4] The Site is divided into 12 Operable Units (OUs). Operable Units 1 through 11 are distinctly bounded geographic areas. Operable Unit 12 was added to address site-wide surface and groundwater quality issues remaining after source controls are addressed at the other 11 Operable Units (USEPA 2005). Figure 1-3 shows the Study Area as defined in the Parties' 1994 Consent Decree and the locations of the 11 geographically-based OUs. Table 1-1 provides a summary of the OUs and the designated remediation leads for each OU.

Table 1-1
Operable Units at California Gulch Superfund Site

OU	Operable Unit Name	Remediation Lead
1	Yak Tunnel/ Water Treatment Plant	Res-ASARCO joint venture
2	Malta Gulch Fluvial Tailing/Leadville Corp. Mill/Malta Gulch tailing impoundments	EPA
3	D&RGW Slag Piles/Railroad easement/Railyard	Union Pacific
4	Upper California Gulch	Resurrection
5	ASARCO smelters/Slag/Mill sites	ASARCO
6	Starr Ditch/Penrose Dump/Stray Horse Gulch/Evans Gulch	EPA
7	Apache Tailing Impoundments	ASARCO
8	Lower California Gulch	Resurrection
9	Residential Populated Areas	ASARCO
10	Oregon Gulch	Resurrection
11	Upper Arkansas River Floodplain	EPA, State of Colorado, and mining companies
12	Site-wide Surface and Groundwater Quality	EPA, State of Colorado, and mining companies

[4] EPA FY 2004 New Construction Fact Sheets: California Gulch http://www.epa.gov/superfund/accomp/not_funded/calgul.htm. Accessed 10/14/05.

Figure 1-3



Source: ROD OU11 2005

1.4 PED STUDY AREA

The geographic/resource focus of this PED is on potential injuries to services provided by the following resources:

a) Surface water and groundwater associated with California Gulch and its tributaries[5];

b) The Arkansas River (from its confluence with California Gulch to Pueblo Reservoir);

c) The 500 year floodplain of the Arkansas River within the 11 mile reach, including riparian areas, irrigated meadows and fluvial deposits, as well as areas outside the floodplain that are known to have been irrigated with contaminated water;

d) Superfund Operable Units 4 and 8 fluvial deposits; and

e) Operable Units 5, 7, 8 and 10 mine waste deposits.

The PED focuses on injuries to the above-listed resources for two reasons: first, sufficient information regarding these injuries is available to perform a preliminary estimation, and second, this information indicates that these trust natural resources have been injured as a result of hazardous substances released due to the mining activities that are the subject of the Trustees' assessment. It is important to recognize, however, that other trust natural resources within the Arkansas River Basin may have been affected by such releases. While readily available information does not provide a sufficient basis for their evaluation at the current time, injuries could be substantial. For example, this PED does not evaluate the potential for recreational injuries, smelter-related terrestrial injuries (e.g., contamination from slag piles or soils contaminated by smelter emissions) or injuries related to OU 6 mine waste piles. Studies on additional species (e.g., reptiles, amphibians) may indicate further injury. As a result, damage estimates presented in this document do not fully capture potential natural resource damages within the Upper Arkansas River Basin attributable to the subject releases.

1.5 CONTAMINANTS OF POTENTIAL CONCERN

Numerous studies document the widespread presence of many contaminants of potential concern (COPCs) in the study area. The Site Characterization Report for the Upper Arkansas River Basin (SCR), a key summary source of information on contamination and natural resource injuries in the study area, focuses its evaluation on four primary metals: cadmium, copper, lead and zinc. As noted in the SCR, this contaminant focus is based on a review of existing studies and data, a basic understanding of the mining history and ore bodies, toxicity considerations and the predominance of these metals in the fluvial systems of the UARB (SCR 2002, pp. 2-1, 2-2). Further, as indicated in the SCR:

[5] Several California Gulch tributaries currently have EPA assigned as remediation lead. Potential injuries at these locations (e.g., Malta Gulch, Stray Horse Gulch, Evans Gulch, Oregon Gulch) are not included in the current draft of the PED but may be considered at a future time.

> "The presence and consistent occurrence of these metals is representative of the nature and extent of all metals that have increased presence due to mining. Existing data, along with an understanding of both mining and milling processes and fate and transport processes, indicate that these metals define the nature and extent of contamination. As such, mining impacts will be accurately defined by these constituents. A focused approach, using a smaller group of signature metals, is consistent with CERCLA investigations conducted for other large mining sites" (SCR 2002, p. 2-2).

Additional metals and metalloids have been and continue to be released from the Site, including (but not limited to) arsenic, manganese, aluminum, and iron. Low pH of ground water and surface water affected by acid mine drainage is also a concern. While the information presented in this PED generally focuses on cadmium, copper, lead and zinc, injuries associated with other hazardous substance releases are identified as relevant.

1.6 BASELINE CONDITIONS

For natural resource damage assessment purposes, baseline conditions are defined as the conditions that would have existed in the assessment area had the release of hazardous substances under investigation not occurred.[6] Geological information indicates that, except in the glaciated valleys, sulfides below the oxidized zone were below the water table that would have existed just prior to mining, and that, therefore, acid mine drainage would have been minimal (Tweto 1968). Baseline conditions, consequently, are assumed to include some physical disturbances but not significant chemical contamination.

1.7 TEMPORAL SCOPE OF NRD INJURY EVALUATION

While contamination-related resource injuries have been observed in the study area for many decades, consistent with relevant regulations the PED calculates interim service losses beginning in 1981 (the first full year after CERCLA promulgation).[7] Loss calculations continue until services are expected to return to baseline condition, taking benefits from remediation activities and natural attenuation processes into account.

1.8 SUMMARY OF PRELIMINARY FINDINGS

Significant injuries to both aquatic and terrestrial resources as a result of mining activities are identified. Past injuries (i.e. 1981 to present) are the largest portion of the loss. Quantification of damages from aquatic injuries in the 11-mile reach indicates potential costs of $9.3 to $12.1 million for compensatory restoration. In California Gulch, preliminary damage estimates for groundwater and surface water are $18.7 to $21.8 million. In the Arkansas River downstream of the 11-mile reach, service losses are lower per acre, but cover a much larger area,

[6] See 43 CFR 11.14(e).

[7] See 43 CFR 11.24(b)(1)(ii).

leading to a preliminary damage estimate of between $9.5 and $17.8 million. The preliminary damage estimate for terrestrial resources is $16.3 million. In total, these preliminary damage estimates range between approximately $53.8 and $68.0 million. As noted previously, these preliminary damage estimates do not fully capture potential natural resource damages within the Upper Arkansas River Basin attributable to the subject releases (e.g., potential injuries to California Gulch tributaries, recreational use, smelter-affected terrestrial resources, OU 6 mine waste piles, and wildlife and birds). These and other potential injuries may be evaluated as part of future assessment activities; associated damage estimates would be in addition to those presented in this document.

1.9 OUTLINE OF THE PED

The remainder of the PED is organized as follows:

- Chapter 2 provides a preliminary evaluation of California Gulch surface water and groundwater degradation, as well as surface water service degradation in the 11-mile reach of the Arkansas River and downstream areas;

- Chapter 3 provides a preliminary evaluation of terrestrial service loss in the 500 year floodplain of the Arkansas River, Superfund OU 4 and 8 fluvial deposits, and Superfund OU 5, 7, 8 and 10 mine waste deposits.