Expanded Site Inspection Report
on
Molycorp Inc, Questa Division
Taos County, New Mexico

(CERCLIS ID# NMD002899094)

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TABLE OF CONTENTS

I. **INTRODUCTION** . . . 1
- A. **Expanded Site Inspection Objectives** . . . 1
- B. **Site Description** . . . 1
- C. **Operational History** . . . 2
- D. **Regulatory History** . . . 3
  - 1. Other Agency Involvement . . . 3
  - 2. Involvement by New Mexico Environment Dept. (NMED) . . . 5

II. **EXPANDED SITE INSPECTION** . . . 6
- A. **Waste Source Characteristics** . . . 6
  - 1. Source Identification and Quantity . . . 6
  - 2. Waste Characteristics-Methods . . . 7
  - 3. Waste Characteristics-Results . . . 8
  - 4. Waste Characteristics-Discussion . . . 9
- B. **Groundwater Migration Pathway** . . . 9
  - 1. Geology and Aquifer Description . . . 9
  - 2. Groundwater Use . . . 11
  - 3. Groundwater Pathway-Methods . . . 13
  - 4. Groundwater Pathway-Results . . . 16
  - 5. Groundwater Pathway-Discussion . . . 17
- C. **Surface Water Migration Pathway** . . . 20
  - 1. Surface Water Flow Characteristics . . . 20
  - 2. Surface Water Use . . . 20
  - 3. Surface Water Pathway-Methods . . . 22
  - 4. Surface Water Pathway- Results . . . 23
  - 5. Surface Water Pathway-Discussion . . . 24
- C. **Soil Exposure Pathway** . . . 27
  - 1. Soil Exposure Pathway- Methods . . . 27
  - 2. Soil Exposure Pathway-Results . . . 27
  - 3. Soil Exposure Pathway-Discussion . . . 28
- D. **Air Migration Pathway** . . . 30

III. **SUMMARY AND CONCLUSIONS** . . . 31

REFERENCES . . . 32

LIST OF TABLES

Table 1. Metal Concentrations in Mine Waste Dumps (mg/kg)

Table 2. Metal Concentrations in Tailings (mg/kg)

Table 3. Metal Concentrations in Hydrothermal Scars (mg/kg)

Table 4. Ratio of Metal Concentrations between Waste Sources and Background Soil

Table 5. Metal Concentrations in Fagerquist Well (Nearest to Mine) and Surrounding Surface/Ground Waters

Table 6. Background Metal Concentrations for Determining a Release to Alluvial Aquifer via Seeps

Table 7. Release of CERCLA Hazardous Substances to Downgradient Seeps of Alluvial Aquifer

Table 8. Release of CERCLA Hazardous Substances to Fractured Rock Aquifer at Molycorp Mine

Table 9. Metal Concentrations and General Chemistry Parameters in Private Wells below the Tailings Ponds

Table 10. Total Metal Concentrations in Selected Monitoring Wells near Tailings Ponds

Table 11. Dissolved Metal Concentrations and General Chemistry Parameters in Selected Monitoring Wells near Tailings Ponds

Table 12. Total and Dissolved Metal Concentrations in Discharges below Tailings Ponds

Table 13. Ratio of Metal Concentration in Leachate or Drainage from Mine Dumps to Hydrothermal Scars

Table 14. Ratio of Metal Concentrations in Leachate from Mine Waste Dumps and Hydrothermal Scars

Table 15. Total Metal Concentrations in Surface Water near Molycorp Mine

Table 16. Dissolved Metal Concentrations and General Chemistry Parameters in Surface Water near Molycorp Mine

Table 17. Metal Concentrations and General Chemistry Parameters in the Red River near Molycorp Mine: 6/26/94

Table 18. Metal Concentrations in Sediments from the Red River near Molycorp Mine Area

Table 19 Metal Concentrations in Selected Seeps and Surface Water Bodes near the Tailings Ponds

Table 20. Loading of Sulfate and Selected Metals into the Red River by Stream Segment during ESI Sampling

Table 21. Sulfate Gain Observed in the Red River between Molycorp Property and USFS Ranger Station

Table 22. Metal Concentrations in Residential Areas near Tailings Ponds: South

Table 23. Metal Concentrations in Residential Areas near Tailings Ponds: North

LIST OF FIGURES

Figure 1. Location of Molycorp Site
Figure 2. Molycorp Site Map
Figure 3. Sampling Locations near the Mine Area
Figure 4. Sampling Locations near the Tailings Ponds
Figure 5. Hydrothermal Scar Areas (ref. 7)
Figure 6. Soil Type in Vicinity of the Tailings Ponds (ref. 5)
Figure 7. Extent of Soil Contamination in the Vicinity of the Ponds

ATTACHMENTS

Attachment A. Groundwater Data Near the Tailings Ponds by NMED, 1987-1988.

Attachment B. X-ray Fluorescence Screening Data during ESI Sampling.

Attachment C. Well Logs.

Attachment D. Sulfate Gain to the Red River over Time in the Vicinity of the Mine.

Molycorp Inc., Questa Division
Taos County, New Mexico

Expanded Site Inspection

New Mexico Environment Department
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I. INTRODUCTION

Molycorp Inc., Questa Division (or Molycorp Site) is a molybdenum mine and tailings disposal site in Northern New Mexico. It is currently under review by the New Mexico Environment Department (NMED), Superfund Program to determine whether the site is a potential candidate for inclusion on the National Priorities List (NPL) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980. To further evaluate the site, an Expanded Site Inspection (ESI) was conducted to obtain information critical for this assessment.

A. Expanded Site Inspection Objectives

This Expanded Site Inspection (ESI) was performed to obtain information relevant to the evaluation of the Molycorp Site using the Hazard Ranking System (ref. 1). The purpose of the ESI is to determine whether Molycorp Site poses a potential threat to human health and the environment. The information collected involved sampling various environmental media and review of records to more accurately determine the presence and distribution of CERCLA hazardous substances (listed in the Superfund Chemical Data Matrix, ref. 2) along the air, soil, surface water and groundwater migration/exposure pathways. Environmental media sampled included mining waste, soil, sediment and water. Air was not sampled during this investigation since recent monitoring data from NMED showed no exceedances of any ambient air quality standards.

B. Site Description

The Molycorp Site is situated in Taos County near Questa, New Mexico (Fig. 1) and consists of two separate areas: the mine and the tailings ponds (Fig. 2). The Molycorp Site and surrounding area are located on the following USGS 7½' quadrangle maps: Sunshine NM, Cerro NM, Latir Peak NM, Guadalupe Mountain NM, Questa NM and Red River NM (ref. 3). The mine, surrounded by Carson National Forest, occupies approximately three square miles on patented land owned by Molycorp, Inc. The mine, located at 36° 42' 30" N latitude and 105° 30' 30" W longitude (ref. 3), lies along the Red River and several side drainages including Sulphur Gulch,

Spring Gulch, Goathill Gulch and Capulin Canyon (Fig. 2). The mine consists of both underground and open pit operations, a mill and two waste disposal areas (Fig. 3). Other features present in the mine area of the site are several groundwater seeps along the Red River, catchment basins to control run-off, a network of mining-related roads and several areas of erosion subsequently referred to as hydrothermal scars (ref. 4, photos 1, 3, 5). In the vicinity of the Molycorp mine, precipitation varies from about 16 inches per year at elevations of 8,000 feet to approximately 35 inches per year at elevations up to 11,000 feet (ref. 5, p. 33). Mean annual temperature near the mine is about 40° F.

Tailings ponds occupy approximately 1 square mile and consist of two large ponds (designated by Molycorp as Ponds 1 & 4) and two smaller ponds (Ponds 2 and 5A; Fig. 2). These tailings ponds are located 1-2 miles west of Questa, NM and 5-6 miles west of the mine on land owned by Molycorp, Inc. The coordinates of the tailings ponds are 36° 42' 30" N latitude and 105° 37' 0" W longitude. A series of pipelines transported the tailings from the mill site to the ponds until Molycorp became inactive in 1992. In the vicinity of the tailings ponds, annual precipitation is approximately 12.5 inches with average annual temperature of 45° F (ref. 6, p. III-8, 9).

The Red River is located immediately south of the Molycorp mine and tailings ponds and flows in a westerly direction (Fig. 2). The drainage area covers approximately 190 square miles and ranges in elevation from the top of Wheeler Peak (elev. 13,161 feet) to the confluence with the Rio Grande (elev. 6,500 feet) (ref. 7, p. 14, 15). Two tributaries to the Red River in the vicinity of the mine and tailings ponds are Columbine Creek and Cabresto Creek (Fig. 2). Four to five miles below the tailings ponds, the Red River enters the Rio Grande.

C. Operational History

Molybdenum Corporation of America (MCA) acquired mining rights to Sulphur Gulch, a side drainage to the Red River, in 1920. They conducted small-scale mining operations until 1923 when a mill was constructed. The old underground workings consisted of adits, winzes and raises which followed the irregular vein system. In 1941, a haulage adit approximately one mile long was constructed to facilitate ventilation and drainage (ref. 8, p. 8). By 1954 this underground complex contained over 35 miles of workings at 14 production levels ranging in elevation from 7764 to 8864 feet. By 1954 all but the lowest three working levels were designed to drain by gravity out a mile-long service portal (known as the Moly Tunnel) located above the elevation of the Red River. The lower three working levels gathered drainage in a sump and this water was pumped to the service portal where it was allowed to drain by gravity to the Red River. This original underground Molycorp mine continued to grow until the open pit mine was developed. In 1965, MCA switched to an open pit operation which required the transport of tailings via a pipeline approximately eight miles downstream to tailings ponds located 1-2 miles west of the town of Questa. Dam # 1 is located in Section 36 of T 29 N, R 12 E. Decant water from the associated pond was discharged to the Red River via culvert tunnels through the dam. To ensure integrity of Dam #1, a smaller dam was constructed in 1969 just north of Dam # 1 which contained overflow weir structures to keep waste water from the dam face (ref. 9, Table 1).

Waste water was conveyed to a small holding pond (called Pope Lake) for further settling before discharge to the Red River. Molycorp referred to this discharge point as outfall # 001 of their permit under the National Pollution Discharge Elimination System (NPDES) (ref. 10). In 1971, a second large dam (Dam # 4) was constructed southwest of Dam # 1 (in Section 35 of T 29 N, R 12 E) with an impermeable membrane on the dam face. Surface water diversion ditches were installed in 1974 on the north, east and west sides of the ponds to divert surface water run-on around the ponds (ref. 9). The following year, interceptor trenches (called seepage barriers) were constructed below Dam # 1 and east of Dam # 4 to collect leachate from the tailings ponds. This waste water is diverted around dwellings below the dams and discharged to the Red River through NPDES outfall # 002.

In 1978, Unocal 76 Corporation purchased Molybdenum Corporation of America and shortened the name to Molycorp, Inc. Molycorp constructed an ion exchange plant near Pope Lake in 1983 to treat the waste water prior to discharge. After extensive mineral exploration in Goathill Gulch during the 1970's and early 1980's, Molycorp ceased open pit operations in 1985 and reverted back to underground mining techniques. The recent mining activity is referred to as the new underground workings. Production declined significantly in 1989 due to decreased value of molybdenum. The number of employees at this time shrank from a maximum of over 1,000 to approximately 200. Low production continued until December 1991 when operations stopped (ref. 11, p. 3). There are currently only 16 employees who are preparing the mine for potential re-opening (ref. 11, p.2). In 1994 Molycorp began pumping the water that had been flooding the mine, and discharges this mine water via the tailings pipelines to the tailings ponds at Questa (ref. 12, p. 6).

D. Regulatory History

1. Other Agency Involvement

In 1966, the U.S. Department of Health, Education and Welfare (HEW), Federal Water Pollution Control Administration, conducted a baseline water quality survey of the Red River. A moderate increase of sulfate in the downstream direction was noted but metal concentrations varied little (ref. 13, p. V-1,2). The most significant effects observed were increased coliform counts from the town of Red River and the Red River Fish Hatchery (ref. 13, p. V-10). The overall quality of the river, including the segment adjacent to the Molycorp mine site, was determined to be high (ref. 13, p. II-1).

In November 1971, EPA conducted a study of the Red River in which they concluded that the chemical quality and biological conditions of the Red River water remained very good but that occasional breaks in the tailings pipeline resulted in some degradation of stream quality and biota (ref. 14, p. 4). During this same period of the late 1960s and early 1970s, however, the New Mexico Game and Fish Department discovered in the course of routine population studies that fish were conspicuously absent in the middle reach of the Red River where thriving populations

had once existed (ref. 15). Fish census data of 1960 indicate that approximately 572 fish per mile were estimated in the river. The 1988 fish census found no fish in this same reach (ref. 16).

In 1982, EPA evaluated the Red River for potential impairment from metal loading (ref. 17). Among the findings were that concentrations of ambient total arsenic, cadmium, and silver exceeded EPA-recommended acute criteria; that 'Control' stations contained higher concentrations of all metals except zinc; and bioassay results from tests with Red River water suggested some biological toxic response may be occurring in the Red River (ref. 17, p. 35).

In 1983, the Red River and the Rio Grande in the vicinity of the confluence were designated a Wild and Scenic River (ref. 18, p. 49). In response to the designation the BLM published results of its study of water quality in the Red River and Rio Grande between 1978 and 1983. This study documented pollution sources and found a downstream increase in concentrations of various constituents, at times exceeding water quality standards, and found that the major impacts were due to mining and related activities. Nonpoint sources were found to be a major cause of elevated trace element concentrations (ref. 18, p. 49).

The U.S. EPA Superfund program (Region VI, Dallas, TX) conducted a Preliminary Assessment (PA) of the Molycorp site in May, 1980 and a Site Inspection (SI) in June, 1981. The conclusions of these reports, respectively, were for no further remedial action and placing the site at a lower priority (ref. 19). However, EPA funded field investigation teams (FIT) to investigate Molycorp in 1983 and 1985 (refs. 20, 21). Part of these investigations was an assessment of the Molycorp waste disposal area ("landfill") located near the head of Spring Gulch (above the mill area). This landfill was described as a mine rubble pile more than 100 feet thick that was also used as a disposal area for discarded equipment and parts. Some unrinsed reagent drums from the mill were the only "hazardous" wastes observed (ref. 20, p. 4). Soil samples were collected and analyzed for metals and organics in these EPA FIT investigations of the area, but were inconclusive, in part because appropriate background soil samples were not collected for comparison. The 1985 inspection observed a small oil spill (not sampled) and commented that the area was still active as a dump for empty drums and old equipment. Conclusions from the 1985 investigation included the recommendation for further study of this landfill under RCRA authority (ref. 21, p. 4). Molycorp has had two landfills (in Spring and Goathill Gulches) which are exempted from NM Solid Waste Management Regulations since they received only demolition and construction debris (ref. 22). The Spring Gulch site is inactive, having been covered with several hundred feet of overburden during subsequent mining operations that filled Spring Gulch.

In 1992, a report was submitted to the Congress of the United States by the New Mexico Water Quality Control Commission (WQCC) which reported an increase concentration in the Red River in the vicinity of the Molycorp Mine of several metals including cadmium, copper, lead, silver and zinc (ref. 23). Because these metals are listed CERCLA hazardous substances, the Molycorp Site was re-opened for investigation under CERCLA authority.

During 1994, another newly created state agency became involved in regulatory investigations at the Molycorp site. The NM Office of Natural Resource Trustee (ONRT) is investigating natural resource damages from Molycorp in the Red River area and has participated in sampling activities and review of Molycorp reports and workplans (ref. 24, p. 46, 47). A natural resource damage assessment (NRDA) is being conducted.

2. Involvement by New Mexico Environment Department (NMED)

Water quality concerns relating to the Molycorp site have been studied by several programs within NMED, predominantly by the Nonpoint Discharge Section of the Surface Water Quality Bureau and the Groundwater and Superfund Sections of the Ground Water Protection and Remediation Bureau. Point source discharges from the tailings ponds at Questa have been monitored through an NPDES permit issued by the U.S. Environmental Protection Agency. Renewal of the permit in 1993 (permit # NM0022360) included two additional discharge points for stormwater runoff from the mining site (ref. 10).

Groundwater monitoring data presented by Molycorp to NMED-Groundwater Section in April 1987 revealed contamination in one private well downgradient from the tailings ponds. The data, covering 1985 and 1986, showed an average lead concentration of 0.056 ppm (N = 8) in the water from this well (ref. 25). This level was greater than three times the reported background concentration of 0.016 ppm and above the WQCC standard of 0.05 ppm (ref. 25, p. 4). The maximum and minimum concentrations reported were 0.12 ppm and 0.01 ppm, respectively (ref. 25, p. 6). Comparing the results to the New Mexico State WQCC standards, Molycorp concluded the violation of the standard for lead on four different occasions (ref. 25 p. 12). Analytical results from seven private wells sampled in 1987 and 1988 by NMED, which included the well previously showing a violation, showed no detectable levels of lead or cadmium (Attachment A). Use of groundwater from this well for drinking had stopped by 1988 (ref. 24, p. 18).

Two studies conducted by the NMED-Surface Water Quality Bureau (SWQB) in 1986 and 1988 confirmed high metal loading of the Red River by periodic storm events, but found that metal concentrations in surface water and stream sediments were not elevated to the point of causing aquatic toxicity (refs. 26, 27). In these studies, the major elements which became elevated between the Red River Waste Water Treatment Plant and the Questa (USFS) Ranger Station were iron and aluminum. A portion of this segment abuts Molycorp property where mining operations have occurred. One conclusion drawn from these surface water surveys was that episodic run-off events may erode oxidized sulfide-rich soils from barren slopes and mining scars (ref. 26, p. 4; ref. 27, p. 3). This process generates acidic run-off, which mobilizes and transports trace elements, including heavy metals, to the Red River. The acidic run-off temporarily reduces the pH of the river. Metals precipitate out of solution downstream as the pH becomes more neutral. These surveys also concluded that biomonitoring in the Red River generally showed no chronic or acute toxicity but that biological indices were reduced in the area below the Molycorp mine (ref. 27, p. 3).

Groundwater seeps have been observed emerging and entering Red River in the vicinity of Molycorp Mine (ref. 24, p. 14-17; ref. 4, photo 3). Within this stretch of the Red River, the 1988 study by NMED-SWQB detected over a three-fold increase in manganese concentrations (ref. 27, p. 43, 51). Concentrations of zinc and total aluminum were elevated two to three times over this same reach of the river. Other reports have determined that there is a general increase in the loading of sulfate, manganese, iron, zinc and aluminum in the downstream direction, with those seeps located below Capulin Canyon being the major contributors (ref. 28, p. 31, 33).

A number of other investigations of Molycorp have been generated by the regulatory involvement of NMED-Groundwater Section. During 1987-90 Molycorp was proposing to build a new tailings impoundment area in the Guadalupe Mountain saddle area located on BLM lands several miles north of the existing ponds. Molycorp directed a number of hydrogeologic studies of the area as part of the requirements for an Environmental Impact Statement but never built the proposed new tailings facility because the mine operations ceased in 1992. In 1993, the GWPRB-Groundwater Section required Molycorp to submit an application for a Ground Water Discharge Plan for the tailings impoundments (application # 933). A similar request was made for the mine waste dumps in 1994 (application # 1055; ref. 29). While site investigation and monitoring processes are ongoing, approval of either Discharge Plan application is pending.

II. EXPANDED SITE INSPECTION

Molycorp was evaluated along four migration or exposure pathways: groundwater, surface water, air and soil. Environmental media sampled included the following: 1) waste samples from the mining waste rock piles and tailings ponds; 2) soil samples near the tailings ponds to identify the area of contamination; 3) groundwater samples from wells and seeps/springs to determine if a release from the waste sources has occurred; and 4) surface water and sediment samples from the Red River to identify a release of CERCLA hazardous substances and determine level of contamination.

A. Waste Source Characteristics

1. Source Identification and Quantity

Two areas of the Molycorp Site have been identified as potential waste sources for CERCLA hazardous substances: the mine waste dumps and the tailings ponds. While there are separate sub-units within each area (eg. multiple mine waste dumps and tailings ponds), these sub-units were considered collectively as mine waste dumps and tailings ponds due to their similarity of respective waste types.

The development of the open pit between 1965 and mid 1980's resulted in the deposition of mine waste rock in Capulin Canyon, Goathill, Sulphur and Spring Gulches and adjacent to the Red

River in areas referred to as Sugar Shack (Figs. 2, 3). A recent report has estimated the amount of waste material in each of the disposal areas (ref. 30, p. 45). The total amount of waste material at the mine waste dumps is 328 million tons (ref. 30, p. 45). While most of the dump material in Capulin Canyon and Goathill Gulch consists of altered volcanics, those dumps south and east of the pit consist primarily of andesite, aplite and granite (ref. 30, p. 7, 36). Prior to conducting the ESI and completion of a preliminary waste dump characterization study directed by Molycorp, little information was available regarding CERCLA constituents in the mine waste dumps. One field test performed by NMED-Surface Water Quality Bureau demonstrated the acid generating potential in several waste samples in which the pH of test water was reduced when samples of waste were shaken with water over a several minute period (ref. 31).

Tailings Ponds at Molycorp consist of fine-grained tailings and waste water located in a series of ponds west of Questa (Figures 2, 4). No bottom liner is present in any of four ponds (ref. 9, p. 3). Transmission of waste water from the tailings ponds to groundwater may be slowed by the deposition of fine-grained sediment on the bottom of the ponds. The amount of tailings in these ponds is estimated to be 95 million tons (ref. 30, p. 7). One split sample of the tailings analysis conducted by Molycorp and the Questa Board of Education in 1982 detected lead, copper and zinc at concentrations ranging from 90 ppm (lead) to 240 ppm (zinc) (ref. 32, p. B-13).

2. Waste Characteristics-Methods

Seven waste source samples were collected from the mine dumps during June 1994 to determine the presence of CERCLA hazardous substances. Sample locations were selected to evaluate the waste characteristics from each dump area (Fig. 3). Specific locations were initially intended to be selected based upon high relative readings of metal concentrations by x-ray fluorescence (XRF). Failure of the XRF resulted in visual selection of sampling points at more highly discolored locations (ref. 24, p. 51), which may be indicative of acid generation.

To assess whether the hydrothermal scar areas surrounding the mine waste dumps also could be a potential source of CERCLA hazardous substances, three composite soil samples (including one duplicate) were collected from the Eagle Rock and Hanson Creek scar areas (Fig. 3). Samples collected for analysis were homogenized in a designated plastic bag or in place prior to their transfer into two 4-oz. or one 8-oz. sample jar equipped with a Teflon-lined cap. All samples were split with Molycorp's consultant and analyzed for Target Analyte List metals under EPA's Contract Laboratory Program (CLP).

Collection of waste material in the tailings ponds occurred during April 1994 (Fig. 4). Eight waste samples from the four tailings ponds (including one duplicate sample) were collected and analyzed to identify the presence of CERCLA hazardous substances, with at least two samples from each of the two larger ponds (Ponds 1 and 4; Fig. 4). Because different tailings ponds were utilized at different times, samples from each pond, or various locations within a pond, may reflect changes in composition of the tailings over the period of operation.

At each sampling location within the tailings ponds, three waste locations 100 feet to 200 feet apart were screened for metal concentrations using x-ray fluorescence (Spectrace 9000). Selection of sampling location for waste source identification was based upon those screening locations which demonstrated higher XRF readings. Results for iron, barium and molybdenum were generally used as the basis for determining metal concentrations at each XRF screening location (ref. 24, p. 32-37). Results from the screening procedure are presented in Attachment B. Sample collection of the waste material from the tailings ponds involved the removal of the soil cap material (where present) with a hand auger, and collection of the upper 3 to 6 inches of tailings with a stainless steel hand auger (ref. 24, p. 32). Decontamination of the hand auger between waste samples was performed using deionized water. Samples collected for analysis were homogenized in a designated plastic bag prior to their transfer into two 4-oz. or one 8-oz. sample jar equipped with a Teflon-lined cap. All samples were split with Molycorp's consultant and analyzed for Target Analyte List metals under EPA's Contract Laboratory Program.

3. Waste Characteristics-Results

Analytical results of the average metal concentrations and the range of concentrations in the mine waste dumps are presented in Table 1 (ref. 65). Results indicate that most metals included in EPA's Target Analyte List were detected in the mine waste samples above the detection limits. Metals detected at the highest concentrations are those which are most abundant in the earth's crust including aluminum, calcium, iron, magnesium and potassium. Other metals ranged in concentrations from non-detectable levels (e.g. mercury) to over 1,000 mg/kg (e.g. manganese; Table 1). The large ranges of metal concentrations seen for most metals (e.g. cadmium, silver, zinc) demonstrates the heterogeneous nature of the mine waste dumps. This variation can be measured relative to the average concentration by calculating the coefficients of variation for each metal (Table 1). These values ranged between 50 and 245 % for all detected metals (Table 1).

Results of waste sampling at the tailings ponds is presented in Table 2 (ref. 65). Most metals on EPA's Target Analyte List were detected. Concentrations are fairly consistent as shown by coefficients of variation which are generally less than 50% (Table 2). Most metals demonstrating higher concentrations are those which are most abundant in the earth's crust such as aluminum, calcium, iron and magnesium.

Most metals on EPA's Target Analyte List were detected in the mine waste dumps and the tailings ponds with higher average concentrations generally noted in the tailings (iron, lead, zinc excluded; ca. Tables 1 and 2). While finding CERCLA hazardous substances in the waste sources does not require a comparison to background, evaluation of their potential to impact the surrounding environment should take into account effects from other potential sources. In the vicinity of the mine, hydrothermal scar areas represent another source of metal loading to groundwater and the Red River. Several composite soil samples from three of these scar areas (Eagle Rock, Goathill Gulch and Hanson Creek) were collected and analyzed for TAL metals. Results for the average concentration for each metal are presented in Table 3 (ref. 65). Variation in metal concentrations noted in the mine waste dumps is also apparent in the scar material.

4. Waste Characteristics-Discussion

Detecting differences between the mine waste dumps and hydrothermal scar areas is important in assigning attribution of any potential effects to groundwater and the Red River. To assist in detecting differences between the mine waste dump and scar material, ratios of average metal concentrations between the two sources were calculated (Table 4; ref. 65). Any dissimilarities in metal concentrations between the two areas are reflected in concentration ratios which deviate from unity. The mine waste dumps exhibited greater average concentrations (e.g. 2 to 5 times) of molybdenum, zinc, copper and manganese, while hydrothermal scar material had higher average levels of iron, alkali metals (potassium and sodium) and silver (Table 4).

Average metal concentrations of the tailings in the impoundments were also determined and compared to that of two surrounding soil types by calculating concentration ratios similar to those for the mine waste dumps (Table 4). Concentration ratios show that several metals exhibiting the highest average metal concentrations in tailings relative to surrounding soil are copper, calcium, magnesium, chromium and nickel (Table 4). Comparing these concentration ratios at the mine area and tailings ponds demonstrate that the tailings are more easily distinguishable from the surrounding soil (i.e. have higher ratios) than the mine waste dumps are from the hydrothermal scar areas (Tables 4).

B. Groundwater Migration Pathway

1. Geology and Aquifer Description

1.1 General Geology

The Molycorp mine is located along the Red River drainage in the Taos Range of the Sangre de Cristo Mountains where complex geologic history stems from Tertiary magmatism and regional block-faulting of the Rio Grande Rift (ref. 33, p. 3, 5, 7, 9). The Red River is located along a normal fault and is the southern boundary of a down-faulted area known as the Red River Graben (ref. 34, p. 94, 95, 99). North of the Red River fault but within the Red River drainage, there is a line of hydrothermal alteration scars marking a parallel fault (ref. 34, p. 95). A series of high angle normal faults which trend north has caused significant segmentation of this graben (ref. 34, p. 95).

The lithology in the vicinity of Molycorp mine is comprised of a Precambrian basement of igneous rock (granite) and metamorphic rock (amphibolites, quartzites and schists) which is overlain by Tertiary volcanics (ref. 8, p. 11). The volcanics consist of flows, breccias and tuffs of andesite, latite and rhyolite. These formations were intruded by a granitic stock of Miocene age (23 m.y.) and later by quartz and monzonite porphyries. Most of these intrusions, along with mineralizations associated with hydrothermal fluids, centered along the Red River Graben.

The town of Questa and the tailings ponds are located 5 miles to the west of the mine on the Taos Plain. This plain is situated within the Rio Grande Basin, a deep basin which was created through Miocene uplifting of the Taos Range (ref. 35, p. 12). This downfaulted area has received alluvial sediment from the Taos Range. Intermittent extrusion of basalt and andesite flows from the Guadalupe Mountains during late Pliocene and early Pleistocene (approximately 1.6 m.y.) resulted in interbedding of lava with alluvium. These lithologies, together with occasional lake deposits, comprise the Santa Fe Group (ref. 35, p. 15).

1.2 Hydrogeologic Setting

Mine Area

The principle aquifer in the vicinity of the mine is comprised of fractured igneous and volcanic bedrock (subsequently referred as Fractured-Bedrock Aquifer) and a second, overlying aquifer within the alluvium of the Red River channel and side channels (called Alluvial Aquifer) (ref. 12, p. 5). [For the purposes of this ESI, the "valley-fill mudflow and alluvial valley-fill aquifers" outlined in reference 12 were combined into the Alluvial Aquifer.] The depth of the alluvium within the Red River channel is as much as 150 feet thick (ref. 12, fig. 5). The placement of 12 new monitoring wells drilled in the Molycorp mine area in 1994 evaluated each of these aquifers (ref. 12, p. 3). Based upon pump tests of wells in the mine area, the aquifers are considered interconnected (ref. 12, p. 12). The hydraulic conductivity of the fractured bedrock was recently reported between 5.1 gallons/day/ft^2 and 629 gallons/day/ft^2 (.00024 cm/sec to .03 cm/sec; ref. 12, p. B-10); whereas that of the alluvium was 1,141 gallons/day/ft2 (.0539 cm/sec) (ref. 12, p. B-9). The variability seen in the fractured bedrock depends upon the degree of fracturing present at a given location.

A number of seepage studies have demonstrated that the Red River is a gaining stream in the vicinity of both the mine area and tailings area. In the middle reach of Red River (the reach from Red River to Questa, which includes the Molycorp mine area) seepage studies have documented accretion from groundwater into the Red River at average rates of 4 cubic feet per second (cfs) (ref. 36, p. 84, 85). As an approximation, this recharge rate could be assumed to be equally apportioned to each side of the river. Therefore, a portion of the 2 cfs from the north side originates from the drainage area of the Molycorp Mine. Other studies estimated groundwater recharge to the Red River from the Molycorp Mine drainage area to be between 1.45 and 2.56 cfs (ref. 12, p. B-6).

Tailings Ponds

The Santa Fe Group, underlying Questa and the tailings ponds, is the major water-bearing unit in the Rio Grande Basin of Taos County (ref. 35, p. 15). Depth to water in the Questa area is generally in the range of 60 to 160 feet (ref. 35, p. 22). The groundwater gradient in the vicinity of Questa is approximately 100 feet per mile (ref. 35, Plate 2). Groundwater flow near the town of Questa and the tailings ponds is generally southwest away from the mountains, and recharges

the Red River and Rio Grande by numerous springs which generally emerge from a basalt layer. The lower reach of Red River (from Cabresto Creek to mouth of Red River, Fig. 2) has been measured as having an average accretion rate from groundwater of approximately 33 cfs (ref. 35, p. 40). Those springs which recharge the Red River are located southwest of the tailings ponds toward the confluence of the Red River and Rio Grande (ref. 37, p. 20, 23). Some of these springs are hydrologically connected to the waste water which leaches through the tailings ponds (ref. 37, p. 19, 24).

2. Groundwater Use

Mine Area

The Fagerquist's Cottonwood Park is a small, 12 unit resort approximately 1/3 mile south of the Molycorp mine and 100 feet below the confluence of Columbine Creek and the Red River (Fig. 3; ref. 65). The resort's well is the well nearest the mine which supplies drinking water. Other supply wells which provide drinking water in the vicinity of the mine are the U.S. Forest Service wells located in Columbine, Fawn Lakes, Elephant Rock and Junebug Campgrounds (Fig. 3). With a depth of 56 feet (ref. 65, p. 1), the Fagerquist well taps the Alluvial Aquifer which is in hydraulic communication with the Fractured-Bedrock Aquifer. With the Fagerquist well located on the south side of the Red River, much of the recharge may be from the Columbine Creek area. This is suggested by the low concentrations of metals and sulfate and high alkalinity detected in the well as compared to Molycorp monitoring wells north of the Red River (Table 5).

Drinking water wells in the vicinity of Questa include private wells and community wells (ref. 38). These wells are west of the regional blockfault which created the Taos Range. While on the opposite side of the fault from the mine, nothing is known to preclude inter-communication among the Santa Fe Group Aquifer and the Fractured-Bedrock and Alluvial Aquifers near the mine. Therefore, most of the wells west of the regional block fault, including the Questa community supply wells, are potentially impacted by groundwater in the vicinity of the mine. The population served by groundwater wells within four miles of the mine is presented below:

Distance from Mine (mi.)	# Private Wells (ref. 39)	Population Served by Private Wells	# Community Wells (ref. 38, 40)	Population Served by Community Wells	Total Population
0-1/4	0	0	0	0	0
1/4-1/2	1	2*	0	0	2
1/2-1.0	0	0	0	0	0
1.0-2.0	0	0	0	0	0
2.0-3.0	4	12	1	44	56
3.0-4.0	10	30	4	1733**	1763
	Total Population:				1,821

* Fagerquists (Nearest Well; ref. 65)
** Includes Questa population or 1,644 persons (ref. 38)

Tailings Ponds

Several private wells located below the tailings ponds were used by residents for drinking water purposes until Molycorp offered to switch their drinking water supply to the Questa community well system (ref. 41). The basis for this switch was due to elevated concentrations of Total Dissolved Solids (TDS) and sulfate (personal communication, Dave Shoemaker, Site Manager). The switch from private wells to the Questa community well system began in approximately 1976 (ref. 24, p. 19). Several families refused to have their water supply switched; by November 1993, all but three wells had been switched (ref. 42).

Groundwater analysis submitted September 1993 by Molycorp, Inc. used an off-gradient well to reflect background conditions. This well, labelled MW-CH, is screened in the middle to lower units of the Santa Fe Group Aquifer (ref. 43, p. 15). Results from this sampling event show elevated levels above background of iron, manganese and zinc in several monitoring wells and detected levels of chromium and lead in one monitoring well (ref. 43, p. 23). Three private wells were also sampled during September 1993 with results showing no exceedances of New Mexico WQCC Standards (ref. 44); however, comparison of the reported concentrations of zinc in the private wells to the background value reported in the September 1993 report demonstrates over a three-fold increase in zinc in each private well (ca. ref. 43, p. 23 and ref. 44). Upon presenting the results from the sampling of private wells to the owners, Molycorp continued to offer to switch residents below the tailings ponds to Questa community water supply (ref. 44, p. 2). The Feliciano Rael well (Fig. 4) is believed to be the only private well currently used for drinking purposes (ref. 45; ref. 24, p. 43).

The population served by groundwater was evaluated within 4 miles of the tailings ponds. Locations for the Questa Community Wells, other community wells and the Rael well are shown in Reference 3. Location of drinking water wells were determined using well information from the New Mexico State Engineer's Office (ref. 39) and information provided by the Superintendents of the towns of Questa (ref. 38) and Red River (ref. 40). The two community supply wells for the town of Questa, with roughly equal pumping rates, provide water for 1,644 persons (ref. 38). Three additional community wells identified near Questa are an unnamed well near the offices for the Town of Questa, Eagle Lake Trailer Park and Cerro de Oro (ref. 38). Each have 10 - 15 service connections. Population served by each well was calculated by multiplying the number of connections and the number of persons per household (i.e. 2.95; ref. 46, Questa Village). The population of Cerro was estimated to be 396 (ref. 46, 47) and was assumed to be serviced equally from each of two community supply wells (Cerro East and West, ref. 40). Total population served by groundwater within 4 miles of the tailings ponds is presented below:

Distance from Tailings Ponds (mi.)	# Private Wells (ref. 39)	Population Served by Private Wells	# Community Wells (ref. 38, 40)	Population Served by Community Wells	Total Population
0-1/4	1	1	0	0	1
1/4-1/2	0	0		0	0
1/2-1.0	2	6	3	882*	888
1.0-2.0	20	59	2	852*	911
2.0-3.0	5	15	1	198**	213
3.0-4.0	22	61	1	198**	259
	Total Population:				2,272

* Includes ½ of Questa population or 822 persons (ref. 38)

** Includes ½ of Cerro population or 198 persons (ref. 46, 47)

3. Groundwater Pathway-Methods

The purpose of evaluating groundwater in the mine area and tailings ponds is to determine whether a release of CERCLA hazardous substances from the site has occurred. A release is observed where contaminant concentrations in downgradient groundwater exceed three times the upgradient or background concentration for a particular analyte. An alternative definition for a release is the detection of an analyte in downgradient samples when undetected in the background sample(s). Therefore, field sampling focused upon the collection and analysis of groundwater from both background and downgradient locations within each aquifer.

In the area of the mine where elevated concentrations of metals in seeps, springs and the Red River have been previously noted (refs. 12, 24, 28), much attention focused upon the attribution of these elevated contaminants to Molycorp operations above any contribution from hydrothermal scar areas. During this ESI, attempts to distinguish site-related discharge from that of background conditions were used to identify and attribute the release of hazardous substances to the mining activities.

Much of the sampling for the groundwater pathway involved the sampling of seeps/springs. [For this ESI, these terms will be interchangeable]. Because the seeps and springs most likely reflect groundwater quality and ultimately reach a surface water body, they were also evaluated through the groundwater-to-surface water pathway. A release of any CERCLA hazardous substances from a seep or spring to surface water can only be achieved if a release to groundwater has first been established.

Mine Area: Alluvial Aquifer

In the vicinity of the mine, background groundwater quality is highly variable and likely depends, in part, on the degree to which it has been impacted by mineralized areas of the lithology. To address the variability of the Alluvial Aquifer, four groundwater sampling locations were chosen to reflect background conditions: one of the Molycorp Mill wells, U.S. Forest Service wells at Elephant Rock and Junebug Campgrounds and the wastewater treatment plant (WWTP) for the town of Red River (Fig. 3). The first three wells are screened in the alluvium of the Red River channel while the well at the WWTP is screened in a mudflow (alluvium) representing a fan delta from a side channel (Attachment C). For the purposes of this ESI, the highest reported concentration of each analyte from any of the four background wells was used to represent the background condition.

A release to the Alluvial Aquifer was determined by sampling six seeps along the Red River in the vicinity of Molycorp haulage adit, Goathill Gulch, Capulin Canyon and Old Eagle Rock Campground (called Cliff Seep) (Fig. 3; ref. 24, p. 46-47, 64). Collection included both filtered and unfiltered samples to distinguish between dissolved and total metals. Comparisons of metal concentrations in downgradient groundwater locations to background were restricted to samples of similar fractions (dissolved or total).

Mine Area: Fractured-Bedrock Aquifer

No background well for the Fractured-Bedrock Aquifer was located. Those wells screened in the alluvium (Red River channel or tributaries) are not representative of background for this aquifer. The only water which may serve this function is within the mine workings. Although the mine workings may be impacting the water quality, mine water provides the best available approximation for background water quality in the Fractured-Bedrock Aquifer. Numerous groundwater locations within the mine workings have been sampled by Molycorp (ref. 30, Table 1.4; ref. 12, Table D-4). While their data does not include all Target Analyte List metals,

their data best addresses temporal and spatial representativeness of this aquifer and was used for background water quality within the Fractured-Bedrock Aquifer. Cabin Spring also represents fractured bedrock flow since it is located where mudflows from hydrothermal scars are absent (ref. 12, figure 4) and emerges directly from bedrock (ref. 24, p. 71). For the purposes of this ESI, the highest metal concentrations within the mine workings was used as background to identify releases of CERCLA hazardous substances to Cabin Spring and the 4 monitoring wells which are screened in the fractured bedrock.

Identifying a release to groundwater focused upon downgradient monitoring wells (which were installed after completion of the ESI workplan) and seeps/springs. A total of four monitoring wells and six seeps were sampled and analyzed for total and dissolved metal concentrations and general chemistry (Cabin Spring excluded). Location of all monitoring wells and seeps sampled are presented in Figure 3. Four 1-liter high density polyethylene (HDPE) bottles were needed at each sampling location for total (unfiltered) and dissolved (filtered) metals and general chemistry. The latter required both a preserved and unpreserved sample. Water samples requiring filtering were initially collected in 4-liter containers. Samples were acidified to pH 2 with nitric acid (sulfuric for general chemistry) and kept on ice until arrival at the analytical laboratory. Samples were split with Molycorp's consultant and analyzed for Target Analyte List (TAL) metals under EPA's Contract Laboratory Program (CLP). Selected samples were also analyzed for general chemistry parameters under either CLP or the program of the New Mexico State Laboratory Division (SLD). SLD was used for latter sampling events due to the discontinuation of the applicable contract under EPA. In accordance with SLD's operating procedures, general chemistry samples were not filtered.

Tailings Ponds

Ten monitoring wells located below (south - southwest) the tailings ponds were sampled to identify a release of CERCLA hazardous substances from the ponds to the Santa Fe Group Aquifer. Analyses conducted on samples from each well included total metals, dissolved metals and general chemistry parameters. Results from these downgradient wells were compared to that from the Change House well which represented background conditions. Locations of all wells sampled are presented in Figure 4.

Five seeps, labelled A through E, were identified between the tailings ponds and the Red River Fish Hatchery (Fig. 4). Those seeps which demonstrated higher relative readings of conductivity (eg. seeps A, D, E) were assumed to have a higher metal content and samples were collected for laboratory analysis (ref. 24, p. 40). Water from a seep identified along Embargo Road below tailings pond #1 and Molycorp's discharge (Outfall #002) was collected along with the warm and cold water springs which provide water to the Red River Fish Hatchery and the hatchery's abandoned cold water spring collection point (Fig. 4).

Four 1-liter HDPE bottles were needed at each sampling location for total (unfiltered) and dissolved (filtered) metals and general chemistry. The latter required both a preserved and

unpreserved sample. Water samples requiring filtering were initially collected in 4-liter containers. Samples were acidified to pH 2 with nitric acid (sulfuric for general chemistry) and kept on ice until arrival at the analytical laboratory. Samples were split with Molycorp's consultant and analyzed for Target Analyte List (TAL) metals under EPA's Contract Laboratory Program (CLP) (ref. 24, p. 62).

4. Groundwater Pathway-Results

Mine: Alluvial Aquifer

Analytical results of the four background wells sampled during this ESI are presented in Table 6 (ref. 65). The metal concentration used as background groundwater quality to which downgradient seeps were compared is the highest concentration reported among the four wells. Results of metal analyses of various groundwater seeps and their comparison to background is presented in Table 7 (ref. 65). Results show that metal concentrations were generally the same for filtered (dissolved) and unfiltered (total) samples. Two CERCLA metals (beryllium and copper) were elevated above three times background in at least one downgradient seep of the Alluvial Aquifer (Table 7). Copper demonstrated a 7 to 30-fold increase over background whereas Be showed up to a 4-fold increase (Table 7). Also, the non-CERCLA metals aluminum and manganese were elevated in at least a single seep. The highest concentrations of all four metals were noted in the Capulin Channel Seep.

Mine: Fractured-Bedrock Aquifer

Analytical results of metal concentrations (total and dissolved) in downgradient monitoring wells and Cabin Spring are presented in Table 8 (ref. 65). Representing background for the Fractured-Bedrock Aquifer are the highest metal concentrations reported from Molycorp mine workings (Table 8). Data show that several metals were elevated in at least one downgradient well and/or Cabin Spring including three CERCLA metals--arsenic, cadmium and copper (Table 8). All metals reported were most elevated in MW-7. Cabin Spring, represented by an unfiltered sample only, demonstrated copper and aluminum concentrations which were elevated 14 and 28-fold, respectively.

Tailings Ponds: Santa Fe Group Aquifer

Groundwater from three private wells located south of the tailings ponds were sampled for metals and general chemistry parameters. Of the three wells, only one is currently used for drinking purposes (ref. 45). Analytical results of the groundwater in private wells near the tailings ponds is presented in Table 9 (ref. 65). The results show that arsenic, chromium and lead (CERCLA hazardous substances) were detected in either the filtered or unfiltered sample from one of the private wells while undetected in the background sample. Arsenic was detected in the filtered sample from the Duran well at 4.7 ug/L (Table 9). This level is below EPA's Maximum Contaminant Level (MCL) of 50 ug/L. Groundwater results from the Herrera well show

detectable amounts of lead (estimated at 8.5 ug/L in the filtered sample only) and chromium (16.6 ug/L in the unfiltered sample only). The levels at which these metals were detected are also below their respective MCL (Table 9). Groundwater from the Rael well showed detectable levels of zinc in both the filtered and unfiltered samples (Table 9). The estimated zinc concentration of 260 ug/L observed in the unfiltered sample is over three times the background concentration of 75 ug/L but well below the MCL of 5,000 ug/L (Table 9). Concentrations of several non-CERCLA metals were elevated in both filtered and unfiltered samples from private wells (downgradient) at least three times the background concentration (at Change House Well; Table 9). Elevated concentrations of sulfate were noted in both the Rael and Herrera wells.

Analytical results of groundwater from the monitoring wells, presented in Tables 10 and 11, reveal that most of the elevated concentrations of metals were detected in unfiltered samples whereas only a few non-CERCLA metals (e.g. calcium, magnesium and manganese) were consistently elevated in filtered samples (Table 11). Two CERCLA metals were detected in both filtered and unfiltered samples but were not elevated above background in both fractions. These include lead in MW-3 and MW-4 and copper in MW-7b (Tables 10, 11). Lead was noted in the filtered samples from MW-3 and MW-4 at elevated concentrations of 8.3 ug/L and 4.2 ug/L, respectively (Table 11). The respective lead concentrations of 1.5 ug/L and 2.4 ug/L in the unfiltered samples were not elevated above the background concentration of 2.5 ug/L (Table 10). Lead concentrations in these wells are below EPA's Maximum Contaminant Level (MCL) of 15 ug/L. Copper was detected at 3.5 ug/L and 38.9 ug/L in the filtered and unfiltered samples from MW-7b while undetected in background samples (Tables 10, 11). The concentration of copper from both filtered and unfiltered samples is below the MCL of 1,300 ug/L (Tables 10, 11).

Analytical results of the seeps sampled near the tailings ponds are presented in Table 12 (ref. 65). Several seep samples along the Red River (e.g. Seeps A, D and E), the North Irrigation Ditch (near Embargo Road) and Outfall #002 were compared to background groundwater at the Change House Well to determine whether a release of CERCLA hazardous substances to groundwater had occurred. Results show elevated concentrations of arsenic in both filtered and unfiltered samples from the Warm Spring (Table 12). Several non-CERCLA hazardous substances were also elevated in at least one seep, including aluminum, manganese, sulfate and Total Dissolved Solids (TDS) (Table 12). Other than aluminum and sulfate, which were observed at the Embargo Road seep at the highest concentrations, all other parameters were most elevated in Outfall #002 (Table 12).

5. Groundwater Pathway-Discussion

Mine Area

One area of uncertainty when evaluating groundwater quality downgradient from the mine area is the selection of a background sample. Two different aquifer types can be distinguished at Molycorp Mine: Fractured-Bedrock and Alluvium. Seeps along Red River are likely influenced

by both aquifers since nothing precludes hydrologic communication between the two aquifers. Since the seeps are located within the alluvium (Cabin Spring excepted), the selection of background focused within this aquifer. Water quality of the Alluvial Aquifer is highly variable as demonstrated by the analysis of groundwater from the WWTP and Molycorp Mill well (Table 6). The probable reason for this difference is that the Red River WWTP well is screened in the alluvium of a side channel (Hot-N-Tot Creek) which is more greatly influenced by drainage from a hydrothermal scar area. Because the WWTP well and portions of the Molycorp mine area are likely impacted by drainage from hydrothermal scars, the water quality observed from the WWTP well represents the most conservative selection of background water quality for the Alluvial Aquifer. Comparison of downgradient seeps to this background demonstrated a release of CERCLA hazardous metals (beryllium and copper) to this aquifer.

A second method of identifying a release to the seeps below the Molycorp Mine focused upon the comparison to an upgradient seep near Hanson Creek. This seep most probably drains Hanson Creek where one of the largest hydrothermal scars is located (ref. 28, figure A). Previously reported data show over a 3-fold increase between Hanson Creek Seep (or Spring) and downstream seeps in aluminum, copper, lead, manganese and zinc (ref. 28, Appendix 1). Except for beryllium which was not reported, the three metals defining a release to the seeps (aluminum, copper and manganese) during the ESI were also elevated in this previous report. Furthermore, aluminum, beryllium, copper and manganese were detected at greater concentrations in the leachate from mine waste than hydrothermal scars (Table 13; ref. 65). A similar result is seen with data from another study which used a greater number of samples (Table 14; ref. 30, Table 1.2). Copper and manganese were also detected at twice the concentrations in soil samples from the waste dumps than the scar areas (Table 4). The consistency with which increased concentrations of beryllium, copper and manganese were detected in the mine waste dumps, the leachate from the dumps and in the seeps provides sufficient evidence for partially attributing to Molycorp the release of CERCLA hazardous metals to the Alluvial Aquifer.

All downgradient monitoring wells sampled during this ESI are screened in bedrock and represent the Fractured-Bedrock Aquifer. Evaluation of data from this aquifer resulted in a release of CERCLA metals (arsenic, cadmium and copper) in at least a single monitoring wells and/or Cabin Spring (Table 8). Because cadmium and copper were detected at greater concentrations in the soil and leachate samples from mine waste dumps as compared to hydrothermal scars (Tables 4, 13, 14), the release of CERCLA hazardous metals to the Fractured-Bedrock aquifer is partially attributable to Molycorp. This conclusion is supported by another study which demonstrated, through tritium dating, similarities between the water from MW-11 and Cabin Spring and that from mine waste leachate (ref. 12, p. D-8).

Tailings Ponds

Increased metal concentrations were noted primarily in the unfiltered (total metals) samples of private wells located downgradient from the tailings ponds (Table 9). These elevated levels, however, may not be representative of the aquifer they tap (Santa Fe Group Aquifer). Unfiltered

samples can be affected by well construction and are less likely to be representative of groundwater characteristics than filtered samples. Although purging of a well is supposed to alleviate problems from well construction and completion, the difference in metal concentrations between the filtered (dissolved fraction) and unfiltered (total metals) samples seen for aluminum, iron and manganese in the Herrera well (Table 9) suggests that the unfiltered sample may be incorporating particulates and may not be providing a true reflection of the aquifer. Contrarily, arsenic and lead were detected solely in the filtered (dissolved fraction) sample from the Duran and Herrera wells, respectively. If either metal truly exists at their reported level, one would expected similar results from the unfiltered samples. However, arsenic and lead were not detected in the unfiltered sample from the Duran and Herrera well, respectively. This inconsistency most likely reflects analytical variability. Further proof that As and Pb are not elevated in these wells is provided by Molycorp's data (from split sampling) which showed undetected levels of these metals in the Duran and Herrera wells (ref. 48, p. 2-4). For the purposes of this ESI, a release to groundwater required at least a three-fold increase of an analyte in both the filtered and unfiltered samples. Using this definition, no release of CERCLA hazardous substances to private wells was observed. While the concentration of zinc was elevated in the unfiltered sample from the Rael Well, it was not elevated above three times background for the filtered sample (Table 9). Therefore the Rael well, which remains as the only private well for drinking water purposes, is subject to potential contamination from the ponds rather than actual contamination.

Analytical results from the monitoring wells downgradient from the tailings ponds showed several metals including aluminum (Al), calcium (Ca), magnesium (Mg), manganese (Mn) and potassium (K) which are elevated in both filtered and unfiltered samples (Tables 10, 11). These metals, however, are not listed as CERCLA hazardous substances. Copper was detected in both filtered and unfiltered samples from MW-7b while remaining undetected in background samples (Tables 10, 11). The sample detection limit for copper in the background sample, however, is greater than the level detected in the filtered sample for MW-7b (6 ug/L vs. 3.5 ug/L, respectively). It is uncertain whether the level detected in MW-7b (dissolved fraction) is truly greater than the concentration (though undetected) in the background sample. Due to this uncertainty, copper is not considered elevated in MW-7b. No other metal listed as a CERCLA hazardous substance is elevated in both filtered (dissolved fraction) and unfiltered (total metals) samples in downgradient monitoring wells. Therefore, a release of CERCLA hazardous substances to monitoring wells has not been established in the vicinity of the tailings ponds.

Seeps and springs which were sampled during this ESI flow directly into the Red River (Seeps A, D, E, Old Cold Spring Collection), into the North Irrigation Ditch (Embargo Road Seep) or are collected by the Red River Fish Hatchery (Warm and Cold Springs). They represent locations where groundwater enters a surface water body. Arsenic was detected in both filtered and unfiltered samples from Warm Spring while remaining undetected in the background well (MW-CH; Table 12). However, arsenic was detected in only three of the eight tailings samples and at levels slightly greater than the detection limit (Table 2). With arsenic concentrations in background soil which equal or exceed those in the tailings (Table 4), the elevated level in Warm Spring cannot be attributed to the tailings ponds. The elevated concentrations of other metals

noted in the seeps (e.g. Al, Ca, Mg, Mn and K) are restricted to parameters which are not defined as CERCLA hazardous substances.

Laboratory results of groundwater (from private wells, monitoring wells and seeps) near the tailings ponds demonstrated elevated concentrations of non-CERCLA hazardous substances such as aluminum, iron and manganese in both filtered and unfiltered samples from at least one downgradient groundwater sampling location (Tables 10-12). An elevated level of arsenic (a CERCLA metal) was detected at a single location, but is unlikely attributable to the tailings due to the virtual absence of As in the tailings. Therefore, a site-related release of CERCLA hazardous substances to groundwater in the vicinity of the tailings ponds has not been established.

C. Surface Water Migration Pathway

1. Surface Water Flow Characteristics

The Red River is located immediately south of the Molycorp mine and tailings ponds and flows in a westerly direction (Fig. 2). The average annual flow of the Red River at Questa Ranger Station (located between the mine and the tailings ponds) is approximately 41 cubic feet per second (cfs, ref. 28, Fig. B). Two tributaries to the Red River are Columbine and Cabresto Creeks which enter the Red River between the Molycorp mill area and the tailings ponds. Additional inflows to the Red River include seeps and springs, NPDES discharges from Molycorp, Inc. and return water from the Red River Fish Hatchery, which is located one-and-a quarter mile below Molycorp's most downstream NPDES discharge point (called outfall #001; ref. 10). Three miles below the hatchery, the Red River enters the Rio Grande (Fig. 2).

Drainage (via overland flow) from Molycorp first enters the Red River at the uppermost outfall of their NPDES permit (outfall #005) located near the mill area (Fig. 2). This location is the first probable point of entry (PPE-1). Approximately one-third mile below PPE-1, drainage from Molycorp's mine waste in Sulphur Gulch also enters the Red River through groundwater migration (ref. 4, photo 2). The bottom or toe of this dump was constructed in a manner which purposely conveys any collected water to the Red River via the alluvium of the river channel (ref. 24, p. 24). This location is the first where groundwater enters the Red River (called PPE-g). The furthest downstream location where drainage from Molycorp is known to enter the Red River (called PPE-2) occurs at outfall #001 (NPDES discharge point; ref. 10; Fig. 2). Between PPE-1 and PPE-2 are other known and potential drainage inputs from Molycorp to the Red River such as additional NPDES discharge points and seeps/springs (see Groundwater Pathway).

2. Surface Water Use

The Red River is a popular recreational area supporting activities such as skiing, hiking and fishing. The stream reach between the mine and State Highway 522 near Questa (a length of approximately 5 miles) is often referred to as the "Dead Zone" as it no longer supports a natural

fishery (ref. 49). The last fish survey within this reach reported zero fish (ref. 16). Anecdotes persist regarding the presence of abundant fish in the Red River in the 1960's. This is substantiated by the decrease in fish counts in the Red River over time (ref. 15).

Although a self-supporting fishery is lacking, Eagle Rock Lake, which is within the "Dead Zone", is heavily stocked by the New Mexico Department of Game & Fish (ref. 49). Red River is stocked bi-weekly between May and September with fish which can be caught (> 9 inches). The annual production of fish stocked in this area is 11,000 pounds, all of which is assumed to be caught (ref. 50). Water from the Red River is used at the Red River Fish Hatchery where it provides about 40% of the water for the raising of fish (ref. 51). The supplement of water comes from the collection of groundwater at Warm and Cold Water Springs (ref. 51). The total fish production at the Red River Fish Hatchery is approximately 300,000 pounds (ref. 50).

Numerous wetlands have been delineated by the US Fish & Wildlife Service along the Red River (ref. 63). Below the uppermost probable point of entry (PPE-1) where Molycorp's Outfall #005 for their NPDES permit is located, at least ten wetlands have been identified (ref. 63). The length of these wetlands varies between 0.1 and 0.5 mile. The total length of all the wetlands along the Red River below Molycorp Mine was estimated to be 1.8 miles (ref. 63).

The Red River also provides water for irrigation purposes near the town of Questa. Four surface water diversions are located below the mine: Questa Forest Service Ranger Station (North Irrigation Ditch); near the Old Eagle Rock Campground area (South Irrigation Ditch); and two within the town of Questa (Middle and Molino Ditches; Fig. 2). These diversion structures provide water for approximately 700 acres of agriculture (ref. 52). Water in the ditches or in the Red River is not used for drinking purposes (ref. 53).

Two miles below Outfall #001, the Red River has been designated as a Wild and Scenic River (Fig. 2); This designation extends down the Red River and Rio Grande for at least 15 miles (Fig. 2). Included within the Wild and Scenic designation (approx. 12 miles below Outfall #001) is the Canon del Rio Grande Recreation Area which extends approximately two miles down the Rio Grande. (Fig. 2).

Several species may occur at the Molycorp Site which are either threatened or endangered (as designated by US Fish & Wildlife) (ref. 54). Species include the Bald Eagle, American Peregrine Falcon and Southwestern Willow Flycatcher (ref. 54). The list of state threatened or endangered species which may occur in the area also includes the Baird's Sparrow and Meadow Jumping Mouse (ref. 55). Only the Bald Eagle has been verified by New Mexico Department of Game & Fish within four miles of Molycorp and 12 miles downstream (ref. 55). A single sighting of a Southwestern Willow Flycatcher along the Red River has been recorded, but the Red River is generally considered poor habitat for this species as it requires slow meandering waters with willow overgrowth (ref. 49). While unverified by the New Mexico Department of Game & Fish, the American Peregrine Falcon represents a (State) threatened species whose range is known to include the Red River (ref. 49). American Peregrine Falcon has a foraging range of up to 20

miles, and may be present at either the mine area or the tailings ponds where its range overlaps that of the Prairie Falcon (ref. 49). With the American Peregrine Falcon having such a large range, the Molycorp site (mine and tailings ponds) may account for a small proportion of it; however, one was sighted on the mine waste dumps during ESI field activities (ref. 24, p. 52).

3. Surface Water Pathway-Methods

A release of CERCLA hazardous substances from waste sources to the Red River was evaluated by the collection and analysis of surface water and streambed sediment samples upstream and downstream from the mine area. Near the tailings ponds, a release to North Irrigation Ditch was also evaluated for potential impact to surface water. Discharges by Molycorp to the Red River which may have exceeded those permitted under NPDES were also examined by direct sampling (at outfall #002).

Mine Area

Twenty-one sampling locations along the Red River near the mine area were selected to determine whether CERCLA hazardous substances have migrated into the river from the mine site (Fig. 3). The selection of sampling locations were based upon the presence of various inputs to the Red River such as creeks, seeps and springs. Media sampled included surface water, seeps and streambed sediments. Samples taken within the Red River were generally collected in a progressively upstream direction to minimize the possibility of disturbance of previous sampling from upstream locations. Samples were collected on three separate sampling events and analyzed for Target Analyte List (TAL) metals under EPA's Contract Laboratory Program (CLP). Selected samples were also analyzed for general chemistry parameters under either CLP or the New Mexico State Laboratory Division (SLD). SLD was used for latter sampling events due to the discontinuation of general chemistry analyses under CLP.

Water samples were collected prior to sediment samples to prevent elevated amounts of suspended sediment in the water samples caused by sediment sampling. Four 1-liter HDPE bottles were needed for total and dissolved metals and general chemistry. A preserved and unpreserved sample of filtered water were needed for general chemistry. Water samples requiring filtering were initially collected in 4-liter containers. All water samples were collected upstream from where the sampler was standing. Samples were acidified to pH 2 with nitric acid (sulfuric for general chemistry) and kept on ice until arrival at the analytical laboratory. Sediment samples were collected with an individually wrapped (sterile) plastic scoop to a depth of 1 to 2 inches so as to collect the maximum precipitate which may have formed on the streambed. Samples were collected in a plastic bag and homogenized prior to their transfer to either one 8-oz. or two 4-oz. jars equipped with a Teflon-lined cap. All samples were split with Molycorp's consultant.

Tailings Ponds

Determining a release of CERCLA hazardous substances to surface water near the tailings ponds followed three lines of investigation: input of groundwater directly to the Red River by seeps and springs; input of a particular seep near the tailings ponds to the North Irrigation Ditch; and exceedances of Molycorp's NPDES permit at outfall #002 (Fig. 4). Media sampled included surface water and seeps.

Four 1-liter HDPE bottles were needed for total and dissolved metals and general chemistry. A preserved and unpreserved sample of filtered water were needed for general chemistry. Water samples requiring filtering were initially collected in 4-liter containers. Samples were acidified to pH 2 with nitric acid (sulfuric for general chemistry as appropriate) and kept on ice until arrival at the analytical laboratory. Samples were split with Molycorp personnel and were analyzed for Target Analyte List (TAL) metals and general chemistry parameters under EPA's Contract Laboratory Program (CLP).

4. Surface Water Pathway- Results

Mine Area

Results from the analyses of Red River water samples show a general downstream increase of both total and dissolved metals (Table 15, 16; ref. 65). Using a sampling location above Molycorp property as the background surface water quality (sampling location #16, Fig. 3), an increase of at least three-fold was observed for both manganese and zinc (Table 16). This 3-fold increase first occurred for zinc at Goathill Gulch whereas that for manganese occurred below Capulin Canyon Seeps (sampling locations #7 and #3, respectively; Fig. 3). The highest reported concentration of either occurred where the Molycorp tailings pipeline crosses the Red River (Old Eagle Rock Campground; sampling location #2, Fig. 3). Elevated concentrations of manganese and zinc were also noted in this reach of the Red River during an earlier ESI sampling event (Table 17; ref. 65).

A release of CERCLA hazardous substances to the river is also documented by streambed sediment samples. Analytical results of the metal contents for 13 sediment samples are presented in Table 18 (ref. 65). This contamination may be due to suspended sediment deposition or precipitation of metal oxides originating from groundwater seeps. Using the data from the Red River above Molycorp property as background condition, several metals were elevated at various locations along the 8 downstream sampling locations (Table 18). Beryllium (Be), copper (Cu), lead (Pb), manganese (Mn) and zinc (Zn) were elevated above three times the background concentration in at least one-half of these locations (locations A through D and I, Fig. 3). Except for Mn, these metals are listed as CERCLA hazardous substances. Be, Cu and Zn demonstrated at least a five-fold increase at the location reporting the highest concentration. While the elevated concentrations generally increased in a downstream direction, the highest value was not necessarily at the farthest downstream location (Red River above Pipeline Crossing).

Tailings Ponds

Results for all seeps which may affect the Red River and the North Irrigation Ditch near Embargo Road are presented in the Groundwater Migration Pathway (Table 12). Impacts from the Embargo Road Seep to the adjacent irrigation ditch was evaluated by the collection of surface water in the irrigation ditch both above and below the inflow of the seep (Fig. 4; Table 19; ref. 65). While the concentration of several parameters increased below the input of the seep, including aluminum, manganese, sulfate and TDS, none of the elevations resulted in at least a three-fold increase (Table 19). A third sample from this ditch was taken above its return to the Red River and incorporates field drainage between Embargo Road and the river (Fig. 4). Data from this sample show that several metals increased dramatically. Calcium was documented at a 3-fold increase and magnesium, at a 20-fold increase for this location. Aluminum and manganese decreased in this sample (Table 19).

5. Surface Water Pathway-Discussion

Mine Area

Two sets of surface water data obtained during the ESI show a general increase in metal concentrations below the mine (Tables 15-17). The first set of data (June 26, 1994) documents over a three-fold increase in Mn and Zn concentrations between Columbine Creek and the USGS gaging station at the US Forest Service Ranger station near Questa (locations #9 and #1, Fig. 3; Table 17). Although a background sample was collected above Hanson Creek during this sampling event (location #18, Fig. 3), it did not adequately characterize surface water quality at the Molycorp property boundary since contributions of metals from Hanson Creek are unknown. Analysis from the second sampling event (Nov. 1994) demonstrates at least a three-fold increase of Mn and Zn between Molycorp property boundary (representing background) and where the Molycorp pipeline crosses the river (locations #16 and #2, respectively, Fig. 3; Tables 15, 16). The concentration at which Zn was detected in the Red River above the pipeline crossing (159 ug/L at location #2; Table 16; Fig. 3) exceeds the Ambient Water Quality Standard of 110 ug/L (ref. 2, p. B-54). The dilution effect from Columbine Creek may preclude the three-fold increase of other metals between these two sampling locations.

Analytical results from sampling events prior to this ESI have also shown elevated concentrations of Zn in the Red River below the Molycorp Mine and in Eagle Rock Lake (ref. 28, Appendix 2, p. 1, 2). During both sampling events the concentration of Zn in Eagle Rock Lake exceeded the Ambient Water Quality Standard of 110 ug/L.

The increase in metal concentrations in surface water is not uniform throughout the Red River between Molycorp property boundary and the pipeline crossing (locations # 16 and #2, respectively, Fig. 3). The largest gain of sulfate, Mn and Zn during ESI sampling was generally between Columbine Creek and Goathill Gulch (Table 20). This finding is consistent with two other data sets which focused on sulfate gain (Table 21; ref. 28, Appendices 2, 3). The data set

from 10-22-92 shows a much larger contribution from the upper reach (Molycorp mill to Columbine Creek). This is likely the result of discontinued surface flow from the mine waste dumps in Capulin Canyon due to the installation of the leachate collection system in 1992. The reach which demonstrated the second largest increase from the 10-22-92 data set is between Columbine Creek and Goathill Gulch.

The increase in manganese and zinc concentrations in surface water samples of the Red River near the Molycorp Mine is at least partially attributable to Molycorp's mining activities. Manganese and zinc were both elevated in the seeps along the Red River as well as waste source and leachate samples from the mine waste dumps. The consistency with which these two metals are elevated in waste material and drainage from mine dumps and downgradient water samples provides strong qualitative data to impart at least partial attribution of these increases to Molycorp activities. Supporting evidence of partial attribution was noted as changes over time of sulfate gain in the Red River were examined near the Molycorp mine (Attachment D). Results suggest that Molycorp operations have increased the proportion of sulfate gain contributed by the lower reach (i.e. Columbine Creek to Questa Ranger Station). Because sulfate gain in the Red River has ostensibly changed by Molycorp activities, partial attribution of this increase (and hence, Mn and Zn) to Molycorp operations is demonstrated.

Analytical results of streambed sediment sampling along the Red River near the Molycorp Mine demonstrated at least a three-fold increase in metal concentrations above background at several downstream locations (A through I, Fig. 3; Table 18). Metals exhibiting an increase in sediments include Be, Co (cobalt), Cu, Pb, Mn and Zn with all demonstrating at least a three-fold increase in the sediment sample below the mine at the pipeline crossing (location #2, Fig. 3; Table 18). These same metals were most elevated in soil samples from mine waste dumps relative to scar material (Table 4) lending support that the release of metals to the Red River in the vicinity of the mine is partially attributable to Molycorp.

The concentrations of metals in the Red River reflect contributions from various sources including drainage from the hydrothermal scars and from Molycorp mining activities. Other sources above Molycorp property likely include development near the town of Red River and grazing in the upper areas of the watershed (ref. 23, p. 210-211). Through surface water and streambed sediment sampling, a release of CERCLA hazardous substances to the Red River in the vicinity of the mine has been established and that the release is partially attributable to Molycorp activities.

Tailings Ponds

The sample collected from the outflow of the irrigation ditch (located approximately 50 feet west of outfall #002) includes seeps or field drainage in the area between Embargo Road and the Red River. This field is used primarily for grazing. Impacts from this field drainage should be reflected in any changes in water quality of the irrigation ditch below Embargo Road Seep and its inflow into the Red River. Several parameters increased due to the input of the field drainage with only sodium and chloride demonstrating at least a three-fold increase (Table 19); however,

none of these parameters are listed as CERCLA hazardous substances.

One study which evaluated contribution of leachate from Molycorp tailings to various seeps in the area of the ponds found increased concentrations of sulfate which was attributed to Molycorp activities (ref. 37, p. 19, 24). The seep at Embargo Road likely represents a fugitive release from Pond #1 which is not collected by the seepage barrier system. This conclusion is supported by the concentrations of calcium, magnesium, sulfate and TDS in the Embargo Road Seep which most closely parallels that of outfall #002 (Table 19).

Evaluation of impacts to the Red River initially included sample collection and analysis for metals and general chemistry parameters in river water samples. At the time of field collection of the water from seeps/springs and the irrigation ditch near the tailings ponds, the flow in the Red River was determined to be too high to safely sample. The high run-off would likely have diluted or masked any potential impacts to the Red River from the seeps and springs. Review of the analytical data from the seeps and springs, however, failed to establish a release of CERCLA hazardous substances in the seeps and springs; the absence of a documented release to these seeps and springs (which reflects the lack of impacts of CERCLA hazardous substances to groundwater), precluded the need to sample the Red River for potential impacts.

The surface water standards for the State of New Mexico include several use designations for the Red River in the vicinity of the Molycorp mine and tailings ponds including a coldwater fishery designation (ref. 56, sec. 3119). Acute and chronic standards exist which are relevant to coldwater fisheries. Comparison of chronic water quality standards to Outfall #002 and Embargo Seep provides a measure to evaluate potential effects of Molycorp discharge to aquatic systems. The sole metal elevated in waste water from the ponds (e.g. Outfall #002 and Embargo Road Seep) for which a chronic standard exists is aluminum. However, aluminum is not listed as a CERCLA hazardous substance. Embargo Road Seep had dissolved aluminum concentration of 119 ug/L (Table 19) which exceeds the State standard of 87 ug/L. While aluminum in the receiving surface water body (North Irrigation Ditch) increased due to the input from this seep, this increase was not significant. Fortunately, the concentration of dissolved aluminum in this irrigation ditch decreases to below the standard upon re-entering the Red River. The concentration of aluminum in Molycorp's discharge to the Red River is 148 ug/L which, while above the chronic standard of 87 ug/L, is a permitted discharge under their NPDES permit (permit # NM00222360; ref. 10, Part I, p. 3, 4).

A release of CERCLA hazardous substances to the Red River was evaluated through the groundwater-to-surface water pathway by examining seeps along the river. One seep entering an irrigation ditch was also evaluated. A release to the Red River also focused on the waste water discharged by Molycorp to the Red River. Comparing the seeps (and Molycorp waste water) to background groundwater quality failed to identify elevated concentrations of CERCLA hazardous substances. Therefore a release to surface water in the vicinity of the tailings ponds has not been established.

C. Soil Exposure Pathway

Soil sampling surrounding the tailings ponds was conducted to identify any elevated concentrations of CERCLA hazardous substances in residential soils which are attributable to the site. Determining areas of soil contamination required the comparison of soil constituents in residential yards to that of background soil locations.

1. Soil Exposure Pathway- Methods

Eight waste samples, including one duplicate, were collected from the tailings ponds to identify the presence of CERCLA hazardous substances. Soil samples were collected from residential yards south, east and north of the ponds and from Questa Jr. High School to the north of the ponds (Fig. 4). Soils from these residential areas represent two soil classifications as determined by the U.S. Soil Conservation Service: Sedillo series (residences to the south) and Silva Series (residences and school to the east and north) (Fig. 6). Background soil sampling locations were chosen for similarity in soil type to residential sampling areas and were generally upwind (south) from the tailings ponds (Fig. 4). The Silva soil type present at the eastern and northern residences and the junior high school is not present south (i.e. upwind) of the ponds; a location representing background was chosen further downwind (north). Sampling locations for waste (i.e. tailings) and soil are shown on Figure 6.

Generally, soil samples at each sampling location were first screened using x-ray fluorescence (XRF) for metal concentrations (ref. 24, p. 36, 37; Attachment B). Those with the highest metal content were chosen for laboratory analysis. This screening was abandoned due to time constraints; no XRF screening was conducted at background sampling locations (ref. 24, p. 38). Soil samples were collected from the top 1 or 2 inches with emphasis toward finer grain-sized particles. Sieving of samples was not conducted. Samples were homogenized in a designated plastic bag prior to their transfer into two 4-oz. or one 8-oz. sample jar equipped with a Teflon-lined cap. All samples were split with Molycorp's contractor and were analyzed under EPA's Contract Laboratory Program for Target Analyte List (TAL) metals.

2. Soil Exposure Pathway-Results

Analytical data of the metal concentrations in residential soil and the comparison to background concentrations is presented in Tables 22 and 23 (ref. 65). Results from residential areas to the south of the ponds and near the Change House area east of the ponds show concentrations of three metals which exceed three times the highest background concentration, namely chromium (Cr), copper (Cu) and nickel (Ni; Table 23). Only Ni was elevated in each of soils from the residential and Change House areas. Two of the three metals have soil benchmarks associated with them: Cr at 2,900 mg/kg; and Ni at 12,000 mg/kg (Table 22, ref. 2, p. B-59, B-66). The concentrations seen in residential or Change House soils are at least two orders of magnitude less than their respective benchmarks.

A release of CERCLA hazardous substances to the soil involves the evaluation of the top 2 feet of potentially contaminated areas. Because the capped portions of the tailings ponds have only one foot of soil (ref. 57), the entire tailings ponds were included in the soil exposure pathway. Chromium, copper and nickel, which were elevated in residential areas south of the ponds, was also elevated in the tailings ponds. Average concentrations of Cr, Cu and Ni in the tailings ponds were 40 mg/kg, 188 mg/kg and 30 mg/kg, respectively (Table 2). These concentrations were 7 to 26 times greater than that seen in the highest background soil (Table 22).

Soils found at the Trujillo and Martinez residences were initially interpreted as the Fernando Series and several background soil samples from this soil type were collected. Further study of the U.S. Soil Conservation Service map correctly identified the soil type at these residences as the Silva Series. Soil samples from the Fernando Series likely would misrepresent background for these residential areas. Therefore, the one soil sample collected approximately 1/4-mile north of Questa Jr. High School, which was initially intended to represent background conditions for samples collected at the school, also would provide background conditions for the Trujillo and Martinez residences. Analytical results of the soil metal concentrations using this single sample for background is presented in Table 23. Results show a single incident of a metal concentration being elevated, namely zinc at the Martinez residence. To determine whether this single background sample was sufficiently far from the tailings ponds to be representative of background conditions of this soil type, three additional soil samples (including one duplicate) was collected further north (i.e. downwind) from the tailings ponds (Fig. 4). Results using the latter sampling locations as background (near the road to Cerro) failed to define any release to soil (Table 23).

3. Soil Exposure Pathway-Discussion

Tailings Ponds

A release of CERCLA hazardous substances to soils surrounding the tailings ponds is defined by any metal concentration which exceeds three times background and is attributable to the waste source (e.g. tailings ponds). Elevated metal concentrations have been determined; to prove likely attribution of these hazardous substances to the tailings ponds, metal concentrations from the tailings were compared to that in background soil for the same soil types sampled in residential yards. A ratio of average analyte concentrations in the tailings to the highest concentration in background soil was calculated (Table 22). With ratios exceeding one, the tailings were found to have higher concentrations of most metals than in the Sedillo soil type sampled in background locations. Three CERCLA hazardous metals demonstrated at least a seven-fold increase in the tailings: Cr, Cu and Ni (Table 22). Each of these metals was elevated in at least two of the four soil sampling locations within the Sedillo soil type and thus providing justification of attribution of the elevated metals concentrations to the tailings ponds (Table 22).

Zinc was elevated in the soil of the Martinez residence (Fig. 7) when compared to the initial background sample (location #23, Table 23). Using the highest background concentration from subsequent sampling failed to identify a release. Because the average and highest zinc

concentrations in the tailings ponds (Table 23 and Table 4, respectively) are below the concentration noted at the Martinez residence, the elevated level of zinc noted at the Martinez residence is not likely attributable to the tailings and does not define an area of soil contamination.

The current extent of soil contamination has been shown to include the tailings ponds and several residential areas south of the tailings ponds (Fig. 7). No soil contamination to the east and north has been identified. Areas between residences which demonstrate an observed release are inferred to lie within the area of soil contamination. The total area of soil contamination is 20,635,000 ft^2 of which 35,000 ft^2 is beyond the extent of the tailings ponds (ref. 24, p. 5, 73). The number of persons residing within the area of soil contamination and the respective level of contamination is presented below:

Residence Sampled	Additional # of Residences w/in Obs. Release	# of Persons	CERCLA Substance Defining Release	Soil Benchmark Exceeded (metal)?
Herrera		2	Cr, Cu, Ni	No
	2 (ref. 24, p. 37, 72)	6*	Cr, Cu, Ni	No
Rael		1	Cr, Cu, Ni	No
Clines		1	Cr, Cu, Ni	No

* calculated from number of houses within area of soil contamination and number of persons per household (ref. 46)

The total number of persons residing in areas of soil contamination is 10. No schools or daycares are present within 200 feet of the area of contamination.

Mine Area

Soil contamination in the vicinity of the mine was not examined past the extent of the mine waste dumps. While physically accessible (i.e. no fence exists), the dumps are private property and provide no public recreational use. The owners of the Fagerquist Cottonwood Park (2 persons) are the nearest residents and live within a half-mile of the mine waste dumps at Sugar Shack South (Fig. 3). Molycorp workers and terrestrial sensitive environments are potentially exposed to the mine waste dumps. It is assumed that the 16 persons currently employed by Molycorp (ref. 11) work within 200 feet of the mine waste dumps.

During waste source sampling for this ESI, a Peregrine Falcon was seen perched on the waste dump near the open pit (ref. 24, p. 52). Conversation with the Wildlife Biologist for the Questa Ranger Station has confirmed that the Red River valley is included within the range of a nesting pair (ref. 49). The appearance of the Peregrine Falcon on the waste dumps suggests its range likely includes the entire mining site. Whether the waste dumps present a health risk to Peregrines

is unknown. No other endangered species or other species representing sensitive environments are present in areas of waste source material or contaminated soils.

D. Air Migration Pathway

1. Existing Data

Several incidents of exposure to tailings dust at Questa Jr. High School, located 0.3 mile NE of the northern edge of the tailings ponds (Fig. 2), have been recorded with the New Mexico Environment Department (ref. 58, p. 1, 5). During the spring months, the school is predominantly downwind from the tailings ponds. Numerous incidents of impaired health of students have been recorded by the school nurse (ref. 59). Since the installation of a sampling device at Questa Jr. High School (formerly, the high school) in 1979 (ref. 58, p. 4), NMED has conducted ambient air measurements of total suspended particulates. While information concerning the heavy metal concentrations in these particulate samples is not abundant, several sampling events had measurable concentrations of Pb (average of 0.09 ug/m^3). Although detected, Pb concentrations were below the National Ambient Air Quality Standard of 1.5 ug/m^3 (ref. 58, Table II). In response to potential releases of airborne particulates from the tailings ponds, Molycorp has implemented the use of soil stabilizers and a temporary soil cap of approximately one foot over much of the ponds (ref. 57; ref. 4, photo 4). Current dewatering of the mine has resulted in rewatering a portion of the tailings ponds. An automated continuous air monitoring device, which has recorded total particulates at the school since June 1993, has shown no violation of air quality standards at Questa Jr. High School (ref. 60). The number of incidents of impaired health at the school is likely to have decreased since the installation of the tailings cap (ref. 59).

Since the temporary capping of the tailings ponds, no release of hazardous substances via air migration pathway has been reported. One sensitive environment initially identified for the air migration pathway was a federally designated Wild and Scenic River (Fig. 2). The Wild and Scenic River designation of the Red River begins 1 to 2 miles downstream (southwest) from the tailings pond and is administered by US Bureau of Land Management. With the prevailing winds in the Questa area heading north, the Wild and Scenic River portion of the Red River (and Rio Grande) are not likely to be significantly impacted by airborne tailings; however, its receipt of airborne particulates is not precluded.

Two other potential habitats for species under consideration for their federally endangered or threatened status which were initially identified were the Southwestern Willow Flycatcher and Small-headed Goldenweed (ref. 51). The Red River is generally considered poor habitat for the Southwestern Willow Flycatcher despite a single sighting. The Small-headed Goldenweed can be removed from consideration as potential sensitive habitat near the Molycorp site as its only reported location is west of the Rio Grande (ref. 61). The range for the Peregrine Falcon, however, is certain to include the tailings ponds as it travels up to 20 miles to forage (ref. 49).

III. SUMMARY AND CONCLUSIONS

The Molycorp Site was evaluated under CERCLA authority for the presence and distribution of CERCLA hazardous substances along the groundwater, surface water, soil exposure and air pathways. Both mine waste dumps and tailings ponds contain CERCLA hazardous substances. In the vicinity of the mine, a release has been determined to groundwater (in both Alluvial and Fractured-Bedrock Aquifers) and the Red River. Evaluation of sulfate gain to the Red River over time suggest partial attribution of the releases of CERCLA hazardous substances by Molycorp activities. No such release has been established at the tailings ponds.

The Questa community water supply system consists of two wells which are approximately one mile east of the tailings ponds and four miles west of the mine site. The system provides drinking water for 1644 residents of Questa. The number of people served by other community wells and private wells and is 486 and 142, respectively. All wells, including the Questa community system, are subject to potential contamination from both the tailings ponds and mine waste.

A release of CERCLA hazardous metals to the Red River has been observed in the vicinity of the Molycorp Mine. Several areas or habitats which are of concern or have protected status were identified near the Molycorp Site. These include fisheries at Eagle Rock Lake and below the Red River Fish Hatchery, the Wild and Scenic River designation of the Lower Red River and Rio Grande, wetlands along the Red River and the habitat of the American Peregrine Falcon. Sampling conducted prior to this ESI identified levels of contamination at Eagle Rock Lake which exceeded Ambient Water Quality Standards. Fisheries or habitats below Eagle Rock Lake are subject to potential contamination from the site via surface water.

Soil sampling near the tailings ponds identified areas of soil contamination which include residential yards. At least ten residents have been identified who live within the area of contamination. Concentrations of metals which defined the area of soil contamination are far below health-based standards.

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56. State of New Mexico Standards for Interstate and Intrastate Streams. New Mexico Water Quality Control Commission. Dec. 23, 1994.

57. Record of Telephone Conversation: Bill Renison, Molycorp, Inc. Date: 7/23/93

58. Ambient Air Quality Data and Associated Data Collected in the Questa, New Mexico Area (1979-1983), Summary Report. Williams, C. New Mexico Environmental Improvement Division, Air Quality Bureau. 4/11/85.

59. Record of Telephone Conversation: Mary Henderson, Former Nurse, Questa School District. Date: 1995.

60. 1993 PM-10 Graph at Questa Jr. High School; and 1994 PM-10 data for monitors at Questa Jr. High School. NMED - Air Quality Bureau.

61. Handbook of Rare and Endemic Plants of New Mexico. New Mexico Native Plants Protection Advisory Committee.

62. Hill, R. D., 1976. Water Pollution Caused by Inactive Ore and Mineral Mines: A National Assessment. Environmental Protection Technology Series, EPA-600/2-76-298.

63. Classification of and Deepwater Habitats of the United States. Cowardin, L. M. U.S. Fish and Wildlife Service. FWS/OBS-79/31. Included: National Wetlands Inventory Map for Wheeler Peak, New Mexico.

64. Expanded Site Inspection-Analytical Data using Contract Laboratory Program.

65. Record of Telephone Conversation: Billye Fagerquist, owner/operator of Fagerquist's Cottonwood Park. 5/7/93. Included is information regarding well and water schematic.

Table 1. Metal Concentrations in Mine Waste Dumps (mg/kg)

Map Location	P Capulin Waste Dump #1	Q Capulin Waste Dump #2	R Goathill Waste Dump	S Sugar Shack West Dump	T Sugar Shack South Dump	U Along Truck Shop Road	V Along Lower Bench Road	Average Waste Dump Concentration (# of samples=7)	Coefficient of Variation (%)
Date Sampled	6/27/94	6/27/94	6/27/94	6/28/94	6/28/94	6/28/94	6/28/94		
Field ID #	SS-4	SS-5	SS-6	SS-7	SS-8*	SS-9	SS-10		
CLP #	SF5804	SF5805	SF5806	SF5816	SF5819	SF5817	SF5818		
Analyte (mg/Kg)									
Al	1910	2730	5860	6190	18900	9130	5810	7219	73
Sb	nd	nd	nd	nd	nd	nd	nd	nd	na
As	2.6Jv	2.5Jv	11.4Jv	1.6Jv	0.96Jv	na	1.1Jv	3	124
Ba	45.2	171	46.2	27.5	246	41.2	4	83	100
Be	0.25	0.27	0.27	0.59	0.63	0.89	1.3	1	60
Cd	nd	nd	nd	nd	nd	nd	3.9	1	245
Ca	195	1350	2280	8860	18400	8670	15100	7836	83
Cr	nd	4.6	17.5	10.4	81.7	17	nd	19	142
Co	nd	2.4	3.5	5.6	9	13.3	2.9	5	80
Cu	26.3	45.4	41.6	126	140	222	92.5	99	65
Fe	13800	16800	27700	22700	46000	25400	7830	22890	50
Pb	431	40.2	91	61	31.1	40.8	275	139	103
Mg	265	1800	3610	4300	18700	4700	1250	4946	118
Mn	64.5	155	473	432	362	293	1080	409	75
Hg	nd	nd	nd	nd	nd	nd	nd	nd	na
Ni	nd	5.5	12.7	12.2	26.9	21.7	3.7	12	76
K	1620	2180	2550	2540	12300	2550	1020	3537	102
Se	na	1.5J	0.43J	0.35J	nd	nd	nd	3	69
Ag	3.2J^	2.9J^	4	nd	4.6	3J^	nd	1	159
Na	27.5	40.5	67	99.9	183	56.1	43.8	74	67
Tl	na	na	na	na	2.4Jv	na	na	2	0
V	1.3	5.9	12.7	14.9	83.3	16.2	3.4	20	135
Zn	86.5	20.8	53.3	66.3	35.4	43.3	569	125	146
Mo	9.3	6.1	24	10.8	168	176	207	86	100

nd = not detected
J = estimated value;
^ = value biased high; v = value biased low
na = not available (data unusable or value cannot be calculated)
* Sample was labelled SS-11 on chain of custody

Table 2. Metal Concentrations in Tailings (mg/kg)

MapLocation	6	7	8	4	5	3	1	2		
Tailings Pond	TP-1	TP-1	TP-2	TP-5A	TP-5A(dupl)	TP-4	TP-4	TP-4	Average	Coefficient
Date Sampled	4/18/94	4/18/94	4/18/94	4/18/94	4/18/94	4/18/94	4/18/94	4/18/94		
Field Station	S-12	S-13	S-14	S-10	S-10A	S-11	S-8	S-9	Conc.	of Variation
CLP ID#	MFT923	MFT924	MFT925	MFT926	MFT927	MFT928	MFT929	MFT930	(mg/kg)	
Analyte (mg/Kg)										
Al	6190	16300	3850	5620	6220	11000	8150	7070	8050	45.7
Sb	nd	nd	nd	nd	nd	nd	nd	nd	nd	na
As	nd	nd	1.2^J	nd	1.4^J	nd	1.1^J	nd	0.78	46.9
Ba	70.4	153	29.9	73.9	90.6	125	78.1	74.8	87.0	40.1
Be	0.59	2.4	0.46	0.47	0.56	1.3	0.79	0.72	0.9	67.7
Cd	nd	nd	nd	nd	1.2	nd	nd	nd	0.2	265
Ca	14500	17900	10200	18800	19700	17700	15700	15500	16250	17.4
Cr	32.9	77.1	19.4	28.5	31	55.8	40.5	36.3	40.2	42.4
Co	8.1	7.9	3.6	14.7	16.2	7.4	12.9	12.4	10.4	38.6
Cu	136	169	37.7	262	274	324	196	109	188	47.2
Fe	13100	19700	8640	19400	20800	16600	18500	16800	16693	22.6
Pb	31.3	51.8	33.2	82.2	82.8	67.8	71.4	40.7	57.7	34.4
Mg	6300	14300	3870	5730	6180	10100	8330	7130	7743	39.0
Mn	352	692	515	386	413	546	461	406	471	21.9
Hg	nd	nd	nd	nd	nd	nd	nd	nd	nd	na
Ni	24.6	42	10.5	30.5	34.9	35.4	31.2	29.8	29.9	29.2
K	4010	8490	1910	3680	3970	6230	5340	4460	4761	38.6
Se	nd	nd	nd	nd	nd	nd	nd	nd	nd	na
Ag	nd	nd	nd	nd	nd	nd	nd	nd	nd	na
Na	118	222	78.6	119	117	173	130	140	137	29.5
Tl	0.42	0.82	ND	0.42	0.53	0.64	0.58	0.42	0.5	46.4
V	30.2	61.8	13.6	26.5	30.4	46.2	37.9	33.8	35.1	38.1
Zn	85.1J	115J	111J	156J	148J	140J	158J	104J	127	19.9

J - estimated value; ^ value biased high

nd - undetected; na - not available or calculable

Table 3. Metal Concentrations in Hydrothermal Scars (mg/kg)

Map Location	M Eagle Rock Scar Area	N Eagle Rock (duplicate)	O Goathill Scar	W Hanson Crk Scar	Average Scar Concentration (# of samples=4)	Coefficient of Variation (%)
Date Sampled	6/27/94	6/27/94	6/27/94	6/26/94		
Field ID#	SS-1	SS-2	SS-3	SS-12		
CLP ID#	SF5897	SF5899	SF1801	SF5860		
Analyte (mg/Kg)						
Al	10300	7770	2220	8210	7125	42
Sb	nd	nd	nd	nd	nd	na
As	na	na	21.2Jv	11.5Jv	16.4	30
Ba	147	131	106	248	158	34
Be	0.52	0.44	0.12J^	0.42	0.4	41
Cd	nd	nd	nd	nd	nd	na
Ca	5590	7680	81.9	8810	5540	61
Cr	47	44.8	nd	12.8	26	78
Co	2.4	2.4	3.7	4.6	3	28
Cu	31.4	31.3	52.4	35.1	38	23
Fe	40200	43500	156000	61500	75300	63
Pb	42.5	45.9	134	138	90	51
Mg	4140	3370	192	7100	3701	66
Mn	200	173	17.7	258	162	55
Hg	nd	nd	nd	nd	nd	na
Ni	12.6	9.1	nd	12.4	9	60
K	6250	5630	23700	3300	9720	84
Se	3.6J	3.7J	3.4J	2.2J	3	19
Ag	3.8J^	4.1	12.5	6	6	80
Na	908	1200	1200	689	999	22
Tl	2.1Jv	na	2.9Jv	na	3	16
V	43	37.7	16.2	18.6	29	40
Zn	31.4	27.5	23.9	55.9	35	36
Mo	7.5	9.6	35.6	16.6	17	64

nd = not detected
J = estimated value;
^ = value biased high; v = value biased low
na = not available (data unusable or value cannot be calculated)

Table 4. Ratio of Metal Concentrations between Waste Sources and Hydrothermal Scars or Background Soil

Analyte (mg/kg)	Average Metal Concentration: Waste Dumps (N=7)	Average Metal Concentration: Scars (N=4)	Ratio of Concentrations (waste dump/scar)	Average Metal Concentration: Tailings (N=8)	Average Metal Concentration: Background Soil Sedillo Soil Type* (N=3)	Ratio of Concentrations (tailings/backgroud) Sedillo Soil Type	Average Metal Concentration: Background Soil Silva Soil Type* (N=3)	Ratio of Concentrations (tailings/backgroud) Silva Soil Type
Al	7219	7125	1.0	8050	2887	2.8	10813	0.7
Sb	nd	nd	na	0	2.4	na	nd	na
As	3	16.4	0.2	0.78	0.78	1.0	4.9	0.2
Ba	83	158	0.5	87.0	48.7	1.8	167	0.5
Be	1	0.4	1.6	0.9	0.18	5.0	0.8	1.1
Cd	1	nd	na	0.2	nd	na	0.4	0.4
Ca	7836	5540	1.4	16250	1111	14.6	2477	6.6
Cr	19	26	0.7	40.2	3.5	11.5	14.8	2.7
Co	5	3	1.6	10.4	3.0	3.4	12.1	0.9
Cu	99	38	2.6	188	6.3	29.9	23.6	8.0
Fe	22890	75300	0.3	16693	7177	2.3	20633	0.8
Pb	139	90	1.5	57.7	12.6	4.6	22.9	2.5
Mg	4946	3701	1.3	7743	1051	7.4	2787	2.8
Mn	409	162	2.5	471	298	1.6	783	0.6
Hg	nd	nd	na	0.0	nd	na	nd	na
Ni	12	9	1.4	29.9	3.8	7.9	12.3	2.4
K	3537	9720	0.4	4761	1049	4.5	2330	2.0
Se	3	3	1.1	0.0	nd	na	1.1	0.0
Ag	1	6	0.2	0.0	nd	na	nd	na
Na	74	999	0.1	137	38.5	3.6	90	1.5
Tl	2	3	1.0	0.5	nd	na	nd	na
V	20	29	0.7	35.1	7.9	4.5	36.8	1.0
Zn	125	35	3.6	127	33.5	3.6	66.4	1.9

*ref. 5; nd - not detected; na - not available (cannot be calculated)
N = Number of Samples

Table 5. Metal Concentrations in Fagerquist Well (Nearest to Mine) and Surrounding Surface/Ground Waters

Date Sampled Side from Red River Analyte (mg/L)	Fagerquist Well* 9/9/93 south	Columbine Creek 11/7/94 south	Columbine C.G. Well* 8/24/93 south	Molycorp MW-8b** 11/8/94 north	Molycorp MW-10a** 11/8/94 north	Molycorp MW-10c** 11/8/94 north
Al	<0.1	0.05	<0.1	0.44	33.4	31.1
Sb	na	<0.003	na	<0.05	<0.05	<0.05
As	<0.005	<0.0012	<0.005	<0.05	<0.05	<0.05
Ba	<0.1	0.042	<0.1	0.016	<0.01	0.014
Be	<0.1	<0.0004	<0.1	0.008	0.008	0.007
Cd	<0.001	<0.004	<0.001	<0.0005	0.03	0.03
Ca	24	23	26	206	275	204
Cr	<0.005	<0.004	<0.005	<0.01	<0.01	<0.01
Co	<0.05	<0.005	<0.05	<0.01	0.15	0.11
Cu	<0.05	<0.003	<0.05	<0.01	0.56	0.38
Fe	<0.1	0.05	<0.1	<0.05	<0.05	<0.05
Pb	<0.005	<0.0009	0.01	<0.002	<0.002	<0.002
Mg	2	2.3	2.6	55.5	77.9	75.2
Mn	<0.05	<0.002	<0.05	0.2	13.8	16.3
Hg	<0.0005	<0.0002	<0.0005	<0.0002	<0.0002	<0.0002
Ni	<0.1	<0.017	<0.1	0.06	0.33	0.03
K	1	0.8	2	2.9	2.8	2.8
Se	<0.005	<0.001	<0.005	<0.005	<0.005	<0.005
Ag	<0.1	<0.004	<0.1	<0.1	<0.1	<0.1
Na	2	2.1	3	33.9	26.5	20.2
Tl	na	<0.004	na	<0.005	<0.005	<0.005
V	<0.1	<0.0009	<0.1	<0.01	<0.01	<0.01
Zn	<0.05	0.003	1.6	0.2	2.3	3.2
pH	8.15	7	7.51	6.4	5.8	4.7
Conductivity (umhos)	142	80	169	1780	2400	2000
Depth of Well (feet)	52	na	80	129	144	50

* unfiltered sample collected by NMED-Surface Water Quality Bureau
** filtered sample collected by South Pass Resources, Inc. (ref. 12)

Table 6. Background Metal Concentrations for Determining a Release to Alluvial Aquifer via Seeps

Map Location	21 Red River WWTP	15 Molycorp Mill Well	20 Elephant Rk Campground	22 Junebug Campground	Highest Conc. for Background Purposes	21 Red River WWTP	15 Molycorp Mill Well	20 Elephant Rk Campground	22 Junebug Campground	Highest Conc. for Background Purposes
CLP ID#	MFQ267	MFQ270	MFQ268	MFQ269		MFQ262	MFQ265	MFQ263	MFQ264	
Temp (C)						11	6	5.5	6	
pH						3.85*	6	5.5	6	
Cond. (umhos)						1200	202	150	163	
	Filtered	Filtered	Filtered	Filtered	Filtered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Analyte (ug/L)										
Al	36500	144	nd	nd	36500	36700	716	nd	nd	36700
Sb	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
As	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ba	11.1	21	32.9	34.4	34.4	5.3	22.2	34.1	39	39
Be	5.1	nd	nd	nd	5.1	5.2	nd	nd	nd	5.2
Cd	6.1J	nd	nd	nd	6.1	7.8J	nd	nd	nd	7.8
Ca	151000	43700	33900	34200	151000	151000	45700	34300	36600	151000
Cr	5.8	nd	nd	nd	5.8	8.5	nd	nd	nd	8.5
Co	97.4	nd	nd	nd	97.4	101	nd	nd	nd	101
Cu	58.3	4.9	5		58.3	60.8	21.6	12.4	54.7	60.8
Fe	30100	nd	97.1J^	128	30100	30200	273	610	4850	30200
Pb	3.7J^	nd	nd	nd	3.7	3.6J^	3.1J^	1.5J^	5.6J^	5.6
Mg	51500	8880	6600	6920	51500	52200	9190	6710	7620	52200
Mn	5700	110	5.6	82.6	5700	5720	108	6.1	78.5	5720
Hg	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ni	227	nd	nd	nd	227	232	nd	nd	nd	232
K	2540	771	792	732	2540	2910	941	535	585	2910
Se	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ag	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Na	15100	5140	3870	4180	15100	14900	4810	3720	4060	14900
Tl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
V	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Zn	2090	41	107	252	2090	2090	46.1	109	404	2090

nd - not detected
* provided by Red River WWTP
J^ - estimated value biased high

Table 7. Release of CERCLA Hazardous Substances to Downgradient Seeps of Alluvial Aquifer

Map Location	Background Concentrations for Determining a Release in Alluvial Aquifer		S-1 Cliff Seep (Old Eagle Rock CG)		S-2 Capulin Channel Seep		S-3 Capulin Canyon Seep: Lower		S-3 (Duplicate) Capulin Canyon Seep: Lower		S-4 Capulin Canyon Seep: Upper		S-5 Goathill Seep		S-7 Adit Seep	
Date Sampled CLP ID# Analyte (ug/L)	filtered	unfiltered	filtered 6/26/94 SF5831	unfiltered 6/26/94 SF5832	filtered 6/26/94 SF5823	unfiltered 6/26/94 SF5827	filtered 6/26/94 SF5824	unfiltered 6/26/94 SF5828	filtered 6/26/94 SF5825	unfiltered 6/26/94 SF5829	filtered 6/26/94 SF5826	unfiltered 6/26/94 SF5830	filtered 6/26/94 SF5839	unfiltered 6/26/94 SF5842	filtered 6/26/94 SF5840	unfiltered 6/26/94 SF5843
Al	36500	36700	43100	43500	127000	120000	104000	108000	105000	105000	113000	114000	28500	28800	13700	17500
Sb	nd	nd	nd	nd	nd	nd	32.1	nd	nd	nd	nd	nd	nd	nd	nd	nd
As	nd	nd	nd	nd	1.8J	1.0J	1.1J	nd	1.1J	1.3J	2.1J	1J	nd	nd	nd	nd
Ba	34.4	39	12.8	13.5	8.1	7.9	9.8	12.2	13.6	13.9	8.2	8.1	20.1	25	62.5	58.1
Be	5.1	5.2	13.1	13.1	25.6	21.3	19.6	20.4	20	19.9	17.6	17.6	5.5	5.5	3.6	4.2
Cd	6.1	7.8	17.7J	23J	nd	5.7	9.2J	12.1J	13.1J	15.2J	6.8J	nd	11.1J	15.1J	13J	51.4J
Ca	151000	151000	79800	79500	224000	218000	199000	206000	201000	202000	216000	216000	275000	273000	206000	210000
Cr	5.8	8.5	2.9	nd	3.3	3.8	4	3.4	3.8	3.9	5	3.9	nd	4.6	nd	nd
Co	97.4	101	127	125	216	202	179	185	183	183	195	194	113	115	nd	nd
Cu	58.3	60.8	361	363	1010	916	741	775	755	753	1130	1140	233	234	22	37.9
Fe	30100	30200	47	146	4730	6010	7550	7860	7430	7900	14600	17500	27.9	602	18.4	59.1
Pb	3.7	5.6	2.1J	2.5J	4.0J	4.9J	4.4J	3.8J	5J	5.1J	3.6J	4.4J	3.4J	6.8J	1.7J	1.4J
Mg	51500	52200	44100	44000	63000	58100	50800	53000	51500	51900	55500	55900	104000	103000	80300	87000
Mn	5700	5720	19000	18900	19200	17000	14700	15200	14800	14900	15900	16000	4270	4250	6350	9450
Hg	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ni	227	232	368	353	430	409	357	373	367	364	393	412	412	414	342	413
K	2540	2910	1650	1980	2770	3000	3290	3000	3210	3220	2460	3200	3270	3360	3150	3000
Se	nd	nd	na	na	na	na	na	na	na	na	na	na	1.3J	na	1.4J	1.5J
Ag	nd	nd	nd	nd	nd	nd	3.9	3.6	nd	3.2	nd	5.4	nd	nd	nd	nd
Na	15100	14900	10700	10500	26500	25500	22200	23000	22500	22300	27100	27100	32200	31600	22200	22400
Tl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
V	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Zn	2090	2090	4560	4570	4890	4370	3790	3940	3840	3880	4230	4290	1650	1650	2470	3100

J - estimated value; nd - not detected; na - not available
Shaded data indicate concentrations which exceed 3 x background.
Note: Only Be and Cu represent CERCLA Hazardous Substances

Table 8. Release of CERCLA Hazardous Substances to Fractured Rock Aquifer at Molycorp Mine

	Highest Background Concentration*	Capulin Canyon (MW-3)**	Sugar Shack West (MW-7)**	Sugar Shack South (MW-10b)**	Sugar Shack South (MW-11)**	Sugar Shack South (MW-11 dup.)**	Cabin Spring**
CLP ID#		MFQ252	MFQ251	MFQ250	MFQ249	MFQ248	MFQ266
	F	F	F	F	F	F	UF
Analyte (ug/L)							
Al	1200	876	777000	6720	48800	45900	34500
As	<10	1.4J^	46.2J	nd	nd	nd	nd
Cd	19	nd	97.4	23.3J	30.3J	32.3	28.8
Cu	30	16.7	4220	111	832	787	424
Fe	39000	121J^	329000	227	nd	nd	nd
Mn	43600	28400	54700	7640	24900	23600	20100
Zn	25600	1190	8750	1120	4330	4090	3540

* ref.12, Table D4; ref. 30, Table 1.4 (highest reported value)
** ref. 64
F = filtered; UF = unfiltered
J - estimated value; ^ - datum biased high; nd - not detected
Shaded data indicate concentrations which exceed 3 x background.
Note: Only As, Cd and Cu represent CERCLA Hazardous Substances which have been released.

Table 9. Metal Concentrations and General Chemistry Parameters in Private Wells below the Tailings Ponds

Map Location	A		C		D	E		N		MCL
Field Station	CHANGE HOUSE WELL* W-1 (Background)		DURAN WELL* W-5		Duplicate W-5.5	RAEL WELL* W-5**		HERRERA WELL* W-6.5		
CLP ID#	MFT996	MFT995	MFQ072	MFQ071	MFQ073	MFQ998	MFQ997	MFQ982	MFQ981	
	Filtered	Unfiltered	Filtered	Unfiltered	Unfiltered	Filtered	Unfiltered	Filtered	Unfiltered	
Date Sampled	4/21/94		4/25/94			4/21/94		4/21/94		
Used for Drinking?			No			Yes		No		
Analyte (ug/L)										
Al	<34	108	nd	nd	nd	nd	55.8	nd	3210	50-200
Sb	<50	<50	nd	nd	nd	nd	nd	nd	nd	6
As	<1.0	<1.0	4.7	nd	nd	nd	nd	nd	1.4J	50
Ba	44.1	44.7	54	54.9	54.9	65.7	70	34.5	295	2000
Be	<1.0	<1.0	nd	nd	nd	nd	nd	nd	nd	4
Cd	<5.0	<5.0	nd	nd	nd	nd	nd	nd	nd	5
Ca	28200	28000	47400	46100	46000	80800	84000	231000	232000	
Cr	<9.0	<9.0	nd	nd	nd	nd	nd	nd	16.6	100
Co	<9.0	<9.0	nd	nd	nd	nd	nd	nd	nd	
Cu	<6.0J	<6.0J	nd	nd	nd	nd	nd	nd	7.2J	1300al
Fe	19	360	nd	1220	1420	13.5	849	184	17900	300
Pb	<1.0	2.5	nd	ND	3.1	nd	ND	8.5^J	2.5	15al
Mg	5260	5180	10400	10100	9970	14600	15600	44300	44400	
Mn	3.1	6.8	146	158	157	3.3	4.1	22	215	50a
Hg	<0.2	<0.2	nd	nd	nd	nd	nd	nd	nd	2
Ni	<11	<11	nd	nd	nd	nd	nd	nd	nd	100
K	<667	<667	867	877	873	<667	766	2840	2940	
Se	<2.0	2.6	nd	nd	nd	nd	nd	nd	nd	50
Ag	<5.0	<5.0	nd	nd	nd	nd	nd	nd	nd	50
Na	66300	66400	15800	15100	14900	26100	26900	71400	69900	
Tl	<2.0J	<2.0J	nd	nd	nd	nd	nd	nd	nd	2
V	<7.0	<7.0	nd	nd	nd	nd	nd	nd	7.2	
Zn	75.4J	75.1J	101J	150	165	206J	260J	nd	8.5J	5000a
	SF1386		SF1389		SF1390	SF1387		SF1385		
Gen. Chem. (ug/L)					(filtered)					
Alk	190000		103000		104000	112000		154000		
COD	ND		nd		nd	nd		nd		
TDS	292000		288000		277000	454000		1290000		500000a
TSS	ND		nd		nd	nd		nd		
NH3	ND		nd		nd	nd		nd		
Cl	<2000		6140		6140	8420		18300		250000a
NOX	400		260		280	400		1040		
TOC	5340J		nd		nd	2460J		5820J		
TPO4	120		nd		nd	120		170		
SO4	58000		72000		84000	209000		752000		250a

* ref. 64; ** Sample inadvertently labelled as W-5; nd - not detected; J - estimated value; ^ - value biased high

MCL - EPA Maximum Contaminant Level; a - aesthetic standard; i - irrigation standard

Stippled data are > 3 x background (or detected when undetected in background); additional shading for CERCLA Hazardous Substances

Table 10. Total Metal Concentrations in Selected Monitoring Wells near Tailings Ponds (ref. 64)

Map Location	A Change House Well (Background)	B MW-4	F MW-9a	K MW-3	L MW-1	M MW-1 (Duplicate)	G MW-2	H MW-C	I MW-7b	J MW-7c	MCL
Date Sampled	4/21/94	4/21/94	4/25/94	4/21/94	4/21/94	4/21/94	4/21/94	4/21/94	4/25/94	4/25/94	
pH (paper)	6.5	6.5	7.7*	6.5	6.5	6.5	6.5	6.5	7.6*	7.3*	
Conductivity (umhos)	328	1280	710	1120	1190	-	1340	1390	1180	1080	
Field ID#	W-1	W-2	W-4	W-6	W-7	W-7.5	W-8	W-9	W-11	W-12	
CLP ID#	MFT995	MFT969	MFQ076	MFQ979	MFT975	MFT977	MFT971	MFT973	MFQ074	MFQ069	
	UF	UF	UF	UF	UF	UF	UF	UF	UF	UF	
Analyte (ug/L)											
Al	108	36	78800	115	179	161	3690	94.3	53200J	2540J	50-200
Sb	<50	nd	nd	nd	nd	nd	nd	nd	nd	nd	6
As	<1J	nd	23.7	nd	nd	nd	nd	nd	15.2	nd	50
Ba	44.7	36.1	570	35.8	40	26.4	152	35	514	53.7	2000
Be	<1.0	nd	4.7	nd	nd	nd	nd	nd	4.6	nd	4
Cd	<5.0	nd	nd	nd	nd	nd	nd	5.1	nd	nd	5
Ca	28000	157000	197000	255000	224000	195000	222000	311000	274000	248000	
Cr	<9.0	nd	109	13.1	nd	nd	22	nd	88.1	nd	100
Co	<9.0	nd	32.1	nd	nd	nd	nd	nd	15.8	3.7	
Cu	<6J	nd	65.7	nd	nd	nd	nd	nd	38.9	7.8	1300al
Fe	360	643	69500	455	612	562	25200	170	38600	1900	300
Pb	2.5	2.4	65.6	1.5	nd	nd	4.4vJ	nd	44.9	5.3	15al
Mg	5180	31800	49900	46500	46000	40500	50000	53200	60500	45700	
Mn	6.8	43.5	1880	14.9	24.2	19	774	2420	743	37.3	50a
Hg	<0.2	nd	nd	nd	nd	nd	nd	nd	nd	nd	2
Ni	<11	nd	82.2	nd	nd	nd	22.7	nd	65.3	nd	100
K	<667	nd	11000	1240	2770	2470	3150	3420	13800	3250	
Se	2.6	nd	nd	nd	nd	nd	nd	nd	nd	2.6	50
Ag	<5.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	50
Na	66400	65700	41100	67600	61100	52300	92100	87900	42300	39600	
Tl	<2J	nd	nd	nd	nd	nd	nd	nd	nd	nd	2
V	<7.0	nd	91.7	nd	nd	nd	nd	nd	48.8	3.9	
Zn	75.1J	nd	288	nd	nd	nd	nd	nd	177	16.4	5000a

* pH measured by laboratory

UF - unfiltered sample; nd - not detected; J - estimated value; v - value biased low

MCL - EPA Maximum Contaminant Level; a - aesthetic std.; i - irrigation std.

Stippled data are > 3 x background (or detected when undetected in background); additional shading for metals representing CERCLA hazardous substances

Table 11. Dissolved Metal Concentrations and General Chemistry Parameters in Selected Monitoring Wells near Tailings Ponds (ref. 64)

Map Location	A Change House Well (Background)	B MW-4	F MW-9a	K MW-3	L MW-1	M MW-1 (Duplicate)	G MW-2	H MW-C	I MW-7b	J MW-7c	MCL
Field ID#	W-1	W-2	W-4	W-6	W-7	W-7.5	W-8	W-9	W-11	W-12	
CLP ID #	MFT996	MFT970	MFQ077	MFQ980	MFT976	MFT978	MFT972	MFT974	MFQ075	MFQ070	
Analyte (ug/L)	F	F	F	F	F	F	F	F	F	F	
Al	<34	55.7	nd	nd	nd	48	128	135	nd	nd	50-200
Sb	<50	nd	nd	nd	nd	nd	nd	nd	nd	nd	6
As	<1J	nd	nd	nd	nd	nd	nd	nd	nd	3.6	50
Ba	44.1	36	92.7	31.4	26.2	ND	22.4	35.4	57.5	34	2000
Be	<1.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	4
Cd	<5.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	5
Ca	28200	158000	144000	243000	225000	222000	204000	307000	231000	237000	
Cr	<9.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	100
Co	<9.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Cu	<6J	nd	nd	nd	nd	nd	nd	nd	3.5	nd	1300al
Fe	19	31.3	ND	40.1	nd	nd	290	nd	nd	nd	300
Pb	<1.0	4.2	ND	8.3^J	nd	nd	nd	nd	nd	nd	15al
Mg	5260	30900	28100J	45000	46900	45800	45200	53800	43600	43400	
Mn	3.1	1.7	573J	1.9	3.2^J	3^J	550	2400	12	ND	50a
Hg	<0.2	nd	nd	nd	nd	nd	nd	nd	nd	nd	2
Ni	<11	nd	nd	nd	nd	nd	nd	nd	nd	nd	100
K	<667	945	1420J	973	2630	2690	2900	3620	5770	2670	
Se	<2.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	50
Ag	<5.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	50
Na	66300	66600	40700J	65900	61300	59800	89200	89300	40600	38200	
Tl	<2J	nd	nd	nd	nd	nd	nd	nd	nd	nd	2
V	<7.0	nd	nd	nd	nd	nd	nd	nd	nd	2.6	
Zn	75.4J	nd	37J	nd	nd	nd	nd	nd	26.1J	7.8J	5000a
Gen. Chem.											
CLP ID#	SF1386	SF1368	SF1392	SF1384	SF1382	SF1383	SF1380	SF1381	SF1391	SF1388	
Alk	190000	188000	162000	179000	152000J	150000J	67500J	179000J	134000	131000	
COD	nd	nd	nd	nd	nd	7200	nd	5860	6600	nd	
TDS	292000	928000	81400	1340000	1162000	1313000	1314000	1690000	1330000	1280000	
TSS	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
NH3	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	
Cl	1000	8340	23500	18400	18300	18300	15600	17900	15200	16200	
NOX	400	320	360	370	710	710	nd	nd	330	340	
TOC	5340J	7370J	2150	5970J	3030J	4770J	1990J	5310J	2280	1390	
TPO4	120	120	nd	120	150	160	nd	120	nd	nd	
SO4	58000	521000	384000	779000	701000	749000	825000	1013000	818000	740000	

F - filtered sample; nd - not detected; J - estimated value; ^ - value biased high; v - value biased low
MCL - EPA Maximum Contaminant Level
Stippled data are > 3 x background (or detected when undetected in background); additional shading for metals representing CERCLA hazardous substances

Table 12. Total and Dissolved Metal Concentrations in Discharges below Tailings Ponds (ref. 64)

Map Location	A Change House Well (Background)		W Seep A		V Seep D		U Seep E		O Embargo Rd. Seep		R Outfall #002		X Warm Spring		Y Cold Spring		T Old Coldwater Spring Collection	
CLP ID#	MFT996	MFT995	MFT955	MFT954	MFT953	MFT952	MFT952	MFT951	MFT959	MFT958	MFT963	MFT962	MFT947	MFT946	MFT949	MFT948	MFT967	MFT966
Analyte (ug/L)	F	UF	F	UF	F	UF	F	UF	F	UF	F	UF	F	UF	F	UF	F	UF
Al	<34	108	nd	480	nd	658	50.3	66.9	119	248	148	135	35.5	nd	nd	nd	nd	44.5
Sb	<50	<50	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
As	<1J	<1J	1.2vJ	2.2vJ	1.3vJ	2.1vJ	2.1vJ	2.7vJ	nd	nd	nd	nd	3vJ	2.9vJ	1.6vJ	nd	nd	nd
Ba	44.1	44.7	66.4	73.8	27.7	41.8	28.1	27.6	13.5	16.2	27.1	27.3	20.1	18.3	45.1	44.8	52.6	54.3
Be	<1.0	<1.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Cd	<5.0	<5.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ca	28200	28000	33600	33100	30800	30800	31200	31200	265000	269000	277000	291000	22200	21600	50900	50400	101000	105000
Cr	<9.0	<9.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Co	<9.0	<9.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Cu	<6J	<6J	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fe	19	360	nd	494	nd	900	nd	nd	nd	nd	nd	19.9	nd	nd	nd	nd	nd	nd
Pb	<1.0	2.5	nd	5	nd	2.7	nd	nd	1	1.7	nd	nd	nd	nd	nd	nd	nd	nd
Mg	5260	5180	10800	10700	9770	10000	9960	9850	45400	47200	46400	47400	6830	6730	8790	9120	16700	17400
Mn	3.1	6.8	3.7vJ	8.6	nd	56.8	2.8vJ	4.8vJ	569	650	1820	1860	1vJ	nd	nd	nd	nd	nd
Hg	<0.2	<0.2	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ni	<11	<11	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
K	<667	<667	3670	3490	2740	3140	2960	2690	4140	4350	3520	4010	2390	2280	1120	1210	1860	2130
Se	<2.0	2.6	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ag	<5.0	<5.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Na	66300	66400	41200	41100	33000	33800	31800	31700	90100	92000	91700	91600	24900	24300	25100	24700	46000	48000
Tl	<2J	<2J	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
V	<7.0	<7.0	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Zn	75.4J	75.1J	nd	nd	nd	11.8	nd	nd	nd	8.3	nd	nd	nd	nd	nd	nd	nd	nd
Gen. Chem.																		
	SF1386		SF1373		SF1371		SF1372		SF1375		SF1377		SF1369		SF1370		SF1379	
Alk	190000		92900J		80200J		80200J		160000		158000J		84400J		158000J		184000J	
COD	nd		nd		nd		nd		nd		nd		nd		nd		nd	
TDS	292000		320000		287000		281000		1633000		1580000		199000		266000		563000	
TSS	nd		nd		nd		nd		nd		nd		nd		nd		nd	
NH3	nd		nd		nd		nd		nd		nd		nd		nd		nd	
Cl	<2000		12000		10300		9610		16000		15600		8880		6080		9530	
NOX	400		210		300		390		nd		nd		350		630		370	
TOC	5340J		1780J		1090J		nd		3430J		2560J		nd		1660J		2780J	
TPO4	120		170		170		170		130		160		160		100		nd	
SO4	58000		127000		68000		105000		1005000		973000		54000		67000		254000	

F - filtered sample; UF - unfiltered sample
nd - not detected; J - estimated value; v - value biased low
Stippled data are > 3 x background (or detected when undetected in background); additional shading for metals representing CERCLA hazardous substances

Table 13. Ratio of Metal Concentrations in Leachate or Drainage from Mine Dumps to Hydrothermal Scars

Analyte (ug/L)	Average Mine Leachate Concentration (# of Samples=2)	Average Scar Leachate Concentration (Goathill & Hanson Crk) (# of Samples=2)	Ratio Mine Dump/Hydrothermal Scar
Al	1245000	162850	7.6
Sb	nd	24	na
As	51	11	4.8
Ba	na	na	na
Be	439	57	7.7
Cd	490	11	43.8
Ca	383500	234500	1.6
Cr	320	11	29.0
Co	2910	286	10.2
Cu	12150	2445	5.0
Fe	663500	484435	1.4
Pb	10	4	2.7
Mg	952500	57900	16.5
Mn	603500	41905	14.4
Hg	nd	0.2	na
Ni	6550	559	11.7
K	801	3605	0.2
Se	7	8	1.0
Ag	80	35	2.3
Na	25150	8915	2.8
Tl	3	3	1.1
V	8	16	0.5
Zn	133000	8835	15.1
Mo	34	16	2.1

nd - not detected; na - not available or not calculable
Note: one half detection limit was used in calculating average when detected in the other sample.

Table 14 . Ratio of Metal Concentrations in Leachate from Mine Waste Dumps and Hydrothermal Scars*

Analyte (mg/L)	Mine Waste Mean (n=9)	Scar Mean (n=8)	Ratio
Al	471	230	2.1
Cd	0.14	0.03	5.4
Cr	1.24	0.48	2.6
Co	0.16	0.08	2.1
Cu	3.89	2.19	1.8
Fe	230	317	0.7
Mn	210	31	6.7
Ni	2.54	1.20	2.1
Pb	0.18	0.10	1.8
Zn	36.0	7.2	5.0

* ref.30, Table 1.2

Table 15. Total Metal Concentrations in Surface Water near Molycorp Mine (ug/L)

Map Location	18 Red River above Hanson Creek	17 Red River below Hanson Creek	16 Red River above Molycorp (Background)	12 Red River below (30') Adit Seep	11 Red River above Columbine Creek	10 Columbine Creek	9 Red River below Columbine Creek	7 Red River @ Goathill Gulch Seep	6 Red River above Capulin Seeps	5 Red River between Capulin Seeps	3 Red River below (20') Capulin Seeps	3 (duplicate) Red River below (20') Capulin Seeps	2 Red River above Pipeline Crossing
Station	RR-12	RR-11	RR-10	RR-9	RR-8	RR-7	RR-6	RR-5	RR-4a	RR-4	RR-3	RR-2	RR-1
CLP ID#	MFQ393	MFQ392	MFQ272	MFQ271	MFQ243	MFQ199	MFQ198	MFQ197	MFQ196	MFQ195	MFQ194	MFQ193	MFQ192
Date Sampled	11/8/94	11/8/94	11/8/94	11/8/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94
Temp (C)	na	4.5	5	5	6	4.5	5.5	6	4.5	6	6	6	7
pH	6	6	6	6.5	6.5	7	7	7	6.5	6.5	7	6.5	6.5
Cond. (umhos)	na	160	178	190	195	80	172	230	222	235	250	250	261
	UF	UF	UF	UF	UF	UF	UF	UF	UF	UF	UF	UF	UF
Analyte (ug/L)													
Al	347	612	1070	1290	1080	49.7	856	1270	1540	1690	2050	2050	2590
Sb	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
As	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ba	40.9	40.5	41.1	39.6	36.5	41.8	37.4	37.1	36.7	36.1	36.5	36.7	36.9
Be	0.35	0.35	0.34	nd	0.35	nd	0.45	0.59	0.45	0.54	0.45	0.55	0.7
Cd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ca	33300	34200	36900	40700	39800	23000	36600	44600	46000	46100	46900	46600	47000
Cr	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Co	nd	nd	nd	nd	nd	nd	nd	6.8	nd	nd	nd	7.9	7.4
Cu	13.1	11.2	14.3	15.9	15.6		10	16.2	21.8	20.5	24.3	26.1	29.8
Fe	294	376	394	557	320	49.7	263	265	269	279	386	355	407
Pb	-	-	1.1	-	0.93	-	-	1.1	1	nd	nd	nd	1.3
Mg	7090	7240	8220	9200	9070	2290	7670	10100	10500	10500	10700	10600	11000
Mn	109	138	208	299	267	-	208	495	531	553	607	603	851
Hg	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ni	nd	nd	nd	nd	nd	nd	nd	nd	nd	18.7	nd	23	nd
K	1200	1140	1030	999	1210	810	983	1320	-	1090	668	1130	971
Se	nd	nd	nd	nd	nd	nd	nd	nd	873	nd	nd	nd	nd
Ag	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Na	5260	5120	5430	5230	5530	21000	4830	5250	5620	5610	5660	5550	5490
Tl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
V	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Zn	32.1	48.7	60.9	92.8	75.3	3.3	56.5	123	132	136	153	149	205

nd - not detected

Shaded data is > 3 x background; only Zn is a listed CERCLA hazardous substance

Table 16. Dissolved Metal Concentrations and General Chemistry Parameters in Surface Water near Molycorp Mine

Map Location	18 Red River above Hanson Creek	17 Red River below Hanson Creek	16 Red River above Molycorp (Background)	12 Red River below (30') Adit Seep	11 Red River above Columbine Creek	10 Columbine Creek	9 Red River below Columbine Creek	7 Red River @ Goathill Gulch Seep	6 Red River above Capulin Seeps	5 Red River between Capulin Seeps	3 Red River below (20') Capulin Seeps	3 (duplicate) Red River below (20') Capulin Seeps	2 Red River above Pipeline Crossing
Station	RR-12	RR-11	RR-10	RR-9	RR-8	RR-7	RR-6	RR-5	RR-4a	RR-4	RR-3	RR-2	RR-1
CLP ID#	MFQ397	MFQ396	MFQ395	MFQ394	MFQ253	MFQ254	MFQ255	MFQ256	MFQ257	MFQ258	MFQ259	MFQ260	MFQ261
	F	F	F	F	F	F	F	F	F	F	F	F	F
Analyte (ug/L)													
Al	115	48.4	115	51.5	nd	nd	nd	nd	nd	nd	nd	nd	nd
Sb	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
As	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ba	44.2	40.2	36.7	33.6	37	43.4	37	36.1	35.4	35	36.3	35.2	36.5
Be	nd	0.3	nd	0.3	nd	nd	nd	nd	nd	nd	nd	nd	nd
Cd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ca	33400	34300	36900	38800	42200	24600	38400	46500	48600	48800	49200	49000	49900
Cr	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Co	nd	nd	nd	nd	nd	nd	nd	nd	nd	5.1	nd	nd	6.7
Cu	6.8	3.7	3.7	4.4	4.3	nd	3.1	3.7	3.1	5.6	4.9	6.2	6.8
Fe	29.5	12.7	19.3	29	nd	nd	nd	211	nd	nd	nd	nd	nd
Pb	nd	nd	1.9	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Mg	7050	7260	8140	8760	9540	2540	8080	10800	11200	11100	11200	11200	11600
Mn	106	130	195	250	275	-	216	513	550	573	630	628	875
Hg	nd	nd	nd	nd	0.22J^	0.2J^	nd	nd	nd	nd	nd	nd	nd
Ni	nd	nd	nd	nd	nd	nd	nd	nd	22.1	19.5	28.7	20.4	33
K	868	775	1320	1220	720	697	1170	613	1020	1110	1080	1190	1070
Se	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ag	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Na	5400	5270	5640	5750	5250	2160	4660	5290	5560	5480	5480	5410	5600
Tl	nd	nd	nd	nd	nd	nd	nd	nd	nd	1.4	nd	nd	nd
V	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Zn	22.1	28.8	29.9	62	49.4	6.6	45.1	103	103	110	125	126	159
Gen. Chem.													
(mg/L)*													
Ca	41	42	45	48	49	26	40	49	51	50	52	53	54
Mg	7	7	8	9	9	3	8	11	11	11	12	12	12
K	4	4	4	4	4	4	4	4	4	4	4	4	4
Na	5	5	6	6	6	-	5	6	6	6	6	6	6
Hardness	131	134	145	154	157	74	135	166	175	171	176	179	184
Alkalinity	64	62	58	56	56	64	58	52	50	49	47	46	42
HCO3	78	76	72	69	68	78	71	64	61	60	57	57	52
Cl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
SO4	55	59	74	88	89	10	71	106	112	114	117	118	122
TDS	200	206	220	246	234	98	224	256	262	266	282	284	283
TSS	4	6	9	9	10	-	5	9	8	10	10	13	8

F = filtered sample

- not detected; J^ - estimated value which is biased high

* New Mexico State Laboratory Division data

Shaded data is > 3 x background of which only Zn is a listed CERCLA hazardous substance

Table 17. Metal Concentrations and General Chemistry Parameters in the Red River near Molycorp Mine: 6/26/94

	Red River above Hanson Creek		Red River below Columbine Creek		Red River at USFS Ranger Station	
Date Sampled CLP ID#	6/26/94 SF5850 F	6/26/94 SF5852 UF	6/26/94 SF5841 F	6/26/94 SF5844 UF	6/26/94 SF5861 F	6/26/94 SF5862 UF
Analyte (ug/L)						
Al	73.3	286	84.1	284J^	nd	1360
Sb	nd	nd	31.7	nd	nd	nd
As	nd	nd	nd	na	na	na
Ba	25.6	29.4	32.3	38J	26.9J	39.8J
Be	nd	nd	nd	nd	nd	nd
Cd	nd	nd	nd	nd	nd	nd
Ca	21500	21200	21200	21700J	29000J	29800J
Cr	nd	nd	nd	nd	nd	nd
Co	nd	nd	nd	nd	5.4J	5.9J
Cu	nd	nd	nd	nd	nd	nd
Fe	40.3	331	15.3	nd	nd	nd
Pb	nd	nd	nd	2.5J	na	2J
Mg	3520	3510	2850	2960	5890	6210
Mn	29.4	37.1	33.3	55.8	369	407
Hg	0.2	nd	nd	nd	nd	0.22
Ni	nd	nd	nd	nd	nd	nd
K	796	nd	nd	nd	nd	nd
Se	na	na	na	nd	nd	nd
Ag	nd	nd	nd	nd	nd	nd
Na	2210	2070	1900	nd	nd	nd
Tl	nd	nd	nd	nd	nd	nd
V	nd	nd	nd	nd	nd	nd
Zn	18.3	10.1	10.1	25.7	62.8	95.2
Gen. Chem.						
	SF5854		SF5848		SF5863	
Alk	57000		63300		45400	
COD	nd		nd		nd	
TDS	102000		92000		156000	
TSS	10000		12000		14000	
NH3	nd		nd		nd	
Cl	nd		nd		nd	
NOX	150		100		160	
TOC	2650		2550		2700	
TPO4	240		140		nd	
SO4	21000		12600		53700	

Shaded data are > 3 x concentration below Columbine Creek

Note: of the elevated parameters, only Zn is a CERCLA Hazardous Substance

nd - not detected; na - not usable; F - filtered sampled; UF - unfiltered sample

J - estimated value; ^ - value biased high

Table 18. Metal Concentrations in Sediments from the Red River near Molycorp Mine Area

Map Location	L Red River above Hanson Crk.	K Red River below Hanson Crk.	J Red River above Molycorp Property (Background)	I Red River below (30') Adit Seep	H Red River above Columbine Creek	G Columbine Creek	F Red River below Columbine Creek	E Red River below Goathill Seep	D Red River above Capulin Seeps	C Red River between per and low Capulin Seeps	B Red River below (20') Capulin Seeps (duplicate)	B Red River below (20') Capulin Seeps	A Red River above Pipeline Crossing
Date Sampled:	11/8/94	11/8/94	11/8/94	11/8/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94	11/7/94
Field ID #	S-12	S-11	S-10	S-9	S-8	S-7	S-6	S-5	S-4a	S-4	S-3	S-2	S-1
CLP ID#	MFQ696	MFQ695	MFQ399	MFQ398	MFQ191	MFQ190	MFQ189	MFQ187	MFQ188	MFQ186	MFQ185	MFQ184	MFQ182
Analyte (mg/kg)													
Al	15000	4510	5250	12200	12600	10500	10500	10900	13900	24200	19500	16000	12600
Sb	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
As	10Jv	5.6Jv	4Jv	8.5Jv	11.2Jv	1.2Jv	8.4Jv	6.1Jv	7.4Jv	9.2Jv	8.8Jv	6.1Jv	11Jv
Ba	787	262	439	694	601	78.5	567	406	537	578	569	508	499
Be	1.1	0.34	0.43	1.3	1.2	0.46	1.1	1.1	2.1	2.4	1.8	1.5	1.8
Cd	nd	nd	nd	nd	nd	nd	nd	nd	2.1	nd	nd	nd	nd
Ca	3690	1190	1470	2340	2900	2490	3020	2210	3230	1860	2150	1980	2990
Cr	23.5	6.5	8.8	22.1	20.5	12.5	16.8	20.3	18.7	22.3	23.9	20.7	18.5
Co	12.9	4	6.9	13.2	14.1	13.1	12.7	13.3	19	13.5	14.6	12.2	21.8
Cu	142	22	25.1	135	78.9	21.2	71.1	104	126	152	116	98.3	116
Fe	45800	14800	17600	40600	38400	26700	33600	31300	33700	47600	41800	38000	34400
Pb	163	21.4	29.3	94.1	130	118	106	91.1	97.5	144	119	102	132
Mg	6110	1700	2210	5310	5300	7420	4560	5090	4640	5400	5680	4970	4670
Mn	636	115	165	534	538	701	550	466	1080	553	501	468	1310
Hg	nd	nd	nd	nd	nd	0.13	nd	nd	0.23	nd	nd	nd	nd
Ni	23.2	8.6	13.9	24	31.2	7.4	30.9	18.1	59.2	29.4	32.5	27.3	53.6
K	5290	1980	1700	3640	3980	1030	3130	2540	3080	4330	3960	3390	2890
Se	1.8	0.44	nd	1.1	1.6	nd	1.1	1.4	1.1	1.1	1.3	0.94	1.3
Ag	3.3	nd	nd	nd	nd	1.9	1.9	2.3	2.5	nd	nd	1.8	1.5
Na	292	76.5	122	297	277	54.4	238	245	254	326	290	241	232
Tl	nd	nd	nd	nd	nd	nd	nd	nd	nd	0.69	nd	nd	nd
V	24.8	6.5	7.9	20.5	20.6	43.6	16.8	22.2	18.9	21.2	24.7	21.6	18.6
Zn	274	44.5	93.9	190	237	136	221	182	548	298	250	220	469

nd - not detected; Jv - estimated value is biased low

Stippled data are > 3 x background concentration (or detected when undetected at background location)

Additional shading for those metals representing CERCLA hazardous substances

Table 19. Metal Concentrations in Selected Seeps and Surface Water Bodies near the Tailings Ponds

Map Location	O Embargo Rd. Seep		P Irrigation Ditch above Seep		Q Irrigation Ditch below Seep		R #002 OUTFALL		S 50' W of 002 OUTFALL	
CLP ID#	MFT959 F	MFT958 UF	MFT961 F	MFT960 UF	MFT957 F	MFT956 UF	MFT963 F	MFT962 UF	MFT965 F	MFT964 UF
Analyte (ug/L)										
Al	119	248	111	971	136	1050	148	135	40	149
Sb	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
As	nd	nd	nd	nd	1.2	nd	nd	nd	nd	nd
Ba	13.5	16.2	27.4	32	26	37.7	27.1	27.3	57.5	60.8
Be	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Cd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ca	265000	269000	49100	46800	45700	52900	277000	291000	123000	119000
Cr	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Co	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Cu	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Fe	nd	nd	109	963	116	1160	nd	19.9	33.4	251
Pb	1	1.7	nd	nd	nd	1.4vJ	nd	nd	nd	nd
Mg	45400	47200	9190	8970	8500	9910	46400	47400	20700	20800
Mn	569	650	8.8vJ	36.4	15.8	65	1820	1860	11	10.9vJ
Hg	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ni	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
K	4140	4350	863	1110	791	1390	3520	4010	1060	1370
Se	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Ag	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Na	90100	92000	15400	ND	14700	ND	91700	91600	48000	46700
Tl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
V	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
Zn	nd	8.3	nd	nd	nd	nd	nd	nd	nd	nd
Gen. Chem.										
(ug/L)										
CLP ID#	SF1375		SF1376		SF1374		SF1377		SF1378	
Alk	160000		71800J		71800J		158000J		167000J	
COD	nd		8410		6840		nd		nd	
TDS	1633000		273000		304000		1580000		679000	
TSS	nd		nd		nd		nd		nd	
NH3	nd		nd		nd		nd		nd	
Cl	16000		3630		3860		15600		12300	
NOX	nd		130		130		nd		nd	
TOC	3430J		3000J		2890J		2560J		2840J	
TPO4	130		nd		110		160		100	
SO4	1005000		121000		127000		973000		290000	

F - filtered sample; UF - unfiltered sample

nd - not detected; J - estimated value; v - value is biased low

Table 20. Loading of Sulfate and Selected Metals into the Red River by Stream Segment during ESI Sampling

Location:	Flow (cfs)*	SO4 conc.	**SO4 gain**	Mass gain	% of total gain	
		mg/l	(flow x conc)			
Abv. Molycorp Mill	18	74	1332	499.8	31.8	Moly Mill to Columbine Ck.
Below Columbine Crk.	25.8	71	1832	1030.2	65.6	Columbine to Goathill Gulch
Goathill Gulch	27	106	2862	418.4	26.6	Goathill to Blw Capulin Cyn
Blw Capulin Canyon	27.8	118	3280	196.6	12.5	Blw Capulin Cyn to Eagle Rk CG
Eagle Rock CG	28.5	122	3477			
FS Ranger St.	29					
			Total Gain =	2145		
Location:	Flow (cfs)	Al conc.	**Al gain**	Mass gain	% of total gain	
		mg/l	(flow x conc)			
Abv. Molycorp Mill	18	1.07	19.3	2.8	5.2	Moly Mill to Columbine Ck.
Below Columbine Crk.	25.8	0.856	22.1	12.2	22.4	Columbine to Goathill Gulch
Goathill Gulch	27	1.27	34.3	22.7	41.6	Goathill to Blw Capulin Cyn
Blw Capulin Canyon	27.8	2.05	57.0	16.8	30.8	Blw Capulin Cyn to Eagle Rk CG
Eagle Rock CG	28.5	2.59	73.8			
FS Ranger St.	29					
			Total Gain =	54.6		
Location:	Flow (cfs)	Mn conc.	**Mn gain**	Mass gain	% of total gain	
		mg/l	(flow x conc)			
Abv. Molycorp Mill	18	0.195	3.5	1.9	8.9	Moly Mill to Columbine Ck.
Below Columbine Crk.	25.8	0.208	5.4	8.0	38.6	Columbine to Goathill Gulch
Goathill Gulch	27	0.495	13.4	3.4	16.4	Goathill to Blw Capulin Cyn
Blw Capulin Canyon	27.8	0.603	16.8	7.5	36.1	Blw Capulin Cyn to Eagle Rk CG
Eagle Rock CG	28.5	0.851	24.3			
FS Ranger St.	29					
			Total Gain =	20.7		
Location:	Flow (cfs)	Zn conc.	**Zn gain**	Mass gain	% of total gain	
		mg/l	(flow x conc)			
Abv. Molycorp Mill	18	0.061	1.098	0.4	7.9	Moly Mill to Columbine Ck.
Below Columbine Crk.	25.8	0.057	1.4706	1.9	39.0	Columbine to Goathill Gulch
Goathill Gulch	27	0.123	3.321	0.9	19.7	Goathill to Blw Capulin Cyn
Blw Capulin Canyon	27.8	0.153	4.2534	1.6	33.5	Blw Capulin Cyn to Eagle Rk CG
Eagle Rock CG	28.5	0.205	5.8425			
FS Ranger St.	29					
			Total Gain =	4.7		

* Flow was estimated by applying flow rates from Vail 1993 to gauged flow of 29 cfs.

Shaded data represents reach of Red River demonstrating highest gain

Table 21. Sulfate Gain Observed in Red River between Molycorp Property and USFS Ranger Station

Nov. 7, 1994	flow (cfs)	SO4 conc. (mg/l)	SO4 gain	Gain w/in stream reach	% of total gain	
Blw Hanson Crk	13.9	59	820	246	13.5	Hanson Crk to Moly Mill
Abv Moly Mill	14.4	74	1066	314	17.3	Moly Mill to Columbine Ck.
Abv Col. Crk	15.5	89	1380	794	43.7	Columbine to Goathill G.
Goathill Gulch	20.5	106	2173	317	17.5	Goathill to Blw Capulin Cyn
Blw Cap. Cyn	21.1	118	2490	145	8.0	Blw Capulin Cyn to Eagle Rk C
Eagle Rock CG	21.6	122	2635			
FS Ranger St.	25		0			
				1815		

Feb. 16, 1993 (ref. 28, App. 2, 3)	flow (cfs)	SO4 conc. (mg/l)	SO4 gain	Gain w/in stream reach	% of total gain	
Blw Hanson Crk	13.9	33.81	470	180	7.9	Hanson Crk to Moly Mill
Abv Moly Mill	14.4	45.17	650	234	10.2	Moly Mill to Columbine Ck.
Abv Col. Crk	15.5	57.06	884	1276	55.5	Columbine to Goathill G.
Goathill Gulch	20.5	105.38	2160	206	9.0	Goathill to Blw Capulin Cyn
Blw Cap. Cyn	21.1	112.13	2366	401	17.5	Blw Capulin Cyn to Ranger St.
FS Ranger St.	22	125.77	2767			
				2297		

Oct. 22, 1992 (ref. 28, App. 2, 3)	flow (cfs)	SO4 conc. (mg/l)	SO4 gain	Gain w/in stream reach	% of total gain	
Blw Hanson Crk	15.8	66	1043	326	11.7	Hanson Crk to Moly Mill
Abv Moly Mill	16.1	85	1369	638	22.9	Moly Mill to Columbine Ck.
Abv Col. Crk	17.6	114	2006	1069	38.4	Columbine to Goathill G.
Goathill Gulch	23.3	132	3076	284	10.2	Goathill to Blw Capulin Cyn
Blw Cap. Cyn	24	140	3360	465	16.7	Blw Capulin Cyn to Ranger St.
FS Ranger St.	25	153	3825			

Nov. 29, 1988 (ref. 28, App. 2, 3)	flow (cfs)	SO4 conc. (mg/l)	SO4 gain	Gain w/in stream reach	% of total gain	
Blw Hanson Crk	10.7	46	492	216	11.8	Hanson Crk to Moly Mill
Abv Moly Mill	10.9	65	709	468	25.5	Moly Mill to Columbine Ck.
Abv Col. Crk	12	98	1176	499	27.2	Columbine to Goathill G.
Goathill Gulch	15.8	106	1675	297	16.2	Goathill to Blw Capulin Cyn
Blw Cap. Cyn	16.3	121	1972	357	19.4	Blw Capulin Cyn to Ranger St.
FS Ranger St.	17	137	2329			
				1837		

Nov. 25, 1988 (ref. 28, App. 2, 3)	flow (cfs)	SO4 conc. (mg/l)	SO4 gain	Gain w/in stream reach	% of total gain	
RR@Elephant CG	16	46	736	564	16.7	Hanson Crk to Moly Mill
Abv Moly Mill	20	65	1300	562	16.7	Moly Mill to Columbine Ck.
Abv Col. Crk	19	98	1862	1000	29.6	Columbine to Goathill G.
Goathill Gulch	27	106	2862	647	19.2	Goathill to Blw Capulin Cyn
Blw Cap. Cyn	29	121	3509	601	17.8	Blw Capulin Cyn to Ranger St.
FS Ranger St.	30	137	4110			
				3374		

Shaded data represent reach of Red River demonstrating highest SO4 gain

Table 22. Metal Concentrations in Residentials Areas near Tailings Ponds: South

Map Location CLP ID# Soil Type* Analyte (mg/kg)	Average Metal Conc. in Tailings (N=8)	Highest Metal Conc. in Background Soil Sedillo Soil Type*	Ratio of Conc. (tailings/bckgrd)	17 Change House MFT934 Sedillo	15 Feliciano Rael MFT937 Sedillo	14 Roger Herrera MFT938 Sedillo	16 Cecil Clines MFT939 Sedillo	Benchmark (ref. 2)
Al	8050	3180	2.5	8290	7140	7070	8300	
Sb	nd	7.3	na	nd	nd	nd	nd	
As	0.78	0.84	0.9	1.9	1.5	1.3	1.4	
Ba	87	54.1	1.6	157	108	156	121	
Be	1	0.21	4.3	0.63	0.56	0.58	0.49	
Cd	0.2	nd	na	nd	nd	nd	nd	
Ca	16250	1230	13.2	5360.0	2490.0	8670.0	3060	
Cr	40	4.2	9.6	12.8	16.4	14	17.5	2900
Co	10	3.3	3.2	7.3	9.1	7.1	8.7	
Cu	188	7.0	26.9	31.7	20.1	20.3	22.7	na
Fe	16693	7780	2.1	11700	14200	11300	15400	
Pb	58	13.5	4.3	33.7	17.3	21.7	15.7	
Mg	7743	1120	6.9	3520.0	3350.0	3710.0	3830.0	
Mn	471	317	1.5	527	541	548	469	
Hg	nd	nd	na	nd	nd	nd	nd	
Ni	30	4.0	7.5	13.6	15.5	15.4	15.6	12000
K	4761	1100	4.3	1650	1650	2960	1650	
Se	nd	nd	na	nd	nd	nd	nd	
Ag	nd	nd	na	nd	nd	nd	nd	
Na	137	45.8	3.0	56.7	49.4	97.8	89.9	
Tl	0.5	nd	na	nd	nd	nd	nd	
V	35	8.7	4.0	18.6	19.3	14.8	21.9	
Zn	121	38.4	3.1	63.7J	57.8J	80.8J	52.4J	

* ref.5

** Cancer Risk Screening Concentration (ref. 2)

Shaded data are CERCLA hazardous substances which are > 3 x background concentrations.

J - estimated value; nd - not detected; na - not available or calculable

Table 23. Metal Concentrations in Residentials Areas near Tailings Ponds: North

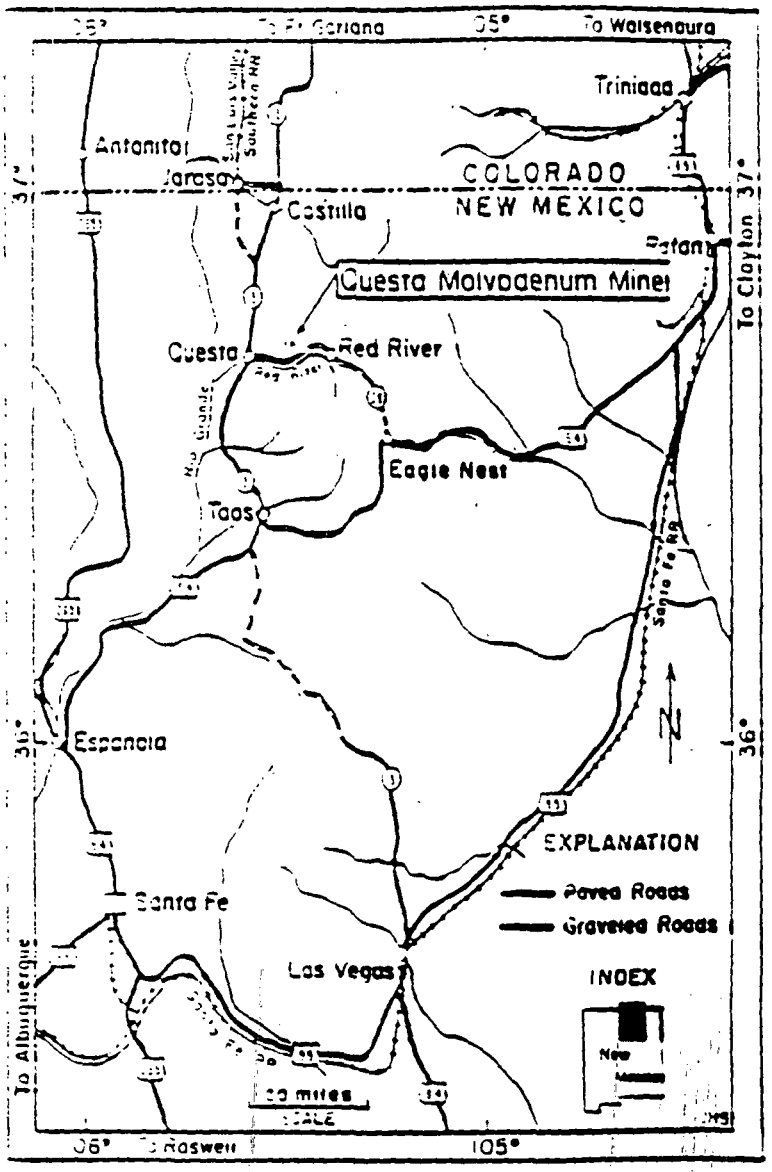
Map Location CLP ID# Soil Type* Analyte (mg/kg)	Average Metal Concentration in Tailings (N=8)	23 1/4-mile north of Questa Jr. High (initial background) MFT945 Silva	24 Cerro Rd. # 1 (background) MFQ-082 Silva	25 Cerro Rd. # 2 (background) MFQ-083 Silva	26 Cerro Rd. # 2 (duplicate) MFQ-084 Silva	Average Background Concentration Silva Soil Type	Ratio of Concentrations (tailings/bckgrd)	22 Questa Jr. High School-2 MFT931 Silva	20 Questa Jr. High School-3 MFT932 Silva	21 Questa Jr. High School-3 (duplicate) MFT933 Silva	18 Arch Trujillo MFT935 Silva	19 Romolo Martinez MFT936 Silva
Al	8050	13600	9790	8950	13700	11510	0.7	12300	8000	10900	8710	8650
Sb	nd	nd	nd	nd	nd	nd	na	nd	nd	nd	nd	nd
As	0.78	nd	4.7	4.4	5.5	3.7	0.2	2.3	2	nd	2.5	1.5
Ba	87	187	156	159	185	172	0.5	218	196	195	167	192
Be	1	0.75	0.72	0.79	0.97	0.81	1.1	0.88	0.67	0.69	0.62	0.62
Cd	0.2	0.98	nd	0.57	0.65	0.55	0.4	nd	nd	1.2	nd	nd
Ca	16250	4670	2570	2280	2580	3025	5.4	9970	7680	7010	13700	14000
Cr	40	13.2	13.1	13.7	17.7	14.4	2.8	11.8	8.2	11.5	9	14.5
Co	10	7.1	10	12	14.3	10.9	1.0	8.7	7.7	6.7	6.6	7.8
Cu	188	14.4	17.4	24.3	29.2	21.3	8.8	19.5	16.9	16	16.4	30.2
Fe	16693	17200	17500	19400	25000	19775	0.8	15000	10700	14300	13200	12500
Pb	58	16.2vJ	20.3	23.5	24.9	21.2	2.7	18.7	15.8	3.3vJ	16.4	48.4
Mg	7743	4100	2550	2590	3220	3115	2.5	4100	3100	3700	3980	4280
Mn	471	493	655	789	904	710	0.7	589	504	518	457	542
Hg	nd	nd	nd	nd	nd	nd	na	nd	nd	nd	nd	nd
Ni	30	12.4	11	11.6	14.3	12.3	2.4	12.6	9.2	11.2	11.5	14.3
K	4761	2650	1850	2230	2910	2410	2.0	3040	1700	2070	2090	2630
Se	nd	0.21J	1.1J	0.92	1.4J	0.23	0.0	nd	nd	nd	nd	nd
Ag	nd	nd	nd	nd	nd	nd	na	nd	nd	nd	nd	0.81
Na	137	86.9	86.2	79.6	105	89.4	1.5	104	61.6	73.5	93.7	85.6
Tl	nd	nd	nd	nd	nd	nd	na	nd	nd	nd	nd	nd
V	35	24.8	36.1	33	41.3	33.8	1.0	19.8	19.9	22.4	24.5	21
Zn	121	49.3	48.5	65.3	85.3	62.1	1.9	60.7J	42.1J	44.1	52.6J	202J

* ref. 5

J = estimated value; v - value biased low

nd = not detected; na = not available or calculable

Note: Shaded datum is > 3 x background but also > average concentration in tailings



INDEX MAP SHOWING THE LOCATION OF THE QUESTA MOLYBDENUM MINE.

Figure 1 (from Ref. 8)

LATIR PEAK AND WHEELER PEAK WILDERNESSES
CARSON NATIONAL FOREST
NEW MEXICO
1990

MAP LEGEND

- Forest Service Land
- Pueblo de Taos Indian Reservation
- Other Land
- Cañon del Rio Grande Wild River
- Cañon del Rio Grande Recreation Area
- National Forest Boundary
- National Forest Administrative Boundary
- Wilderness Boundary
- Wilderness Study Area Boundary
- County Boundary
- Primary Highway
- Secondary Highway
- Improved Dirt or Gravel Road
- Unimproved Dirt Road
- Trail
- U.S. Highway
- State Highway
- Forest Service Road
- Forest Service Trail
- Ranger District Office
- Forest Service Recreation Site
- Other Recreation Site
- Suggested Campsites
- Mine
- Locked Gate
- Fenceline
- Powerline
- Perennial Stream
- Intermittent Stream
- Spring

Tailings Ponds
#1
#2
#4
#5A
Mine Waste Dumps
North Ditch
Middle Ditch
South Ditch
Molino Ditch
Red River
BLM Wild & Scenic River
Rio Grande
LATIR PEAK WILDERNESS
CARSON
NATIONAL
Questa
Pinabete Peak
Eagle Rock
Elephant Rock
Flag Mountain
Cebolla Mesa
Red River State Fish Hatchery
N
1-mile

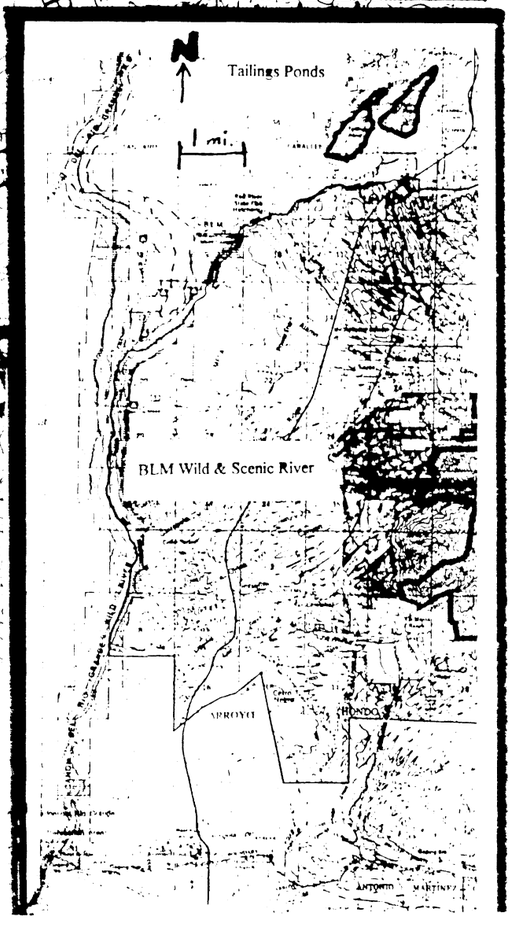


Figure 2. Molycorp Site Map

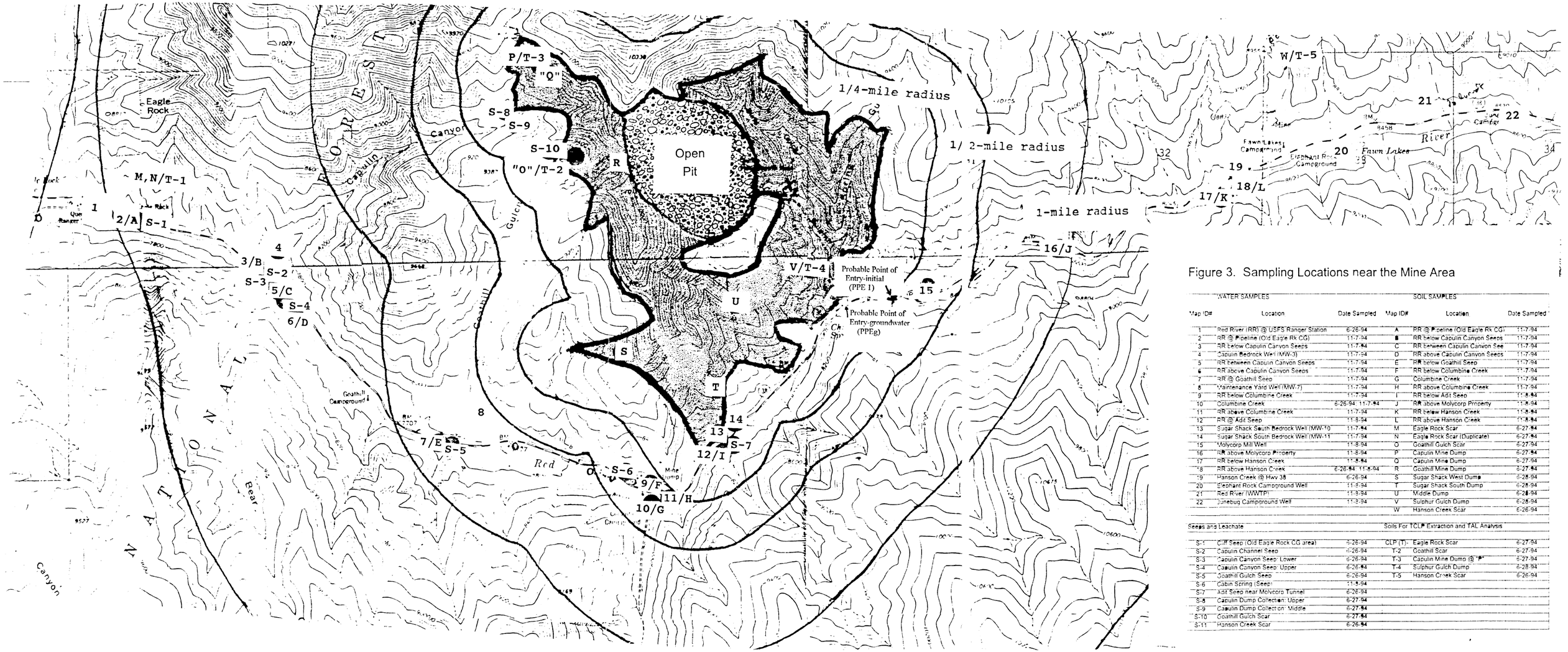


Figure 3. Sampling Locations near the Mine Area

WATER SAMPLES			SOIL SAMPLES		
Map ID#	Location	Date Sampled	Map ID#	Location	Date Sampled
1	Red River (RR) @ USFS Ranger Station	6-26-94	A	RR @ Pipeline (Old Eagle Rk CG)	11-7-94
2	RR @ Pipeline (Old Eagle Rk CG)	11-7-94	B	RR below Capulin Canyon Seeps	11-7-94
3	RR below Capulin Canyon Seeps	11-7-94	C	RR between Capulin Canyon See	11-7-94
4	Capulin Bedrock Well (MW-3)	11-7-94	D	RR above Capulin Canyon Seeps	11-7-94
5	RR Between Capulin Canyon Seeps	11-7-94	E	RR below Goathill Seep	11-7-94
6	RR above Capulin Canyon Seeps	11-7-94	F	RR below Columbine Creek	11-7-94
7	RR @ Goathill Seep	11-7-94	G	Columbine Creek	11-7-94
8	Maintenance Yard Well (MW-7)	11-7-94	H	RR above Columbine Creek	11-7-94
9	RR below Columbine Creek	11-7-94	I	RR below Adit Seep	11-8-94
10	Columbine Creek	6-26-94, 11-7-94	J	RR above Molycorp Property	11-8-94
11	RR above Columbine Creek	11-7-94	K	RR below Hanson Creek	11-8-94
12	RR @ Adit Seep	11-8-94	L	RR above Hanson Creek	11-8-94
13	Sugar Shack South Bedrock Well (MW-10	11-7-94	M	Eagle Rock Scar	6-27-94
14	Sugar Shack South Bedrock Well (MW-11	11-7-94	N	Eagle Rock Scar (Duplicate)	6-27-94
15	Molycorp Mill Well	11-8-94	O	Goathill Gulch Scar	6-27-94
16	RR above Molycorp Property	11-8-94	P	Capulin Mine Dump	6-27-94
17	RR below Hanson Creek	11-8-94	Q	Capulin Mine Dump	6-27-94
18	RR above Hanson Creek	6-26-94, 11-8-94	R	Goathill Mine Dump	6-27-94
19	Hanson Creek @ Hwy 38	6-26-94	S	Sugar Shack West Dump	6-28-94
20	Elephant Rock Campground Well	11-8-94	T	Sugar Shack South Dump	6-28-94
21	Red River (WWTP)	11-8-94	U	Middle Dump	6-28-94
22	Junebug Campground Well	11-8-94	V	Sulphur Gulch Dump	6-28-94
			W	Hanson Creek Scar	6-26-94

Seeps and Leachate			Soils For TCLP Extraction and TAL Analysis		
S-1	Cliff Seep (Old Eagle Rock CG area)	6-26-94	CLP (T)-	Eagle Rock Scar	6-27-94
S-2	Capulin Channel Seep	6-26-94	T-2	Goathill Scar	6-27-94
S-3	Capulin Canyon Seep Lower	6-26-94	T-3	Capulin Mine Dump @ "P"	6-27-94
S-4	Capulin Canyon Seep Upper	6-26-94	T-4	Sulphur Gulch Dump	6-28-94
S-5	Goathill Gulch Seep	6-26-94	T-5	Hanson Creek Scar	6-26-94
S-6	Cabin Spring (Seep)	11-8-94			
S-7	Adit Seep near Molycorp Tunnel	6-26-94			
S-8	Capulin Dump Collection: Upper	6-27-94			
S-9	Capulin Dump Collection: Middle	6-27-94			
S-10	Goathill Gulch Scar	6-27-94			
S-11	Hanson Creek Scar	6-26-94			

Figure 4. Sampling Locations near the Tailings Ponds

SOIL SAMPLES		
Map ID#	Location	Date Sampled
1	Tailings Pond (TP)-4	4-18-94
2	TP-4	4-18-94
3	TP-4	4-18-94
4	TP-5A	4-18-94
5	TP-5A (dupl.)	4-18-94
6	TP-1	4-18-94
7	TP-1	4-18-94
8	TP-2	4-18-94
9	Along USFS Rd. 493	4-19-94
10	Along USFS Rd. 493	4-19-94
11	Along USFS Rd. 493	4-19-94
12	300' E of Fenceline	4-19-94
13	700' E of Fenceline	4-19-94
14	Roger Herrera	4-19-94
15	Feliciano Rael	4-19-94
16	Cecil Clines	4-19-94
17	Change House	4-19-94
18	Arch Trujillo	4-19-94
19	Romolo Martinez	4-19-94
20	Questa Jr. High 2	4-19-94
21	Questa Jr. High 3	4-18-94
22	Questa Jr. High 3 (dupl.	4-18-94
23	1/4 mi. N of Jr. High	4-19-94
24	Cerro Road #1	5-9-95
25	Cerro Road #2	5-9-95
26	Cerro Rd. #2 (duplicate	5-9-95

WATER SAMPLES		
Map ID#	Location	Date Sampled
A	Change House Well	4-21-94
B	MW-4	4-21-94
C	Duran Well	4-25-94
D	Duran Well (dupl.)	4-25-94
E	Rael Well	4-21-94
F	MW-9a	4-25-94
G	MW-2	4-21-94
H	MW-6	4-21-94
I	MW-7b	4-25-94
J	MW-7c	4-25-94
K	MW-3	4-21-94
L	MW-1	4-21-94
M	MW-1 (dupl.)	4-21-94
N	Herrera Well	4-20-94
O	Embargo Road Seep	4-20-94
P	Irrigation Ditch abv "O"	4-20-94
Q	Irrigation Ditch btw "O"	4-20-94
R	Outfall #002	4-20-94
S	Irrigation Ditch @ Red R	4-20-94
T	Old Coldwater Spr. Collectio	4-20-94
U	Seep "E" @ Red R	4-20-94
V	Seep "D" @ Red R	4-20-94
W	Seep "A" @ Red R.	4-20-94
X	Warm Spring @ Hatchery	4-20-94
Y	Cold Spring @ Hatchery	4-20-94

1-mile radius

1/2-mile radius

1/4-mile radius

2-mile radius

Probable Point of Entry-final (PPE 2)

Boundary of Federally Designated Wild and Scenic River

N

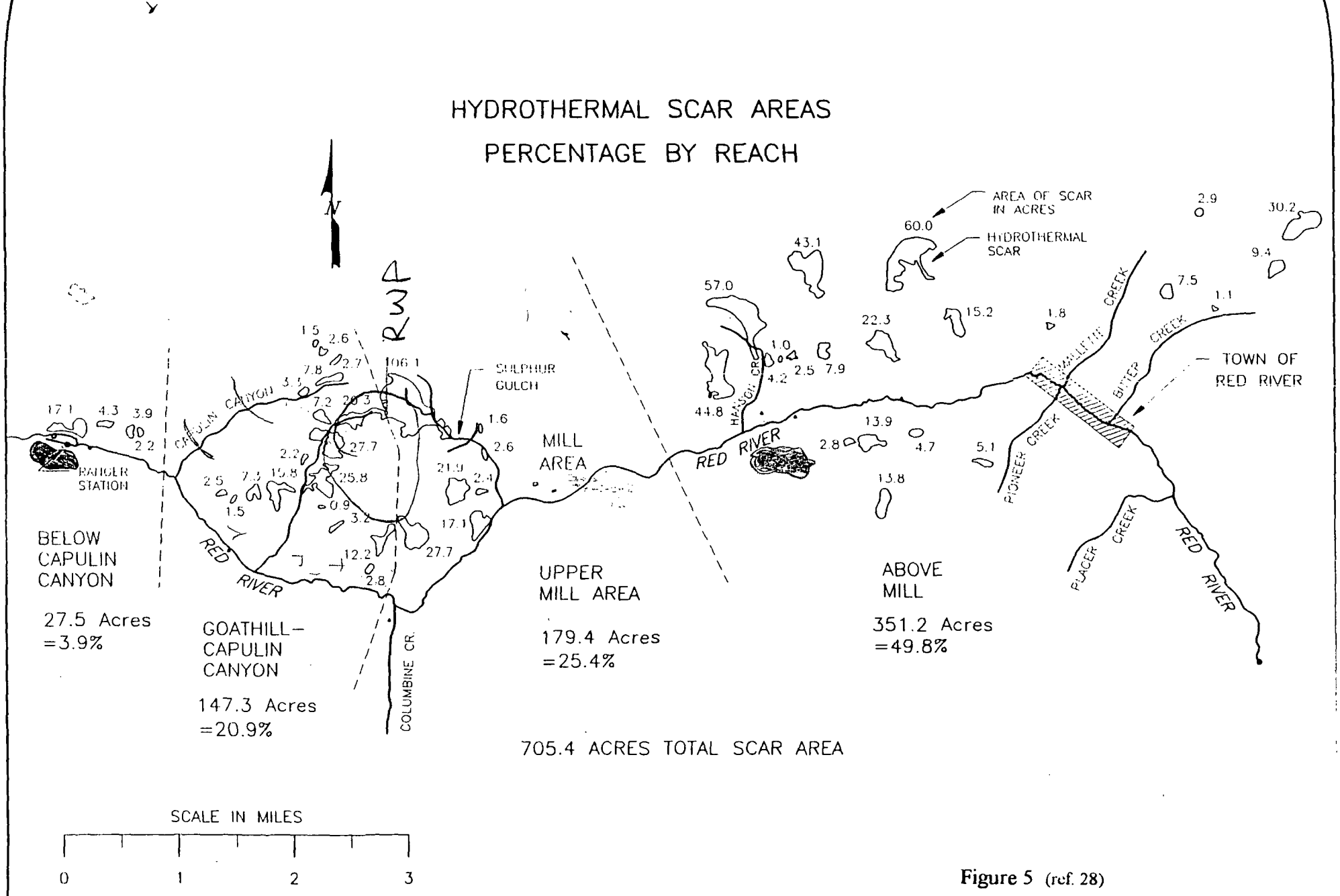


Figure 5 (ref. 28)

HYDROTHERMAL SCAR AREAS

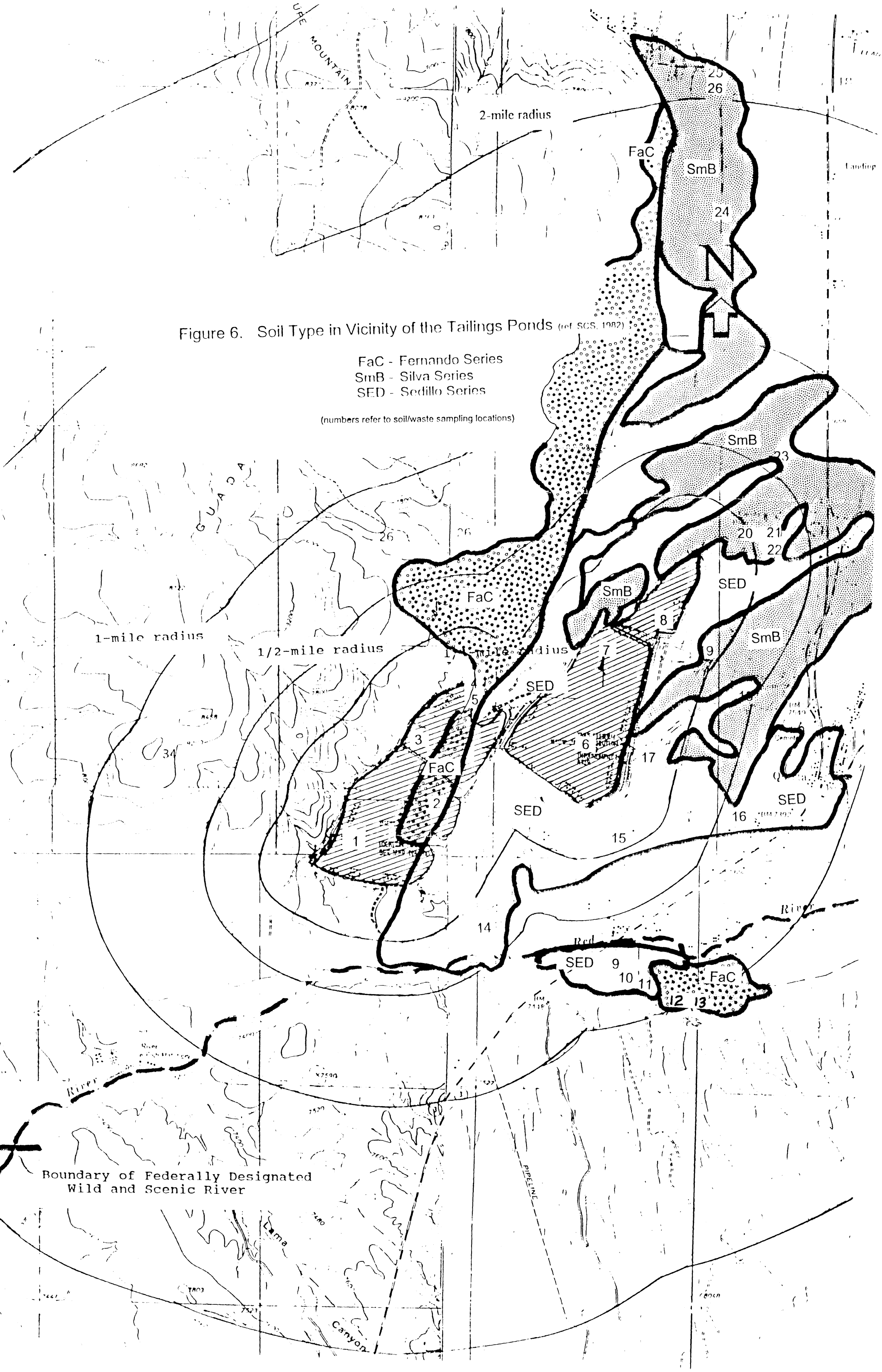


Figure 6. Soil Type in Vicinity of the Tailings Ponds (ref. SCS, 1982)

FaC - Fernando Series
SmB - Silva Series
SED - Sedillo Series

(numbers refer to soil/waste sampling locations)

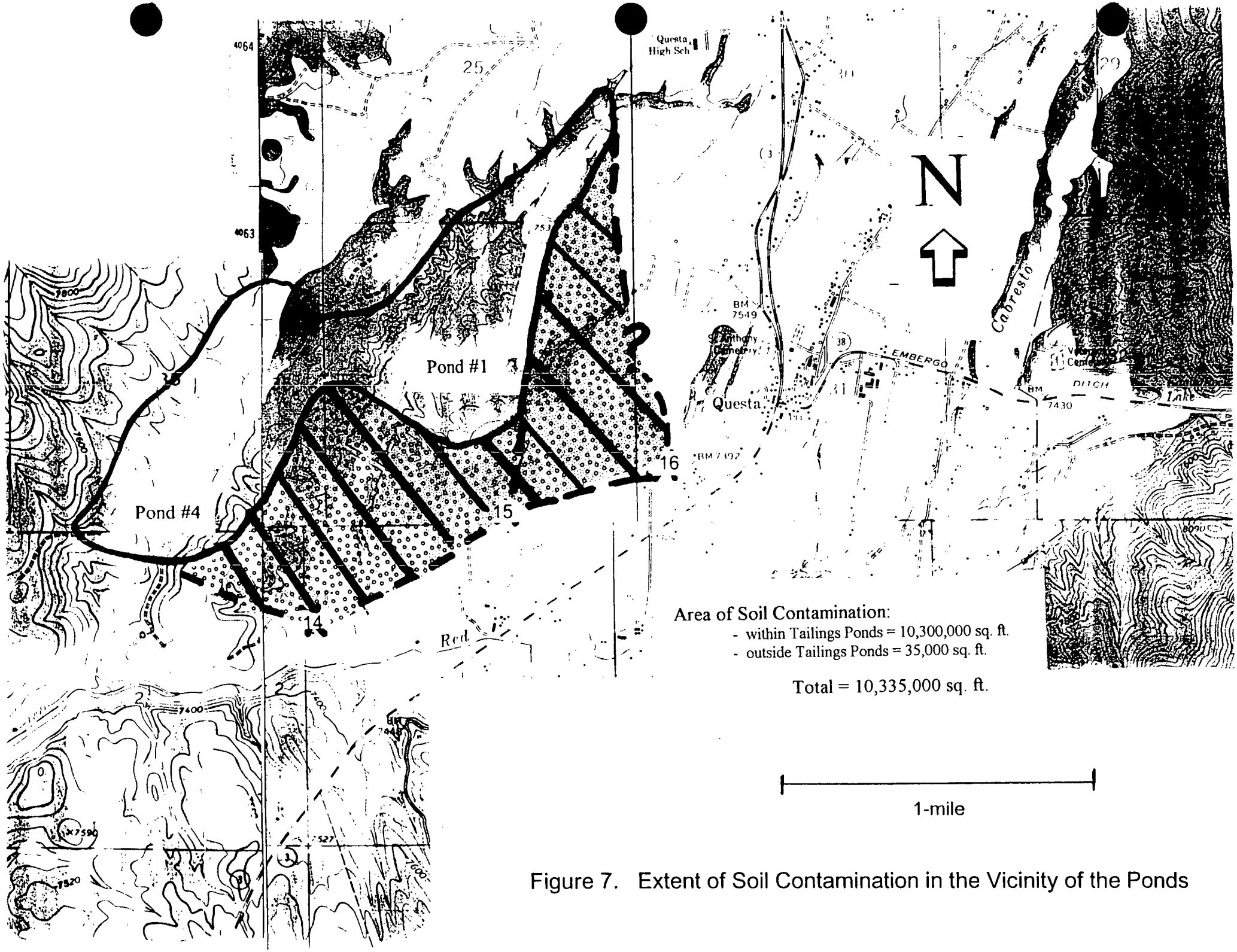


Figure 7. Extent of Soil Contamination in the Vicinity of the Ponds

Attachment A

Table 4 Summary of Groundwater Analysis by NMED of Private Wells and Monitoring Wells Below (South) Molycorp Tailings Ponds (in ppm)

Well Location	Ownership	Date Sampled	TDS	SO4	Cd	Cr	Cu	Mn	Pb	Zn
P-1	Herrera	2-4-87	1406	325	<0 001	<0 005	<0 1	<0 05	<0 01	0 2
		5-26-87	1316	837						<0 1
		3-28-88	1652	875	<0 1	<0 1			<0 1	
P-4a	Rael	2-4-87	792	<10	<0 001	<0 005			<0 01	
		5-26-87	-	-						
P-4b	Rael	2-4-87	356	93						0 2
		5-26-87	270	88						0 1
P-5	T Durane	-	982	504	-	-	-	-	-	-
P-7	S Durane	2-4-87	274	78	<0 001	<0 005	<0 1	<0 05	<0 01	0 3
		5-26-87	260	79						0 2
P-8	J Durane	5-26-87	186	32						<0 1
MW-1		4-19-88	1360	750						
MW-2			1446	815						
MW-3			928	465		0 006				
MW-4			1114	545		<0 005				
MW-A			844	425						
MW-C			1224	645				1 2		

ref 39

3)

755
wex

88-0416-C

SCIENTIFIC LABORATORY DIVISION

700 Camino de Salud NE
Albuquerque, NM 87106 841-2570

REPORT TO: CYNTHIA ARDITO
HED-EID Ground Water
P.O. BOX 968
SANTA FE NM 87504-0968

S.L.D. No. OR- 416 A+B
DATE REC. 3-31-88
PRIORITY
PHONE(S):

COLLECTION CITY: Questa ; COUNTY:

COLLECTION DATE/TIME CODE: (Year-Month-Day-Hour-Minute) 8 8 0 3 2 8 1 0 3 0

LOCATION CODE: (Township-Range-Section-Tracts) 36° 41' 41", 105° 37' 18" (10N06E24342)

USER CODE: 5 9 3 0 1 SUBMITTER: ARDITO CODE:

SAMPLE TYPE: WATER [X], SOIL [ ], FOOD [ ], OTHER:

RECEIVED APR 28 1988 GROUND WATER/HAZARDOUS WASTE BUREAU

This form accompanies ____ Septum Vials, 2 Glass Jugs, and/or ____

Samples were preserved as follows:

- [ ] NP: No Preservation; Sample stored at room temperature.
- [X] P-Ice Sample stored in an ice bath (Not Frozen).
- [ ] P-$Na_2S_2O_3$ Sample Preserved with Sodium Thiosulfate to remove chlorine residual.

ANALYSES REQUESTED: Please check the appropriate box(es) below to indicate the type of analytical screens required. Whenever possible list specific compounds suspected or required.

PURGEABLE SCREENS

- [ ] (753) Aliphatic Headspace (1-5 Carbons)
- [ ] (754) Aromatic & Halogenated Purgeables
- [ ] (765) Mass Spectrometer Purgeables
- [ ] (766) Trihalomethanes

Other Specific Compounds or Classes

- [ ] ____
- [ ] ____
- [ ] ____
- [ ] ____
- [ ] ____

EXTRACTABLE SCREENS

- [X] (751) Aliphatic Hydrocarbons
- [X] (755) Base/Neutral Extractables
- [ ] (758) Herbicides, Chlorophenoxy acid
- [ ] (759) Herbicides, Triazines
- [ ] (760) Organochlorine Pesticides
- [ ] (761) Organophosphate Pesticides
- [ ] (767) Polychlorinated Biphenyls (PCB's)
- [X] (764) Polynuclear Aromatic Hydrocarbons
- [ ] (762) SDWA Pesticides & Herbicides

Remarks: Carlos Herrera well claimed water tastes like oil - maybe diesel fuel - Molycorp

FIELD DATA:

pH=____; Conductivity=____umho/cm at ____°C; Chlorine Residual=____mg/l

Dissolved Oxygen=____mg/l; Alkalinity=____mg/l; Flow Rate____ ____/____

Depth to water ____ft.; Depth of well____ft.; Perforation Interval ____-____ft.; Casing____

Sampling Location, Methods and Remarks (i.e. odors, etc.)

I certify that the results in this block accurately reflect the results of my field analyses, observations and activities.(signature collector)____ Method of Shipment to the Lab ____

CHAIN OF CUSTODY

I certify that this sample was transferred from ____ to ____

at (location) ____ on ____/____/____ - ____ ____ and that

the statements in this block are correct. Evidentiary Seals. Not Sealed [ ] OR Seals Intact: Yes [ ] No [ ]

(4)

SCIENTIFIC LABORATORY DIVISION

754 wpu

88-0417-C

700 Camino de Salud NE
Albuquerque, NM 87106 841-2570

REPORT TO: Cynthia Ardito
HED-EID Ground Water
P.O. Box 968
Santa Fe NM 87104-0968

S.L.D. No. OR- 417 A+B
DATE REC. 3-31-88
PRIORITY
PHONE(S):

COLLECTION CITY: Questa ; COUNTY:

COLLECTION DATE/TIME CODE: (Year-Month-Day-Hour-Minute) 8 8 0 3 2 8 1 0 3 0

LOCATION CODE: (Township-Range-Section-Tracts) 36° 41' 41", 105° 37' 18" (10N06E24342)

USER CODE: 5 9 3 0 1 SUBMITTER: C. Ardito CODE:

SAMPLE TYPE: WATER [X], SOIL [ ], FOOD [ ], OTHER:

RECEIVED JUN 15 1988 GROUND WATER/HAZARDOUS WASTE BUREAU

This form accompanies 2 Septum Vials, ____ Glass Jugs, and/or ____

Samples were preserved as follows:

- [ ] NP: No Preservation; Sample stored at room temperature.
- [X] P-Ice Sample stored in an ice bath (Not Frozen).
- [ ] P-$Na_2S_2O_3$ Sample Preserved with Sodium Thiosulfate to remove chlorine residual.

ANALYSES REQUESTED: Please check the appropriate box(es) below to indicate the type of analytical screens required. Whenever possible list specific compounds suspected or required.

PURGEABLE SCREENS

- [ ] (753) Aliphatic Headspace (1-5 Carbons)
- [X] (754) Aromatic & Halogenated Purgeables
- [ ] (765) Mass Spectrometer Purgeables
- [ ] (766) Trihalomethanes

Other Specific Compounds or Classes

- [ ] ____
- [ ] ____
- [ ] ____
- [ ] ____
- [ ] ____

EXTRACTABLE SCREENS

- [ ] (751) Aliphatic Hydrocarbons
- [ ] (755) Base/Neutral Extractables
- [ ] (758) Herbicides, Chlorophenoxy acid
- [ ] (759) Herbicides, Triazines
- [ ] (760) Organochlorine Pesticides
- [ ] (761) Organophosphate Pesticides
- [ ] (767) Polychlorinated Biphenyls (PCB's)
- [ ] (764) Polynuclear Aromatic Hydrocarbons
- [ ] (762) SDWA Pesticides & Herbicides

Remarks: Carlos Herrera well claimed smelled & tasted like oil - Molycorp.

FIELD DATA:

pH=____; Conductivity=____umho/cm at ____°C; Chlorine Residual=____mg/l

Dissolved Oxygen=____mg/l; Alkalinity=____mg/l; Flow Rate____ ____/____

Depth to water ____ft.; Depth of well____ft.; Perforation Interval ____-____ft.; Casing:____

Sampling Location, Methods and Remarks (i.e. odors, etc.)

I certify that the results in this block accurately reflect the results of my field analyses, observations and activities.(signature collector):____ Method of Shipment to the Lab:____

CHAIN OF CUSTODY

I certify that this sample was transferred from ____ to ____

at (location) ____ on ____/____/____ - ____:____ and that

the statements in this block are correct. Evidentiary Seals: Not Sealed [ ] OR Seals Intact: Yes [ ] No [ ]

Signatures ____ ____

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud N.
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received		Lab No.		User Code	☐ 59400 ☐ 59300	☐ 53400 ☐ 59500	☐ 53300 ☒ 59301

COLLECTION DATE & TIME: yy 88 | mm 04 | dd 19 | hh 09 | mm 35

COLLECTED BY: C ARDID

RECEIVED

TO:

GROUND WATER BUREAU

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

ATTN: CYNTHIA ARDID
PHONE: 827-2703

COLLECTION SITE DESCRIPTION
Rio Grande
Old Taos Airport Pit
IHWA
OWNER:

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)
| | + | | + | | + | | |

STATION/ WELL CODE:

LATITUDE, LONGITUDE: 36° 42' 04" 105° 37' 07"

SAMPLING CONDITIONS:

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water Level:	Discharge:	Sample Type: INAIR

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
6.9	500 µmho	14.0 °C	µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☒ WPF: Water Preserved w/HNO_3 Filtered	☒ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	9.7	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	0.9	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☐ <0.001	Vanadium	<0.1	
Calcium	160.		Zinc	<0.1	
Chromium	<0.1	☒ <0.005	Arsenic		☒ <0.005
Cobalt	<0.05		Selenium		☒ <0.005
Copper	<0.1		Mercury		☒ <0.0005
Iron	<0.1				☐
Lead	<0.1	☐ <0.01			☐
Magnesium	29.				☐
Manganese	<0.05				☐
Molybdenum	0.5				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB
Analysis Date: 5/3/88

Reviewer: [signature]
Date Reviewed: 9/6/88

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	7/12/88	Lab No.	TCP 13	User Code	☐ 59400 ☐ 59300	☐ 53400 ☐ 59500	☐ 53300 ☒ 59301

COLLECTION DATE & TIME: yy 88 | mm 04 | dd 19 | hh 14 | mm 52

COLLECTED BY: CAROLD

COLLECTION SITE DESCRIPTION: [illegible]

RECEIVED JUL 19 1988 GROUND WATER BUREAU

RECEIVED JUL 19 1988 GROUND WATER/HAZARDOUS WASTE BUREAU

TO:

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HWB
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

OWNER:

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)

ATTN: CYNTHIA AROLD
PHONE: 827-2703

STATION/ WELL CODE:

LATITUDE, LONGITUDE: 36° 41' 48" 105° 37' 05"

SAMPLING CONDITIONS:

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water Level: 14'	Discharge:	Sample Type: water

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
6.29	900 µmho	13.5 °C	µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☒ WPF: Water Preserved w/HNO_3 Filtered	☒ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	9.7	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	1.0	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☒ <0.001	Vanadium	<0.1	
Calcium	170.		Zinc	<0.1	
Chromium	<0.1	☒ 0.006	Arsenic		☒ <0.005
Cobalt	<0.05		Selenium		☒ <0.005
Copper	<0.1		Mercury		☒ <0.0005
Iron	<0.1				☐
Lead	<0.1	☒ <0.01			☐
Magnesium	33.				☐
Manganese	<0.05				☐
Molybdenum	<0.1				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB
Analysis Date: 5/3/88

Reviewer: Jim Ashby
Date Reviewed: 7/15/88

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	4/22/88	Lab No. ICP-142	User Code	☐ 59400 ☐ 59300	☐ 53400 ☐ 59500	☐ 53300 ☒ 59301

COLLECTION DATE & TIME: yy 88 mm 04 dd 19 hh 14 mm 16

COLLECTION SITE DESCRIPTION: Bluecorp Old Tailings Pile MW4

COLLECTED BY: C ARDITO

TO:

OWNER:

RECEIVED JUN 17 1988 HAZARDOUS WASTE BUREAU

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

SITE LOCATION:
County: TAOS

Township, Range, Section, Tract: (10N06E24342)

ATTN: CYNTHIA ARDITO
PHONE: 827-2703

STATION/ WELL CODE:

LATITUDE, LONGITUDE: 36°42' 02" 105° 36' 26"

SAMPLING CONDITIONS:

☐ Bailed ☐ Dipped ☐ Pump ☐ Tap	Water Level: 40.5	Discharge:	Sample Type:

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
6.5	1000 µmho	15.0 °C	µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☒ WPF: Water Preserved w/HNO_3 Filtered	☒ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	9.5	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	1.1	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☒ <0.001	Vanadium	<0.1	
Calcium	190.		Zinc	<0.1	
Chromium	<0.1	☒ <0.005	Arsenic		☒ <0.005
Cobalt	<0.05		Selenium		☒ <0.005
Copper	<0.1		Mercury		☒ <0.0005
Iron	<0.1				☐
Lead	<0.1	☒ <0.01			☐
Magnesium	38.				☐
Manganese	<0.05				☐
Molybdenum	0.1				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB

Analysis Date: 5/3/88

Reviewer: Jim Ashby

Date Reviewed: 6/14/88

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	4/28/88	Lab No.	ICP-140	User Code	☐ 59400 ☐ 59300 ☐ 53400 ☐ 59500 ☒ 53300

COLLECTION DATE & TIME: yy 88 | mm 04 | dd 19 | hh 10 | mm 55

COLLECTED BY: ARDITO

COLLECTION SITE DESCRIPTION: Lucero Pit on Lucero Pit Rd HWY

TO:

OWNER:

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

JUN 17 1988

HAZARDOUS WASTE

ATTN: CYNTHIA ARDITO
PHONE: 827-2703

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)

STATION/ WELL CODE:

LATITUDE, LONGITUDE: 36° 41' 50" 105° 37' 12"

SAMPLING CONDITIONS:

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water Level: 18'	Discharge:	Sample Type: WATER

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
6.1	1210 µmho	12.0 °C	µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☒ WPF: Water Preserved w/HNO_3 Filtered	☒ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	3.6	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	1.6	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☒ <0.001	Vanadium	<0.1	
Calcium	280.		Zinc	<0.1	
Chromium	<0.1	☒ <0.005	Arsenic		☒ <0.005
Cobalt	<0.05		Selenium		☒ <0.005
Copper	<0.1		Mercury		☒ <0.0005
Iron	0.4				☐
Lead	<0.1	☐ <0.01			☐
Magnesium	46.				☐
Manganese	<0.05				☐
Molybdenum	1.8				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB

Analysis Date: 5/3/88

Reviewer: Jim Ashby

Date Reviewed: 6/14/88

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	4/22/88	Lab No. ICP-141	User Code	☐ 59400 ☐ 59300	☐ 53400 ☐ 59500	☐ 53300 ☒ 59301

COLLECTION DATE & TIME: yy 88 mm 04 dd 19 hh 13 mm 32

COLLECTED BY: C. ARDITO

COLLECTION SITE DESCRIPTION: Mulcorp Old Tailings Pile MW1

TO:

OWNER:

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

JUN 1 1988
GROUND WATER/HAZARDOUS WASTE

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)

ATTN: CYNTHIA ARDITO
PHONE: 827-2703

STATION/ WELL CODE:

LATITUDE, LONGITUDE: 36° 41' 38" 105° 57' 30"

SAMPLING CONDITIONS:

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water Level: 51.4'	Discharge:	Sample Type: WATER

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
6.0	1190 µmho	12.0 °C	µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT
Check proper boxes:

☐ WPN: Water Preserved w/HNO_3 Non-Filtered

☒ WPF: Water Preserved w/HNO_3 Filtered

LAB ANALYSIS REQUESTED:

☒ ICAP Scan
Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	11.	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	0.4	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☒ <0.001	Vanadium	<0.1	
Calcium	260.		Zinc	<0.1	
Chromium	<0.1	☒ <0.005	Arsenic		☒ <0.005
Cobalt	<0.05		Selenium		☒ <0.005
Copper	<0.1		Mercury		☒ <0.0005
Iron	<0.1				☐
Lead	<0.1	☒ <0.01			☐
Magnesium	51.				☐
Manganese	<0.05				☐
Molybdenum	<0.1				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB

Analysis Date: 5/3/88

Reviewer: [signature]

Date Reviewed: 6/14/88

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud N.
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	5/12/88	Lab No.	ICP-113	User Code	☐ 59400 ☐ 59300	☐ 53400 ☐ 59500	☐ 53300 ☒ 59301

COLLECTION DATE & TIME: yy 88 | mm 04 | dd 19 | hh 10 | mm 15

COLLECTED BY: C. ARDITO

COLLECTION SITE DESCRIPTION: L-Loop, Old Evap. Pit, NWC

TO:

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

ATTN: CYNTHIA ARDITO
PHONE: 827-2703

OWNER:

SITE LOCATION:
County: Taos
Township, Range, Section, Tract: (10N06E24342)

STATION/ WELL CODE:

LATITUDE, LONGITUDE: 36° 42' 04" , 105° 37' 04"

SAMPLING CONDITIONS:

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water Level: 8.5'	Discharge:	Sample Type: AMBIENT

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
6.2	1050 µmho	11.5 °C	µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☒ WPF: Water Preserved w/HNO_3 Filtered	☒ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	9.7	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	1.4	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☒ <0.001	Vanadium	<0.1	
Calcium	230.		Zinc	<0.1	
Chromium	<0.1	☒ <0.005	Arsenic		☒ <0.005
Cobalt	<0.05		Selenium		☒ <0.005
Copper	<0.1		Mercury		☒ <0.0005
Iron	<0.1				☐
Lead	<0.1	☐ <0.01			☐
Magnesium	40.				☐
Manganese	1.2				☐
Molybdenum	2.0				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB
Analysis Date: 5/3/88

Reviewer: Jim Bobbs
Date Reviewed: 6/14/88

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY ETAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	3/3/88	Lab No.	ICP-102	User Code	☐ 59400 ☐ 59300	☐ 53400 ☐ 59500	☐ 53300 ☐ 59301

COLLECTION DATE & TIME: yy 88 mm 03 dd 28 hh 08 mm 30

COLLECTED BY: CINDY ARDITO / GABRIEL MAY

COLLECTION SITE DESCRIPTION: Indian Creek, Cerro Tierra

TO:

OWNER: Private

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)
28 N+12 E+01 +13

ATTN: CYNTHIA ARDITO
PHONE: 827-2703

STATION/ WELL CODE:

LATITUDE, LONGITUDE: 36° 41' 14", 105° 37' 18"

SAMPLING CONDITIONS:

☐ Bailed ☐ Pump ☐ Dipped ☒ Tap

Water Level:	Discharge:	Sample Type:
		WATER

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
6.9	1150 µmho	15.0 °C	µmho

FIELD COMMENTS: Kitchen Sink at Cerro Tierra

SAMPLE FIELD TREATMENT
Check proper boxes:

☐ WPN: Water Preserved w/HNO_3 Non-Filtered

☒ WPF: Water Preserved w/HNO_3 Filtered

LAB ANALYSIS REQUESTED:

☐ ICAP Scan
Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE		AA VALUE
Aluminum	<0.1		
Barium	<0.1		
Beryllium	<0.1		
Boron	<0.1		
Cadmium	<0.1	☐	
Calcium	250.		
Chromium	<0.1	☐	
Cobalt	<0.05		
Copper	<0.1		
Iron	<0.1		
Lead	<0.1	☐	
Magnesium	47.		
Manganese	<0.05		
Molybdenum	<0.1		
Nickel	<0.1		

ELEMENT	ICAP VALUE	AA VALUE
Silicon	14.	
Silver	<0.1	
Strontium	1.3	
Tin	<0.1	
Vanadium	<0.1	
Zinc	<0.1	
Arsenic		☑ <0.005
Selenium		☒ <0.005
Mercury		☐

LAB COMMENTS:

ICAP Analyst: JB
Analysis Date: 4/30/88

Reviewer: [signature]
Date Reviewed: 5/6/88

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	5/28/87	Lab No.	ICAP-303	User Code	☐ 59400 ☐ 59300	☐ 53400 ☐ 59500	☐ 53300 ☐

COLLECTION DATE & TIME: yy 87 | mm 05 | dd 26 | hh 10 | mm 30

COLLECTED BY: Childers / Ardito

COLLECTION SITE DESCRIPTION: Questa, New Mexico
south of tailings
pi

TO:

OWNER: Carlos Herrera

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

JUN 06 1987
GROUND WATER HAZARDOUS WASTE BUREAU

ATTN: Amy Childers
PHONE: 827-2901

SITE LOCATION:
County: Taos
Township, Range, Section, Tract: (10N06E24342)
2 8 N+1 2 E+0 1 +1 3 1

STATION/WELL CODE:

LATITUDE, LONGITUDE:

SAMPLING CONDITIONS:

☐ Bailed ☑ Pump ☐ Dipped ☐ Tap	Water Level:	Discharge:	Sample Type:

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
6.65	1180 µmho	13.5 °C	1568 µmho

FIELD COMMENTS: pumped for 4 hours

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☑ WPF: Water Preserved w/HNO_3 Filtered	☑ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	12.	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	1.3	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☑ <0.001	Vanadium	<0.1	
Calcium	240.		Zinc	<0.1	
Chromium	<0.1	☑ <0.005	Arsenic		☐
Cobalt	<0.05		Selenium		☐
Copper	<0.1		Mercury		☐
Iron	<0.1				☐
Lead	<0.1	☑ <0.01			☐
Magnesium	44.				☐
Manganese	<0.05				☐
Molybdenum	<0.1				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB+JK
Analysis Date: 6/1/87

Reviewer: [signature]
Date Reviewed: 6/30/87

REPORT TO: GROUND WATER SECTION
Environmental Improvement Division
Health & Environment Department
P.O. Box 968 - Crown Building
Santa Fe, NM 87504-0968
ATTENTION: Amy Childers

LAB NUMBER ICAP-57
DATE RECEIVED 2-6-87
DATE REPORTED 3/17/87 JJA
Initials

SLD USER CODE NUMBER 51.32

Sample Location MolyCorp Questa New Mexico

Station/Well Code P1 Herrera Well

Collected 870204 (Date) 11:30 (Time) By Childers/Dye (Name) Groundwater (Unit)

Pumping Conditions ~~pump~~ ran water at outside faucet for 5 minutes

Water Level _____

Discharge _____

Sample Type _____

pH (00400) 7.02

Conductivity (Uncorrected) 1100 umho

Water Temp (00010) 9 °C

1677 at 25°C

☑ ICAP SCAN METAL ANALYSES ☐ ATOMIC ABSORPTION(AA)

	F, A-HNO_3		Date Analyzed		F, A-HNO_3		Date Analyzed
☐	Arsenic, dissolved	____ mg/l		☑	Aluminum	____ mg/l	
☑	Barium, dissolved	____ mg/l		AA ☑	Chromium	____ mg/l	
AA ☑	Cadmium, dissolved	____ mg/l		☑	Iron	____ mg/l	
AA ☑	Lead, dissolved	____ mg/l		☑	Manganese	____ mg/l	
☑	Molybdenum, diss.	____ mg/l		☑	Nickel	____ mg/l	
☑	Selenium, diss.	____ mg/l		☑	Copper	____ mg/l	
☑	Uranium, diss.	____ mg/l		☑	Cobalt	____ mg/l	
☑	Zinc, dissolved	____ mg/l		☐		____ mg/l	

Remarks ICAP except where marked AA

This form accompanies 1 sample(s) marked as follows to indicated field treatment:

F, A-HNO_3: Filtered sample (0.45u membrane filter); acidified with 5 ml conc. HNO_3/l

RECEIVED
MAR 18 1987
GROUND WATER HAZARDOUS WASTE BUREAU

ICAP SCAN

SLD Lab No. ICP-57 Reviewed by: Jim Bailey

Analyst JK & JB Date Reported: 3/17/87

Date Analyzed 2/9/87

ELEMENT	ICAP VALUE(mg/l)	AA VALUE(mg/l)
Aluminum	<0.1	
Barium	<0.1	
Beryllium	<0.1	
Boron	<0.1	
Cadmium	<0.1	<0.001
Calcium	230.	
Chromium	<0.1	<0.005
Cobalt	<0.05	
Copper	<0.1	
Iron	0.2	
Lead	<0.1	<0.01
Magnesium	42.	
Manganese	<0.05	
Molybdenum	<0.1	
Nickel	<0.1	
Silicon	10.	
Silver	<0.1	
Strontium	1.1	
Tin	<0.1	
Vanadium	<0.1	
Zinc	0.2	
Arsenic		<0.005
Selenium		<0.005
Mercury		
Uranium		0.018

RECEIVED
MAR 20 1987
HAZARDOUS WASTE

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud
Albuquerque, NM 871

HEAV METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	3/3/88	Lab No.	ICP-99	User Code	☐ 59400 ☐ 53400 ☐ 53300 ☐ 59300 ☐ 59500 ☐

COLLECTION DATE & TIME: yy 88 | mm 03 | dd 28 | hh 15 | mm 00

COLLECTED BY: AZDITO GABRIEL

COLLECTION SITE DESCRIPTION: Holy Cr ? HW-1

TO:

OWNER:

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)

ATTN: CYNTHIA ARDITO
PHONE: 827-2703

STATION/ WELL CODE:

LATITUDE, LONGITUDE: 36° 41' 46" 105° 37' 18"

SAMPLING CONDITIONS:

☐ Bailed ☒ Pump ☐ Dipped ☐ Tap	Water Level: 53.4	Discharge:	Sample Type:

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
8.0	1190 µmho	13.5 °C	µmho

FIELD COMMENTS: TD of well 116.4 - purged for 15 minutes
Behind Herrera's house

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☒ WPF: Water Preserved w/HNO_3 Filtered	☑ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE		AA VALUE
Aluminum	<0.1		
Barium	<0.1		
Beryllium	<0.1		
Boron	<0.1		
Cadmium	<0.1	☐	
Calcium	250.		
Chromium	<0.1	☐	
Cobalt	<0.05		
Copper	<0.1		
Iron	<0.1		
Lead	<0.1	☐	
Magnesium	48.		
Manganese	<0.05		
Molybdenum	<0.1		
Nickel	<0.1		

ELEMENT	ICAP VALUE	AA VALUE
Silicon	12.	
Silver	<0.1	
Strontium	0.8	
Tin	<0.1	
Vanadium	<0.1	
Zinc	<0.1	
Arsenic		☒ <0.005
Selenium		☒ <0.005
Mercury		☐
		☐
		☐
		☐
		☐
		☐
		☐

MAY 1988 HAZARDOUS WASTE

LAB COMMENTS:

ICAP Analyst: JB
Analysis Date: 4/14/88

Reviewer: Jim Ashby
Date Reviewed: 5/3/88

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	5/28/87	Lab No.	ICP-298	User Code	☐ 59400 ☐ 53400 ☐ 53300 ☑ 59300 ☐ 59500 ☐

COLLECTION DATE & TIME: yy 87 | mm 05 | dd 26 | hh 14 | mm 12

COLLECTED BY: Amy Childers

COLLECTION SITE DESCRIPTION: Questa, New Mexico
South of Tailings
P8

TO:

OWNER: Jose Durane

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

JUL 06 1987
GROUND WATER HAZARDOUS WASTE

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)
2 | 8 | N+1 | 2 | E+0 | 1+2 | 1 | 3

ATTN: Amy Childers
PHONE: 827-2901

STATION/ WELL CODE:

LATITUDE, LONGITUDE: -

SAMPLING CONDITIONS:

☐ Bailed ☑ Dipped ☐ Pump ☐ Tap	Water Level:	Discharge:	Sample Type:

pH (00400)	Conductivity (Uncorr.)	Water Temp. (00010)	Conductivity at 25°C (00094)
7.25	200 µmho	16 °C	248 µmho

FIELD COMMENTS: Domestic hand dug well, 4 foot diameter

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☑ WPF: Water Preserved w/HNO_3 Filtered	☑ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	7.7	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	0.2	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☑ <0.001	Vanadium	<0.1	
Calcium	35.		Zinc	<0.1	
Chromium	<0.1	☑ <0.005	Arsenic		☐
Cobalt	<0.05		Selenium		☐
Copper	<0.1		Mercury		☐
Iron	<0.1				☐
Lead	<0.1	☑ <0.01			☐
Magnesium	4.8				☐
Manganese	<0.05				☐
Molybdenum	<0.1				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JK + JB

Reviewer: Jim Bobby

Analysis Date: 6/1/87

Date Reviewed: 6/30/87

New Mexico Health and Environment Department
SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud N'
Albuquerque, NM 87106

HEAV' METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	5/28/87	Lab No.	ICP-306	User Code	☐ 59400 ☐ 53400 ☐ 53300 ☑ 59300 ☐ 59500 ☐

COLLECTION DATE & TIME: yy 87 | mm 05 | dd 26 | hh 12 | mm 00

COLLECTED BY: Childers / Ardito

COLLECTION SITE DESCRIPTION: Questa, New Mexico south of tailings

TO:

OWNER: Same

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

JUN 08 1987
GROUND WATER HAZARDOUS WASTE BUREAU

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)
2 | 8 | N+1 | 2 | E+0 | 1 | +1 | 2 | 3

ATTN: Amy Childers
PHONE: 827-2901

STATION/ WELL CODE:

LATITUDE, LONGITUDE:

SAMPLING CONDITIONS:

☐ Bailed ☐ Pump ☐ Dipped ☐ Tap

Water Level:	Discharge:	Sample Type:

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
7.3	310 µmho	16 °C	384 µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT
Check proper boxes:

☐ WPN: Water Preserved w/HNO_3 Non-Filtered

☑ WPF: Water Preserved w/HNO_3 Filtered

LAB ANALYSIS REQUESTED:

☑ ICAP Scan
Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	9.0	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	0.4	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☑ <0.001	Vanadium	<0.1	
Calcium	53.		Zinc	0.2	
Chromium	<0.1	☑ <0.005	Arsenic		☐
Cobalt	<0.05		Selenium		☐
Copper	<0.1		Mercury		☐
Iron	<0.1				☐
Lead	<0.1	☑ <0.01			☐
Magnesium	10.				☐
Manganese	<0.05				☐
Molybdenum	<0.1				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB & JK

Reviewer: Jim Kelly

Analysis Date: 6/1/87

Date Reviewed: 6/30/87

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	5/28/87	Lab No. ICP-302	User Code	☐ 59400 ☐ 53400 ☐ 53300 ☑ 59300 ☐ 59500 ☐

COLLECTION DATE & TIME: yy 87 mm 05 dd 26 hh 11 mm 00

COLLECTED BY: Childers / Ardito

COLLECTION SITE DESCRIPTION: Questa, New Mexico south of tailings

P5

OWNER: Teresa Durand

TO:

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

RECEIVED 06 1987 GROUND WATER/HAZARDOUS WASTE BUREAU

SITE LOCATION:
County: Taos

Township, Range, Section, Tract: (10N06E24342)
28N+12E+01+131

ATTN: Amy Childers
PHONE: 827-2901

STATION/ WELL CODE:

LATITUDE, LONGITUDE: -

SAMPLING CONDITIONS:

☐ Bailed ☑ Pump ☐ Dipped ☐ Tap	Water Level:	Discharge:	Sample Type:

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
7.1	910 µmho	13.5 °C	1209 µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT
Check proper boxes:

☐ WPN: Water Preserved w/HNO_3 Non-Filtered

☑ WPF: Water Preserved w/HNO_3 Filtered

LAB ANALYSIS REQUESTED:

☑ ICAP Scan
Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	13.	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	0.9	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☑ <0.001	Vanadium	<0.1	
Calcium	190.		Zinc	<0.1	
Chromium	<0.1	☑ <0.005	Arsenic		☐
Cobalt	<0.05		Selenium		☐
Copper	<0.1		Mercury		☐
Iron	<0.1				☐
Lead	<0.1	☑ <0.01			☐
Magnesium	34.				☐
Manganese	<0.05				☐
Molybdenum	0.1				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB & JK

Analysis Date: 6/1/87

Reviewer: Jim Ashby

Date Reviewed: 6/30/87

SCIENTIFIC LABORATORY DIVISION
700 Camino de Salud NE
Albuquerque, NM 87106

HEAVY METAL ANALYSIS FORM

Telephone: (505)841-2500

Date Received	5/28/87	Lab No. ICP-301	User Code	☐ 59400 ☑ 59300	☐ 53400 ☐ 59500	☐ 53300 ☐

COLLECTION DATE & TIME: yy 87 mm 05 dd 26 hh 11 mm 45

COLLECTED BY: Childers / Ardito

COLLECTION SITE DESCRIPTION: Questa, New Mexico south of tailings

P46

OWNER: [illegible] Rael

TO:

GROUND WATER & HAZARDOUS WASTE BUREAU
NEW MEXICO EID/HED
PO BOX 968 - RUNNELS BUILDING
SANTA FE, NM 87504-0968

JUL 06 1987
GROUND WATER/HAZARDOUS WASTE

SITE LOCATION:
County: Taos
Township, Range, Section, Tract: (10N06E24342)
28N+12E+01+121

ATTN: Amy Childers
PHONE: 827-2901

STATION/ WELL CODE:

LATITUDE, LONGITUDE: -

SAMPLING CONDITIONS:

☐ Bailed ☐ Dipped	☑ Pump ☐ Tap	Water Level:	Discharge:	Sample Type:

pH(00400)	Conductivity(Uncorr.)	Water Temp.(00010)	Conductivity at 25°C (00094)
7.4	305 µmho	18 °C	359 µmho

FIELD COMMENTS:

SAMPLE FIELD TREATMENT Check proper boxes:		LAB ANALYSIS REQUESTED:
☐ WPN: Water Preserved w/HNO_3 Non-Filtered	☑ WPF: Water Preserved w/HNO_3 Filtered	☑ ICAP Scan Mark box next to metal if AA is required.

ANALYTICAL RESULTS (MG/L)

ELEMENT	ICAP VALUE	AA VALUE	ELEMENT	ICAP VALUE	AA VALUE
Aluminum	<0.1		Silicon	9.1	
Barium	<0.1		Silver	<0.1	
Beryllium	<0.1		Strontium	0.4	
Boron	<0.1		Tin	<0.1	
Cadmium	<0.1	☑ <0.001	Vanadium	<0.1	
Calcium	48.		Zinc	0.1	
Chromium	<0.1	☑ <0.005	Arsenic		☐
Cobalt	<0.05		Selenium		☐
Copper	<0.1		Mercury		☐
Iron	<0.1				☐
Lead	<0.1	☑ <0.01			☐
Magnesium	8.6				☐
Manganese	<0.05				☐
Molybdenum	<0.1				☐
Nickel	<0.1				☐

LAB COMMENTS:

ICAP Analyst: JB & JK

Analysis Date: 6/1/87

Reviewer: [signature]

Date Reviewed: 6/30/87

REPORT TO: GROUND WATER SECTION
Environmental Improvement Division
Health & Environment Department
P.O. Box 968 - Crown Building
Santa Fe, NM 87504-0968
ATTENTION: Amy Childers

LAB NUMBER ICAP-55
DATE RECEIVED 2-6-87
DATE REPORTED 3/17/87 97A
Initials
SLD USER CODE NUMBER 51.32

Sample Location Molycorp Questa New Mexico
Rael's Old well

Station/Well Code P41a

Collected 870204 (Date) 1030 (Time) By Childers/Dye (Name) Groundwater (Unit)

Pumping Conditions bailed

Water Level 9.35'

Discharge

Sample Type

pH (00400) 7.0

Conductivity (Uncorrected) 550 umho

Water Temp (00010) 5 °C

965 at 25°C

☑ ICAP SCAN METAL ANALYSES ☐ ATOMIC ABSORPTION(AA)

	F, A-HNO_3		Date Analyzed		F, A-HNO_3		Date Analyzed
☐	Arsenic, dissolved	mg/l		☑	Aluminum	mg/l	
☑	Barium, dissolved	mg/l		AA ☐	Chromium	mg/l	
AA ☑	Cadmium, dissolved	mg/l		☐	Iron	mg/l	
AA ☐	Lead, dissolved	mg/l		☑	Manganese	mg/l	
☑	Molybdenum, diss.	mg/l		☑	Nickel	mg/l	
☑	Selenium, diss.	mg/l		☑	Copper	mg/l	
☑	Uranium, diss.	mg/l		☑	Cobalt	mg/l	
☑	Zinc, dissolved	mg/l		☐		mg/l	

Remarks ICAP except where marked AA

This form accompanies 1 sample(s) marked as follows to indicated field treatment:

F, A-HNO_3: Filtered sample (0.45u membrane filter); acidified with 5 ml conc. HNO_3/l

RECEIVED
MAR 18 1987
GROUND WATER/HAZARDOUS WASTE BUREAU

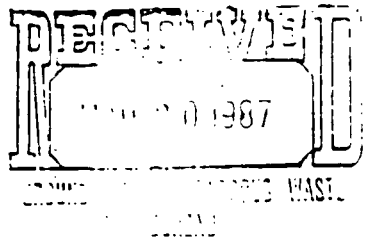
ICAP SCAN

SLD Lab No. ICP-55 Reviewed by: Jim Kelly

Analyst JK Date Reported: 3/17/87

Date Analyzed 2/9/87 P4a

ELEMENT	ICAP VALUE(mg/l)	AA VALUE(mg/l)
Aluminum	<0.1	
Barium	<0.1	
Beryllium	<0.1	
Boron	<0.1	
Cadmium	<0.1	<0.001
Calcium	110.	
Chromium	<0.1	<0.005
Cobalt	<0.05	
Copper	<0.1	
Iron	<0.1	
Lead	<0.1	<0.01
Magnesium	18.	
Manganese	<0.05	
Molybdenum	<0.1	
Nickel	<0.1	
Silicon	7.1	
Silver	<0.1	
Strontium	0.7	
Tin	<0.1	
Vanadium	<0.1	
Zinc	<0.1	
Arsenic		<0.005
Selenium		<0.005
Mercury		
URANIUM		0.012



REPORT TO: GROUND WATER SECTION
Environmental Improvement Division
Health & Environment Department
P.O. Box 968 - Crown Building
Santa Fe, NM 87504-0968
ATTENTION: Amy Childers

LAB NUMBER IEAP-59
DATE RECEIVED 2-6-87
DATE REPORTED 3/17/87 DGA (Initials)
SLD USER CODE NUMBER 51.32

Sample Location Molycorp Questa New Mexico
Rael's new well

Station/Well Code P46

Collected 870204 (Date) 1000 (Time) By Childers/Dye (Name) Grnmdwater (Unit)

Pumping Conditions ran tap for three minutes

Water Level 48.99

Discharge

Sample Type

pH (00400) 6.98

Conductivity (Uncorrected) 310 umho

Water Temp (00010) 5 °C

544 at 25°C

☑ ICAP SCAN METAL ANALYSES ☐ ATOMIC ABSORPTION(AA)

	F, A-HNO_3		Date Analyzed		F, A-HNO_3		Date Analyzed
	☐ Arsenic, dissolved	mg/l		☑	Aluminum	mg/l	
	☑ Barium, dissolved	mg/l		AA ☑	Chromium	mg/l	
AA	☑ Cadmium, dissolved	mg/l		☑	Iron	mg/l	
AA	☑ Lead, dissolved	mg/l		☑	Manganese	mg/l	
	☑ Molybdenum, diss.	mg/l		☑	Nickel	mg/l	
	☑ Selenium, diss.	mg/l		☑	Copper	mg/l	
	☑ Uranium, diss.	mg/l		☑	Cobalt	mg/l	
	☑ Zinc, dissolved	mg/l		☐		mg/l	

Remarks ICAP except where marked AA

This form accompanies 1 sample(s) marked as follows to indicated field treatment:

F, A-HNO_3: Filtered sample (0.45u membrane filter); acidified with 5 ml conc. HNO_3/l

RECEIVED
MAR 18 1987
GROUND WATER/HAZARDOUS WASTE BUREAU

ICAP SCAN

SLD Lab No. ICP-58 Reviewed by: Jim Ashby

Analyst JK + JB Date Reported: 3/17/87

Date Analyzed 2/9/87 P46

ELEMENT	ICAP VALUE(mg/l)	AA VALUE(mg/l)
Aluminum	<0.1	
Barium	<0.1	
Beryllium	<0.1	
Boron	<0.1	
Cadmium	<0.1	<0.001
Calcium	46.	
Chromium	<0.1	<0.005
Cobalt	<0.05	
Copper	<0.1	
Iron	<0.1	
Lead	<0.1	<0.01
Magnesium	8.4	
Manganese	<0.05	
Molybdenum	<0.1	
Nickel	<0.1	
Silicon	80	
Silver	<0.1	
Strontium	0.3	
Tin	<0.1	
Vanadium	<0.1	
Zinc	0.2	
Arsenic		<0.005
Selenium		<0.005
Mercury		
URANIUM		0.006

RECEIVED
MAR 20 1987
HAZARDOUS WASTE

REPORT TO: GROUND WATER SECTION
Environmental Improvement Division
Health & Environment Department
P.O. Box 968 - Crown Building
Santa Fe, NM 87504-0968
ATTENTION: Amy Childers

LAB NUMBER IC47-58
DATE RECEIVED 2.6.87
DATE REPORTED 3/17/87 QFA
Initials
SLD USER CODE NUMBER 51.32

Sample Location Molycorp Questa New Mexico

Station/Well Code Samuel Durane's Well P7

Collected 870204 1415 By Childers/Dye Groundwater
Date Time Name Unit

Pumping Conditions tap

Water Level _____ pH (00400) 7.00

Discharge _____ Conductivity (Uncorrected) 230 umho

Sample Type _____ Water Temp (00010) 7 °C

375 umhos at 25°C

☑ ICAP SCAN METAL ANALYSES ☐ ATOMIC ABSORPTION(AA)

	F, A-HNO_3		Date Analyzed		F, A-HNO_3		Date Analyzed
☑	Arsenic, dissolved	mg/l		☑	Aluminum	mg/l	
☑	Barium, dissolved	mg/l		AA ☑	Chromium	mg/l	
AA ☑	Cadmium, dissolved	mg/l		☑	Iron	mg/l	
AA ☑	Lead, dissolved	mg/l		☑	Manganese	mg/l	
☑	Molybdenum, diss.	mg/l		☑	Nickel	mg/l	
☑	Selenium, diss.	mg/l		☑	Copper	mg/l	
☑	Uranium, diss.	mg/l		☑	Cobalt	mg/l	
☑	Zinc, dissolved	mg/l		☐		mg/l	

Remarks ICAP except where marked AA

This form accompanies 1 sample(s) marked as follows to indicated field treatment:

F, A-HNO_3: Filtered sample (0.45u membrane filter); acidified with 5 ml conc. HNO_3/l

RECEIVED
MAR 18 1987
GROUND WATER HAZARDOUS WASTE

Attachment B

Corresponds with Field ID # (Ref 24)

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 10:48:57
ID: <FE>

	Value	Std. dev.	
CrHI	-96.1794	91.6576	ppm
K	-541.501	133.864	ppm
Ca	-11.6920	71.3030	ppm
Ti	-14.3299	62.0849	ppm
CrLO	-587.529	91.6312	ppm
Mn	1028.19	1906.87	ppm
Fe	1.58410e+06	12963.5	ppm
Co	-7968.34	3548.55	ppm
Ni	2004.07	1834.26	ppm
Cu	-431.183	289.186	ppm
Zn	17.6185	246.161	ppm
As	110.943	275.438	ppm
Se	-45.7995	95.0490	ppm
Sr	-8.32094	35.0492	ppm
Zr	-21.3852	19.9627	ppm
Mo	-35.2383	24.9323	ppm
Hg	486.524	329.960	ppm
Pb	425.192	218.183	ppm
Rb	-186.570	67.2535	ppm
Cd	1827.90	374.342	ppm
Sn	-140.197	176.400	ppm
Sb	-14.4236	126.924	ppm
Ba	71.5412	30.9274	ppm
Ag	-350.127	189.385	ppm
U	-4.05087	5.22127	ppm
Th	7.01167	5.58594	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 10:58:30
ID: <TEF>

	Value	Std. dev.	
CrHI	170.083	178.769	ppm
K	-180.303	67.8999	ppm
Ca	-42.5570	31.6740	ppm
Ti	5.31517	25.3807	ppm
CrLO	-81.8415	45.4744	ppm
Mn	-136.564	132.073	ppm
Fe	100.622	77.0082	ppm
Co	33.2115	69.0697	ppm
Ni	49.4281	45.5349	ppm
Cu	-16.2467	27.7991	ppm
Zn	81.0579	29.2731	ppm
As	-29.0675	17.0430	ppm
Se	26.4686	11.1346	ppm
Sr	5.65901	2.55624	ppm
Zr	0.955914	1.46147	ppm
Mo	1.18177	2.28529	ppm
Hg	-12.0611	21.2429	ppm
Pb	2.51855	8.93381	ppm
Rb	-2.06618	5.08310	ppm
Cd	26.9015	27.8652	ppm
Sn	-34.0288	14.7947	ppm
Sb	-1.73438	9.98196	ppm
Ba	5.99036	2.57855	ppm
Ag	-59.2708	16.5061	ppm
U	-2.61892	5.44314	ppm
Th	-3.95722	4.18638	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 11:13:10
ID: <TEST>
( ) ( )

	Value	Std. dev.	
CrHI	-353.917	182.889	ppm
K	18132.7	625.753	ppm
Ca	12874.3	378.807	ppm
Ti	569.906	123.504	ppm
CrLO	235.136	98.2913	ppm
Mn	-495.858	57.3447	ppm
Fe	-345.899	34.7643	ppm
Co	-78.9908	20.4936	ppm
Ni	-197.559	13.3556	ppm
Cu	-58.6368	7.75127	ppm
Zn	26.7888	0.386147	ppm
As	25.7748	4.46637	ppm
Se	-26.9203	3.14469	ppm
Sr	-6.44687	0.0864763	ppm
Zr	-4.65909	0.0608456	ppm
Mo	-7.01680	0.125239	ppm
Hg	-46.2532	6.99427	ppm
Pb	-16.3569	3.85006	ppm
Rb	-13.7052	0.516106	ppm
Cd	-115.714	50.8852	ppm
Sn	9.14078	28.5787	ppm
Sb	2.26735	18.4337	ppm
Ba	414.362	17.7207	ppm
Ag	-145.104	27.5387	ppm
U	-3.40144	0.682095	ppm
Th	-9.88500	0.408102	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 11:16:47
ID: <>
( ) ( )

	Value	Std. dev.	
CrHI	-802.240	0.788371	ppm
K	-190.544	40.1179	ppm
Ca	125.652	22.2497	ppm
Ti	-88.6958	13.3129	ppm
CrLO	183.499	9.63812	ppm
Mn	-383.950	46.7514	ppm
Fe	-339.466	22.3559	ppm
Co	-65.7791	19.6883	ppm
Ni	-178.924	12.0736	ppm
Cu	-59.9460	0.510628	ppm
Zn	43.7057	9.36003	ppm
As	24.7963	0.481168	ppm
Se	-28.2530	0.0177655	ppm
Sr	-5.68829	0.0147556	ppm
Zr	-4.27015	0.0873057	ppm
Mo	-6.05081	0.415082	ppm
Hg	-50.5117	0.113396	ppm
Pb	-19.1629	0.542636	ppm
Rb	-12.1942	0.484781	ppm
Cd	1.66043	2.47020	ppm
Sn	-17.1710	1.83814	ppm
Sb	-1.17501	1.20732	ppm
Ba	-0.412858	0.00186302	ppm
Ag	10.1491	0.0710489	ppm
U	-3.02734	1.16417	ppm
Th	-9.24841	0.748464	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 11:19:26
ID: <>
( ) ( )

	Value	Std. dev.	
CrHI	-633.168	100.868	ppm
K	-168.064	44.8312	ppm
Ca	94.7920	14.9494	ppm
Ti	-107.695	13.7718	ppm
CrLO	187.316	13.3755	ppm
Mn	-285.044	89.5572	ppm
Fe	-369.549	6.45377	ppm
Co	-29.1228	31.6405	ppm
Ni	-181.500	12.2043	ppm
Cu	-59.9883	0.511502	ppm
Zn	29.6212	4.68796	ppm
As	26.1781	3.45440	ppm
Se	-24.3129	2.84791	ppm
Sr	-5.72344	0.0213422	ppm
Zr	-4.34427	0.107556	ppm
Mo	-6.50509	0.245559	ppm
Hg	-50.8929	0.153611	ppm
Pb	-17.8704	2.56542	ppm
Rb	-11.9643	1.27518	ppm
Cd	1.36105	2.47422	ppm
Sn	-18.8801	1.33746	ppm
Sb	-1.17059	1.20796	ppm
Ba	-0.419799	0.00312322	ppm
Ag	11.6997	1.66026	ppm
U	-2.30360	1.37456	ppm
Th	-8.87331	0.866618	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 11:42:00
ID: <FE2>
(   ) (   )

	Value	Std. dev.	
CrHI	-4.77923	49.1010	ppm
K	-634.083	65.0920	ppm
Ca	-178.774	32.3320	ppm
Ti	-52.5043	30.5144	ppm
CrLO	-796.142	43.0991	ppm
Mn	-169.437	929.900	ppm
Fe	1.57308e+06	6442.53	ppm
Co	-2505.06	1784.25	ppm
Ni	-54.7215	901.720	ppm
Cu	-233.001	157.143	ppm
Zn	-164.304	105.146	ppm
As	159.850	131.003	ppm
Se	-46.4395	45.2732	ppm
Sr	12.8107	18.7559	ppm
Zr	0.0353788	9.54808	ppm
Mo	0.000886668	14.5327	ppm
Hg	22.7883	133.168	ppm
Pb	312.422	101.820	ppm
Rb	-197.204	36.0949	ppm
Cd	1405.88	181.802	ppm
Sn	316.878	95.4090	ppm
Sb	214.297	65.8866	ppm
Ba	56.6826	14.8327	ppm
Ag	-26.6742	99.7737	ppm
U	0.128158	2.73107	ppm
Th	-3.25181	2.33974	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 11:55:47
ID: <TEF2>
( ) ( )

	Value	Std. dev.	
CrHI	-177.234	160.837	ppm
K	-246.174	66.5629	ppm
Ca	-38.9383	31.6980	ppm
Ti	-7.05147	24.8882	ppm
CrLO	-36.4936	46.1921	ppm
Mn	191.758	145.913	ppm
Fe	9.45585	74.0940	ppm
Co	112.623	71.8261	ppm
Ni	-31.4344	42.4699	ppm
Cu	10.2695	28.6921	ppm
Zn	51.1533	28.5628	ppm
As	24.6763	17.7194	ppm
Se	8.58689	10.6425	ppm
Sr	-0.566249	2.25285	ppm
Zr	-2.60991	1.34522	ppm
Mo	4.76508	2.32918	ppm
Hg	-28.8850	20.7209	ppm
Pb	-10.8846	8.20216	ppm
Rb	-4.93942	5.05565	ppm
Cd	9.25222	27.5301	ppm
Sn	-8.59978	14.8897	ppm
Sb	-6.81155	9.82155	ppm
Ba	8.79386	2.61157	ppm
Ag	-17.5314	16.6621	ppm
U	-4.01273	5.35712	ppm
Th	-0.546068	4.15905	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 12:08:16
ID: <TEST2>
( ) ( )

	Value	Std. dev.	
CrHI	-529.156	279.865	ppm
K	32553.4	831.107	ppm
Ca	34636.2	618.288	ppm
Ti	2502.48	203.957	ppm
CrLO	56.2149	128.742	ppm
Mn	122.405	302.610	ppm
Fe	15256.2	662.454	ppm
Co	-238.862	216.644	ppm
Ni	-63.7816	82.2517	ppm
Cu	84.0299	53.9062	ppm
Zn	92.2894	43.0397	ppm
As	-16.0649	25.0650	ppm
Se	-13.4300	15.6980	ppm
Sr	300.723	18.3755	ppm
Zr	175.889	9.63936	ppm
Mo	245.659	12.3261	ppm
Hg	-35.4490	31.8710	ppm
Pb	-1.61831	17.7046	ppm
Rb	177.909	22.7738	ppm
Cd	36.8936	77.1611	ppm
Sn	25.9718	42.2541	ppm
Sb	-52.6464	26.0355	ppm
Ba	791.673	27.1302	ppm
Ag	-18.3051	45.9366	ppm
U	14.6094	16.2614	ppm
Th	18.4617	7.93952	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 12:22:47
ID: <S12-1>
( ) ( )

	Value	Std. dev.	
CrHI	116.808	331.253	ppm
K	30638.1	801.689	ppm
Ca	13010.1	403.359	ppm
Ti	1360.16	161.998	ppm
CrLO	109.539	112.319	ppm
Mn	-150.932	256.076	ppm
Fe	10679.9	541.574	ppm
Co	-16.0066	189.648	ppm
Ni	-38.3929	78.7309	ppm
Cu	39.0511	45.5251	ppm
Zn	39.7533	34.7641	ppm
As	28.9503	25.9306	ppm
Se	-17.4924	13.4639	ppm
Sr	219.412	15.0630	ppm
Zr	114.226	7.54014	ppm
Mo	270.714	12.1990	ppm
Hg	-37.3389	27.5564	ppm
Pb	9.29807	16.2924	ppm
Rb	168.084	20.8420	ppm
Cd	42.1451	67.3479	ppm
Sn	-33.0421	35.5255	ppm
Sb	-10.5085	23.8074	ppm
Ba	617.051	23.0722	ppm
Ag	-53.5541	38.9643	ppm
U	18.1922	17.1169	ppm
Th	5.54740	7.26309	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 12:28:01
ID: <S12-2>
( ) ( )

	Value	Std. dev.	
CrHI	-118.937	309.653	ppm
K	30302.2	798.408	ppm
Ca	15607.1	433.804	ppm
Ti	1652.82	168.571	ppm
CrLO	135.457	114.390	ppm
Mn	897.343	352.918	ppm
Fe	11736.0	570.328	ppm
Co	273.774	214.168	ppm
Ni	-57.2506	80.2908	ppm
Cu	137.226	55.0932	ppm
Zn	62.1760	37.8026	ppm
As	12.1854	24.0208	ppm
Se	-15.0546	14.1384	ppm
Sr	289.143	17.3829	ppm
Zr	131.859	8.29426	ppm
Mo	243.088	11.7153	ppm
Hg	-28.4586	29.6495	ppm
Pb	-6.14389	15.4727	ppm
Rb	185.908	22.1415	ppm
Cd	-62.0291	66.8790	ppm
Sn	7.80509	37.2484	ppm
Sb	27.1149	24.7649	ppm
Ba	608.284	23.0532	ppm
Ag	-22.1033	40.4750	ppm
U	19.3867	16.8356	ppm
Th	9.14582	7.58700	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 12:32:11
ID: <S12-3>
( ) ( )

	Value	Std. dev.	
CrHI	242.122	347.233	ppm
K	34769.7	853.629	ppm
Ca	20166.8	491.312	ppm
Ti	1852.96	182.762	ppm
CrLO	1.80013	118.886	ppm
Mn	-471.331	232.028	ppm
Fe	11625.6	573.052	ppm
Co	-369.086	180.648	ppm
Ni	-51.1432	76.2570	ppm
Cu	83.4329	51.9018	ppm
Zn	34.5493	37.3731	ppm
As	18.0646	25.0336	ppm
Se	-0.608207	16.0256	ppm
Sr	346.812	19.0924	ppm
Zr	104.650	7.91184	ppm
Mo	156.432	10.1446	ppm
Hg	-36.2870	30.1263	ppm
Pb	-15.0033	15.7994	ppm
Rb	173.697	21.4720	ppm
Cd	166.295	77.0916	ppm
Sn	-21.4408	40.2539	ppm
Sb	1.60659	27.5970	ppm
Ba	747.037	25.9024	ppm
Ag	-31.4661	44.5553	ppm
U	33.0951	16.2047	ppm
Th	13.1872	7.83645	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 14:30:13
ID: <S13-1>
( ) ( )

	Value	Std. dev.	
CrHI	-206.663	285.293	ppm
K	25009.3	726.717	ppm
Ca	11032.9	367.177	ppm
Ti	1472.15	155.092	ppm
CrLO	181.340	104.245	ppm
Mn	324.398	285.386	ppm
Fe	10175.7	522.623	ppm
Co	212.291	194.030	ppm
Ni	-91.2722	71.2267	ppm
Cu	51.0097	43.6437	ppm
Zn	114.151	37.0508	ppm
As	-20.2951	24.6555	ppm
Se	-30.4757	10.8110	ppm
Sr	172.910	13.2395	ppm
Zr	99.2143	6.93790	ppm
Mo	264.808	11.6076	ppm
Hg	-101.569	16.5363	ppm
Pb	48.0824	18.8093	ppm
Rb	140.453	19.3784	ppm
Cd	-239.903	52.3960	ppm
Sn	47.2236	31.8364	ppm
Sb	34.1623	20.0809	ppm
Ba	391.443	18.1493	ppm
Ag	-117.351	30.6228	ppm
U	6.69456	15.8988	ppm
Th	12.1150	7.14803	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 14:34:25
ID: <S13-2>
( ) ( )

	Value	Std. dev.	
CrHI	122.914	360.063	ppm
K	34510.4	848.751	ppm
Ca	14075.5	423.241	ppm
Ti	2437.96	182.356	ppm
CrLO	255.281	118.630	ppm
Mn	539.890	341.922	ppm
Fe	14106.2	627.480	ppm
Co	464.558	239.536	ppm
Ni	-168.771	80.2374	ppm
Cu	18.5893	45.9097	ppm
Zn	76.6119	39.9570	ppm
As	-14.2668	27.0133	ppm
Se	-16.9989	14.5572	ppm
Sr	239.928	16.1693	ppm
Zr	150.918	8.73749	ppm
Mo	527.911	16.6777	ppm
Hg	-15.5213	32.6354	ppm
Pb	32.9149	18.9892	ppm
Rb	211.835	25.5049	ppm
Cd	-15.3209	70.9258	ppm
Sn	42.3528	39.5484	ppm
Sb	-29.5685	24.5009	ppm
Ba	570.594	22.7526	ppm
Ag	-53.7304	41.7306	ppm
U	15.8264	19.8960	ppm
Th	5.97398	7.63158	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 14:38:41
ID: <S13-3>
( ) ( )

	Value	Std. dev.	
CrHI	-295.109	244.330	ppm
K	16237.3	590.617	ppm
Ca	7304.51	295.410	ppm
Ti	737.365	128.811	ppm
CrLO	288.023	99.7300	ppm
Mn	-59.0853	215.513	ppm
Fe	5863.63	392.878	ppm
Co	-132.027	132.194	ppm
Ni	-93.1642	57.6983	ppm
Cu	64.2391	40.5874	ppm
Zn	40.8111	26.9212	ppm
As	53.6865	20.0457	ppm
Se	-27.0582	9.40423	ppm
Sr	116.101	10.5176	ppm
Zr	71.7116	5.68271	ppm
Mo	151.976	8.49582	ppm
Hg	-44.4502	20.3028	ppm
Pb	-13.2204	10.9976	ppm
Rb	86.8704	14.5518	ppm
Cd	-214.405	45.7975	ppm
Sn	42.7651	27.8966	ppm
Sb	30.1069	17.6711	ppm
Ba	271.089	14.7038	ppm
Ag	-146.076	25.1785	ppm
U	-9.57826	12.5423	ppm
Th	10.6761	6.18955	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 15:04:45
ID: <S14-1>
(   ) (   )

	Value	Std. dev.	
CrHI	-372.838	285.684	ppm
K	36249.7	870.070	ppm
Ca	14676.0	433.964	ppm
Ti	1428.67	156.095	ppm
CrLO	14.0128	114.051	ppm
Mn	536.030	323.135	ppm
Fe	11269.3	562.592	ppm
Co	323.698	215.905	ppm
Ni	-147.405	73.0913	ppm
Cu	62.9931	49.6316	ppm
Zn	92.0783	41.4720	ppm
As	49.4112	29.8365	ppm
Se	-44.1845	12.0407	ppm
Sr	119.366	11.6317	ppm
Zr	120.530	7.67266	ppm
Mo	241.189	11.7174	ppm
Hg	20.6372	35.0384	ppm
Pb	20.2894	18.1764	ppm
Rb	138.623	21.1768	ppm
Cd	-98.4282	71.1381	ppm
Sn	37.1883	40.1502	ppm
Sb	29.5896	26.2978	ppm
Ba	381.664	18.7200	ppm
Ag	-59.9717	42.6127	ppm
U	42.5667	16.7705	ppm
Th	27.0945	8.20443	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 15:10:17
ID: <S14-2>
( ) ( )

	Value	Std. dev.	
CrHI	-104.960	301.702	ppm
K	36997.6	876.637	ppm
Ca	11411.0	394.417	ppm
Ti	835.787	123.509	ppm
CrLO	130.240	104.039	ppm
Mn	960.967	353.969	ppm
Fe	8020.57	479.620	ppm
Co	-220.408	163.100	ppm
Ni	63.5900	84.3956	ppm
Cu	15.0650	46.0801	ppm
Zn	40.7879	38.7426	ppm
As	-38.7989	25.6807	ppm
Se	0.367400	16.2487	ppm
Sr	150.899	12.7291	ppm
Zr	104.648	7.27240	ppm
Mo	66.3959	7.79532	ppm
Hg	25.8253	35.4345	ppm
Pb	20.2096	19.1797	ppm
Rb	172.535	20.7128	ppm
Cd	271.973	80.4290	ppm
Sn	228.269	45.5037	ppm
Sb	13.2247	29.1263	ppm
Ba	419.129	19.6071	ppm
Ag	-150.370	43.3843	ppm
U	43.4925	15.6005	ppm
Th	29.4623	8.50954	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 15:15:11
ID: <S14-3>
( ) ( )

	Value	Std. dev.	
CrHI	120.556	341.165	ppm
K	41640.8	929.468	ppm
Ca	16612.7	465.273	ppm
Ti	1677.39	161.470	ppm
CrLO	104.194	119.242	ppm
Mn	1152.44	386.878	ppm
Fe	11641.5	580.505	ppm
Co	358.947	225.151	ppm
Ni	-148.904	74.4133	ppm
Cu	58.3667	51.5126	ppm
Zn	141.577	47.1679	ppm
As	55.0743	27.6688	ppm
Se	27.8830	18.9249	ppm
Sr	196.970	14.7923	ppm
Zr	123.286	8.05050	ppm
Mo	146.123	9.99489	ppm
Hg	-36.1147	32.0805	ppm
Pb	-32.1494	15.9153	ppm
Rb	207.393	23.0465	ppm
Cd	50.2805	79.6882	ppm
Sn	128.034	45.5557	ppm
Sb	9.00812	28.7359	ppm
Ba	451.714	20.6546	ppm
Ag	9.62899	48.2402	ppm
U	23.8316	16.0364	ppm
Th	19.4084	7.84479	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 15:43:37
ID: <S10-1>
( ) ( )

	Value	Std. dev.	
CrHI	-336.249	279.378	ppm
K	32242.4	824.038	ppm
Ca	20192.0	487.246	ppm
Ti	1650.31	175.407	ppm
CrLO	-113.692	112.012	ppm
Mn	368.780	310.506	ppm
Fe	12797.8	598.024	ppm
Co	-193.518	198.051	ppm
Ni	-218.582	56.8406	ppm
Cu	124.703	54.3849	ppm
Zn	86.6439	40.8434	ppm
As	-9.50271	26.9936	ppm
Se	-23.4965	13.8865	ppm
Sr	366.741	19.6637	ppm
Zr	140.264	8.76662	ppm
Mo	105.307	8.91923	ppm
Hg	6.65025	33.6764	ppm
Pb	26.4799	19.0501	ppm
Rb	153.549	20.3620	ppm
Cd	-36.4451	70.1740	ppm
Sn	-0.767198	38.7783	ppm
Sb	15.0365	25.5484	ppm
Ba	638.867	23.8403	ppm
Ag	17.9018	43.2540	ppm
U	32.4872	15.1381	ppm
Th	11.7643	7.93297	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 17:12:29
ID: <S8-1>
( ) ( )

	Value	Std. dev.	
CrHI	-341.345	266.695	ppm
K	31363.1	810.960	ppm
Ca	13782.0	414.151	ppm
Ti	1487.80	165.814	ppm
CrLO	108.228	113.931	ppm
Mn	151.791	279.274	ppm
Fe	12292.3	580.729	ppm
Co	199.356	212.335	ppm
Ni	-193.964	60.2420	ppm
Cu	3.10588	41.7936	ppm
Zn	112.764	40.9616	ppm
As	48.5892	25.8814	ppm
Se	-27.2391	12.8166	ppm
Sr	215.155	15.0594	ppm
Zr	111.280	7.56846	ppm
Mo	77.2789	7.86421	ppm
Hg	-12.7792	30.6618	ppm
Pb	-14.0070	15.5821	ppm
Rb	204.506	21.5524	ppm
Cd	2.23142	66.1215	ppm
Sn	-4.83670	35.8001	ppm
Sb	-26.4585	22.8693	ppm
Ba	580.473	22.4374	ppm
Ag	-55.2375	38.5162	ppm
U	16.8533	14.8841	ppm
Th	17.0860	7.57372	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 15:51:19
ID: <S10-2>
( ) ( )

	Value	Std. dev.
CrHI	-16.7546	321.250 ppm
K	34070.0	846.348 ppm
Ca	21427.6	503.179 ppm
Tl	1502.10	177.962 ppm
CrLO	159.931	129.404 ppm
Mn	331.398	317.703 ppm
Fe	13520.6	617.823 ppm
Co	207.334	225.656 ppm
Ni	30.7775	88.9192 ppm
Cu	124.174	56.5103 ppm
Zn	155.496	46.7586 ppm
As	-9.67231	30.5741 ppm
Se	-22.9515	14.5355 ppm
Sr	377.653	20.1698 ppm
Zr	152.570	9.20966 ppm
Mo	115.024	9.27266 ppm
Hg	-18.3882	32.4973 ppm
Pb	56.6427	21.7197 ppm
Rb	144.586	20.5498 ppm
Cd	105.505	76.6935 ppm
Sn	53.2201	42.0511 ppm
Sb	6.76107	27.5948 ppm
Ba	708.994	25.4180 ppm
Ag	-22.9460	45.0131 ppm
U	34.9091	15.1359 ppm
Th	16.9914	8.34119 ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 15:58:00
ID: <S10-3>
( ) ( )

	Value	Std. dev.	
CrHI	-429.338	273.724	ppm
K	31993.2	820.629	ppm
Ca	19358.6	478.112	ppm
Ti	1643.86	171.324	ppm
CrLO	71.3488	116.725	ppm
Mn	980.919	363.390	ppm
Fe	14393.4	633.849	ppm
Co	387.692	238.261	ppm
Ni	-35.3470	84.7123	ppm
Cu	104.468	54.3723	ppm
Zn	81.1215	41.3047	ppm
As	17.9177	27.1481	ppm
Se	-40.6304	12.4703	ppm
Sr	371.294	19.9851	ppm
Zr	122.832	8.42739	ppm
Mo	157.980	10.1023	ppm
Hg	-1.37298	33.9642	ppm
Pb	8.38699	17.1534	ppm
Rb	242.485	23.4732	ppm
Cd	25.8009	72.1010	ppm
Sn	62.7340	40.1520	ppm
Sb	30.8204	26.6682	ppm
Ba	690.223	24.9139	ppm
Ag	-90.0920	41.1161	ppm
U	-5.72788	15.7628	ppm
Th	4.72745	7.43236	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 17:19:36
ID: <S8-2>
( ) ( )

	Value	Std. dev.	
CrHI	120.886	348.370	ppm
K	42131.7	935.851	ppm
Ca	23030.0	532.692	ppm
Ti	2318.50	208.910	ppm
CrLO	63.3614	138.099	ppm
Mn	571.174	354.939	ppm
Fe	16783.6	698.278	ppm
Co	229.263	250.944	ppm
Ni	-88.7997	83.6610	ppm
Cu	103.185	56.9667	ppm
Zn	183.399	50.6080	ppm
As	1.49511	33.8247	ppm
Se	-11.6881	16.4312	ppm
Sr	253.653	17.0990	ppm
Zr	154.175	9.16660	ppm
Mo	150.084	10.4369	ppm
Hg	-69.1073	29.9556	ppm
Pb	66.8756	23.7383	ppm
Rb	195.743	23.3262	ppm
Cd	62.3772	82.4248	ppm
Sn	129.508	46.6115	ppm
Sb	-30.5576	28.6321	ppm
Ba	787.490	27.4079	ppm
Ag	-85.4177	47.4558	ppm
U	23.5336	15.6226	ppm
Th	15.1024	8.02205	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 17:28:15
ID: <S8-3>
( ) ( )

	Value	Std. dev.	
CrHI	300.459	360.365	ppm
K	45218.1	967.477	ppm
Ca	20703.8	514.871	ppm
Ti	2221.51	204.541	ppm
CrLO	-245.083	124.616	ppm
Mn	230.136	321.427	ppm
Fe	14839.8	657.835	ppm
Co	150.688	235.231	ppm
Ni	-4.61543	88.4164	ppm
Cu	170.787	61.7247	ppm
Zn	138.554	46.9384	ppm
As	-12.9408	31.5977	ppm
Se	3.96037	17.3911	ppm
Sr	205.658	15.3886	ppm
Zr	127.294	8.39802	ppm
Mo	109.750	9.37902	ppm
Hg	-20.0316	33.3562	ppm
Pb	53.0898	23.1625	ppm
Rb	194.814	22.7545	ppm
Cd	13.1671	81.3801	ppm
Sn	19.1941	44.5497	ppm
Sb	26.1873	29.7614	ppm
Ba	671.708	25.2597	ppm
Ag	-30.2453	48.5801	ppm
U	28.6363	15.4177	ppm
Th	25.8571	8.41948	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 18:46:53
ID: <SCH1>
( ) ( )

	Value	Std. dev.	
CrHI	-722.656	224.129	ppm
K	20280.0	663.272	ppm
Ca	11820.9	371.789	ppm
Ti	2551.71	201.176	ppm
CrLO	174.828	129.425	ppm
Mn	1179.54	383.356	ppm
Fe	26414.2	833.933	ppm
Co	-180.438	271.512	ppm
Ni	-39.0696	82.0029	ppm
Cu	48.6142	50.2580	ppm
Zn	113.940	44.4314	ppm
As	-58.8525	23.8984	ppm
Se	-20.0525	14.9407	ppm
Sr	271.791	17.4707	ppm
Zr	275.011	11.4602	ppm
Mo	15.0328	6.43158	ppm
Hg	-61.5567	29.2502	ppm
Pb	15.5893	19.0453	ppm
Rb	69.0147	16.2415	ppm
Cd	82.7824	73.1234	ppm
Sn	35.1454	40.0911	ppm
Sb	2.05327	26.1246	ppm
Ba	640.080	24.3017	ppm
Ag	16.1929	43.8948	ppm
U	21.3380	11.1657	ppm
Th	9.46331	7.44435	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 18:53:04
ID: <SCH2>
( ) ( )

	Value	Std. dev.	
CrHI	225.325	330.262	ppm
K	18086.9	630.955	ppm
Ca	14657.6	403.251	ppm
Ti	2216.69	188.858	ppm
CrLO	-18.6401	116.937	ppm
Mn	1009.07	376.030	ppm
Fe	24660.0	806.588	ppm
Co	31.8021	270.863	ppm
Ni	-122.796	73.2886	ppm
Cu	-2.25415	44.1394	ppm
Zn	21.2871	36.4906	ppm
As	7.71369	26.9461	ppm
Se	-31.6420	13.6846	ppm
Sr	254.885	16.9022	ppm
Zr	240.406	10.7412	ppm
Mo	5.48134	5.89566	ppm
Hg	-13.8025	32.7821	ppm
Pb	7.54269	17.8536	ppm
Rb	84.2556	16.3097	ppm
Cd	29.6096	68.7539	ppm
Sn	45.2596	38.2821	ppm
Sb	53.4012	26.1155	ppm
Ba	519.607	21.8258	ppm
Ag	-22.9257	40.6918	ppm
U	13.8867	11.1031	ppm
Th	18.2629	7.73477	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 18-APR-1994 19:08:13
ID: <S27>
( ) ( )

	Value	Std. dev.	
CrHI	-399.822	252.739	ppm
K	13945.1	556.619	ppm
Ca	10470.6	340.993	ppm
Ti	1995.78	174.126	ppm
CrLO	144.636	110.148	ppm
Mn	1012.04	361.875	ppm
Fe	23782.4	780.480	ppm
Co	32.7641	261.652	ppm
Ni	-126.248	69.1211	ppm
Cu	62.7380	48.1068	ppm
Zn	27.9212	34.3528	ppm
As	26.3510	26.3265	ppm
Se	-14.0952	14.2743	ppm
Sr	248.353	16.4090	ppm
Zr	293.216	11.4671	ppm
Mo	-1.57763	5.66914	ppm
Hg	-31.6151	29.3390	ppm
Pb	8.61701	16.7321	ppm
Rb	53.7756	14.5777	ppm
Cd	-86.3339	64.5092	ppm
Sn	-6.21295	35.4221	ppm
Sb	16.7022	23.5680	ppm
Ba	541.457	21.8923	ppm
Ag	-100.877	37.0383	ppm
U	24.8535	10.7468	ppm
Th	7.44766	7.20854	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 08:00:39
ID: <FE3>
( ) ( )

	Value	Std. dev.	
CrHI	-13.9463	43.5969	ppm
K	-476.445	66.5451	ppm
Ca	-101.673	33.0505	ppm
Ti	-3.02988	29.8319	ppm
CrLO	-597.327	44.0023	ppm
Mn	220.650	949.046	ppm
Fe	1.59977e+06	6544.89	ppm
Co	-6491.91	1796.28	ppm
Ni	4155.31	991.447	ppm
Cu	-249.429	171.701	ppm
Zn	154.584	134.259	ppm
As	426.940	130.256	ppm
Se	13.1196	51.9025	ppm
Sr	5.92377	18.3081	ppm
Zr	-12.3774	9.99050	ppm
Mo	19.4972	14.3401	ppm
Hg	47.5020	137.303	ppm
Pb	75.3002	92.6568	ppm
Rb	-137.344	37.7123	ppm
Cd	1346.00	184.471	ppm
Sn	228.946	95.4423	ppm
Sb	198.296	66.5306	ppm
Ba	52.8786	14.9241	ppm
Ag	-179.510	98.9867	ppm
U	-7.59128	2.44982	ppm
Th	4.30327	2.56485	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 08:13:38
ID: <TEF3>
( ) ( )

	Value	Std. dev.	
CrHI	86.4669	175.013	ppm
K	-288.333	65.6323	ppm
Ca	-28.3538	31.8653	ppm
Ti	-24.2387	25.8187	ppm
CrLO	-59.9332	46.0995	ppm
Mn	106.468	144.059	ppm
Fe	17.8425	74.2483	ppm
Co	-33.6121	66.1372	ppm
Ni	-5.29807	43.2040	ppm
Cu	29.2872	29.4294	ppm
Zn	-16.9026	26.8796	ppm
As	-34.7756	17.5812	ppm
Se	12.4935	10.7384	ppm
Sr	2.59992	2.41384	ppm
Zr	3.58123	1.48959	ppm
Mo	4.46072	2.34519	ppm
Hg	-16.0900	21.1453	ppm
Pb	20.7980	9.58852	ppm
Rb	-7.12293	4.89995	ppm
Cd	-35.0624	27.3778	ppm
Sn	-22.5855	14.7724	ppm
Sb	6.86318	9.88845	ppm
Ba	12.1907	2.67580	ppm
Ag	-54.8740	16.4080	ppm
U	-5.38968	5.25526	ppm
Th	-10.1313	4.01387	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 09:34:13
ID: <S23-1>
( ) ( )

	Value	Std. dev.	
CrHI	-410.831	244.522	ppm
K	14466.8	567.324	ppm
Ca	11400.9	355.045	ppm
Tl	1898.74	174.273	ppm
CrLO	-50.1693	104.603	ppm
Mn	773.620	335.943	ppm
Fe	18898.5	696.687	ppm
Co	-18.5937	233.023	ppm
Ni	-166.034	59.3148	ppm
Cu	42.3428	43.6911	ppm
Zn	54.9019	33.9480	ppm
As	23.8615	23.9964	ppm
Se	-6.81105	13.9173	ppm
Sr	208.915	14.8367	ppm
Zr	302.915	11.3055	ppm
Mo	13.9747	5.91397	ppm
Hg	-21.6134	27.8704	ppm
Pb	3.42278	15.5808	ppm
Rb	68.1730	14.4583	ppm
Cd	-147.906	58.9358	ppm
Sn	16.2317	33.7143	ppm
Sb	8.33891	21.3805	ppm
Ba	438.496	19.4649	ppm
Ag	-74.6950	34.9898	ppm
U	10.9690	10.5270	ppm
Th	3.50967	6.93092	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 09:42:31
ID: <S23-2>
( ) ( )

	Value	Std. dev.	
CrHI	369.276	354.432	ppm
K	18503.8	650.479	ppm
Ca	38622.9	626.331	ppm
Ti	2204.26	190.217	ppm
CrLO	121.440	122.833	ppm
Mn	619.973	354.441	ppm
Fe	21051.6	764.777	ppm
Co	-99.1998	252.815	ppm
Ni	-80.5158	76.6487	ppm
Cu	-4.24691	43.8063	ppm
Zn	104.742	42.0016	ppm
As	75.0606	27.5935	ppm
Se	-33.7517	13.1419	ppm
Sr	283.741	18.0216	ppm
Zr	256.180	11.1991	ppm
Mo	24.9002	6.73510	ppm
Hg	-33.0711	30.7930	ppm
Pb	-20.8680	14.3923	ppm
Rb	70.5583	15.9981	ppm
Cd	-186.738	67.7997	ppm
Sn	-16.2615	37.9910	ppm
Sb	59.2694	26.0119	ppm
Ba	540.007	22.4498	ppm
Ag	-76.6202	40.7642	ppm
U	15.9776	11.0058	ppm
Th	9.43630	7.06089	ppm

Application:SOILS/with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 09:47:45
ID: <S23-3>
( ) ( )

	Value	Std. dev.	
CrHI	-787.559	220.335	ppm
K	24629.6	726.079	ppm
Ca	11475.9	375.340	ppm
Ti	2842.98	208.256	ppm
CrLO	-86.0840	122.512	ppm
Mn	1292.63	395.645	ppm
Fe	23197.5	788.930	ppm
Co	541.410	286.648	ppm
Ni	-76.1262	83.9401	ppm
Cu	-24.7887	43.2993	ppm
Zn	83.3078	42.5024	ppm
As	43.7076	28.8467	ppm
Se	24.8366	18.8136	ppm
Sr	350.495	19.7858	ppm
Zr	343.541	12.8596	ppm
Mo	32.1336	7.45255	ppm
Hg	12.5253	36.4862	ppm
Pb	-18.3365	18.8794	ppm
Rb	107.014	18.3066	ppm
Cd	156.674	82.8738	ppm
Sn	189.642	47.0254	ppm
Sb	35.5657	30.4824	ppm
Ba	785.830	27.1129	ppm
Ag	-143.819	45.6311	ppm
U	16.7368	12.4302	ppm
Th	32.8227	8.76992	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 10:42:22
ID: <S24-1>
( ) ( )

	Value	Std. dev.	
CrHI	19.9582	311.320	ppm
K	20140.0	665.267	ppm
Ca	16833.8	432.712	ppm
Ti	2605.75	202.144	ppm
CrLO	41.4263	128.152	ppm
Mn	216.018	314.284	ppm
Fe	22908.5	780.709	ppm
Co	123.139	266.439	ppm
Ni	20.9577	87.7725	ppm
Cu	-19.8944	42.9489	ppm
Zn	115.047	43.6370	ppm
As	-1.70678	27.7020	ppm
Se	-35.8316	13.2441	ppm
Sr	215.412	15.5718	ppm
Zr	285.546	11.4449	ppm
Mo	20.0495	6.41575	ppm
Hg	-10.6477	33.0873	ppm
Pb	28.6372	18.2993	ppm
Rb	86.0870	15.8260	ppm
Cd	18.8500	66.7600	ppm
Sn	25.9663	36.4574	ppm
Sb	47.5128	25.2713	ppm
Ba	365.460	18.4803	ppm
Ag	-98.5076	37.4354	ppm
U	0.581839	10.7648	ppm
Th	9.23370	7.47258	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 10:49:04
ID: <S24-2>
( ) ( )

	Value	Std. dev.	
CrHI	47.1906	325.813	ppm
K	19330.5	656.438	ppm
Ca	22616.4	491.910	ppm
Ti	2296.03	198.821	ppm
CrLO	-226.327	119.320	ppm
Mn	1354.93	409.562	ppm
Fe	23990.3	805.456	ppm
Co	-197.088	263.935	ppm
Ni	-27.9529	85.0748	ppm
Cu	49.7054	52.5669	ppm
Zn	236.804	54.6109	ppm
As	-18.0830	31.8880	ppm
Se	-3.30742	17.4140	ppm
Sr	298.686	18.4312	ppm
Zr	298.776	12.0630	ppm
Mo	23.9976	7.00122	ppm
Hg	-60.0144	31.6577	ppm
Pb	49.9198	22.7228	ppm
Rb	77.1310	16.7862	ppm
Cd	69.1100	75.2194	ppm
Sn	86.3954	41.9047	ppm
Sb	2.58486	26.8632	ppm
Ba	523.732	22.2434	ppm
Ag	-79.4387	42.9282	ppm
U	16.6835	11.5893	ppm
Th	15.4127	8.17709	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 10:56:55
ID: <S24-3>
( ) ( )

	Value	Std. dev.	
CrHI	30.2206	316.932	ppm
K	19089.3	652.957	ppm
Ca	27075.2	532.226	ppm
Ti	2055.79	179.971	ppm
CrLO	23.9252	113.833	ppm
Mn	468.109	338.267	ppm
Fe	23299.9	794.143	ppm
Co	-208.751	257.274	ppm
Ni	23.9089	86.5819	ppm
Cu	-17.1297	43.3972	ppm
Zn	110.807	43.2714	ppm
As	19.5479	25.8404	ppm
Se	-6.86833	15.9823	ppm
Sr	308.297	18.6383	ppm
Zr	263.384	11.3678	ppm
Mo	15.8820	6.50970	ppm
Hg	-46.3617	29.7539	ppm
Pb	-10.9235	16.4390	ppm
Rb	67.0112	15.9202	ppm
Cd	-123.097	64.2936	ppm
Sn	-14.2469	36.0585	ppm
Sb	49.0158	24.5257	ppm
Ba	468.631	20.8382	ppm
Ag	2.06285	40.1804	ppm
U	20.6062	11.2194	ppm
Th	15.6270	7.57155	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 12:08:27
ID: <S21-1>
( ) ( )

	Value	Std. dev.	
CrHI	-337.326	265.499	ppm
K	17656.8	622.151	ppm
Ca	11629.4	364.371	ppm
Ti	2304.59	186.472	ppm
CrLO	-17.8970	113.109	ppm
Mn	695.601	346.908	ppm
Fe	25837.7	821.396	ppm
Co	408.223	288.412	ppm
Ni	-79.3793	80.0038	ppm
Cu	-79.7461	34.3371	ppm
Zn	117.950	42.5339	ppm
As	-22.2961	23.7011	ppm
Se	-10.7391	15.2105	ppm
Sr	269.903	17.3418	ppm
Zr	281.721	11.4864	ppm
Mo	-4.86071	5.26728	ppm
Hg	-69.0335	26.3852	ppm
Pb	9.23341	16.7028	ppm
Rb	72.9134	14.9411	ppm
Cd	-46.5385	69.5113	ppm
Sn	19.6068	38.7118	ppm
Sb	13.8128	25.2291	ppm
Ba	695.229	25.0932	ppm
Ag	-29.2473	41.6877	ppm
U	1.73538	9.87459	ppm
Th	8.97488	7.28814	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 12:16:15
ID: <S21-2>
( ) ( )

	Value	Std. dev.	
CrHI	18.8218	294.526	ppm
K	17902.8	621.687	ppm
Ca	6953.30	295.283	ppm
Ti	1580.03	167.126	ppm
CrLO	155.107	114.014	ppm
Mn	102.104	283.649	ppm
Fe	19909.2	715.531	ppm
Co	106.660	244.043	ppm
Ni	-60.2424	73.5748	ppm
Cu	25.0433	43.4389	ppm
Zn	147.923	42.3535	ppm
As	-20.5478	24.3159	ppm
Se	-22.7596	12.9394	ppm
Sr	210.229	14.9724	ppm
Zr	216.567	9.80576	ppm
Mo	9.20104	5.25179	ppm
Hg	4.70712	31.3696	ppm
Pb	31.8527	17.4976	ppm
Rb	64.3017	13.8427	ppm
Cd	-98.2836	64.2505	ppm
Sn	30.1303	36.4444	ppm
Sb	-9.63311	22.6938	ppm
Ba	614.668	23.0677	ppm
Ag	-56.4063	38.2659	ppm
U	-1.55978	9.61918	ppm
Th	8.69029	6.89328	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 12:20:25
ID: <S21-3>
(   ) (   )

	Value	Std. dev.	
CrHI	2.54610	291.336	ppm
K	17697.9	617.663	ppm
Ca	7203.83	298.372	ppm
Ti	1893.46	162.714	ppm
CrLO	293.329	111.062	ppm
Mn	361.374	306.127	ppm
Fe	21292.4	739.894	ppm
Co	-438.653	227.441	ppm
Ni	-9.85522	74.0538	ppm
Cu	-8.18263	39.4180	ppm
Zn	84.2164	36.7818	ppm
As	0.867300	23.1088	ppm
Se	-23.0002	12.6826	ppm
Sr	192.261	14.3589	ppm
Zr	202.824	9.59125	ppm
Mo	-4.04719	4.73997	ppm
Hg	-10.0972	29.6592	ppm
Pb	5.03128	16.3541	ppm
Rb	53.2394	13.4397	ppm
Cd	-202.224	61.0614	ppm
Sn	-55.5870	34.1020	ppm
Sb	71.7086	24.1199	ppm
Ba	584.648	22.5263	ppm
Ag	2.09411	38.9646	ppm
U	8.24331	9.52087	ppm
Th	23.6842	7.49719	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 17:57:42
ID: <S18>
( ) ( )

	Value	Std. dev.	
CrHI	-477.503	217.630	ppm
K	13742.7	547.761	ppm
Ca	5452.93	259.800	ppm
Ti	1203.75	139.735	ppm
CrLO	262.203	104.124	ppm
Mn	416.566	276.604	ppm
Fe	11090.2	531.195	ppm
Co	74.3736	188.422	ppm
Ni	-56.3621	65.7666	ppm
Cu	-41.8773	33.0537	ppm
Zn	73.0350	34.5018	ppm
As	28.0041	21.5064	ppm
Se	-45.2175	9.20879	ppm
Sr	102.142	10.2138	ppm
Zr	112.494	6.88576	ppm
Mo	0.207016	4.08729	ppm
Hg	-7.40771	27.6823	ppm
Pb	-9.20578	12.2630	ppm
Rb	23.7822	10.2955	ppm
Cd	-103.590	55.8428	ppm
Sn	-82.1658	29.3033	ppm
Sb	25.1148	20.8669	ppm
Ba	572.548	21.3083	ppm
Ag	-68.0735	32.8142	ppm
U	5.93177	8.42509	ppm
Th	10.7503	6.32157	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 18:01:43
ID: <S19>
( ) ( )

	Value	Std. dev.	
CrHI	-163.163	279.186	ppm
K	21251.6	676.321	ppm
Ca	8651.27	329.445	ppm
Ti	1406.00	171.168	ppm
CrLO	67.0907	122.041	ppm
Mn	219.378	291.482	ppm
Fe	14736.8	622.446	ppm
Co	136.362	221.122	ppm
Ni	-107.944	68.5213	ppm
Cu	-70.5204	34.7115	ppm
Zn	68.3676	39.0208	ppm
As	0.0808053	25.3460	ppm
Se	-7.60585	15.0994	ppm
Sr	186.290	13.9645	ppm
Zr	218.807	9.74599	ppm
Mo	-8.84239	4.72215	ppm
Hg	-38.5992	29.1415	ppm
Pb	2.99966	17.1535	ppm
Rb	58.6054	14.2379	ppm
Cd	5.19316	71.3492	ppm
Sn	3.61760	38.9273	ppm
Sb	2.20551	25.6274	ppm
Ba	935.286	28.1957	ppm
Ag	-36.1467	42.2341	ppm
U	14.8458	10.2358	ppm
Th	22.6938	7.77810	ppm

Application:SOILS with U,Th,Ag Q018 01-20-1994
Meas Time: 19-APR-1994 18:07:08
ID: <S20>
( ) ( )

	Value	Std. dev.	
CrHI	-493.703	232.513	ppm
K	13916.9	554.351	ppm
Ca	7900.45	302.783	ppm
Ti	2054.83	175.972	ppm
CrLO	128.514	110.271	ppm
Mn	439.654	307.509	ppm
Fe	19712.1	707.387	ppm
Co	291.167	249.288	ppm
Ni	-126.260	67.2694	ppm
Cu	38.0732	44.0327	ppm
Zn	127.309	40.4739	ppm
As	24.6486	27.0158	ppm
Se	-4.62622	14.4307	ppm
Sr	209.395	14.8578	ppm
Zr	293.826	11.1602	ppm
Mo	0.312584	5.68263	ppm
Hg	-6.61246	29.6880	ppm
Pb	28.3787	17.8639	ppm
Rb	48.9525	13.4717	ppm
Cd	-302.651	56.4016	ppm
Sn	-38.7061	32.6043	ppm
Sb	20.5167	20.9299	ppm
Ba	470.872	20.0614	ppm
Ag	-60.1604	35.5278	ppm
U	23.1719	10.7251	ppm
Th	6.30243	7.18427	ppm

Attachment C

Well Logs + Information: Mine Area

SOUTH PASS RESOURCES, Inc.
8669 East San Alberto Drive Suite 101
Scottsdale Arizona 85258
Telephone 602 948 7171
Fax 602 948 7205

PROGRESS REPORT ON THE GEOLOGY, HYDROGEOLOGY, AND WATER QUALITY OF THE MINE AREA
Molycorp Facility
Taos County, New Mexico

prepared for
Molycorp, Inc.
Questa Division
P O Box 469
Questa, NM 87556

prepared by
South Pass Resources, Inc./SPRI

RECEIVED
MAY 11 1995
GROUND WATER BUREAU

April 21, 1995

SUMMARY OF 1994 WELL CONSTRUCTION DATA AT MOLYCORP/QUESTA

MMW-2 **Capulin Canyon, Valley fill Well, TD 68 feet**

Valley fill 0 - 58 feet
Bedrock (andesite) 58 - 68 feet
8 inch PVC screen 38 - 58 feet
Tail pipe 58 - 68 feet
Dry

MMW-3 **Capulin Canyon, Bedrock well, TD 140 feet**

Valley fill 0 - 60 feet
Bedrock (andesite & rhyolite) 60 - 140 feet
8 inch PVC Screen 75 - 115 feet
Depth to Water - 60 feet

X

MMW-7 **Shaft #1 Area, Bedrock well, TD 161 feet**

Valley fill 0 - 84 feet
Bedrock (andesite) 84 - 161 feet
8 inch PVC Screen 90 - 160 feet
Depth to water - 90 feet

70 column

X

MMW-8A **East of Sewage Pond, Bedrock well, TD 178 feet**

Valley fill 0 - 121 feet
Bedrock (andesite/rhyolite) 121-178 feet
8 inch PVC Screen 130 - 150 feet
Depth to water - 88 5 feet

MMW-8B **East of Sewage Pond, Valley fill Well, TD 129 feet**

Valley fill 0 - 117 feet
Bedrock (andesite/rhyolite) 117 - 129 feet
8 inch PVC Screen 77 - 117 feet
Dry

MMW-10A **Sugar Shack South, Valley fill well, TD 144 feet**

Valley fill 0 - 129 feet
Bedrock (quartz monzonite) 129 - 144 feet
8 inch PVC Screen 89 - 129 feet
Tailpipe 129 - 139 feet
Depth to water - 21 8 feet

X - Sampled During ESI

MMW-10B **Sugar Shack South, Bedrock well, TD 189 feet**

Valley fill 0 - 134 feet
Bedrock (quartz monzonite) 134 - 189 feet
8 inch PVC Screen 137 177 feet
Depth to water - 21 8 feet

MMW-10C **Sugar Shack South, Valley fill well, TD 50 feet**

Valley fill 0 - 50 feet
4 inch PVC Screen 34 5 - 49 5 feet
Depth to water - 21 8 feet

MMW-11 **Sugar Shack South, Bedrock well, TD 184 feet**

Valley & mine fill 0 - 145 feet
Bedrock (quartz monzonite) 145 - 184 feet
4 inch PVC Screen 149 - 179 feet
Depth to water - 83 5 feet

MMW-13 **Middle Dump, Valley fill Well, TD 145 feet**

Valley fill 0 - 120 feet
Bedrock (quartz monzonite) 120 - 145 feet
8 inch PVC Screen 90 - 120 feet
Depth to water - 105 3 feet

MMW-14 **Sulphur / Spring Gulch Dump, Valley fill Well, TD 75 feet**

Valley fill 0 - 75 feet
8 inch PVC Screen 60 - 60 feet
Dry

MMW-16 **Sulphur / Spring Gulch, Valley fill Well, TD 98 feet**

Valley fill 0 - 90 feet
Bedrock (granite) 90 - 98 feet
8 inch PVC Screen 48 - 88 feet
Tail pipe 88 - 98 feet
Dry

MARKS	Blows/0 5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			0			Fill	Fill fragments of andesite and phyrite
			10			GC	BROWN SANDY CLAYEY GRAVEL clasts of andesite and rhyolite matrix Matrix sandy clay to clayey sand
			45				andesite boulder associated with coarse gravel
			80			Rock	DARK GRAY ANDESITE bedrock contact, some flow banding and tan to gray rhyolite
							andesiste pyritic

DRILL DATE
ART 8/24/94 FINISH. 8/26/94 LOGGED By: W Opfel DRILL RIG Air Rotary/ Casing Drive SAMPLE TYPE: Cuttings

UTH PASS RESOURCES, Inc.

JECT No 001-05 | DATE 1/16/95

LOG OF BORING No. MMW-3
Molycorp, Inc.
Questa, New Mexico

FIGURE No. C14

APPENDIX D

REMARKS	Blows/0 5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			80				
			85				
			90				
			95				
			100				
			105				
			110				
			115				
			120				
			125				
			130				
			135				
			140				
			145				Boring terminated at 145 0 feet and monitor well installed.
			150				
			155				
			160				

DRILL DATE
START 8/24/94 FINISH: 8/26/94 LOGGED By W Opfel DRILL RIG: Air Rotary/ Casing Drive SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.

PROJECT No 001-05 | DATE 1/16/95

LOG OF BORING No. MMW-3
Molycorp, Inc.
Questa, New Mexico

FIGURE No
C14a

REMARKS	Blows/0.5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			0			GM	Fill or Colluvium angular fragments of yellow, gray and red rhyolite with minor amounts of dark glassy porphyritic volcanics
			25			GM/GC	BROWN CLAYEY GRAVEL clasts of andesite, rhyolite, welded tuff, and dark volcanics, subangular to subrounded. Matrix of silt, clay and sand.
			45				larger chips, cobbles and boulders
Moisture content check up at 50 -55 silty clays			50				clay content increasing in matrix, strong yellow color to clay
			75				more andesite clasts
			80				

DRILL DATE
START 8/10/94 FINISH 8/13/94 LOGGED By W Opfel DRILL RIG: Air Rotary/ Casing Drive SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.		LOG OF BORING No. MMW-7 Molycorp, Inc. Questa, New Mexico	FIGURE No
PROJECT No	DATE		
001-05	1/16/95		C15

REMARKS	Blows/0.5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			80				
Borehole water is < 1 gpm			85			Rock	GRAY ANDESITE bedrock contact, porphyritic andesite, pyrite and calcite vein fill
			90				
Borehole water 1-2 gpm unaltered pyrite in fractures			95				
			100				
			105				
			110				
			115				
			120				
			125				
			130				
			135				
			140				
			145				
			150				
			155				
			160				

DRILL DATE
START 8/10/94 FINISH 8/13/94 LOGGED By W Opfel DRILL RIG Air Rotary/ Casing Drive SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.

PROJECT No 001-05 | DATE 1/16/95

LOG OF BORING No. MMW-7
Molycorp, Inc.
Questa, New Mexico

FIGURE No C15a

REMARKS	Blows/0.5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			160				Boring terminated at 1810 feet and monitor well installed.
			165				
			170				
			175				
			180				
			185				
			190				
			195				
			200				
			205				
			210				
			215				
			220				
			225				
			230				
			235				
			240				

DRILL DATE
START 8/10/94 FINISH: 8/13/94 LOGGED By W Opfel Air Rotary/ DRILL RIG. Casing Drive SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.		LOG OF BORING No. MMW-7 Molycorp, Inc. Questa New Mexico	FIGURE No.
PROJECT No	DATE		C15b
001-05	1/16/95		

REMARKS	Blows/0.5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			0			GW	SANDY GRAVEL angular fragments of andesite with some rhyolite. Much iron staining on clasts Brown matrix of sand
			5				
			10				
			15				
			20				
			25				
enole water 2-3			30				
			35			GC/GW	DARK BROWN-BLACK CLAYEY GRAVEL
			40				
enole water 3-5			45			GW	SANDY GRAVEL angular fragmnets of rhyolite and quartz monzonite
			50				
enole water 2-3			55			CL	TAN TO YELLOW CLAY gypsum present
			60			GW	SANDY GRAVEL angular fragments of quartz monzonite, rhyolite and pegmatite Iron oxide coatings, pyrite present Matrix of brown sand
			65				
			70				
			75				
			80				

DRILL DATE
START 7/11/94 FINISH 7/14/94 LOGGED By W Opfel DRILL RIG: Casing Drive Air Rotary SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.
PROJECT No DATE

LOG OF BORING No. MMW-10B
Molycorp, Inc.

FIGURE No
C19

010

MARKS	Blows/0.5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			80–95				Buried log (laying horizontal) present
			95–135			SP	BROWN-GRAY GRAVELLY SAND medium-grained, well rounded, 90% quartz Well rounded clasts of rhyolite, pegmatite, andesite, quartz gravelly sand alternating with medium-grained sand black organic material at 121–122 feet
			135–160			Rock	QUARTZ MONZONITE bedrock contact, pyritic, fractured

DRILL DATE
START 7/11/94 FINISH 7/14/94 LOGGED By: W Opfel DRILL RIG Air Rotary Casing Drive SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.

PROJECT No 001-05 | DATE 1/16/95

LOG OF BORING No. MMW-10B
Molycorp, Inc.
Questa, New Mexico

FIGURE No C19a

APPENDIX E

APPENDIX D

011

REMARKS	Blows/0.5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			180				
			185				
			190				Boring terminated at 189.0 feet and monitor well installed
			195				
			200				
			205				
			210				
			215				
			220				
			225				
			230				
			235				
			240				

DRILL DATE
START: 7/11/94 FINISH: 7/14/94 LOGGED By W Opfel DRILL RIG: Air Rotary Casing Drive SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.

PROJECT No 001-05 DATE 1/16/95

LOG OF BORING No. MMW-10B
Molycorp, Inc.
Questa, New Mexico

FIGURE No
C19b

REMARKS	Blows/0.5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
ncreasing moisture content no free water			80				
			85				
Borehole water 1-2 gpm			90				
			95			SP	SANDY GRAVEL clasts as above but rounded.
			100				
			105			CL	GRAVELLY CLAY clasts as above, clay content 75%
			110				
Borehole water 1 gpm			115			GC	CLAYEY GRAVEL clay content 10%-20%
			120				
Borehole water 2-3 gpm			125				
			130				
			135				
Borehole water 2-4 gpm			140				
Borehole water 2-4 gpm			145			Rock	QUARTZ MONZONITE bedrock contact
Borehole water 5-10 gpm			150				
			155				Cuttings to 165 feet, > 1/2 inch slight decrease in chip size below 165 feet Fracture zone better developed above 165 feet.
			160				

DRILL DATE
START 7/15/94 FINISH: 7/17/94 LOGGED By W Opfel DRILL RIG: Casing Drive Air Rotary/ SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.		LOG OF BORING No. MMW-11 Molycorp, Inc. Questa, New Mexico	FIGURE No C21a
PROJECT No 001-05	DATE 1/16/95		

013

REMARKS	Blows/0 5 Ft	PID	SAMPLE DEPTH	SAMPLE INTERVAL	GRAPHIC LOG	USCS CLASS	DESCRIPTION
			180				
			185				
			170				
			175				
			180				
			185				Boring terminated at 185 0 feet and monitor well installed.
			190				
			195				
			200				
			205				
			210				
			215				
			220				
			225				
			230				
			235				
			240				

DRILL DATE
START 7/15/94 FINISH: 7/17/94 LOGGED By W Opfel DRILL RIG: Air Rotary/ Casing Drive SAMPLE TYPE: Cuttings

SOUTH PASS RESOURCES, Inc.		LOG OF BORING No. MMW-11 Molycorp, Inc. Questa, New Mexico	FIGURE No C21b
PROJECT No 001-05	DATE 1/16/95		

Monitor/Extraction Wells Installed in Mine Area July/August 1994			
Well No.	**Total Depth (feet)**	**Screened Interval (feet)**	**Well Completed In**
MMW-2	68	38 - 58	mudflow
MMW-3	145	65 - 115	andesite bedrock
MMW-7	161	86 - 161	andesite bedrock
MMW-8A	161	125 - 161	andesite bedrock
MMW-8B	129	67 - 117	mudflow
MMW-10A	144	79 - 130	alluvial gravel/ sand overlying quartz monzonite bedrock
MMW-10B	189	133 - 189	quartz monzonite bedrock
MMW-10C	50	31 5 - 50	mudflow
MMW-11	185	145 - 185	quartz monzonite bedrock
MMW-13	148	105 - 148	sandy gravel, gravelly sand overlying quartz monzonite
MMW-14	75	48 - 75	sandy gravel gravelly sand
MMW-16	98	45 - 98	sandy gravel gravelly sand overlying light grey granite

A partial listing of the other monitor and extraction wells in the Mine Area that pre-date SPRI field activities are summarized below (Note a complete list of all wells located in the study area is unknown at this time)

Other Wells Located in the Mine Area (Partial Listing)		
Well No.	**Total Depth (feet)**	**Year Installed**
Mill Well 1A-1	176	1977
Mill Well No 1	150	1962
Columbine No 1	89	1965
Columbine No 2	140	1965
Columbine No 1 redrill	153	1971

X Sampled During ESI

System Name	Code 736-24 748-29	Owner	Phone
MOLYCORP		Molycorp Inc.	586-0212

Mailing Address	County	Type of Establishment	Avg. # Persons Served Daily:
P.O. Box 469 Questa	Taos	mine and mill	150 per 8hour shift

Location, if Different than Address	Disinfection. Avg. Daily Residual
between Questa & Red River	☐ Chlorine ☐ Iodine ☐ Other ☒ None

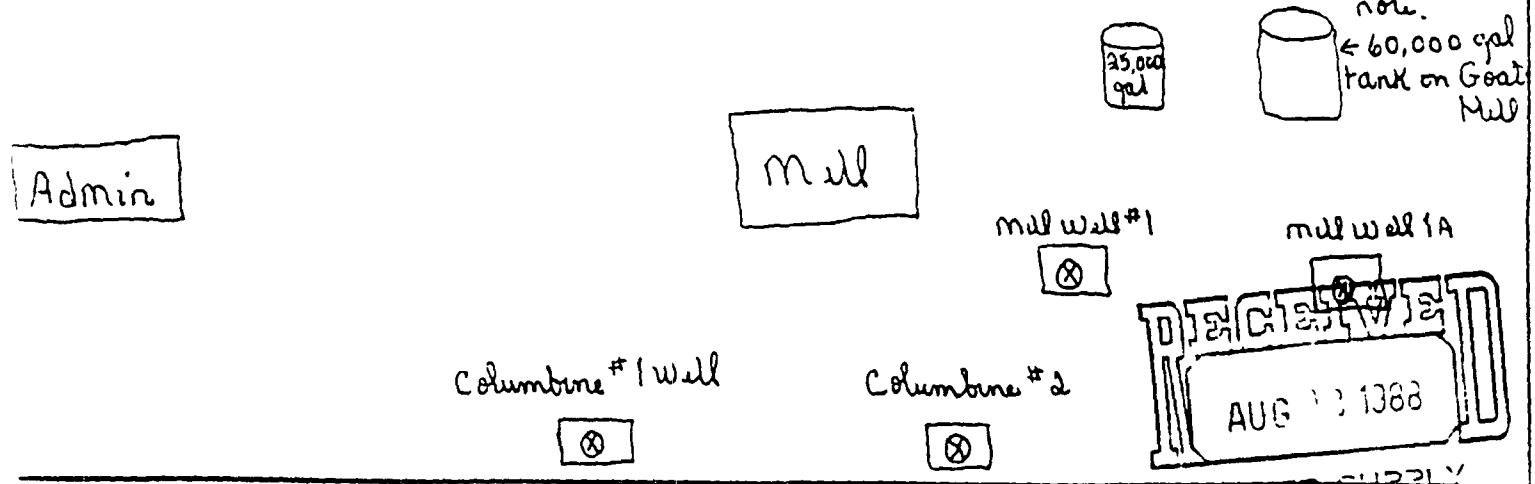
Operating Dates, if Seasonal	# Connections	# Meters	Average Daily Water Usage
not operating at this time	25	6	2,500 gal/8 hr shift

SOURCES (Please Check Boxes if Conditions are Satisfactory)

☒ WELLS - # 4	☐ SPRING(S) - #	☐ SURFACE	☐ OTHER
☒ Pedestal Provided ☐ Slab Provided Size ____ ☐ Casing 1 ft. above slab ☐ Sanitary Seal ☒ Pump House ☐ Pressure Tank Well Depth ____ Pump Setting ____	☐ Approved Box ☐ Protection from Run-off ☐ Overflow Pipe Protected ☐ Cover Locked	☐ Intake Protected ☐ Filter Provided ☐ Treatment: ____ ☐ Turb. Monitoring Performed Avg. Daily Turb. ____	☐ Transport Approved ☐ Approved Source

STORAGE	DISTRIBUTION SYSTEM	PIPE MATERIAL	SAMPLING
☒ Ground 2 tanks ☐ Elevated 600,00 Goat Hill 25,000 Mill Capacity ____	☐ Gravity ☒ Pressure	☒ PVC ☒ Steel ☐ Other ____	Micro. Sampling Status 1 per quarter Last Nitrate Date ____

Schematic of Water and Liquid Waste System (Indicate North)



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AUG 12 1988
WATER SUPPLY
REGULATION SECTION

Cross Connection or Back Siphonage:

Where Applicable, Give Distances from Nearest.

____ Liquid Waste Disposal Fields ____ Feed Lots ____ Septic Tanks,
____ Solid Waste Disposal Site ____ Deep Well Waste Injection ____ Cessoools
____ Other

Comments and Recommendations
Mill well #1, depth to water, 104'.
Mill well 1A, depth to water, 107'. ← Sampled during ESI
Columbine 1, depth to water, 27'.
Columbine 2, depth to water, 35'.

Surveyed by: Ernest J. Gutierrez | Date | Phone

Table 1: Groundwater Samples Collected for Red River Project, August-September, 1993

#	Date	Type*	Depth to water	Analyses**	Conduct.	Temp	pH	Notes
25	8/24/93	W	39	MT,+/-	160	7	7.1	Elephant Rock C.G.
26	8/24/93	W	93	MT,+/- ✓	175	13	6.8	Junebug C.G.
27	8/24/93	ST	-	MD,+/-	155	20	7.2	Bitter Creek
28	8/24/93	W	10	MT,+/-	420	10	4.9	Harrison Well
29	8/24/93	W	15	MT,+/-	195	16	4.6	Davis Well
30	9/8/93	S	-	MD,+/- ✓	220	8	5.3	Mallette Road (S-6)
31	9/9/93	W	12	MT,+/- ✓	104	12	6.8	Fagerquist Motel
32	9/9/93	S	-	MD,+/- ✓	500	15	6.1	Sulfur Culch (S-5)
33	9/10/93	S	-	MT,+/- ✓	195	16	6.9	lower RR spring
34	9/21/93	S	-	MD,+/- ✓	1140	12	4.2	Seep (S-7)
35	9/21/93	S	-	MD,+/-	2450	16	3.9	Seep (S-8) excavation
36	9/21/93	S	-	MD,+/- ✓	1800	19	3.3	Seep (S-9) "trench"
37	9/21/93	S	-	MD,+/- ✓	1670	14	3.8	Seep (S-10)
38	9/21/93	S	-	MD,+/- ✓	850	13	4.5	Seep (S-11)
39	9/21/93	S	-	MD,+/- ✓	1200	13	4.9	Seep (S-12)

*W = well, S = seep or spring, ST = stream
**MD = metals, dissolved; MT = metals, total; +/- = anions & cations

017

Need dullen lice

APR 29 1982

☐ NO EXCEPTIONS NOTED
☐ EXCEPTIONS NOTED
☐ RETURNED FOR CORRECTION
REVISE & RESUBMIT

WELL RECORD

Section 1 GENERAL INFORMATION

(A) Owner of well Town of Red River Owner's Well No _____
Street or Post Office Address _____
City and State _____

Well was drilled under Permit No _____ and is located in the

a _____ ¼ _____ ¼ _____ ¼ _____ ¼ of Section _____ Township _____ Range _____ N M

b Tract No _____ of Map No _____ of the _____

c Lot No _____ of Block No _____ of the _____
Subdivision recorded in _____ County

d X= _____ feet, Y= _____ feet, N M Coordinate System _____ Zone
the _____ Gra

(B) Drilling Contractor Cook Drilling Co. License No _____

Address RT 1 Box 149 E Espanola, N.Mex. 87532

Drilling Began 3-26-82 Completed 4-13-82 Type tools Rotary Size of hole 12" i

Elevation of land surface or _____ at well is _____ ft Total depth of well 210 f

Completed well is ☒ shallow ☐ artesian Depth to water upon completion of well 133 f

Section 2 PRINCIPAL WATER BEARING STRATA

Depth in Feet From	Depth in Feet To	Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
198	200	2	Fractured Rock	120

Section 3 RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in	Depth in Feet Top	Depth in Feet Bottom	Length (feet)	Type of Shoe	Perforations From	Perforations To
6 5/8	PVC sch 80		0	195	195			
6 5/8	s s screen		195	210 25?	20	flat bottom	195	210

Section 4 RECORD OF MUDDING AND CEMENTING

Depth in Feet From	Depth in Feet To	Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
6	54	12"		32	gravity

Section 5 PLUGGING RECORD

Plugging Contractor _____
Address _____
Plugging Method _____
Date Well Plugged _____
Plugging approved by _____
State Engineer Representative

No	Depth in Feet Top	Depth in Feet Bottom	Cubic Feet of Cement
1			
2			
3			
4			

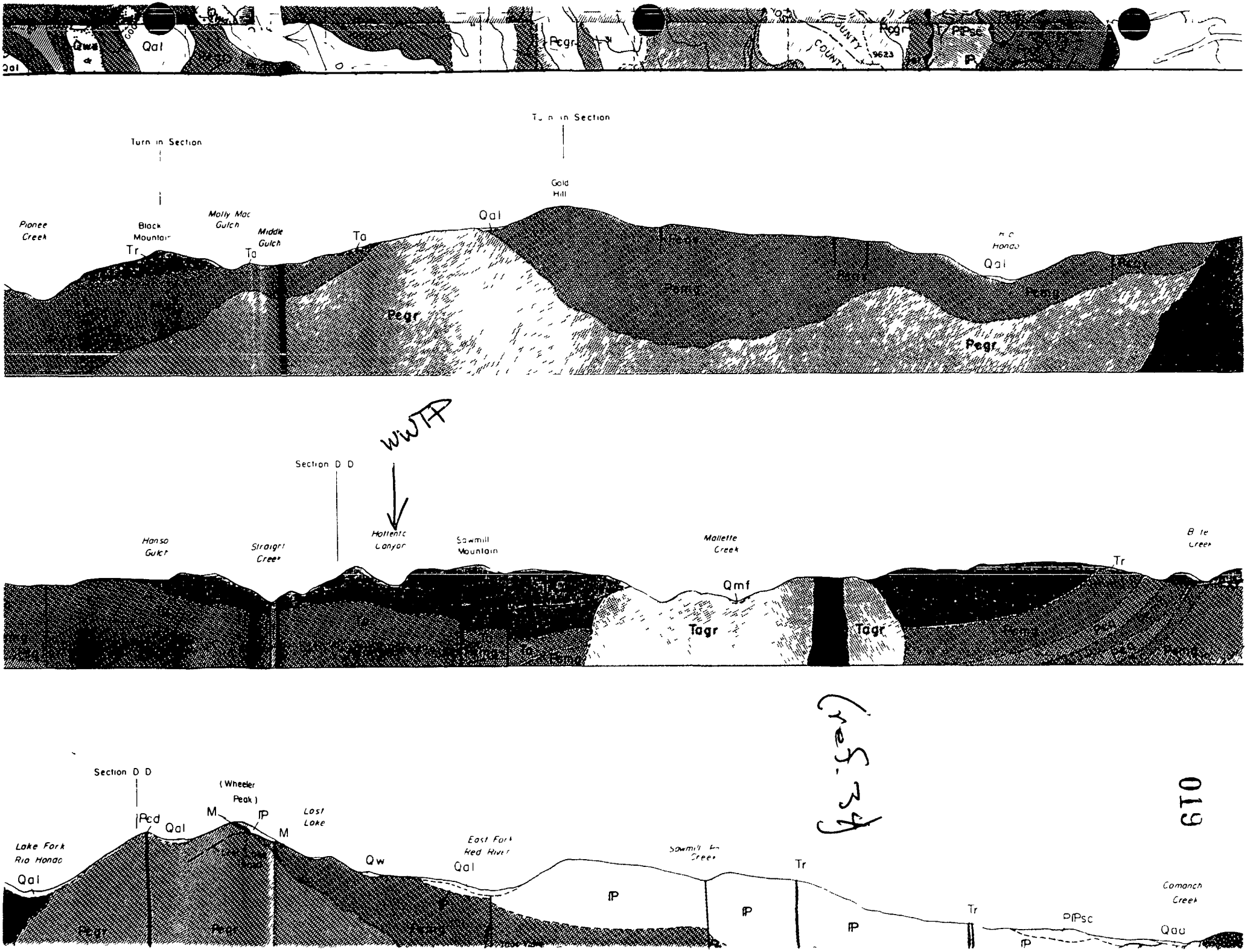
FOR USE OF STATE ENGINEER ONLY

Date Received

Quad _____ FWL _____ FSL _____

File No _____ Use _____ Location No _____

0	8	8	caving yellow overburden
8	105	97	yellow unconsolidated rock
105	180	75	yellow consolidated rock
180	198	18	hard yellow rock
198	200	2	fractured yellow rock
200	208	8	yellow rock
208	220	12	granite red in color



WWTP

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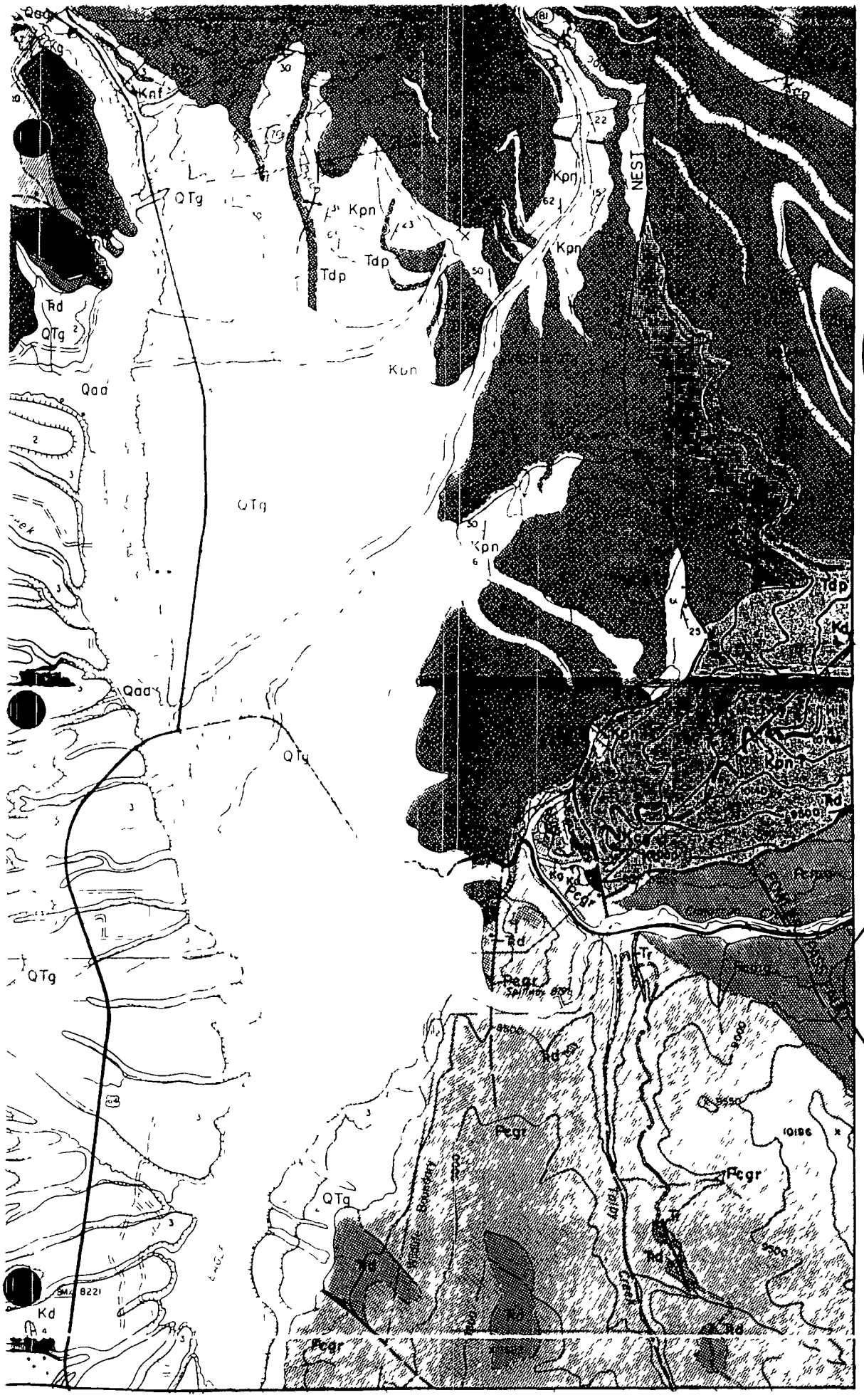

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(ref. 34)

Section B B

Section A A

Geology by K F Clark 1968,

Well Logs +
Information:

Tailings Ponds

021

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SEP 24 1993
GROUND WATER BUREAU

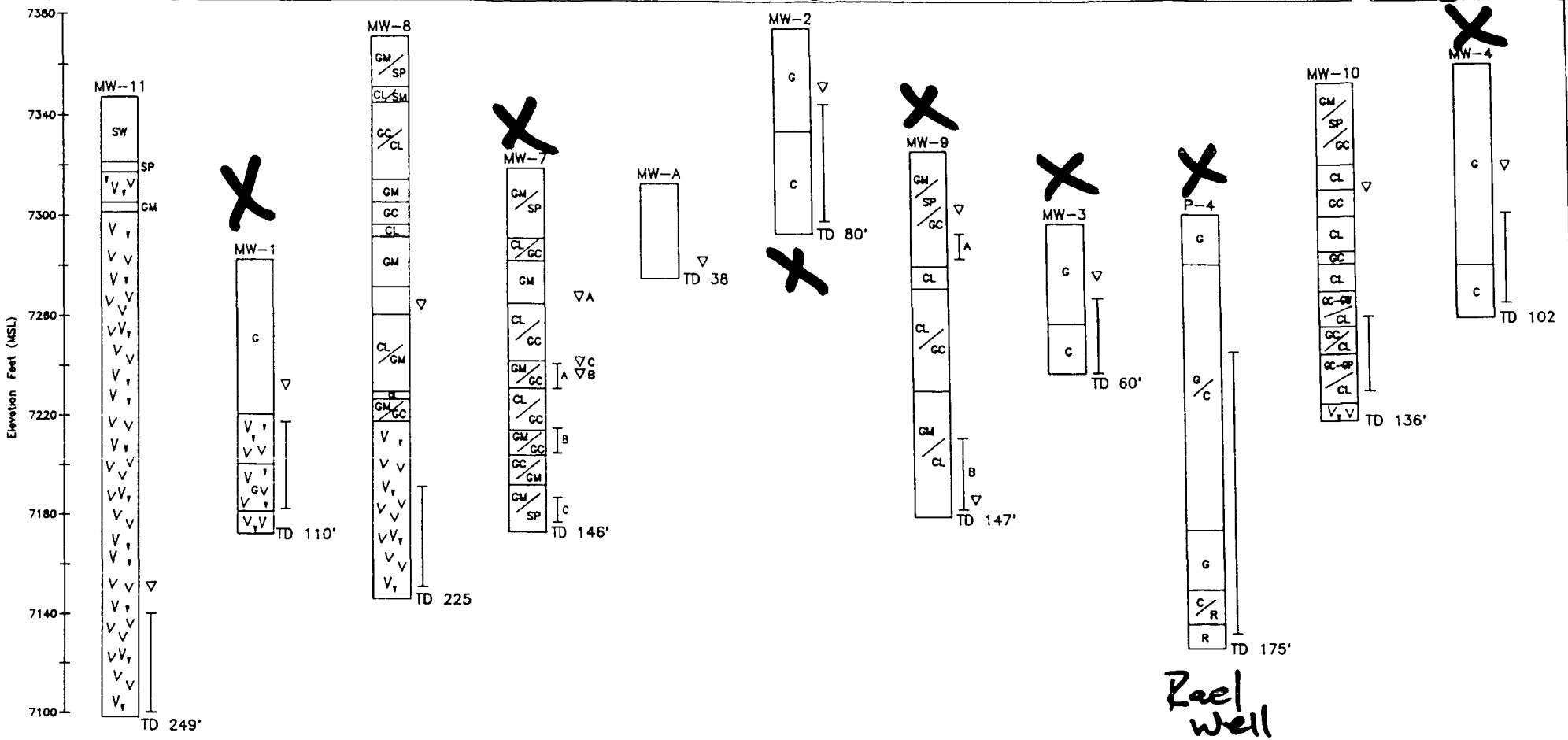
Hydrogeologic Evaluation of Tailings Ponds

Molycorp
Questa Division
Questa, New Mexico

prepared for
Molycorp, Inc. - Questa Division

prepared by
South Pass Resources, Inc./SPRI

September 23, 1993



LEGEND

CL	Silty Clays, Sandy Clays Gravelly Clays	SM	Silty Sand	C	Clay (1979 well)
GC	Clayey Gravel	SP	Gravelly Sand to Poorly Graded Sand	G	Gravel (1979 well)
GM	Sandy Gravel	SW	Well Graded Sand	R	Rock, possible Volcanic Unit
GP	Poorly Graded Gravels (narrow size range) less than 5% Fines	GM/CL	Unit with Interbedded Sandy Gravel and Gravelly Clay and/or Clay (top unit more abundant)	MW-11	Monitor Well
GW	Well Graded Gravels (wide range if sizes) less than 5% Fines			P-4	Private Well, 1964 no current water level

▽ Water Level

I Position of Well Screen Letter refers to a Piezometer in a Multiple Completion Well

0 20 40
VERTICAL SCALE IN FEET

BOREHOLE STATIGRAPHY
TAILINGS PONDS AREA
Molycorp, Inc
Questa, New Mexico

SOUTH PASS RESOURCES, Inc.

PROJECT NO.	DATE	AUTHOR	DRAWN BY	FIGURE
001-02	9-20-93		M O'M	3

X - Sampled During ESI

Boring Log No. MW-7

PROJECT NUMBER: 001-02 **DATE:** 9-20-93 **LOGGED BY:** W. J. Opfel 023

DRILL RIG: Air Rotary Casing Hammer **HOLE DIA.:** 12" in **SAMPLER:** Grab

INITIAL GW DEPTH: ft **FINAL GW:** ft **HOLE ELEV.:** 7320.10

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT	REMARKS
TAN SILTY SANDY GRAVEL	GP		0			Final groundwater depths 7A = 58 5' 7B = 82 3' 7C = 74 3'
			5			
TAN SILTY GRAVELLY SAND with tan silty sandy gravel (80%), 1 to 2 inches No observable moisture	SP		10	⊠		
			15			
SILTY SANDY GRAVEL & SILTY GRAVELLY SAND layers alternate with possible clay layers Gravels appear to be fine-grained volcanics with a trace of plutonic sand from 25 to 26' sand is brown clayey and coarse-grained Well-rounded brown to tan clay balls appear to be silty gravelly clay	GM		20	⊠		
			25			
SILTY GRAVELLY SAND & SILTY CLAY moist with trace gravel	GM CL					
REDDISH BROWN SILTY SANDY CLAY	CL		30			
BROWN CLAYEY SANDY GRAVEL moist, poorly sorted angular (volcanics) with interbedded clay	GC			⊠		
			35			
BROWN SANDY GRAVEL & WHITE QUARTZ no clay, volcanic fragments	GP		40			

SOUTH PASS RESOURCES, Inc.

Environmental Consultants
Phoenix, Arizona

TAILINGS PONDS AREA
MOLYCORP, Inc.
Questa, New Mexico

Figure No
A1

Boring Log No. MW-7

PROJECT NUMBER: 001-02 | **DATE.** 9-20-93 | **LOGGED BY:** W. J. Opfel

DRILL RIG: Air Rotary Casing Hammer | **HOLE DIA.** 12" in | **SAMPLER:** Grab

INITIAL GW DEPTH: ft | **FINAL GW** ft | **HOLE ELEV.:** 7320.10

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT	REMARKS
gravelly/clayey mudballs at surface	GP		40			Losing water to formation above 55 feet
BROWN GRAVELLY CLAY fine-grained silicates (volcanic) up to 1 1/2" clay is silty	CL		45			
BROWN CLAYEY GRAVEL light to dark fine-grained volcanics small to large up to 1 1/2	GC		50			
REDDISH BROWN GRAVELLY CLAY fine-grained 1/4' to 1/2'	CL		55			
coarse gravel at 77 to 78			60			
			65			
			70			
			75			
			80			

SOUTH PASS RESOURCES, Inc.

Environmental Consultants
Phoenix, Arizona

TAILINGS PONDS AREA
MOLYCORP, Inc.
Questa, New Mexico

Figure No
A1a

Boring Log No. MW-7

PROJECT NUMBER: 001-02 | DATE: 9-20-93 | LOGGED BY: W J. Opfel | 025

DRILL RIG: Air Rotary Casing Hammer | HOLE DIA.: 12" in | SAMPLER: Grab

INITIAL GW DEPTH: ft | FINAL GW: ft | HOLE ELEV.: 7320 10

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT	REMARKS
	CL		80	☒		
SANDY GRAVEL coarse-grained, mixed volcanics (80%) and plutonic (20%)	GM		85			Yielding water at 20 gpm
REDDISH BROWN GRAVELLY CLAY interbedded coarse sandy gravel	CL GM		90	☒		
			95			
coarse gravel yielding water			100	☒		
			105			Yielding water at 3 gpm at 107-108'
RED-BROWN GRAVELLY CLAY some green clay lenses, reddish brown clay is dense, dry and hard	CL		110	☒		
coarse gravel with large 2" chips of clay with red and green volcanic pieces 115 to 118'			115			
			120			

SOUTH PASS RESOURCES, Inc.

Environmental Consultants
Phoenix, Arizona

TAILINGS PONDS AREA
MOLYCORP, Inc.
Questa, New Mexico

Figure No
A1b

Boring Log No. MW-7

PROJECT NUMBER: 001-02 **DATE:** 9-20-93 **LOGGED BY:** W J Opfel

DRILL RIG: Air Rotary Casing Hammer **HOLE DIA.** 12" in. **SAMPLER:** Grab

INITIAL GW DEPTH: ft **FINAL GW:** ft. **HOLE ELEV.:** 7320.10

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT	REMARKS
gravel is red, green brown and black, volcanic fragments clay is dense and dry	CL		120	⊠		
CLAYEY GRAVEL gravel up to 70-80%	GC		125			Yielding water 5 to 8 gpm
TAN COARSE SANDSTONE with volcanic and granitic fragments sandstone chips from 1/4" to 2 , 35% quartz, 35% sandstone 30% volcanics	SS		130	⊠		
SANDY GRAVEL/GRAVELLY SANDS no indication of cementation 35% granitic 35% sandstone 30% red and black volcanic fragments - 132' to 133' 30% sandstone, 30% red and black volcanics - 133 to 138 Volcanic gravel below 138'	GP		135 140	⊠		
Boring terminated at 146 0 feet See Monitor Well Completion Detail			145 150 155 160			

SOUTH PASS RESOURCES, Inc.

Environmental Consultants

TAILINGS PONDS AREA
MOLYCORP, Inc.
Questa, New Mexico

Figure No
A1c

Boring Log No. MW-9

027

PROJECT NUMBER: 001-02 | DATE: 9-20-83 | LOGGED BY: W. J. Opfel

DRILL RIG: Air Rotary Casing Hammer | HOLE DIA. 12" in | SAMPLER: Grab

INITIAL GW DEPTH: ft | FINAL GW: ft. | HOLE ELEV.: 7328.00

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT	REMARKS
	CL		80	⊠		
BROWN CLAY moist with trace gravel	CL		85			
BROWN GRAVELLY CLAY	CL		90	⊠		
GRAVEL with trace clay	GW		95			
			100	⊠		Losing return water at 10 gpm - 103 to 14
CLAYEY GRAVEL/GRAVELLY CLAY gravel contains volcanic and granitic fragments	GC CL		105			
			110	⊠		
BROWN CLAYEY GRAVEL with trace clay	GC GW		115			making water, 1 to 2 gpm - 115 to 125
			120			

SOUTH PASS RESOURCES, Inc.

Environmental Consultants
Phoenix, Arizona

TAILINGS PONDS AREA
MOLYCORP, Inc.
Questa, New Mexico

Figure No
A3b

Boring Log No. MW-9

PROJECT NUMBER: 001-02 | DATE: 9-20-93 | LOGGED BY: W. J. Opfel

DRILL RIG: Air Rotary Casing Hammer | HOLE DIA.: 12" in | SAMPLER: Grab

INITIAL GW DEPTH: ft | FINAL GW: ft | HOLE ELEV.: 7328 00

028

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT	REMARKS
TAN SILTY SANDY GRAVEL	GM		0			
TAN SILTY SANDY CLAY	CL		5			
GRAVEL	GP		10			
TAN SILTY SANDY CLAY	CL					
TAN SANDY GRAVEL/GRAVELLY SAND moist, 80% volcanic gravels, 20% granitic gravels	GP SP		15			
CLAYEY SANDY GRAVEL moist clay content increase with depth	GC		20			
BROWN CLAYEY GRAVEL/GRAVELLY CLAY moist	GC CL		25			
			30			
			35			
			40			

SOUTH PASS RESOURCES, Inc.

Environmental Consultants
Phoenix, Arizona

TAILINGS PONDS AREA
MOLYCORP, Inc.
Questa, New Mexico

Figure No
A3

Boring Log No. MW-9

PROJECT NUMBER: 001-02 | DATE: 9-20-93 | LOGGED BY: W. J. Opfel

DRILL RIG: Air Rotary Casing Hammer | HOLE DIA.: 12" in. | SAMPLER: Grab

INITIAL GW DEPTH: ft | FINAL GW: ft | HOLE ELEV.: 7326.00

029

DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT	REMARKS
			40			
BROWN GRAVELLY CLAY moist	GC CL CL					
			45			
BROWN CLAY moist, thin gravelly clay layers	CL					
			50			
BROWN CLAYEY GRAVEL moist	GC		55			
			60			
coarse sand and trace of gravel/gravelly clay 62 to 65 feet			65			
BROWN GRAVELLY CLAY moist, thin layers of clayey gravel	CL GC					
			70			
BROWN CLAYEY GRAVEL moist	GC		75			
BROWN GRAVELLY CLAY moist	CL		80			

SOUTH PASS RESOURCES, Inc.
Environmental Consultants

TAILINGS PONDS AREA
MOLYCORP, Inc.

Figure No.
A3a

Boring Log No. MW-9

PROJECT NUMBER: 001-02 | DATE: 9-20-93 | LOGGED BY: W J Opfel

DRILL RIG: Air Rotary Casing Hammer | HOLE DIA.: 12" in | SAMPLER: Grab

INITIAL GW DEPTH: ft | FINAL GW: ft | HOLE ELEV.: 7328 00

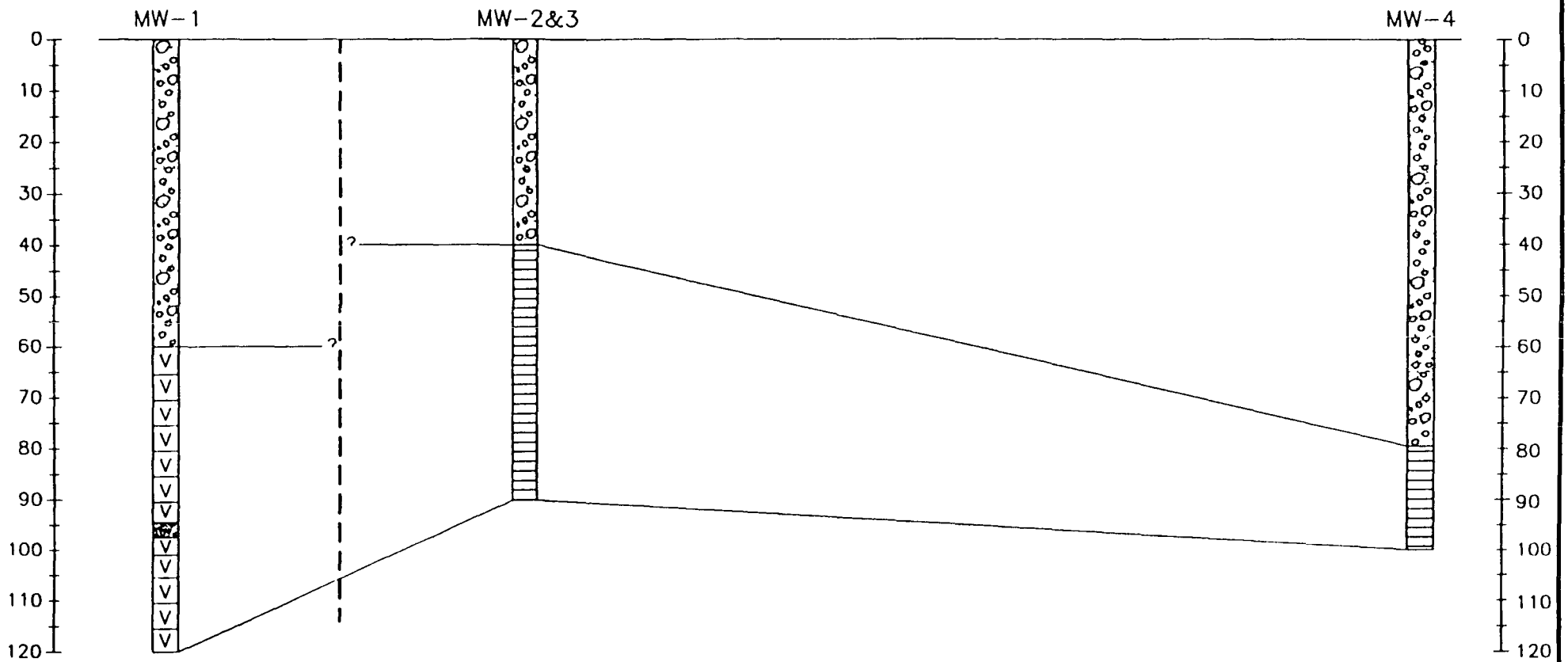
DESCRIPTION	USCS CLASS	GRAPHIC LOG	DEPTH	SAMPLE	BLOWS/FT	REMARKS
BROWN GRAVELLY CLAY	GC GW CL		120	☒		
			125			
			130	☒		
BROWN CLAYEY GRAVEL volcanic and white granitic fragments	GC		135			
			140	☒		
			145			
Boring terminated at 147 feet See Well Completion Detail			150			
			155			
			160			

SOUTH PASS RESOURCES, Inc.

Environmental Consultants
Phoenix, Arizona

TAILINGS PONDS AREA
MOLYCORP, Inc.
Questa, New Mexico

Figure No
A3c



LEGEND

- Sandy Gravel
- Clay
- V — Volcanic Unit
- Postulated Fault

0 300 600
HORIZONTAL SCALE IN FEET

0 15 30
VERTICAL SCALE IN FEET

FIGURE 3

The GeoWest Group Inc.

PROJECT No	DATE	AUTHOR	DRAWN BY
001-02	5-25-93	JCK	M O'M

MONITOR WELL CROSS-SECTION

Molycorp, Inc
Questa, New Mexico

Well	Diameter	Depth of Well(s)	Depth to Water(s)	Case Height (ft)	Volume (gal)	Volume Purged (gal)
4-21-94						
MW-4	6"	110'	42 61	674	97	364
			44 19 after sampling at 9.53			
MW-2	6"	80'	19 84	61.2	88	<150
			well pumped almost dry after 12 minutes. Pump rate and vol was .75 L/min.			
MW-C	6"	6 52	3.10	3.4	5.0	130
MW-1	6"	110	55 18	56 8	82	300
MW-3	6"	52'	19 76 (casing = 0 52)	32 6	47	195
P-1 (Herrera)	6"	72 30	33 48	38 8	56	525 slow
			(casing in? was 110)			
Ht-Well		250'				1000 (estimate)
			Purge Time ~ 50 min., Purge Rate ~ 20 gal/m			
P-4b (Reed)	-	110'	—	—	—	—
4-25-94						
MW-7c	2"	142	88	54	8.7	>30 (est.)
MW-7b	2"	114	108 82	5.2	0.8	10
P-5 (Duran)	-	—	—	—	—	87
P-9a	2"	43	38.40	14.6	2.3	

Well	Time	Conductivity (umhos)	Temp (C)	Sample Collected
P-1	14 54	1100	12 5	
	14 59	1132	11.5	
	15 04	1120	11.5	
	15 13			W-65
				pH-6
CH-Well	Estimated time Molycorp began purging was 15.00			
	15.48	335	13.0	
	15.57	329	12.0	
	15:49			W-1 pH-6
B (Rinse)				W-5
	4-25-94			
MW 7c	11 47	1090	10.5	W-12
MW-7b		1100 (1st 5 gal)	9.0	gray & cloudy
	13 00	1180 (2nd 5 gal)		
	14.54			W-11
P-5 (Rinse)	14.27	275	10c	
	14.33	279	10.0	
	14.34	(sample collected three gardens here)		W-5
	14 44			W-55 (Dupl.
MW-9a	15.42	710	—	W-4

@ 19:00 the following pH's were measured at Molycorp lab

	W-12	W-4	W-5	W-11
pH:	6.76	7.71	7.68	8.02

Well	Time	Conductivity (umhos)	Temp (C)	Sample collected
MW-4	9:25	312	13.6	
	9:30	1170	—	
	9:37	1230	—	
	9:43	1190	12.7	
	9:47	1270	12.3	
	9:52	1280	12.3	
	9:53			W-2
				pH paper - 6.5 @ 10 -
MW-2	10:25	1200	—	
	10.37	1340	-	
	10 42			W-8 Dark color
				pH paper - 6.5 @ -
MW-C	11:23	1200	13.0	
	11 27	1400	13 0	
	11 . 31	1390	11.5	
	11 . 32			W-9
				pH - 6.5 at 16:45
MW-1	12:28	1260	13 0	
	12-35	1180	12.5	
	12:40	1190	13 0	
	12:41			W-7
	12.47			W-7.5 Duplicate
				pH - 6.5
MW-3	14:18	1135	13.5	
	14:22	1120	12 0	
	14:27	1120	12.0	
	14:28			W-6

Attachment D

Sulfate Gain to the Red River over Time in the Vicinity of the Mine.

A release of CERCLA hazardous substances to the Red River has been identified through surface water sampling and sediment sampling The following exercise was conducted to assess potential attribution of the observed release to the Red River to Molycorp activities

D-1 Attribution of Release-Method

Attribution of metal loading to the Red River by Molycorp operations was evaluated by examining how the loading of metals to the river has changed over time Sulfate was used as a proxy for metals since the mobilization of the latter (due to lowered pH) results from the formation of sulfuric acid by the oxidation of sulfate (ref 62, p 31) Sulfate loading to the Red River was evaluated near the Molycorp mine by calculating the percent of total sulfate increase or gain attributed to different segments of the river While another study used this same approach to evaluate gain over a larger reach of the Red River (ref 28, app 4), this study concentrated on the gain solely between Molycorp property and the USFS Questa Ranger Station Sulfate gain was evaluated from the upper Molycorp property line to Columbine Creek (upper segment) and Columbine Creek to Ranger Station (lower segment) for eight different data sets covering 29 years (1965-1994, refs 28, 13, 14) Sulfate gain for a given data set or sampling event was calculated by multiplying flow of the Red River by sulfate concentration The total gain was apportioned to each segment The advantage of this approach is that data from different weather conditions, which would affect the flow of the Red River and sulfate concentrations can be compared Due to the differences of sampling strategy of each event, estimations of several parameters such as flow at each river location or sulfate concentration below Columbine Creek was necessary to normalize the data from each study Any attribution of sulfate loading to the Red River by Molycorp operations would likely be reflected in changes in the relative contribution of sulfate reflected in each segment of the river

D-2 Attribution of Release-Results and Discussion

If Molycorp's mining operations have contributed to the metal loading of the Red River, then those reaches of the river which are impacted by mining should contribute a higher percentage of the total loading over time To make this comparison, eight data sets spanning 29 years (1965-1994) were used to determine the contribution from areas between Molycorp milling area and Columbine Creek (upper reach) and between Columbine Creek and the USFS ranger station near Questa (lower reach) For data sets which do not include flows at each sampling location, estimated flows were applied by calculating the proportion of flow at a given location from other data sets (Table D-1) Percentage of flow at each sampling location was fairly consistent regardless of total gauged flow

Results of the contribution of sulfate from each stream reach over time is presented in Table D-2 Prior to the commencement of open pit mining by Molycorp, the lower reach contributed slightly over a half of the total gain The mine dumps were initially deposited in the Sulphur Gulch drainage and small drainages in the Sugar Shack South area (ref 4, photo 6) Analytical results from a 1971 report show the upper reach had a higher percent contribution of sulfate than before open pit mining began (Table D-2, ref 14, p 41) By 1988 (next available data set), deposition of the mine waste dumps had expanded into both Goathill Gulch and Capulin Canyon (ref 4, photo 7) Also, Molycorp had suspended open pit operations in 1985 and reverted to underground techniques The contribution of sulfate observed in the lower reach of the river had increased to over 80% of the total gain (Table D-2) Analytical results of surface water flow from each of these drainage demonstrated higher levels of sulfate than in background drainages such as Hanson Creek (ref 28, app 1) The Capulin collection system, which was installed in 1992, re-routed acid drainage (both mine and scar related) to groundwater via a bore hole in Goathill Gulch This action cut off much of the surface water flow in these drainages The contribution of sulfate gain seen in the lower reach of the Red River abruptly decreased by October of 1992 to 52% (Table D-2) This level of contribution is approximately the same as that prior to open pit operations Since the installation of the collection system, however, the sulfate gain in the lower stream reach has increased (Table D-2) This result suggests that a new source for sulfate had developed since 1992 Because the hydrothermal scar areas have not likely increased in surface area since 1992 and can be assumed to already have achieved its greatest acid generating potential, the increase in sulfate most likely has resulted from groundwater recharge which is impacted by either the mine waste dumps or mine workings

An alternative method for evaluating (partial) attribution of releases to the Red River focused upon metal concentrations in both the sediments which defined a release and the mine waste dumps Those metals which were higher in concentration in the mine waste dumps than the scar areas were compared to those metals which demonstrated a three-fold increase in the sediment samples A ratio of average metal concentrations in mine dump material to natural scar material was calculated (Table 4) The highest ratios are those for Mo, Zn, Cu, Mn and Be (in decreasing order) Except for Mo, for which sediment analysis was not conducted, four of the five metals which were elevated in at least half of the downstream sediment samples are the same metals with the highest concentration ratio between the mine dump material and scar areas (ca Table 4 and Table 18) With the few number of samples (waste and sediment), this comparison does not definitively prove attribution of elevated metal concentrations to Molycorp but does suggest a likely connection

Table D-1 Calculation of Flow Rates of Red River Relative to Gauging Station at USFS Ranger Station in Questa

Date	11-04-65	11-04-70	10-25-88	11-29-88	10-22-92	02-16-93
Location						
Above Molycorp Mill	17	12 7	20	10 9	16 1	14 1
Blw Columbine Crk	23 6	16 1	25	15 2	22 4	19 7
Goathill Gulch			28 3	15 8	23 3	20 5
Below Capulin Canyon			29	16 3	24	21 1
USFS Ranger St	26 3	17 7	30	17	25	22

Percent of gauged flow at USFS Ranger Station

Date	11-04-65	11-04-70	10-25-88	11-29-88	10-22-92	02-16-93	Average % of flow gauged @ USFS station
Location							
Above Molycorp Mill	64 6	71 8	66 7	64 1	64 4	64 1	65 9
Blw Columbine Crk	89 7	91 0	83 3	89 4	89 6	89 5	88 8
Goathill Gulch			94 3	92 9	93 2	93 2	93 4
Below Capulin Canyon			96 7	95 9	96 0	95 9	96 1
USFS Ranger St	100 0	100 0	100 0	100 0	100 0	100 0	100 0

Estimated Flows during ESI Sampling*

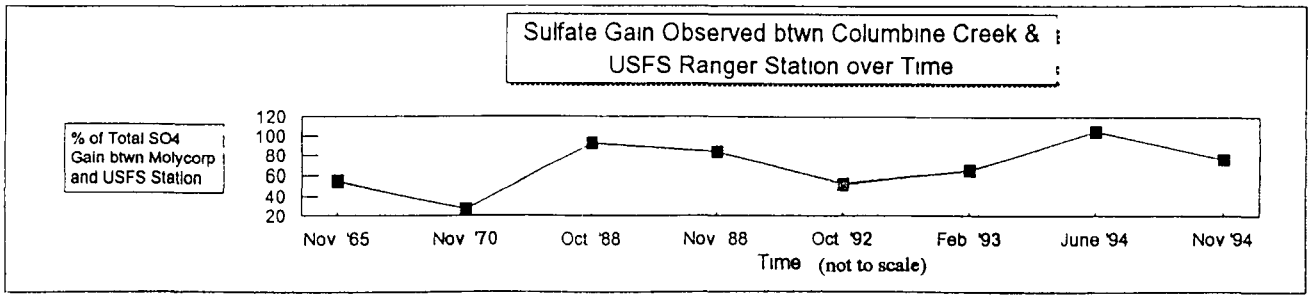
Date		06-26-94	11-07-94
Location			
Above Molycorp Mill		102	19
Blw Columbine Crk		138	26
Goathill Gulch		145	27
Below Capulin Canyon		149	28
USFS Ranger St **		155	29

* Calculated using average % flow
** Recorded by USGS

Table D-2 Loading of Sulfate into the Red River over Time by Stream Segments

Location	Flow (cfs)	Sulfate Conc	SO4 gain	Mass gain	% of total gain	
ESI sampling 11-07-94*		(mg/l)	(flow x conc)			
Abv Moly Mill	18	74	1332	500	23 3	Moly Mill to Columbine Ck
Blw Col Crk	25 8	71	1832	1645	76 7	Columbine to Eagle Rock GC
Eagle Rock CG	28 5	122	3477			
Total				2145		
ESI sampling 06-26-94*						
Abv Moly Mill (abv Hanson Crk)	98	21	2058	-307	-4 9	Moly Mill to Columbine Ck
Below Col Crk	139	12 6	1751	6572	104 9	Columbine Crk to Ranger St
FS Ranger St	155	53 7	8324			
Total				6266		
02-16-93 **						
Abv Moly Mill	14 1	113	1593	987	34 6	Moly Mill to Columbine Ck
Blw Col Crk@ Company Cabin	19 7	131	2581	1863	65 4	Columbine Crk to Ranger St
FS Ranger St	22	202	4444			
Total				2851		
10-22-92 **						
Abv Moly Mill	16 1	85	1369	1163	47 8	Moly Mill to Columbine Ck
Blw Col Crk@ Company Cabin	22 4	113	2531	1269	52 2	Columbine Crk to Ranger St
FS Ranger St	25	152	3800			
Total				2432		
11-29-88 **						
Abv Moly Mill	10 9	65	709	249	15 4	Moly Mill to Columbine Ck
Blw Col Crk@Thunder Bridge	15 2	63	958	1371	84 6	Columbine Crk to Ranger St
FS Ranger St	17	137	2329			
Total			3995	1621		
10-25-88 **						
Abv Moly Mill	20	67	1340	160	7 3	Moly Mill to Columbine Ck
Below Col Crk (calculated)	25	60	1500	2040	92 7	Columbine Crk to Ranger St
FS Ranger St	30	118	3540			
Total				2200		
11-04-70						
Abv Moly Mill	12 69	62 5	793	294	72 6	Moly Mill to Columbine Ck
Below Col Crk	9 63	69	664	111	27 4	Columbine Crk to Ranger St
+ Molycorp dviersion (est)	6 5	65	423			
FS Ranger St	11 19	69 3	775			
+ Molycorp dviersion (est)	6 5	65	423			
Total				405		
11-04-65						
Abv Moly Mill	17	46 8	796	396	45 3	Moly Mill to Columbine Ck
Below Col Crk	23 6	50 5	1192	478	54 7	Columbine Crk to Ranger St
FS Ranger St	26 3	63 5	1670			
Total				874		

* calculated from flow data of 2-16-93, 10-22-92 and USGS gage info at USFS station



** (ref 28, app 3)

HRS
(Not Included)

TARGET SHEET

SITE NAME: MOLYCORP INC.

CERCLIS I.D.: NMD002899094 DATE OF DOC: 10/23/95

TITLE OF DOC.: STATE LETTER/ESI VOL 1-3

NO. OF PGS. THIS TARGET SHEET REPLACES: ?

SDMS #: 908714 KEYWORD: 10.06

CONFIDENTIAL ?		OVERSIZED ITEMS ?	
COLOR ITEMS ?		MISSING PAGES ?	
ENCLOSURES / ATTACH. NOT INCLUDED ?			X
ALTERN. MEDIA ?		CROSS REFERENCE ?	

LAB DOCUMENT ?		LAB NAME:	
ASC./BOX #:		RAW ANALYT. DATA ?	
CASE #:		SDG #:	

COMMENTS : REFERENCE 1-HRS

VERSION 3

SUPERFUND CHEMICAL DATA MATRIX

9 March 1993

Chemical Name (CAS)	Data Element	Next	Current
Maleic anhydride (000108-31-6)			
	Substance Synonym (primary)		
		Furandione 2,5-	
Maleic hydrazide (000123-33-1			
	Substance Synonym (primary)		
		Dihydro-3 6-pyridazinedione 1 2-	
Maleic hydrazide (000123-33-1)			
	Air Gas Mobility		
		1 0000	0 2000
Maleic hydrazide (000123-33-1)			
	Vapor Pressure (Torr		
		1 6900 0000000000000	1 0740000000000
Maleic hydrazide (000123-33-1)			
	Particulate Substance (VP <= 0 1)		
		F	T
Manganese (007439-96-5)			
	MCL / MCLG (mg/L) (pCi/L for radionuclides)		
		1 00000000000	0 20000000000
Manganese (007439-96-5)			
	Drinking Water Cw & Sw) Reference Dose Screening Concentration (mg/L)		
		0 1750000000	1 5000000000
Manganese (007439-96-5)			
	Surface Water Food Chain Reference Dose Screening Concentration (mg/kg)		
		6 5000000000	130 0000000000
Manganese (007439-96-5)			
	Soil Exposure Reference Dose Screening Concentration (mg/kg)		
		2915 0000000000	58300 0000000000

Date 03/08/93 | SUPERFUND CHEMICAL DATA MATRIX | SCDM Version MAR93
Chemical Barium | CAS Number 007440-39 3

TOXICITY

Parameter	Value	Unit	Source
Oral RfD	7 0E-02	mg/kg/day	IRIS
Inhal RfD*		mg/kg/day	
Oral Slope*		(mg/kg/day) -1	
Oral Wt-of-Evid			
Inhal Slope.		(mg/kg/day) -1	
Inhal Wt-of-Evid			
Oral ED10		mg/kg/day	
Oral ED10 Wgt			
Inhal ED10		mg/kg/day	
Inhal ED10 Wgt			
Oral LD50	2 0E+03	mg/kg	ACGIH
Dermal LD50*		mg/kg	
Gas Inhal LC50		ppm	
Dust Inhal LC50		mg/L	
ACUTE			
Fresh AWQC.		ug/L	
Salt AWQC		ug/L	
Fresh AALAC		ug/L	
Salt AALAC.		ug/L	
CHRONIC			
Fresh AWQC:		ug/L	
Salt AWQC		ug/L	
Fresh AALAC		ug/L	
Salt AALAC.		ug/L	
Fresh Ecol LC50	4 1E+05	ug/L	ACQUIRE
Salt Ecol LC50		ug/L	

PERSISTENCE

Parameter	Value	Unit	Source
LAKE - Halflives			
Hydrolysis		days	
Volatility	**	days	
Photolysis		days	
Biodeg		days	
Radio		days	
RIVER - Halflives			
Hydrolysis		days	
Volatility*	**	days	
Photolysis		days	
Biodeg		days	
Radio		days	
Log Kow*			

PHYSICAL CHARACTERISTICS

Parameter	Value
Metal Contain	Yes
Organic	No
Inorganic	Yes
Gas	No
Particulate	Yes
Radionuclide*	No
Rad Element	No
Molecular Wgt	1 4E+02
Density	

MOBILITY

Parameter	Value	Unit	Source
Vapor Press		Torr	
Henry's Law		atm-m3/mol	
Water Solub		mg/L	
Distrib Coef	6 0E+01	ml/g	CH2M_KD
Geo Mean Sol	3 0E+03	mg/L	WEAST

BIOACCUMULATION

Parameter	Value	Unit	Source
FOOD CHAIN			
Fresh BCF			
Salt BCF			
ENVIRONMENTAL			
Fresh BCF			
Salt BCF			
Log Kow			
Water Solub		mg/L	

CLASS INFORMATION

Class	Parent Substance
Toxicity	NA
GW Mob	NA
Other	NA

** This substance should be considered essentially non-volatile

Date 03/08/93
Chemical Barium

SUPERFUND CHEMICAL DATA MATRIX

SCDM Version MAR93
CAS Number 007440-39-3

ASSIGNED FACTOR VALUES

AIR PATHWAY

Parameter	Value
Toxicity	10
Gas Mobility	0 0000
Gas Migration	0

GROUND WATER PATHWAY

Parameter	Value
Toxicity	10
Water Solub	3 0E+03
Distrib	6 0E+01

SOIL EXPOSURE PATHWAY

Parameter	Value
Toxicity	10

SURFACE WATER PATHWAY

Drinking Water

Parameter	Value
Toxicity	10
Persistence	
River	1 0000
Lake	1 0000

Human Food Chain

Parameter	Value
Toxicity	0
Persistence	
River	0000
Lake	0000
Bioaccumulation	
Fresh	0 5
Salt	0 5

Environmental

Parameter	Value
Fresh Tox	1
Salt Tox	1
Persistence	
River	1 0000
Lake:	1 0000
Bioaccumulation	
Fresh	0 5
Salt	0 5

BENCHMARKS

AIR PATHWAY

Parameter	Value	Unit
NAAQS/NESHAPS		ug/m3
Cancer Risk		mg/m3
Reference Dose		mg/m3

GROUND WATER PATHWAY

Parameter	Value	Unit
MCL/MCLG	2 0E+00	mg/L
Cancer Risk		mg/L
Reference Dose	2 5E+00	mg/L

SOIL EXPOSURE PATHWAY

Parameter	Value	Unit
Cancer Risk		mg/kg
Reference Dose	4 1E+04	mg/kg

RADIONUCLIDE

Parameter	Value	Unit
MCL	2 0E+00	pCi/L
UMTRCA		pCi/kg
Cancer Risk:		
Air*	5 4E-01	pCi/m3
DW	1 6E+01	pCi/L
FC	6 0E+02	pCi/kg
Soil Ing	3 1E+05	pCi/kg
Soil Gam:		pCi/kg

SURFACE WATER PATHWAY

Drinking Water

Parameter	Value	Unit
MCL/MCLG	2 0E+00	mg/L
Cancer Risk		mg/L
Reference Dose	2 5E+00	mg/L

Human Food Chain

Parameter	Value	Unit
FDAAL		ppm
Cancer Risk		mg/kg
Reference Dose	9 1E+01	mg/kg

Environmental

Parameter	Value	Unit
ACUTE		
Fresh AWQC:		ug/L
Salt AWQC:		ug/L
Fresh AALAC:		ug/L
Salt AALAC:		ug/L
CHRONIC		
Fresh AWQC:		ug/L
Salt AWQC		
Fresh AALAC*		ug/L
Salt AALAC		ug/L

Date 03/08/93
Chemical Beryllium

SUPERFUND CHEMICAL DATA MATRIX

SCDM Version MAR93
CAS Number 007440-41-7

TOXICITY

Parameter	Value	Unit	Source
Oral RfD	5 0E-03	mg/kg/day	IRIS
Inhal RfD:		mg/kg/day	
Oral Slope	4 3E+00	(mg/kg/day) -1	IRIS
Oral Wt-of-Evid	B2		IRIS
Inhal Slope	8 4E+00	(mg/kg/day) -1	IRIS
Inhal Wt-of-Evid	B2		IRIS
Oral ED10	1 3E-02	mg/kg/day	EPA_ED10
Oral ED10 Wgt	B2		EPA_ED10
Inhal ED10	1 3E-02	mg/kg/day	EPA_ED10
Inhal ED10 Wgt	B2		EPA_ED10
Oral LD50		mg/kg	
Dermal LD50		mg/kg	
Gas Inhal LC50		ppm	
Dust Inhal LC50		mg/L	
ACUTE			
Fresh AWQC		ug/L	
Salt AWQC		ug/L	
Fresh AALAC		ug/L	
Salt AALAC		ug/L	
CHRONIC			
Fresh AWQC		ug/L	
Salt AWQC		ug/L	
Fresh AALAC		ug/L	
Salt AALAC		ug/L	
Fresh Ecol LC50		ug/L	
Salt Ecol LC50		ug/L	

PERSISTENCE

Parameter	Value	Unit	Source
LAKE - Halflives			
Hydrolysis		days	
Volatility	**	days	
Photolysis		days	
Biodeg:		days	
Radio		days	
RIVER - Halflives			
Hydrolysis		days	
Volatility*	**	days	
Photolysis		days	
Biodeg*		days	
Radio		days	
Log Kow			

PHYSICAL CHARACTERISTICS

Parameter	Value
Metal Contain	Yes
Organic	No
Inorganic	Yes
Gas:	No
Particulate*	Yes
Radionuclide	No
Rad. Element	No
Molecular Wgt	9 0E+00
Density	

MOBILITY

Parameter	Value	Unit	Source
Vapor Press		Torr	
Henry's Law		atm-m3/mol	
Water Solub		mg/L	
Distrib Coef	6 5E+02	ml/g	CHEM_KD
Geo Mean Sol	3 4E+02	mg/L	WEAST

BIOACCUMULATION

Parameter	Value	Unit	Source
FOOD CHAIN			
Fresh BCF	1 9E+01		VER_BCF
Salt BCF			
ENVIRONMENTAL			
Fresh BCF	* 9E+01		VER_BCF
Salt BCF			
Log Kow			
Water Solub		mg/L	

CLASS INFORMATION

Class	Parent Substance
Toxicity	NA
GW Mob	NA
Other	NA

** This substance should be considered essentially non-volatile

Date 03/08/93
Chemical Beryllium

SUPERFUND CHEMICAL DATA MATRIX

SCDM Version MAR93
CAS Number 007440-41-7

ASSIGNED FACTOR VALUES

AIR PATHWAY

Parameter	Value
Toxicity	10000
Gas Mobility	0 0000
Gas Migration	0

GROUND WATER PATHWAY

Parameter	Value
Toxicity	10000
Water Solub	3 4E+02
Distrib	6 5E+02

SOIL EXPOSURE PATHWAY

Parameter	Value
Toxicity	10000

SURFACE WATER PATHWAY

Drinking Water

Parameter	Value
Toxicity	10000
Persistence	
River	1 0000
Lake	1 0000

Human Food Chain

Parameter	Value
Toxicity	10000
Persistence	
River	1 0000
Lake	1 0000
Bioaccumulation	
Fresh	50 0
Salt	50 0

Environmental

Parameter	Value
Fresh Tox	0
Salt Tox	0
Persistence	
River	1 0000
Lake	1 0000
Bioaccumulation	
Fresh	50 0
Salt	50 0

BENCHMARKS

AIR PATHWAY

Parameter	Value	Unit
NAAQS/NESHAPS	1 0E-02	ug/m3
Cancer Risk	4 2E-07	mg/m3
Reference Dose		mg/m3

GROUND WATER PATHWAY

Parameter	Value	Unit
MCL/MCLG	1 0E-03	mg/L
Cancer Risk	5 1E-06	mg/L
Reference Dose	1 8E-01	mg/L

SOIL EXPOSURE PATHWAY

Parameter	Value	Unit
Cancer Risk	1 4E-01	mg/kg
Reference Dose	2 9E+03	mg/kg

RADIONUCLIDE

Parameter	Value	Unit
MCL	1 0E-03	pCi/L
UMTRCA		pCi/kg
Cancer Risk		
Air	7 2E+00	pCi/m3
DW*	6.5E+02	pCi/L
FC	2.4E+04	pCi/kg
Soil Ing	1.2E+07	pCi/kg
Soil Gam		pCi/kg

SURFACE WATER PATHWAY

Drinking Water

Parameter	Value	Unit
MCL/MCLG	1 0E-03	mg/L
Cancer Risk	8 1E-06	mg/L
Reference Dose	1 8E-01	mg/L

Human Food Chain

Parameter	Value	Unit
FDAAL		ppm
Cancer Risk	3 0E-04	mg/kg
Reference Dose	6 5E+00	mg/kg

Environmental

Parameter	Value	Unit
ACUTE		
Fresh AWQC.		ug/L
Salt AWQC.		ug/L
Fresh AALAC.		ug/L
Salt AALAC.		ug/L
CHRONIC		
Fresh AWQC.		ug/L
Salt AWQC.		
Fresh AALAC.		ug/L
Salt AALAC.		ug/L

TOXICITY

Parameter	Value	Unit	Source
Oral RfD:	5 0E-03	mg/kg/day	IRIS
Inhal RfD:		mg/kg/day	
Oral Slope:		(mg/kg/day) -1	
Oral Wt-of-Evid			
Inhal Slope		(mg/kg/day) -1	
Inhal Wt-of-Evid			
Oral ED10:		mg/kg/day	
Oral ED10 Wgt			
Inhal ED10	2.6E-03	mg/kg/day	SPHEM
Inhal ED10 Wgt	A		SPHEM
Oral LD50		mg/kg	
Dermal LD50:		mg/kg	
Gas Inhal LC50		ppm	
Dust Inhal LC50		mg/L	
ACUTE			
Fresh AWQC		ug/L	
Salt AWQC.		ug/L	
Fresh AALAC		ug/L	
Salt AALAC		ug/L	
CHRONIC			
Fresh AWQC.		ug/L	
Salt AWQC		ug/L	
Fresh AALAC:		ug/L	
Salt AALAC.		ug/L	
Fresh Ecol LC50	2.2E+01	ug/L	ACQUIRE
Salt Ecol LC50		ug/L	

PERSISTENCE

Parameter	Value	Unit	Source
LAKE - Halflives			
Hydrolysis		days	
Volatility	**	days	
Photolysis		days	
Biodeg:		days	
Radio:		days	
RIVER - Halflives			
Hydrolysis		days	
Volatility	**	days	
Photolysis		days	
Biodeg:		days	
Radio.		days	
Log Kow:			

CLASS INFORMATION

Class	Parent Substance
Toxicity	NA
GW Mob	NA
Other	NA

** This substance should be considered essentially non-volatile

PHYSICAL CHARACTERISTICS

Parameter	Value
Metal Contain	Yes
Organic	No
Inorganic	Yes
Gas:	No
Particulate	Yes
Radionuclide	No
Rad. Element	No
Molecular Wgt:	5 2E+01
Density	

MOBILITY

Parameter	Value	Unit	Source
Vapor Press	0 0E+01	Torr	RAGS
Henry's Law		atm-m3/mol	
Water Solub		mg/L	
Distrib Coef	8 5E+02	ml/g	CHEM_KD
Geo Mean Sol	7 9E+04	mg/L	WEAST

BIOACCUMULATION

Parameter	Value	Unit	Source
FOOD CHAIN			
Fresh BCF	1 0E+00		VER_BCF
Salt BCF	1 9E+02		VER_BCF
ENVIRONMENTAL			
Fresh BCF	1 0E+00		VER_BCF
Salt BCF	1 9E+02		VER_BCF
Log Kow			
Water Solub.		mg/L	

ASSIGNED FACTOR VALUES

AIR PATHWAY

Parameter	Value
Toxicity	10000
Gas Mobility	0 0000
Gas Migration	0

GROUND WATER PATHWAY

Parameter	Value
Toxicity	10000
Water Solub	7 9E+04
Distrib	8 5E+02

SOIL EXPOSURE PATHWAY

Parameter	Value
Toxicity	10000

SURFACE WATER PATHWAY

Drinking Water

Parameter	Value
Toxicity	10000
Persistence	
River	1 0000
Lake	1 0000

Human Food Chain

Parameter	Value
Toxicity	10000
Persistence	
River	1 0000
Lake	1 0000
Bioaccumulation	
Fresh	5 0
Salt	500 0

Environmental

Parameter	Value
Fresh Tox	10000
Salt Tox	10000
Persistence	
River	1 0000
Lake	1 0000
Bioaccumulation	
Fresh	5 0
Salt	500.0

BENCHMARKS

AIR PATHWAY

Parameter	Value	Unit
NAAQS/NESHAPS		ug/m3
Cancer Risk		ug/m3
Reference Dose		mg/m3

GROUND WATER PATHWAY

Parameter	Value	Unit
MCL/MCLG	1 0E-01	mg/L
Cancer Risk		mg/L
Reference Dose	1 8E-01	mg/L

SOIL EXPOSURE PATHWAY

Parameter	Value	Unit
Cancer Risk		mg/kg
Reference Dose	2 9E+03	mg/kg

RADIONUCLIDE

Parameter	Value	Unit
MCL	1 0E-01	pCi/L
UNTRCA:		pCi/kg
Cancer Risk:		
Air*	6.5E+00	pCi/m3
DW	4 6E+02	pCi/L
FC:	1.7E+04	pCi/kg
Soil Ing	8.6E+06	pCi/kg
Soil Gam*		pCi/kg

SURFACE WATER PATHWAY

Drinking Water

Parameter	Value	Unit
MCL/MCLG	1 0E-01	mg/L
Cancer Risk		mg/L
Reference Dose	1 8E-01	mg/L

Human Food Chain

Parameter	Value	Unit
FDAAL		ppm
Cancer Risk		mg/kg
Reference Dose	6 5E+00	mg/kg

Environmental

Parameter	Value	Unit
ACUTE		
Fresh AWQC:		ug/L
Salt AWQC:		ug/L
Fresh AALAC.		ug/L
Salt AALAC*		ug/L
CHRONIC		
Fresh AWQC:		ug/L
Salt AWQC:		
Fresh AALAC:		ug/L
Salt AALAC		ug/L

Date 03/08/93 SUPERFUND CHEMICAL DATA MATRIX SCDM Version: MAR93
Chemical Nickel CAS Number: 007440 02-0

TOXICITY

Parameter	Value	Unit	Source
Oral RfD:	2.0E-02	mg/kg/day	IRIS
Inhal RfD		mg/kg/day	
Oral Slope:		(mg/kg/day) -1	
Oral Wt-of-Evid:			
Inhal Slope:		(mg/kg/day) -1	
Inhal Wt-of-Evid			
Oral ED10		mg/kg/day	
Oral ED10 Wgt:			
Inhal ED10:	1.0E-01	mg/kg/day	SPHEM
Inhal ED10 Wgt:	A		SPHEM
Oral LD50:	5.0E+00	mg/kg	RTECS
Dermal LD50:		mg/kg	
Gas Inhal LC50:		ppm	
Dust Inhal LC50		mg/L	
ACUTE			
Fresh AWQC.	1.4E+03	ug/L	WATCRIT
Salt AWQC	7.5E+01	ug/L	WATCRIT
Fresh AALAC		ug/L	
Salt AALAC.		ug/L	
CHRONIC			
Fresh AWQC.	1.6E+02	ug/L	WATCRIT
Salt AWQC.	8.3E+00	ug/L	WATCRIT
Fresh AALAC.		ug/L	
Salt AALAC:		ug/L	
Fresh Ecol LC50	2.6E+05	ug/L	ACQUIRE
Salt Ecol LC50		ug/L	

PERSISTENCE

Parameter	Value	Unit	Source
LAKE - Halflives			
Hydrolysis:		days	
Volatility:	**	days	
Photolysis		days	
Biodeg:		days	
Radio		days	
RIVER - Halflives			
Hydrolysis		days	
Volatility:	**	days	
Photolysis		days	
Biodeg:		days	
Radio		days	
Log Kow:			

PHYSICAL CHARACTERISTICS

Parameter	Value
Metal Contain:	Yes
Organic.	No
Inorganic	Yes
Gas:	No
Particulate	Yes
Radionuclide:	No
Rad Element:	No
Molecular Wgt:	5.9E+01
Density:	

MOBILITY

Parameter	Value	Unit	Source
Vapor Press:	0.0E+01	Torr	RAGS
Henry's Law		atm-m3/mol	
Water Solub:		mg/L	
Distrib Coef	1.5E+02	ml/g	CH2M_KD
Geo Mean Sol	5.2E-01	mg/L	WEAST
			LANGE

BIOACCUMULATION

Parameter	Value	Unit	Source
FOOD CHAIN			
Fresh BCF	8.0E-01		VER_BCF
Salt BCF.	4.7E+02		VER_BCF
ENVIRONMENTAL			
Fresh BCF	1.1E+02		VER_BCF
Salt BCF:	4.7E+02		VER_BCF
Log Kow			
Water Solub		mg/L	

CLASS INFORMATION

Class	Parent Substance
Toxicity	NA
GW Mob	NA
Other	NA

** This substance should be considered essentially non-volatile

Date 03/08/93 | SUPERFUND CHEMICAL DATA MATRIX | SCDM Version MAR93
Chemical Nickel | CAS Number: 007440-02-0

ASSIGNED FACTOR VALUES

AIR PATHWAY

Parameter	Value
Toxicity	10000
Gas Mobility	0.0000
Gas Migration	0

GROUND WATER PATHWAY

Parameter	Value
Toxicity	10000
Water Solub	5 2E-01
Distrib	1 5E+02

SOIL EXPOSURE PATHWAY

Parameter	Value
Toxicity*	10000

SURFACE WATER PATHWAY

Drinking Water

Parameter	Value
Toxicity	10000
Persistence	
River	1 0000
Lake	1 0000

Human Food Chain

Parameter	Value
Toxicity	10000
Persistence	
River	1 0000
Lake	1 0000
Bioaccumulation	
Fresh	0 5
Salt	500 0

Environmental

Parameter	Value
Fresh Tox	10
Salt Tox	1000
Persistence	
River	1 0000
Lake.	1 0000
Bioaccumulation	
Fresh	500.0
Salt	500.0

BENCHMARKS

AIR PATHWAY

Parameter	Value	Unit
NAAQS/NESHAPS		ug/m3
Cancer Risk		ug/m3
Reference Dose		mg/m3

GROUND WATER PATHWAY

Parameter	Value	Unit
MCL/MCLG	1 0E-01	mg/L
Cancer Risk		mg/L
Reference Dose	7 0E-01	mg/L

SOIL EXPOSURE PATHWAY

Parameter	Value	Unit
Cancer Risk		mg/kg
Reference Dose	1 2E+04	mg/kg

RADIONUCLIDE

Parameter	Value	Unit
MCL	1 0E-01	pCi/L
UMTRCA		pCi/kg
Cancer Risk:		
Air	2 8E+00	pCi/m3
DW	2.2E+02	pCi/L
FC.	8.0E+03	pCi/kg
Soil Ing:	4.1E+06	pCi/kg
Soil Gam:		pCi/kg

SURFACE WATER PATHWAY

Drinking Water

Parameter	Value	Unit
MCL/MCLG	1 0E-01	mg/L
Cancer Risk		mg/L
Reference Dose	7 0E-01	mg/L

Human Food Chain

Parameter	Value	Unit
FDAAL		ppm
Cancer Risk		mg/kg
Reference Dose.	2 6E+01	mg/kg

Environmental

Parameter	Value	Unit
ACUTE		
Fresh AWQC:	1 4E+03	ug/L
Salt AWQC.	7 5E+01	ug/L
Fresh AALAC.		ug/L
Salt AALAC.		ug/L
CHRONIC		
Fresh AWQC:	1 6E+02	ug/L
Salt AWQC.	8 3E+00	
Fresh AALAC:		ug/L
Salt AALAC		ug/L

LATIR PEAK AND WHEELER PEAK WILDERNESSES

CARSON NATIONAL FOREST

NEW MEXICO

1990

Scale 1:63,360

1 1/2 0 1 2miles

MAP LEGEND

- Forest Service Land
- Pueblo de Taos Indian Reservation
- Other Land
- Cañon del Rio Grande Wild River
- Cañon del Rio Grande Recreation Area
- National Forest Boundary
- National Forest Administrative Boundary
- Wilderness Boundary
- Wilderness Study Area Boundary
- County Boundary
- Primary Highway
- Secondary Highway
- Improved Dirt or Gravel Road
- Unimproved Dirt Road
- Trail
- U.S. Highway
- State Highway
- Forest Service Road
- Forest Service Trail
- Ranger District Office
- Forest Service Recreation Site
- Other Recreation Site
- Suggested Campsites
- Mine
- Locked Gate
- Fenceline
- Powerline
- Perennial Stream
- Intermittent Stream
- Spring

CONTOUR INTERVAL = 80 FEET

105°45'

36°52'30"

105°37'30"

105°30'

36°45'

36°37'30"

4-mile radius

3-mile radius

2-mile radius

1-mile radius

1/2 mile radius

Rael Well

Fagerquist Well

Probable Point of Entry-final (PPE 2)

Probable Point of Entry-initial (PPE 1)

Probable Point of Entry-groundwater (PPEg)

PRIVATE LAND
Permit Required For Use
Inquire at Rio Costilla Coop
Livestock Assn. (at Costilla, NM)

LATIR PEAK WILDERNESS

WHEELER PEAK WILDERNESS

CARSON NATIONAL FOREST

N

- Well Nearest to Tailings Ponds/Mine Waste
- Community Supply Wells

Community Supply Wells	Number of Connections	Persons Served
1. Adjacent to Questa Offices	10	30
2. Cerro de Oro	10	30
3. Questa Community System	560	1644
4. Eagle Lake Trailer Park	10	30
5. Cerro	144	396

Reference 3. Site Map with 4-mile Radii and Drinking Water Wells

Photo 1. Mine Waste Dumps (foreground) and hydrothermal Scar at head of Goathill Gulch. View to south. Photo by Stuart Kent.

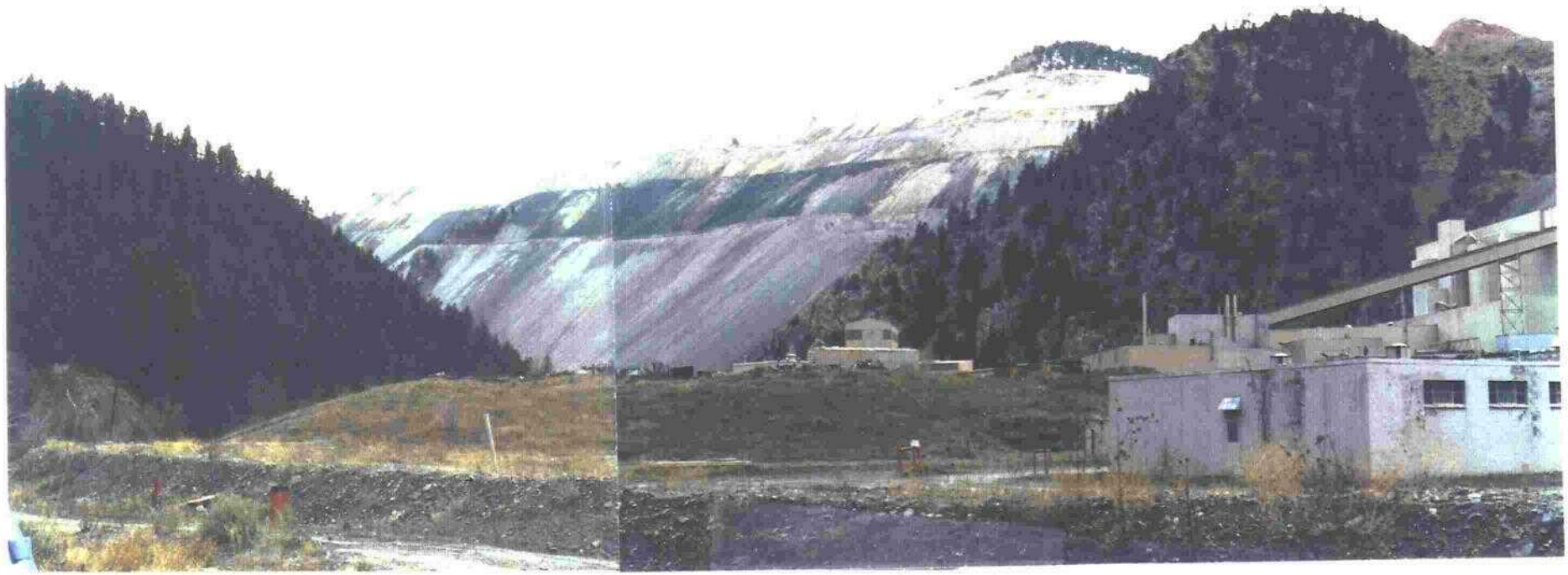


Photo 2. Molycorp Mill Area and Mine Waste Dumps in Sulphur Gulch
View to west. Photo by James MacDonald.

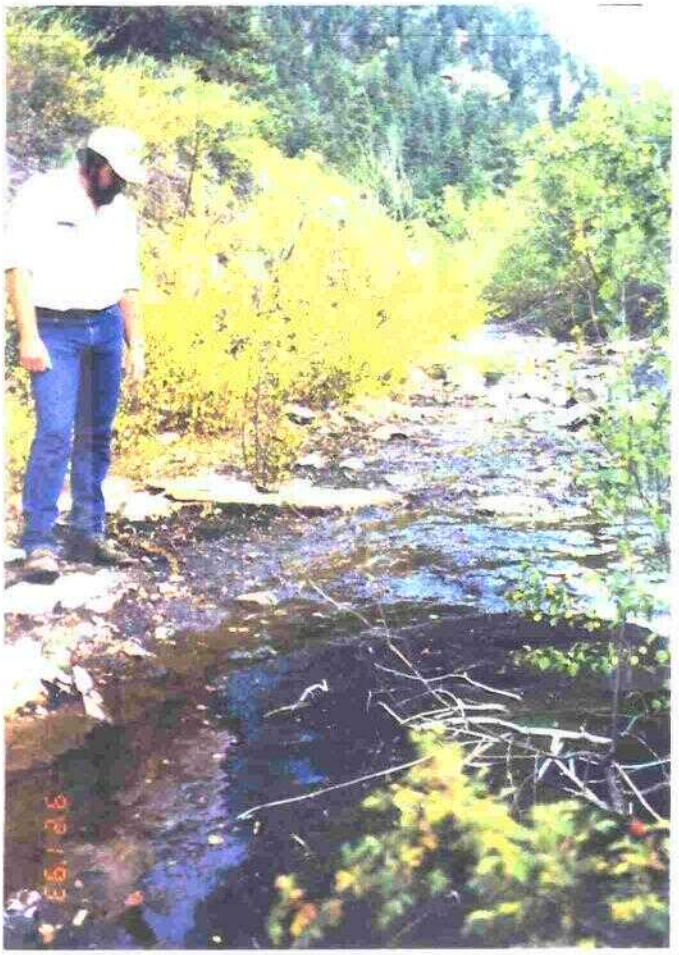


Photo 3. Seep at mouth of Capulin Canyon along old Channel of Red River. Bob Saltar, NMED-Surface Water Quality Bureau pictured. View to east. Photo by Stuart Kent.

Photo 4. Capping of Tailings Ponds with Soil. (Notice airborne soil; tailings not airborne.) View to southwest. Photo by Stuart Kent.

Photo 5. Hydrothermal Scar area (with snow) at head of Hanson Creek.
View to northeast. Photo by Stuart Kent.

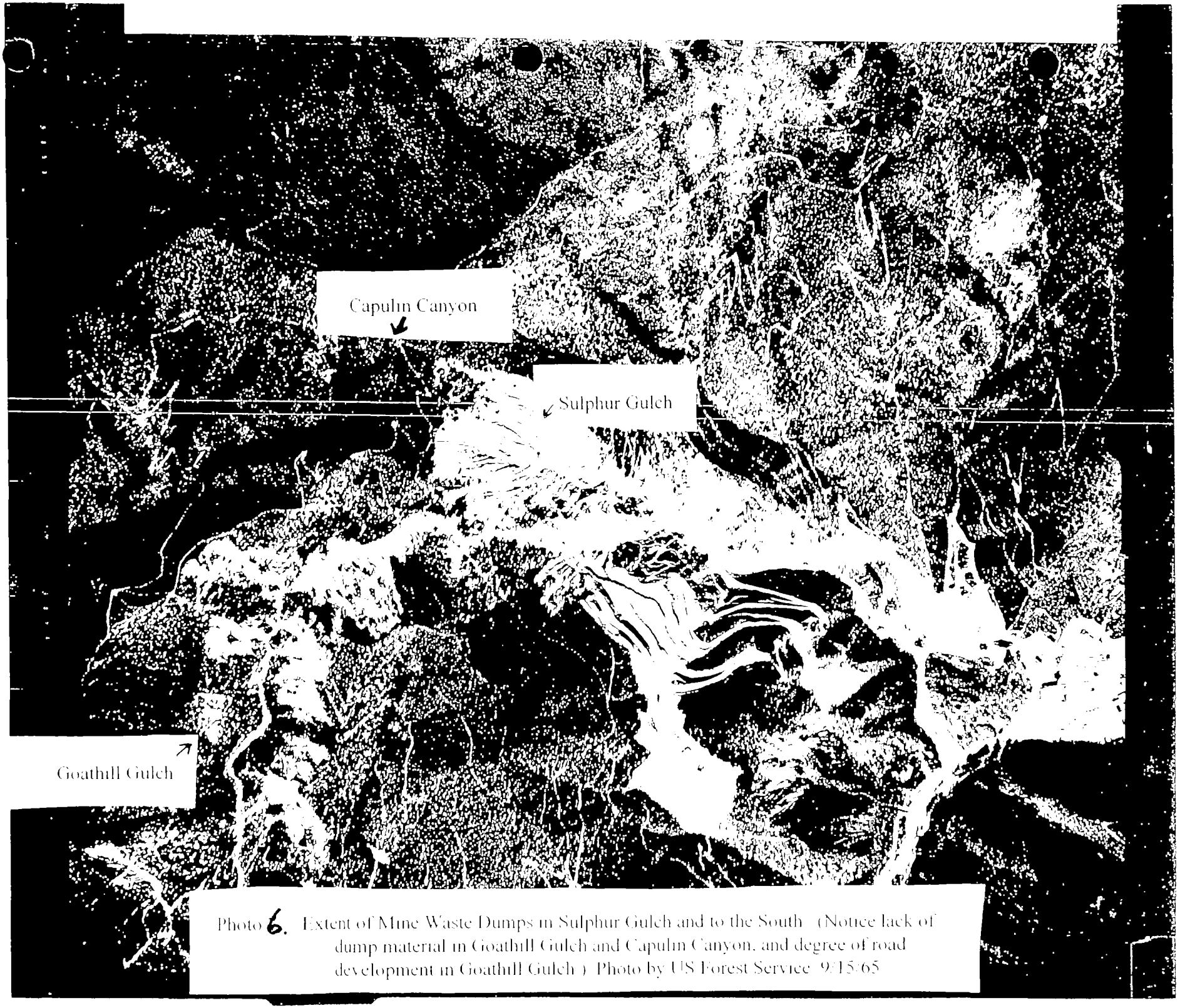
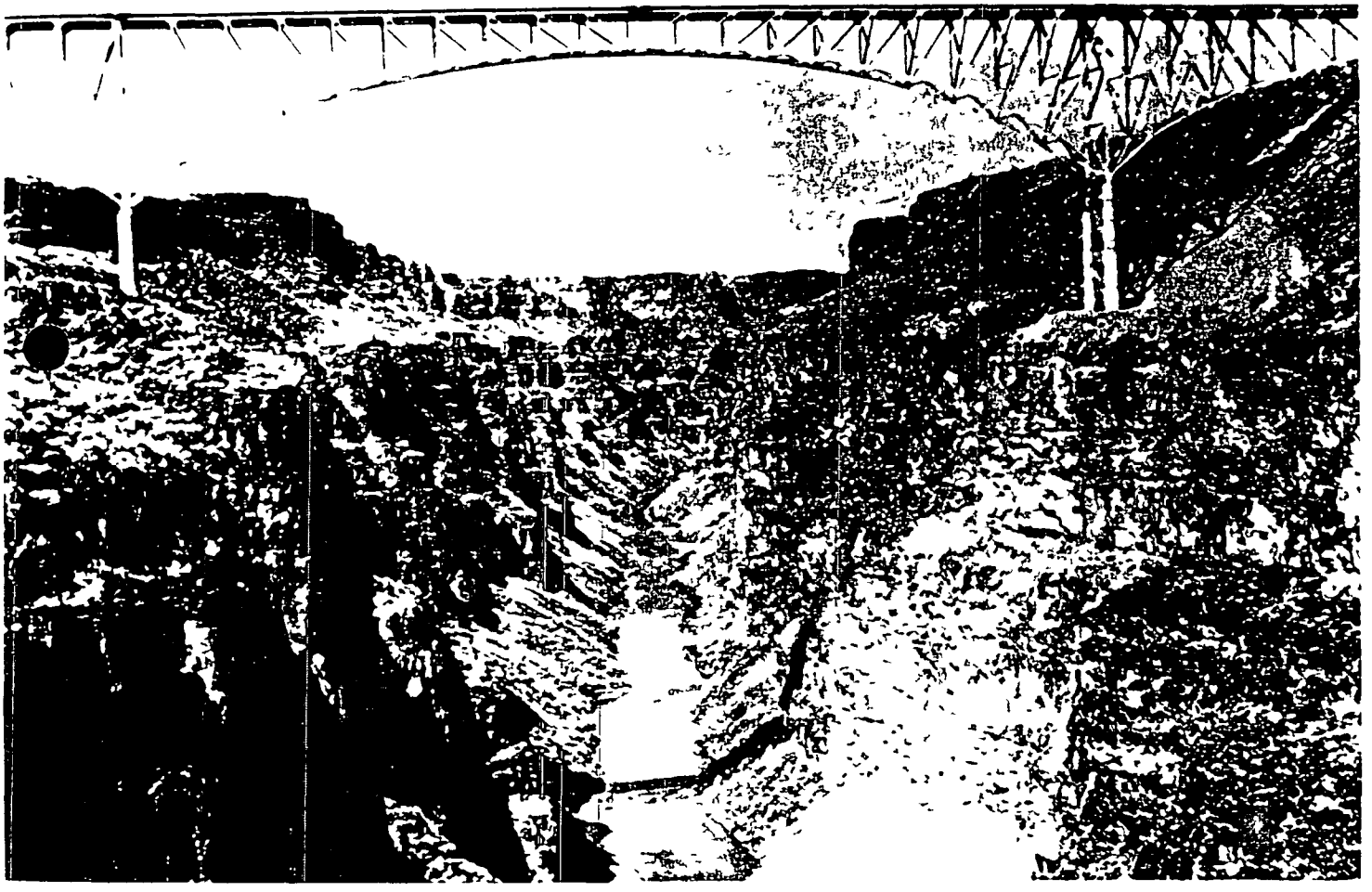


Photo 6. Extent of Mine Waste Dumps in Sulphur Gulch and to the South. (Notice lack of dump material in Goathill Gulch and Capulin Canyon, and degree of road development in Goathill Gulch.) Photo by US Forest Service 9/15/65

6-21-81 USDA 24 613100 781-10

Photo 7 Extent of Mine Waste Dumps (Notice dump material at head of Goathill Gulch and Capulin Canyon and enhanced road development in Goathill Gulch) Photo by US Forest Service 6/21/81

Soil Survey of Taos County
and parts of
Rio Arriba and Mora Counties
New Mexico



United States Department of Agriculture
Soil Conservation Service and Forest Service and
United States Department of the Interior
Bureau of Indian Affairs and
Bureau of Land Management
in cooperation with the
New Mexico Agricultural Experiment Station

index to map units

AMF—Amalia Manzano association steep 13
ATC—Antonito Travelers association gent v sloping 14
CaB—Caruso silty clay loam 0 to 3 percent slopes 14
CHG—Chimayo Rock outcrop complex very steep 15
CRG—Cryoboralfs Rock outcrop association very steep 15
CSC—Cryoborolls 0 to 8 percent slopes 16
CTC—Cryoborolls Cryaquolls complex 0 to 8 percent slopes 16
CUB—Cumulic Haplaquolls nearly level 16
CYB—Cumulic Haploborolls nearly level 17
DeF—Derecho cobbly loam 15 to 40 percent slopes 17
DeG—Derecho Rock outcrop complex 40 to 80 percent slopes 17
DFG—Devisadero Rock outcrop complex very steep 18
DmF—Diamante extremely gravelly loam 15 to 40 percent slopes 18
EGG—Eutroboralfs Glossoboralfs Rock outcrop association very steep 18
FaC—Fernando cobbly loam 1 to 7 percent slopes 19
FbC—Fernando silt loam 0 to 7 percent slopes 19
FcB—Fernando clay loam 1 to 3 percent slopes 20
FeC—Fernando clay loam 3 to 5 percent slopes 20
FfC—Fernando clay loam 5 to 7 percent slopes 21
FHB—Fernando Hernandez association nearly level 21
FLB—Fluvents nearly level 22
HaB—Hernandez gravelly loam 0 to 5 percent slopes 22
HKC—Hernandez Kim association gently sloping 22
HPC—Hernandez Petaca association gently sloping 23
HSC—Hernandez Silva association gently sloping 24
JaD—Jaroso Angostura complex 5 to 15 percent slopes 24
JaF—Jaroso Angostura Mascarenas complex 15 to 40 percent slopes 24
JaG—Jaroso-Angostura Mascarenas complex 40 to 80 percent slopes 25
JRG—Jaroso Angostura Rock outcrop complex very steep 26
LaE—Lama loam 0 to 20 percent slopes 26
LoB—Loveland clay loam 0 to 3 percent slopes 27
LtC—Luhon Travelers complex 3 to 7 percent slopes 27
MaF—Maes cobbly loam 15 to 40 percent slopes 28
MeD—Maes Etoe complex 0 to 15 percent slopes 28
MeF—Maes Etoe complex 15 to 40 percent slopes 28
MeG—Maes Etoe complex very steep 29
MFG—Maes Etoe Rock outcrop complex very steep 29
MNC—Manzano clay loam 0 to 5 percent slopes 30
MnA—Manzano clay loam 0 to 1 percent slopes 30
MnB—Manzano clay loam 1 to 3 percent slopes 31
MnC—Manzano clay loam 3 to 5 percent slopes 31
MrD—Marosa cobbly sandy loam 0 to 15 percent slopes 32
MrF—Marosa cobbly sandy loam 15 to 40 percent slopes 32
MrG—Marosa cobbly sandy loam 40 to 80 percent slopes 32
MSG—Marosa Rock outcrop complex very steep 33
MSG2—Marosa Rock outcrop complex very steep eroded 33
MTE—Marosa Nambe association moderately steep 33
MUG—Mirabal Rock outcrop association very steep 34
MwD—Mirand cobbly loam 0 to 15 percent slopes 34
MxD—Montecito loam 1 to 15 percent slopes 34
MxE—Montecito Rock outcrop complex moderately steep 35
NaD—Nambe cobbly loam 0 to 15 percent slopes 35
NaF—Nambe cobbly loam 15 to 40 percent slopes 36
NaF2—Nambe cobbly loam 15 to 40 percent slopes eroded 36
NaG—Nambe cobbly loam 40 to 80 percent slopes 36
NaG2—Nambe cobbly loam 40 to 80 percent slopes eroded 36
NRG—Nambe Rock outcrop complex very steep 37
NRG2—Nambe Rock outcrop complex very steep eroded 37
OeF—Orejas stony loam 15 to 40 percent slopes 37
OMD—Orejas Montecito association strongly sloping 38
ORG—Orthents Badland association very steep 38
OSG—Orthents Calciorthids association very steep 39
OTG—Orthents Rock outcrop association very steep 39
PAG—Paleboralfs Cryochrepts Rock outcrop association very steep 39
PbD—Penitente gravelly loam 5 to 15 percent slopes 41
PbF—Penitente gravelly loam 15 to 40 percent slopes 41
PeD—Petaca very stony loam 1 to 15 percent slopes 41
PfC—Petaca Prieta complex 1 to 8 percent slopes 42
PGC—Petaca Silva association gently sloping 43
PoB—Poganeab silty clay loam nearly level 43
PrD—Presa cobbly loam 0 to 15 percent slopes 44
PrF—Presa cobbly loam 15 to 40 percent slopes 44
PrG—Presa cobbly loam 40 to 80 percent slopes 45
PSG—Presa Rock outcrop complex very steep 45
PYF—Presa Cryaquolls association steep 45
RaC—Raton very stony silt loam 3 to 8 percent slopes 46
RBE—Raton Stunner association moderately steep 46
RcG—Rock outcrop very steep 47
RdG—Rock outcrop Badland complex very steep 47
RPG—Rock outcrop Penitente complex very steep 47
RRE—Rock outcrop Raton complex moderately steep 47
RUG—Rock outcrop Ustorthents complex very steep 48
RvC—Royosa loamy sand 1 to 8 percent slopes 48
RWL—Royosa Orthents association moderately steep 48
RYD—Royosa Vibo association moderately sloping 49
SaG—Sabe Mirand complex 15 to 80 percent slopes 49
SbD—Sedillo cobbly loam 3 to 12 percent slopes 50
SDD—Sedillo Orthents association strongly sloping 50
SED—Sedillo Silva association strongly sloping 50
SgC—Servilleta Prieta complex 1 to 5 percent slopes 51
ShB—Shawa clay loam 0 to 3 percent slopes 52
SmB—Silva loam 0 to 2 percent slopes 52
SmD—Silva loam 2 to 10 percent slopes 52
SSC—Silva Sedillo association gently sloping 53
StC—Stunner cobbly loam 1 to 5 percent slopes 54
SUC—Stunner Luhon association gently sloping 54
SVC—Stunner Travelers association gently sloping 55
TeB—Tenorio loam 0 to 3 percent slopes 55
TeC—Tenorio loam 1 to 5 percent slopes 56
TrF—Trampas cobbly sandy loam 15 to 40 percent slopes 56
TsE—Trampas cobbly loam 15 to 30 percent slopes 56
TTF—Trampas Diamante association steep 57
TVC—Travelers very stony loam 1 to 8 percent slopes 57
UTG—Ustorthents Trampas complex very steep 58
VbD—Vibo sandy loam 3 to 10 percent slopes 58
WEF—Wellsville Lss association moderately steep 58

summary of tables

Temperature and precipitation (table 1) 111

Acreage and proportionate extent of the soils (table 2) 115
Taos County Rio Arriba County Mora County Total—Area Extent

Yields per acre of irrigated crops and pasture (table 3) 117
Alfalfa hay Grass hay Barley Oats Wheat Pasture

Woodland management and productivity (table 4) 118
Management concerns Potential productivity Trees to plant

Woodland understory vegetation (table 5) 123
Total production Characteristic vegetation Composition

Recreational development (table 6) 132
Camp areas Picnic areas Playgrounds Paths and trails

Wildlife habitat (table 7) 141
Potential for habitat elements Potential as habitat for—Openland wildlife Woodland wildlife Wetland wildlife Rangeland wildlife

Building site development (table 8) 149
Shallow excavations Dwellings without basements Dwellings with basements Small commercial buildings Local roads and streets

Sanitary facilities (table 9) 158
Septic tank absorption fields Sewage lagoon areas Trench sanitary landfill Area sanitary landfill Daily cover for landfill

Construction materials (table 10) 168
Roadfill Sand Gravel Topsoil

Water management (table 11) 177
Pond reservoir areas Embankments dikes and levees Aquifer fed excavated ponds Drainage Irrigation Terraces and diversions

Engineering properties and classifications (table 12) 185
Depth Texture Classification—Unified AASHTO Fragments greater than 3 inches Percentage passing sieve—4 10 40 200 Liquid limit Plasticity index

Physical and chemical properties of the soils (table 13) 201
Depth Permeability Available water capacity Reaction Salinity Shrink swell potential Erosion factors Wind erodibility group

Soil and water features (table 14) 211
Hydrologic soil group Flooding High water table Bedrock Potential frost action Risk of corrosion

Engineering test data (table 15) 219
Depth Mechanical analysis Liquid limit Plasticity index

Classification of the soils (table 16) 220
Family or higher taxonomic class

[illegible]steep [illegible] and Rock outcrop [illegible] elevation [illegible] to 10,500 feet. The mean annual precipitation is [illegible] inches for Eutroboralfs and 30 inches for Glossoboralfs. The mean annual temperature is [illegible] degrees F for Eutroboralfs and 40 degrees F for Glossoboralfs soils. The frost-free season is [illegible] days. This association is about [illegible] percent Eutroboralfs [illegible] 80 percent slopes, [illegible] percent Glossoboralfs [illegible] to [illegible] percent slopes, and 20 percent Rock outcrop. Much of the Rock outcrop is scattered throughout the association as nearly vertical escarpments.

Included in mapping are areas of Eloe and [illegible] soils, which make up about [illegible] percent of this association.

Eutroboralfs are deep, well drained soils on mountain and canyon slopes. They formed in colluvium and residuum of sandstone and shale. The surface layer is cobbly loam or cobbly sandy loam. The subsoil is very cobbly clay loam or very cobbly clay. The substratum is clony silty clay to a depth of 60 inches or more.

Permeability is very slow to moderately slow. The effective rooting depth is 60 inches or more. The available water capacity is moderate. Runoff is medium and the hazard of water erosion is high.

Glossoboralfs are deep, well drained soils on mountain and canyon slopes. They formed in colluvium and residuum of sandstone and shale. The surface layer is cobbly loam or cobbly sandy loam. The subsoil is very cobbly sandy clay or very cobbly clay that extends to a depth of 60 inches or more.

Permeability is very slow to moderately slow. The effective rooting depth is more than 60 inches. The available water capacity is moderate. Runoff is moderate and the hazard of water erosion is high.

Rock outcrop consists of interbedded shale and sandstone and in some areas limestone.

The dominant vegetation on the Eutroboralfs is ponderosa pine and some scattered Gambel oak. The understory consists mainly of kinnikinnick, [illegible] bluegrass, and mountain muhly.

The dominant vegetation on the Glossoboralfs is Douglas-fir and ponderosa pine, and there are scattered white fir, limber pine, and Gambel oak. The understory consists mainly of Kentucky bluegrass, prairie [illegible] bluegrass, mountain brome, and kinnikinnick.

These soils are mainly used for wildlife habitat. The very steep slopes, high erosion hazard, and rock outcrops preclude most other uses. The potential is low for the production of ponderosa pine, Douglas-fir, white fir, and aspen.

This association has medium potential for use as habitat for woodland wildlife.

FaC—Fernando cobbly loam, 1 to 7 percent slopes. This is a deep, well drained, nearly level to moderately sloping soil on alluvial fans at the base of mountains and cones. It formed in mixed alluvium. Slopes are smooth and convex. The areas are [illegible] to [illegible] acres. The elevation is 6,500 to 7,500 feet. The mean annual precipitation is 12 inches, and the mean annual temperature is 49 degrees F. The frost-free season is 125 to 135 days.

Included in mapping are Fernando loam, which makes up about [illegible] percent of the map unit; Hernandez soils, which makes up 15 percent, and Rock outcrop, which makes up 5 percent.

Typically, the surface layer is brown cobbly loam about [illegible] inches thick. The subsoil is brown and light brown loam and clay loam about 20 inches thick. The substratum is light brown loam to a depth of 60 inches or more. Cobbles and gravel cover 15 to 35 percent of the surface.

Permeability is moderately slow. The effective rooting depth is 60 inches or more. The available water capacity is high. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of wind erosion is slight.

This soil is suitable for use as native grazing land for domestic livestock. Proper grazing use improves the plant cover, results in the accumulation of residue, and helps prevent erosion.

A management system that provides definite periods of deferment and grazing use results in a balanced plant community of vigorous and productive forage plants such as western wheatgrass, blue grama, and bottlebrush squirreltail.

When in excellent condition, the vegetation on this soil is western wheatgrass, big sagebrush, galleta, blue grama, and bottlebrush squirreltail. If the condition of the plant community deteriorates, the proportion of desirable forage plants and the plant cover decrease. These plants are replaced by shrubby plants such as rubber rabbitbrush and big sagebrush, and pinyon pine and Rocky Mountain juniper invade the plant community. This deterioration generally results in accelerated wind and water erosion.

The use of machinery in areas of this soil is restricted because of the cobbly surface layer. Constructing earthen ponds, installing pipelines, and managing brush, however, are feasible.

This soil has medium potential for use as habitat for rangeland wildlife.

FbC—Fernando silt loam, 0 to 7 percent slopes. This is a deep, well drained, level to moderately sloping soil on alluvial fans. It formed in mixed alluvium. The areas mainly are rounded and range from 200 to 1,000 acres in size. The elevation is 6,500 to 7,500 feet. The mean annual precipitation is 12 inches, and the average annual temperature is 49 degrees F. The frost-free season is 125 to 135 days.

Included with this soil in mapping are Petaca, Prieta, Servilleta, and Sedillo soils and Orthents, each making up about 5 percent of the map unit.

Typically, the surface layer is light brown silt loam about 2 inches thick. The subsoil is about 34 inches

es thick The substratum to a depth of 60 inches or e consists of mixed cobbles gravel, and stones and a small amount of sandy clay loam

Permeability is moderate The available water capacity is low Runoff is medium, and the hazard of water erosion is moderate

The dominant vegetation is Douglas-fir and Engelmann spruce and some scattered white fir, subalpine fir and aspen The understory is mainly Kentucky bluegrass kinnikinnick grouse whortleberry, Arizona fescue and mountain brome

This soil is used mainly for timber production and for wildlife habitat It has medium potential for the production of Douglas-fir, Engelmann spruce white fir and aspen Conventional methods cannot be used to harvest trees The steep to very steep slopes severely restrict the mobility of most equipment Soil disturbance and erosion should be kept to a minimum during harvest Managing this soil to favor aspen increases timber production and improves the habitat for wildlife

MSG—Marosa-Rock outcrop complex, very steep This complex consists of small areas of Marosa very cobbly sandy loam and Rock outcrop that are so intermingled that they could not be mapped separately at the scale selected The areas are on mountain slopes at an elevation of 9 000 to 11 000 feet Most areas are associated with rhyolite rock The mean annual ecipitation is 35 inches and the mean annual mperature is 40 degrees F The frost-free season is less than 60 days This complex is about 50 percent Marosa very cobbly sandy loam and 30 percent Rock outcrop

Included in mapping are areas of Nambe soils which make up about 20 percent of this complex

The Marosa soil is deep and well drained It formed in colluvium and residuum of acid igneous rock Typically, the surface layer is light brownish gray very cobbly sandy loam about 3 inches thick The subsurface layer is white and very pale brown very gravelly loamy sand about 31 inches thick The subsoil is light yellowish brown very cobbly sandy clay loam about 10 inches thick The substratum to a depth of 60 inches or more consists of mixed cobbles, gravel, and stones, and a small amount of sandy clay loam

Permeability is moderate The available water capacity is low Runoff is medium, and the hazard of water erosion is high

The dominant vegetation is Douglas-fir and Engelmann spruce and some scattered white fir, subalpine fir and aspen The understory is mainly Kentucky bluegrass kinnikinnick grouse whortleberry, Arizona fescue and mountain brome

The Marosa soil is used mainly for timber production and for wildlife habitat It has medium potential for the production of Douglas-fir Engelmann spruce white fir nd aspen Conventional methods cannot be used to harvest trees The very steep slopes the high erosion hazard, and the rock outcrops preclude most uses Managing the Marosa soil to favor aspen increases timber production and improves the habitat for wildlife

This complex has low potential for the development of habitat for openland and woodland wildlife

MSG2—Marosa-Rock outcrop complex, very steep, eroded This complex consists of small areas of Marosa very cobbly sandy loam and Rock outcrop that are so intermingled that they could not be mapped separately at the scale selected The areas are on mountain slopes at an elevation of 9,000 to 11,000 feet. Most areas are associated with rhyolite rock The mean annual precipitation is 35 inches, and the mean annual temperature is 40 degrees F The frost-free season is less than 60 days This complex is about 50 percent eroded Marosa soils and 30 percent Rock outcrop

Included in mapping are areas of Nambe soils, which make up about 20 percent of this complex

The Marosa soil is deep and well drained It formed in colluvium and residuum of acid igneous rock Typically, the surface layer is about 12 inches thick It is light brownish gray very cobbly sandy loam over white and very pale brown very gravelly loamy sand The subsoil is light yellowish brown very cobbly sandy clay loam about 10 inches thick The substratum to a depth of 60 inches or more consists of mixed cobbles, gravel, and stones, and a small amount of sandy clay loam The surface layer ranges from 6 to 25 inches in thickness depending on the degree of erosion

Permeability is moderate The available water capacity is low Runoff is rapid, and the hazard of water erosion is very high

The dominant vegetation is aspen and some scattered Douglas-fir, Engelmann spruce, white fir, and subalpine fir The understory is mainly kinnikinnick, grouse whortleberry, Arizona fescue, and mountain brome

The Marosa soil is used mainly for timber production and for wildlife habitat It has low potential for the production of Douglas-fir, Engelmann spruce, white fir and aspen Conventional methods cannot be used to harvest trees Managing the Marosa soil to favor aspen increases timber production and improves the habitat for wildlife

This complex has low potential for use as habitat for openland and woodland wildlife

MTE—Marosa-Nambe association, moderately steep This association consists of moderately steep soils on north-facing mountain side slopes in the northern part of the survey area The elevation is 9 000 to 11,000 feet The mean annual precipitation is 35 inches, and the mean annual temperature is 40 degrees F The frost-free season is less than 60 days This association is about 45 percent Marosa gravelly sandy loam and 30 percent Nambe gravelly sandy loam The Marosa soil is at the lower elevations, and the Nambe soil is at the higher elevations

A management system is needed in which the seasons of grazing and resting of pasture vary in successive years This system results in a balanced plant community of vigorous and productive forage plants such as bottlebrush squirreltail western wheatgrass, blue grama and winterfat If the condition of the plant community deteriorates, the desirable forage plants decrease in number and are replaced by broom snakeweed, rubber rabbitbrush, and big sagebrush This deterioration generally results in accelerated soil erosion Fences, access roads, and stock trails are needed for livestock distribution

The Raton soil has medium potential for use as habitat for woodland and rangeland wildlife, and the Stunner soil has medium potential for use as habitat for rangeland wildlife

The Raton soil has medium potential for the production of wood crops for firewood and fenceposts

RcG—Rock outcrop, very steep This miscellaneous area is mainly along the sides of the Rio Grande Gorge It consists mainly of escarpments of basalt that have some layers of terrace sediment Slopes are very steep The elevation is 6,000 to 7,000 feet The mean annual precipitation is 12 inches, and the mean annual temperature is 48 degrees F The frost-free season is 120 to 130 days

Local relief is 50 to 600 feet Runoff is very rapid and the erosion hazard is slight This miscellaneous area is used for wildlife habitat It has low potential for this use

RdG—Rock outcrop-Badland complex, very steep This complex consists of Rock outcrop and Badland in small areas that are so intermingled that they could not be mapped separately at the scale selected Rock outcrop and Badland are on steep to very steep mountain slopes Badland formed through hydrothermal activity This complex is almost bare of vegetation

There are three distinct climatic regimes The first climatic regime is at an elevation of 8,000 to 9,000 feet The mean annual precipitation is 16 inches A few oneseed junipers and pinyon pines are scattered along the edge of this area

The second climatic regime is at an elevation of 8 000 to 10,500 feet The mean annual precipitation is 25 inches A few Douglas-firs, white firs, and ponderosa pines are scattered along the edge of this area

The third climatic regime is at an elevation of 9,000 to 11,000 feet The mean annual precipitation is 30 inches A few Douglas-firs Engelmann spruces, and subalpine firs are scattered along the edge of this area

The sediment generated from this complex needs to be stabilized and contained However, the extremely acid soil material and the unstable nature of Badland severely restrict the establishment of vegetation for stabilization The amount of sediment generated increases with an increase in precipitation

This complex has low potential for most uses

High erosion + runoff

RPG—Rock outcrop-Penitente complex, very steep This complex is about 60 percent Rock outcrop and 30 percent Penitente cobbly loam The Penitente soil is in widely scattered pockets surrounded by areas of Rock outcrop The mean annual precipitation is 35 inches, and the mean annual temperature is 30 degrees F The elevation is 12,000 to 13,000 feet

Included in mapping and making up about 10 percent of this map unit are Nambe and Presa soils and soils that are similar to the Penitente soil but are shallow to bedrock These make up about 10 percent of the complex

Rock outcrop consists mainly of acid igneous or metamorphic rock Slopes are steep to very steep

The Penitente soil is deep and well drained It formed in colluvium and residuum of acid igneous or metamorphic rock Typically, the surface layer is dark brown cobbly loam about 10 inches thick The subsoil is brown very cobbly sandy loam about 14 inches thick The substratum is brown very cobbly loam to a depth of 60 inches or more

Permeability is moderately rapid The effective rooting depth is 60 inches or more The available water capacity is low Runoff is medium, and the hazard of water erosion is severe

The dominant vegetation is sheep fescue, Thurber fescue, clovers, kobresia, and dwarf goldenrod

The Penitente soil is used for wildlife habitat The very steep slopes and precipitous rock outcrops preclude most other uses

This complex has medium potential for use as habitat for woodland and rangeland wildlife

RRE—Rock outcrop-Raton complex, moderately steep This complex consists of areas of Rock outcrop and Raton very stony silt loam that are so intermingled that they could not be mapped separately at the scale selected The Raton soil is strongly sloping to moderately steep Rock outcrop is steep to very steep The elevation is 8,000 to 9 000 feet The mean annual precipitation is 15 inches, and the mean annual temperature is 41 degrees F The frost-free season is 90 to 110 days Rock outcrop makes up about 45 percent of this complex, and the Raton soil makes up about 40 percent

Included in mapping are Orthents and Stunner soils, which make up about 15 percent of this complex

Rock outcrop consists of folded, broken, and exposed basalt flows Runoff is rapid, and the erosion hazard is slight

The Raton soil is shallow and well drained It formed in residuum of basalt and in mixed eolian sediment Typically, the surface layer is dark brown very stony silt loam about 4 inches thick The subsoil is dark brown very stony clay about 14 inches thick Basalt bedrock is at a depth of 18 inches

The Raton soil is slowly permeable The effective rooting depth is 10 to 20 inches The available water

capacity is very low Runoff is rapid The hazard of water erosion is moderate, and the wind erosion hazard is slight

The Raton soil is suitable for use as woodland and for grazing use for domestic livestock and wildlife It produces pinyon pine, Rocky Mountain juniper, oneseed juniper, and understory vegetation consisting of mountain muhly, muttongrass, Arizona fescue, and western wheatgrass Proper grazing of the understory vegetation maintains the woodland, improves the plant cover, results in the accumulation of plant residue and helps prevent soil erosion

A management system is needed that provides periods of resting from grazing so that the key management plants can complete their growth cycle The result will be a balanced plant community of productive forage that helps to maintain the woodland

Access roads and trails are needed for livestock distribution The use of machinery for other purposes is not feasible because of the shallow, stony soil and the many rock outcrops

This complex has medium potential for use as habitat for rangeland wildlife and for the production of wood crops for firewood and fenceposts

RUG—Rock outcrop-Ustorthents complex, very steep This complex consists of small areas of Rock outcrop and Ustorthents that are so intermingled that they could not be mapped separately at the scale selected The areas are on mountain slopes at an elevation of 8,000 to 10,000 feet The mean annual precipitation is 20 inches, and the mean annual temperature is 42 degrees F The frost-free season is 60 to 80 days Rock outcrop makes up about 50 percent of this complex, and Ustorthents make up about 30 percent

Included in mapping are areas of Mirabal and Marosa soils which make up about 20 percent of this complex

Rock outcrop consists of igneous and metamorphic rock, including granite, gneiss schist, and rhyolite

Ustorthents are deep and well drained They consist of gravelly loam, very gravelly loam or very gravelly clay loam to a depth of 60 inches or more The content of rock fragments ranges from 25 to 60 percent

Permeability is moderate to moderately rapid The effective rooting depth is 60 inches or more The available water capacity is very low Runoff is rapid, and the hazard of water erosion is severe

The dominant vegetation is Douglas-fir and ponderosa pine The understory is mainly Gambel oak mountain brome, and kinnikinnick

This complex is used for wildlife habitat It has medium potential for the development of habitat for woodland wildlife

RvC—Royosa loamy sand, 1 to 8 percent slopes This is a deep, somewhat excessively drained, gently undulating to gently rolling soil It formed in eolian material on old dunes Slopes are complex The elevation is 6,800 to 7,200 feet The mean annual precipitation is 13 inches, and the mean annual temperature is 43 degrees F The frost-free season is 130 to 140 days

Included with this soil in mapping are areas of Vibo Petaca, and Manzano soils Also included are a few small areas of barren sand dunes Included in the Ojo Caliente area are some small areas of stratified sand and some areas that have a flood hazard The soils th are included in mapping make up about 20 percent of this map unit, but the areas of these soils generally ar less than 5 acres in size

Typically, the surface layer is brown loamy sand abc 8 inches thick The underlying material is brown loamy sand to a depth of 60 inches or more

Permeability is very rapid The available water capac is low The effective rooting depth is 60 inches or mor Runoff is very slow The hazard of water erosion is slight and the wind erosion hazard is high

This soil is suitable for use as woodland and for grazing by domestic livestock and by wildlife It produc pinyon pine, oneseed juniper, and understory vegetatic consisting of blue grama and Indian ricegrass In the C Caliente area, some small areas of this soil are used f farming

Proper grazing of the understory vegetation improve the plant cover, results in the accumulation of plant residue, and helps prevent soil erosion

A management system is needed that provides periods of resting from grazing so that the key management plants can complete their growth cycle The result will be a balanced plant community of productive forage that helps to maintain the woodland

Installing pipelines and constructing fences to facilita grazing management are feasible

This soil has medium potential for use as habitat for openland and rangeland wildlife

RWE—Royosa-Orthents association, moderately steep. This association consists of moderately sloping moderately steep, eroded soils along mesa and canyo breaks and on highly dissected hills The elevation is 6,500 to 7,100 feet The mean annual precipitation is inches, and the mean annual temperature is 50 degree F The frost-free season is 125 to 135 days The Royo soil makes up about 55 percent of this association, an Orthents make up about 30 percent

Included in mapping are areas of Montecito and Silv soils which make up about 15 percent of this association

The Royosa soil is deep and somewhat excessively drained It formed in eolian material Typically, the original surface layer has been lost through erosion T exposed underlying material is brown loamy sand to a depth of more than 60 inches

Permeability is very rapid The effective rooting dept is 60 inches or more The available water capacity is l

The dominant vegetation is ponderosa pine. The understory is mainly Gambel oak, mountain mahogany, and mountain muhly.

These soils are used mainly for timber and for wildlife habitat.

The Sabe soil has low potential for the production of ponderosa pine, and the Mirand soil has medium potential. On slopes of more than 40 percent conventional methods cannot be used to harvest trees. The low available water capacity of the Sabe soil restricts seedling survival and reduces the production of ponderosa pine.

This complex has medium potential for use as habitat for woodland wildlife.

SbD—Sedillo cobbly loam, 3 to 12 percent slopes. This is a deep, well drained, gently sloping to strongly sloping soil. It formed in gravelly alluvium on alluvial fans along the western front of the Sangre de Cristo Mountains. Slopes are smooth and convex. The elevation is 7,000 to 8,000 feet. The mean annual precipitation is 12 inches, and the mean annual temperature is 49 degrees F. The frost free season is 125 to 135 days. Drainage from this soil contributes to the Rio Grande watershed.

Included in mapping are Tenorio soils, which make up about 15 percent of this unit, and Fernando soils, which make up [illegible] percent.

Typically, the surface layer is brown cobbly loam about [illegible]0 inches thick. The subsoil is brown very cobbly loam about [illegible]5 inches thick. The substratum to a depth of 60 inches or more is pink and brown very cobbly sandy loam.

Permeability is moderately slow. The effective rooting depth is 60 inches or more. The available water capacity is low to moderate. Runoff is medium. The hazards of water and wind erosion are slight.

This soil is suited to use as native grazing land for domestic livestock and wildlife. Proper grazing use improves the plant cover, results in the accumulation of residue, and helps prevent soil erosion.

A resource management system is needed that can control the brush species, allow variation in seasons of use, and provide for resting the forage species in successive years. The result will be a balanced plant community of vigorous and productive forage plants such as western wheatgrass, Indian ricegrass, and blue grama. If the condition of the plant community deteriorates, the desirable forage plants decrease in number and are replaced by big sagebrush, rabbitbrush, and broom snakeweed. This deterioration generally results in accelerated soil erosion.

Practices to facilitate range management are restricted because of the cobbles.

This soil has medium potential for the development of wildlife habitat.

SDD—Sedillo-Orthents association, strongly sloping. This association consists of soils on the sides of major drains. Sedillo gravelly loam that has slopes of [illegible] to 15 percent makes up about 45 percent of the association. It is on narrow ridgetops and on the upper part of the slopes of narrow, extremely dissected ridges. Orthents that have slopes of 30 to 45 percent make up about 35 percent of the association. These soils are in extremely dissected areas. The elevation is [illegible] to [illegible],000 feet. The mean annual precipitation is [illegible] inches. The mean annual temperature is 49 degrees F, and the frost free season is 125 to 135 days.

Included in mapping are Silva, Manzano, Fernando, and Hernandez soils, each making up about 5 percent of the association.

The Sedillo soil is deep and well drained. It formed in gravelly alluvium. Typically, the surface layer is brown gravelly loam about 3 inches thick. The subsoil is reddish brown and brown very gravelly clay loam about 8 inches thick. The substratum is pink and brown very gravelly sandy loam to a depth of 60 inches or more. The soil below a depth of 11 inches is slightly calcareous to strongly calcareous.

The Sedillo soil is moderately slowly permeable. The effective rooting depth is 60 inches or more. The available water capacity is low to moderate. Runoff is medium to rapid, and the hazard of water erosion is moderate. The hazard of wind erosion is slight.

Orthents are deep, gravelly, and well drained. Typically, they have a very gravelly loam surface layer. The underlying material is very gravelly clay loam.

Permeability is moderate to moderately rapid. The effective rooting depth is 60 inches or more. The available water capacity is low. Runoff is rapid, and the hazard of water erosion is high. The hazard of wind erosion is slight.

This association is suited to use as native grazing land for domestic livestock and for wildlife. Proper grazing use improves the plant cover, results in the accumulation of residue, and helps prevent soil erosion.

A resource management system is needed that can control the brush species, allow variation in seasons of use, and provide for resting the forage species in successive years. The result will be a balanced plant community of vigorous and productive forage plants such as western wheatgrass, blue grama, galleta, and Indian ricegrass. If the condition of the plant community deteriorates, the desirable forage plants decrease in number and are replaced by ring muhly, broom snakeweed, and big sagebrush. This deterioration generally results in accelerated soil erosion.

In managing range, brush management, range seeding, constructing fences and livestock and wildlife trails, and installing pipelines are feasible.

These soils have medium potential for the development of habitat for rangeland wildlife.

SED—Sedillo-Silva association, strongly sloping. This association consists of soils on uplands that are mainly east of the Rio Grande. The elevation is 6,500 to

500 feet. The mean annual precipitation is ... inches and the mean annual temperature is 47 degrees F. The frost free season is 125 to 135 days. Segillo very gravelly loam makes up about 55 percent of this association and Silva loam makes up about 25 percent. The strongly sloping Segillo soil is on side slopes of narrow ridges. The nearly level to gently sloping Silva soil is on narrow ridge crests and on the adjacent breaks and upper slopes.

Included in mapping are Orthents and Manzano, Fernando, and Hernandez soils, each making up to 5 percent of the association.

The Segillo soil is deep and well drained. It formed in gravelly alluvium. Typically, the surface layer is brown very gravelly loam about 3 inches thick. The subsoil is reddish brown and brown very gravelly clay loam about ... inches thick. The substratum is light brown and brown very gravelly sandy loam to a depth of 60 inches or more. The soil in the upper 11 inches is noncalcareous to slightly calcareous, and it is strongly calcareous below that.

The Segillo soil is moderately slowly permeable in the subsoil and moderately rapidly permeable in the substratum. The effective rooting depth is 60 inches or more. The available water capacity is low to moderate. Runoff is rapid, and the hazard of water erosion is moderate. The hazard of wind erosion is slight.

The Silva soil is deep and well drained. It formed in mixed alluvium and eolian sediment. Typically, the surface layer is brown loam about 3 inches thick. The subsoil is reddish brown clay loam about 26 inches thick. The substratum is pinkish white clay loam to a depth of 60 inches or more.

The Silva soil is slowly permeable. The effective rooting depth is 60 inches or more. The available water capacity is high. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of wind erosion is slight.

These soils are suited to use as native grazing land for domestic livestock and for wildlife.

Proper grazing use improves the plant cover, results in the accumulation of residue, and helps prevent erosion. A resource management system is needed that can control brush species, allow variation in seasons of use, and provide for resting the forage species in successive years. The result will be a balanced plant community of vigorous and productive forage plants such as western wheatgrass, blue grama, and galleta. If the condition of the plant community deteriorates, the desirable forage plants decrease in number and are replaced by big sagebrush, broom snakeweed, threeawn, and cacti. This deterioration generally results in accelerated soil erosion.

Range seeding and constructing trails to facilitate range management are feasible. Care should be taken in using machinery in the areas of more sloping soils.

This association has medium potential for the development of habitat for rangeland wildlife.

SgC—Servilleta-Prieta complex, 1 to 5 percent slopes. This complex consists of small areas of Servilleta and Prieta soils that are so intermingled that they could not be separated in mapping at the scale selected. These soils are nearly level and gently sloping and are shallow and moderately deep. They are on basalt flows. The elevation is 7,000 to 8,000 feet. The mean annual precipitation is ... inches. The mean annual temperature is ... degrees F. The frost-free season is 125 to 145 days. Servilleta silty clay loam makes up about 50 percent of the complex, and Prieta stony silty clay loam makes up about 30 percent. The Servilleta soil is in the more nearly level areas and on the more gentle slopes. The Prieta soil is in the more sloping areas and on ridge crests.

Included in mapping and making up about 10 percent of the complex are areas of Petaca soils near ridgetops and basalt outcrops. Also included are Hernandez, Fernando, and Manzano soils and areas of basalt outcrops, each making up about 5 percent of this complex.

The Servilleta soil is moderately deep and well drained. It formed in material that weathered from basalt and in eolian material. Typically, the surface layer is brown silty clay loam about 3 inches thick. The subsoil is reddish brown and light brown silty clay loam about 22 inches thick. The substratum is light brown silty clay loam about 9 inches thick. Fractured caliche-coated basalt bedrock is at a depth of about 34 inches. The soil is moderately calcareous to strongly calcareous below a depth of ... inches.

The Servilleta soil is slowly permeable. The effective rooting depth is 20 to 40 inches. The available water capacity is mainly moderate. Runoff is medium to slow. The hazard of water erosion is moderate, and the hazard of wind erosion is slight.

The Prieta soil is shallow and well drained. It formed in residuum in mixed eolian sediment. Typically, the surface layer is brown stony silty clay loam about 2 inches thick. The subsoil is brown and light brown stony silty clay loam about 8 inches thick. The substratum is pink very stony silty clay loam about 4 inches thick. Fractured caliche coated basalt bedrock is at a depth of about 14 inches. The soil material is noncalcareous in the surface layer and grades to strongly calcareous in the substratum.

The Prieta soil is slowly permeable. The effective rooting depth is 10 to 20 inches. The available water capacity is very low. Runoff is medium. The hazard of water erosion is moderate, and the wind erosion hazard is slight.

These soils are suited to use as native grazing land for domestic livestock and for wildlife. Proper grazing use improves the plant cover, results in the accumulation of plant residue, and helps prevent soil erosion.

A management system is needed in which the seasons of grazing and resting of pasture vary in successive years. This system results in a balanced

plant community of vigorous and productive forage plants such as western wheatgrass and blue grama If the condition of the plant community deteriorates the desirable plants decrease in number and are replaced by big sagebrush broom snakeweed and cacti This deterioration generally results in accelerated soil erosion

In managing range installing pipelines constructing fences brush management, and range seeding are feasible on the Servilleta soil The use of machinery, except in constructing trails, is not feasible on the Prieta soil

This complex has medium potential for he development of habitat for rangeland wildlife

ShB—Shawa clay loam, 0 to 3 percent slopes This is a deep well drained level and nearly level soil It formed in alluvium on playa bottoms along the Rio de los Pinos Slopes are smooth and concave The elevation is 7,500 to 8 500 feet The mean annual precipitation is 11 inches and the mean annual temperature is 43 degrees F The frost-free season is 80 to 110 days

Included with this soil in mapping are Lumon and Stunner soils, each making up about 5 percent of the map unit

Typically the upper part of the surface layer is dark grayish brown clay loam and very dark grayish brown silty clay loam about 16 inches thick and the lower part is dark brown clay loam about 14 inches thick The underlying material is brown, light brown and pink clay loam to a depth of 60 inches or more

Permeability is moderate The effective rooting depth is 60 inches or more The available water capacity is high Runoff is very slow and the hazard of water erosion is slight

This soil is suited to irrigated hay and pasture to use as native grazing land and to the development of wildlife habitat It provides forage for domestic livestock and wildlife Proper grazing use improves the plant cover results in the accumulation of residue and helps prevent erosion

A management system is needed in which the seasons of grazing and resting of pasture vary in successive years This system results in a balanced plant community of vigorous and productive forage plants such as western wheatgrass blue grama and fourwing saltbush If the condition of the plant community deteriorates the desirable forage plants decrease in number and are replaced by rubber rabbitbrush annual grasses and forbs and cacti This deterioration generally results in accelerated soil erosion

In managing range, constructing earthen ponds and fences seeding, controlling noxious plants and installing pipelines are feasible

This soil is used for irrigated hay and pasture It has high potential for these uses Management concerns include the planting of adapted species fertilization, and timely harvesting

This soil can produce high quality range plants to support habitat for the pronghorn antelope and other rangeland wildlife

SmB—Silva loam, 0 to 2 percent slopes This is a deep well drained level to nearly level soil It formed in mixed alluvium and eolian sediment on upland fans and ridges throughout the survey area Slopes are smooth and convex The elevation is 6 500 to 7 500 feet The mean annual precipitation is 12 inches and the mean annual temperature is 49 degrees F The frost-free season is 125 to 135 days

Included with this soil in mapping are Fernando and Sedillo soils, which make up about 10 percent of this map unit

Typically, the surface layer is brown loam about 5 inches thick The subsoil is brown clay loam about 25 inches thick The substratum is pink clay loam to a depth of 60 inches or more

Permeability is slow The effective rooting depth is 60 inches or more The available water capacity is high Runoff is slow The hazard of water erosion is slight and the hazard of wind erosion is moderate

The major limitations to growing cultivated crops are the short growing season and cool nights which limit the choice of crops and reduce crop yields This soil is suitable for alfalfa small grains, and cool-season grasses Potatoes and vegetables that are adapted to the short growing season and cool nights also can be grown

Growing mainly grasses or legumes or other high residue-producing crops helps to prevent water and wind erosion to maintain soil tilth Fertilization and improved water-management practices help to maintain or increase yields Generally, all crops except legumes respond to nitrogen and all legumes respond to phosphate fertilizer Border furrow corrugation and sprinkler irrigation systems are suitable Rotation grazing increases the yield and quality of pasture Timely harvesting improves the quality of crops

This soil has medium potential for most urban uses Low strength and the high shrink-swell potential and slow permeability in the subsoil are limitations The shrinking and swelling and the low strength can be overcome by good design and careful installation The slow permeability which is a limitation to the use of this soil for septic tank absorption fields can be overcome by increasing the size of the absorption area or by modifying the filter field

If this soil is irrigated, it can produce grains grasses legumes, and shrubs that provide a good habitat for ring-necked pheasant cottontail rabbit, and other farmland wildlife

SmD—Silva loam, 2 to 10 percent slopes This is a deep well drained nearly level to strongly sloping soil It formed in mixed alluvium and eolian sediment on upland fans The elevation is 6,500 to 7,500 feet The mean

Reference 8

12E

PGC

FHB

30

29

28

27

26

25

RRE

FHB

SmB

FfC

MnC

FaC

Guadalupe Mountain

31

33

34

35

36

OMD

Tower

Canon

FHB

RRE

SED

(Joins sheet 50)

5

6

4

RIO

MxE

PGC

RRE

RcG

3

2

1

RED

RIVER

Red River Fish Hatchery

TdC

SED

7

9

10

11

12

RcG

OMD

MxD

UfG

CARSON

NATIONAL

(Joins sheet 50)

Meters

Scale 1:24000

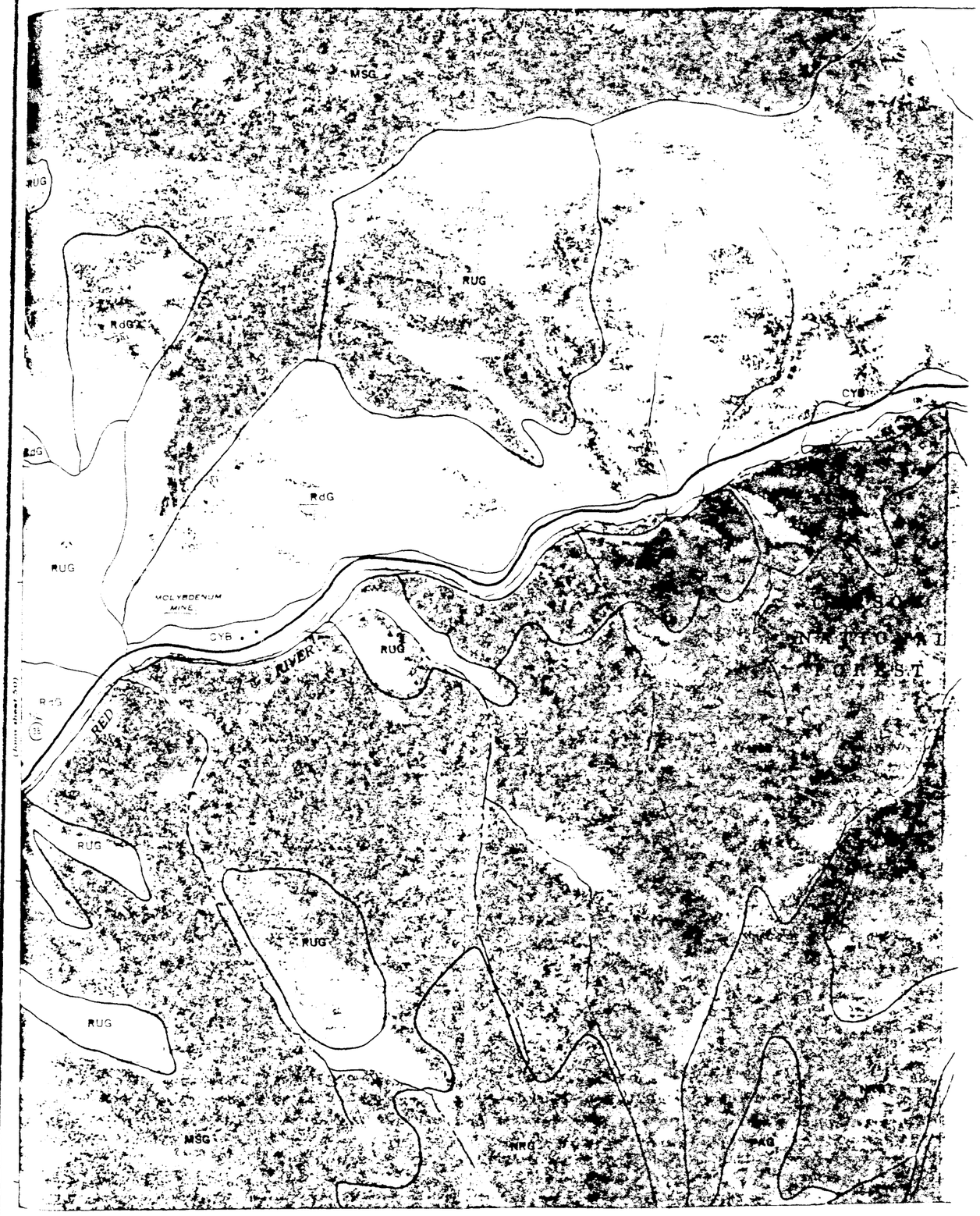
SED
FeC
FfC
SmB
FeB
LoB
AMF
RdG
RUG
PAG
MSG
25
30
29
SED
FeC
TeB
FfC
SmB
FfC
CaB
32
TeC
MnC
SmB
SED
SmB
36
31
32
MnB
CaB
SED
Questa
FeC
TeB
LoB
TeB
TeC
RED
TeB
SED
FaC
6
5
OTG
MSG
RUG
28
32
Eagle
Rock
Canyon
CARSON
NATIONAL
FOREST
CYB
RIVER
RUG
MSG
12
7
LaE
OTG
RUG
Canyon
PAG
BOUNDARY
FOREST
CUB
RIVER
Miles
Feet
5000
0
1000
2000
3000
4000
5000
Scale 1:24000
Placer C
MSG
RUG
MSG
RUG
Goose
Scale 1:24000
4000
3000
2000
1000
0
5000
Feet
Miles
MSG

Scale 1:24000

Scale 1:24000

Joins sheet 501

PAG
PAC
MSG
RUG
Eagle
Rock
RdG
NATIONAL
FOREST
RIVER
CYB
(Joins sheet 51)


MSG
RUG
RdG
CYB
MOLYBDENUM
MINE
RED
RIVER
NATIONAL
FOREST
NRG
PAG

Water Availability & Water Quality

Taos County, New Mexico

Phase A Report: Basic Data on
Geography, Climate, Geology, Surface Water
Ground Water, Water Rights, Water Use,
Water Supply and Water Quality

by

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13 September 1978

Table of Contents

Section		Page
	EXECUTIVE SUMMARY	
I	INTRODUCTION	I-1
II	GEOGRAPHY	II-1
III	CLIMATE	III-1
	Air Masses	III-1
	Topography	III-1
	Data Sources	III-2
	Temperature	III-2
	Precipitation	III-3
	Evaporation and Consumptive Use	III-5
	Other Climatic Aspects	III-6
IV	GEOLOGY	IV-1
	Age and Distribution of Rock	IV-1
	Structural Evolution	IV-2
	Resources and Hazards	IV-3
V	SURFACE WATER	V-1
	Gaging Station Records	V-2
	Average Flows	V-3
	Time Trends	V-4
	Seasonal Patterns	V-5
	Drought and Flood Flows	V-6
	Runoff Forecasting	V-7
	Storage and Diversion Projects	V-8
	Summary	V-10
VI	GROUND WATER	VI-1
	Some Principles of the Occurrence of Ground Water	VI-1
	Data Sources	VI-3
	Well Records	VI-4
	Well Numbering System	VI-5
	Area Summaries	VI-5
	Penasco	VI-7
	Pilar-Ojo Caliente Area	VI-8
	Taos Area	VI-9
	Valdez Area	VI-14
	Mountains	VI-16
	Tres Piedras	VI-17
	Sunshine Valley	VI-20

TABLE OF CONTENTS
(Continued)

Section		Page
VII	WATER USE AND WATER RIGHTS	VII-1
	Existing Water Use	VII-1
	Future Water Use	VII-1
	Irrigation Water Use Budget	VII-2
	Water Rights Laws and Regulations Affecting Irrigation and Other Transfers	VII-3
	State Water Policy	VII-3
	Detailed Information on Irrigation Water Use and Water Rights	VII-9
	Domestic Water Use	VII-11
	Community Water Organizations - Laws and Regulations	VII-11
	Community Water Rights	VII-13
	Inventory of Community Water Systems	VII-14
	Other Water Use and Water Rights	VII-15
VIII	WATER QUALITY	VIII-1
	Regulations and Standards	VIII-1
	The Impact of Water Quality Regulations	VIII-3
	Pollution Sources	VIII-3
	Data	VIII-6
	Existing Water Quality	VIII-6
	Molycorp and the Red River	VIII-8
	Water Quality of the Rio Grande	VIII-9
IX	REFERENCES CITED	IX-1

LIST OF TABLES

Table 1	Statistical and Related Information, Taos County, New Mexico	I-3
Table 2	Natural Units of Taos County	II-2
Table 3	Taos County, Other States, and Mean Precipitation and Temperature Data	III-7
Table 4	Temperature - Taos County	III-8
Table 5	Mean Monthly and Annual Precipitation, Taos County	III-9
Table 6	Mean Monthly and Annual Snowfall, Taos County	III-10
Table 7	Miscellaneous Information on Precipitation Regimes in Red River and Taos Ski	III-11

ST[illegible]
Continued

		Page
Table 7b	Miscellaneous Information [illegible] Regimes [illegible] Taos, N.M.	III-11
Table 8	Storm Rainfall Estimates, Taos County	III-12
Table 9	Consumptive Water Use and Irrigation Requirement for Major Crops, Taos County, N.M.	III-13
Table 10	Prevailing Wind Directions for Stations in Taos County, N.M.	III-14
Table 11	Generalized Description of Rock Units in Taos County	IV-5
Table 12	Drainage Features of Taos County	[illegible]-11
Table 13	Gaging Station Records, Taos County, "Minor Stations"	V-12
Table 14	Gaging Station Records, Taos County, "Major Stations"	V-13
Table 15	Selected Low and High Flow Records, Taos County, New Mexico	V-15
Table 16	Stream Gaging Stations Used in Regional Flood Frequency Analysis	V-16
Table 17	Penasco Area: Summary of Well Records on File at SEO, Santa Fe	VI-24
Table 18	Selected Stratigraphic Logs for Selected Wells in the Penasco Area, Taos County, New Mexico	VI-25
Table 19	Summary of Well Observations in Penasco Area Made During 1977 Field Study	VI-26
Table 20	Data on Mutual Domestic Wells in the Penasco Area	VI-27
Table 21	Pilar-Ojo Caliente area: Summary of Well Records on File at SEO, Santa Fe	VI-28
Table 22	Selected Stratigraphic Logs for Selected Wells in the Pilar-Ojo Caliente Area, Taos County, New Mexico	VI-30

LIST OF TABLES
(Continued)

		Page
Table 23	Summary of Well Observations in Pilar-Ojo Caliente Area Made During 1977 Field Study	VI-3[illegible]
Table 24	Taos area: Summary of Well Records on File at SEO, Santa Fe	VI-32
Table 25	Selected Stratigraphic Logs for Selected Wells in the Taos Area, Taos County, New Mexico	VI-39
Table 26	Summary of Well Observations in Taos Area Made During 1977 Field Study	VI-41
Table 27	Valdez Area: Summary of Well Records on File at SEO, Santa Fe	VI-42
Table 28	Selected Stratigraphic Logs for Selected Wells in the Valdez Area, Taos County, New Mexico	VI-47
Table 29	Summary of Well Observations in Valdez Area Made During 1977 Field Study	VI-49
Table 30	Two Logs for Well [illegible] (DH-1P-[illegible])	VI-50
Table 31	Mountain Area: Summary of Well Records on File at SEO, Santa Fe	VI-51
Table 32	Selected Stratigraphic Logs for Selected Wells in the Mountain Area, Taos County, New Mexico	VI-53
Table 33	Summary of Well Observations in the Mountain Area Made During 1977 Field Study	VI-54
Table 34	Tres Piedras Area: Summary of Well Records on File at SEO, Santa Fe	VI-55
Table 35	Selected Stratigraphic Logs for Selected Wells in the Tres Piedras Area, Taos County, New Mexico	VI-56
Table 36	Summary of Well Observations in Tres Piedras Area Made During 1977 Field Study	VI-58
Table 37	Sunshine Valley Area: Summary of Records on File at SEO, Santa Fe	VI-59
Table 38	Selected Stratigraphic Logs for Selected Wells in the Sunshine Valley Area, Taos County, New Mexico	VI-66

LIST OF TABLES
(Continued)

		Page
Table 39	Summary of Well Observations in Sunshine Valley Area Made During 1977 Field Study	VI-68
Table 40	Water Use in Taos County 1975	VII-17
Table 41	A Possible Water Use Budget for Taos County in the Next 50-100 Years	VII-18
Table 42	Typical Water Use Budget for Irrigation Near Cerro	VII-19
Table 43	Summary of Irrigation Water Use and Water Rights Survey, Taos County	VII-20
Table 44	Irrigation Water Use and Water Rights Survey, Taos County	VII-23
Table 45	Urban Water Budget	VII-45
Table 46	Conservation Budget	VII-46
Table 47	Taos County Water Rights - Non-Agricultural	VII-47
Table 48	Water Use Survey Taos County New Mexico	VII-49
Table 49	Information on Community Water Systems in Taos County	VII-51
Table 50	Withdrawal Rates and Total Dissolved Solids (ppm) for Selected Locations in Taos County	VII-53
Table 51a	Published Comments Regarding Water Supply or Sanitation Needs of Communities in Taos County which Do Not Now Have a Community System	VII-54
Table 51b	Private Water Systems in Taos County Serving the General Public Based on LFD Records	VII-54
Table 52	Stream Standards Which Apply in Taos County	VIII-11
Table 53	Major Requirements of the Interim Primary Drinking Water Regulations	VIII-12
Table 54	Ground Water Quality Standards of the New Mexico Water Quality Control Commission	VIII-13
Table 55	Standards for Point Source Discharges in Taos County	VIII-14

LIST OF TABLES
(Continued)

		Page
Table 56	STORET Records for the Rio Grande near Lobatos Colorado Red River at Fish Hatchery near Questa and Rio Grande Below Taos Junction B	VIII-16
Table 57	STORET Records for U.S Forest Service Mountain Stations 1975-1976	VIII-19
Table 58	Result of LID Monitoring of Rio Fondo 1974-1975	VIII-20
Table 59	Results of Monitoring of Red River, Part A 1971-1972, Part B 1976-1977	VIII-26
Table 60	Miscellaneous Data on Surface Water Quality in Taos County	VIII-27
Table 61	Water Quality of Public Water Systems	VIII-29
Table 62	Data for Taos and Cerro Units of San Juan-Chama Project	VIII-65
Table 63	Chemical Analyses of Ground Water in the Sunshine Valley Area Taos County New Mexico and Costilla County Colorado	VIII-68
Table 64a	Miscellaneous Data on Ground Water Quality in Taos County	VIII-69
Table 64b	Spring Records and Auger Holes in Taos County	VIII-70

LIST OF FIGURES

		Page
Figure 1	Location Map	I-3
Figure 2	Natural Units Map	II-3
Figure 3	Normal Annual Precipitation	III-15
Figure 4	Rainfall Dispersion Diagram of Monthly Rain from Taos County Weather Stations	III-16

LIST OF FIGURES
(Continued)

		Page
Figure 5a	Average Annual Precipitation, Taos County, N.M., 1910-1974	III-17
Figure 5b	Moving Ten Year Average of Precipitation, Taos County, N.M.	III-18
Figure 6.	Average Annual Precipitation vs Elevation, Taos County, N.M.	III-19
Figure 7	Gross Annual Lake Evaporation	III-20
Figure 8	Monthly Distribution of Average Annual Lake Evaporation, North Central New Mexico	III-21
Figure 9	Geology	IV-7
Figure 10a	Generalized Geologic Structure	IV-8
Figure 10b	Schematic West-East Geologic Cross-Section Through Central Taos County	IV-9
Figure 11	Surface Drainage Features	V-17
Figure 12	Gaging Stations	V-18
Figure 13	Average Annual Water Yield, in Inches	V-19
Figure 14	Surface Hydrology of Taos County	V-20
Figure 15	Long-Term Precipitation and Runoff at Arroyo Hondo	V-21
Figure 16	Seasonal Flow Patterns in Taos County Rio Hondo (Near Valdez), Rio Grande Del Rancho (Near Talpa)	V-22
Figure 17	Sample Form for Well Permit Information	VI-69
Figure 18	Taos County Water Resources Study - Well/Spring Schedule	VI-70
Figure 19	System of Numbering Wells in New Mexico	VI-71
Figure 20	Areas for Which Ground Water Data are Summarized	VI-72
Figure 21	Irrigation Water Use Water Rights, June, 1976	VII-55
Plate 1.	Geologic Map	wall map

Table 8 [illegible] storm rainfall estimates [illegible] County

These values are the maximum rainfalls expected [illegible] County over a typical period of time. Return period indicates the frequency [illegible] which a given storm rainfall is likely to occur. Column 1A gives the 6-hour duration rainfalls for [illegible]. For example, the 5-year storm (which will occur on the average [illegible] times [illegible] ntury) [illegible] with it [illegible] 25 inches of rain in six hours. Column 1B gives the range [illegible] rainfalls [illegible] the County with low values generally occurring in the southwest part [illegible] County [illegible] hills in the northeast corner. Column 2A = [illegible]-hour rainfalls [illegible] rainfalls. Countywide based on maps. SCS, 1967.

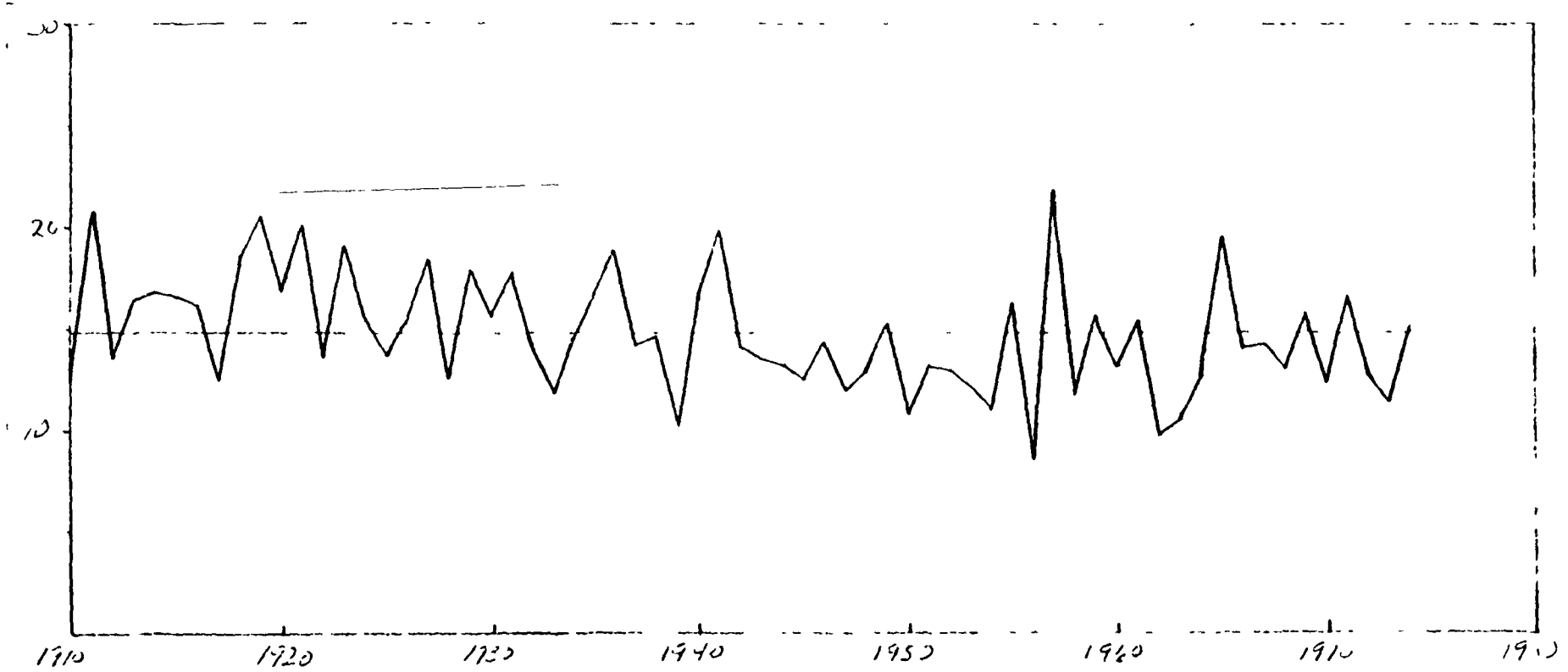
Duration	1B	1A	B	2A
Return Period				
[illegible] years	[illegible]85 - 1.8		[illegible] - [illegible]2	1.20
[illegible] years	[illegible]	[illegible]	[illegible]	1.62
10 years	[illegible] - [illegible]6	[illegible]	[illegible] 3.0	1.84
25 years	[illegible] - 3.0	[illegible]	[illegible]	[illegible]
[illegible]0 years	[illegible]	[illegible]	[illegible]	[illegible]
100 [illegible]ars	[illegible]		[illegible]	

Figure 5a

Average annual precipitation, Taos County*, N.M., 1910-1974

LEGEND. ⩘ average annual precipitation

——— mean precipitation for the period (14.79")



* Average of Cerro, Red River, Taos, and Ires Piedras for entire period

cubic feet per second (c f s) - unit used to measure water flow (i e at a gaging station), equals the rate of flow in a channel with a one square-foot cross-section and velocity of one foot per second One c f s for a 24-hour period equals 86,400 cubic feet or 1 98 acre-feet Then 1 CFS/yr = 722 7 acre feet/yr

inch - a depth of runoff which produces a certain amount of water per unit of land area. For example, twelve inches of water on one acre equals one acre-foot

Average Flows Based on Figure 13 and on the data tables it is evident that almost all runoff in Taos County occurs in mountain streams. For most of the large upland basins the average flow is 3-10 inches/year, measured near the point where the stream enters the Piedmont area In the Piedmont proper runoff is normally 0 5-2 0 inches/year while in the Taos Plains it is less than 0 5 inches/year The following list indicates how much water would be produced from one square mile in each of the three natural units

Mountains	160-600 acre-feet/year
Piedmont	25-100 acre-feet/year
Plains	5- 25 acre-feet/year

The major factor controlling runoff is precipitation, which as discussed previously is closely related to elevation The following equation permits prediction of average runoff, if average basin elevation is known

$$Q = \text{Antilog} \left(\frac{0\ 72E}{1{,}000} - 6\ 19 \right)$$

where Q is runoff in inches/year, and E is elevation in feet. This equation does not apply if average elevation is above about 10,500 feet.

For the major streams gaged in Taos County, average elevation decreases markedly as basin area increases therefore discharge can also be predicted as a function of area, a value which is easier to measure than average elevation. The appropriate equation is

$$Q = 1{,}580A^{0\ 64}$$

where Q is runoff in acre-feet/year, and A is basin area in square miles. This applies only to mountain drainages, not lowland arroyos.

The effect of elevation is especially noticeable for the Rio Fernando de Taos. According to Bureau of Reclamation data (Bureau of Reclamation, 1971), above the gaging station this drainage has an average elevation of 9151 feet, and a unit discharge of 54 acre-feet per square mile The nearby Rio Grande del Rancho is approximately 264 feet higher in average elevation, and has nearly four times the water yield - 204 acre-feet per square mile

Much of the average flow of the Taos County streams is discharged to the Rio Grande either directly or after recharge to ground water and subsequent ground water inflow to the River At the point it enters Taos County the Rio Grande carries mostly return flow from irrigation in the San Luis Valley of southern Colorado This flow is approximately doubled by the time it leaves the County, through the addition of 250,000 - 300,000 acre-feet in a "typical" year, and

Miscellaneous Cont.

Number Assigned	Name and Location of Station	Period of Record	Footnotes
08-[illegible]	New Mexico Branch Cerro Canal near Arroyo Colorado (from Cerro Canal)	94[illegible]-Present	
*08-[illegible]	Cerro Canal at State Line near Arroyo Colorado	973-974	
08-[illegible]	Pinasquito Ditch at Costilla New Mexico (from Costilla Creek)	955-1961	
08-[illegible]	[illegible] Colorado (from Costilla Creek)	944-1959	
*08-[illegible]	[illegible] (from Costilla Creek)	4[illegible]-Present	[illegible]
08-[illegible]	[illegible] Ditch near Questa (from Cabresto Creek)	943-968	
	Acequia Madre at Taos New Mexico (from Rio Pueblo de Taos)	1940-941	C H
	Tenorio Ditch near Arroyo Seco New Mexico (from Rio Lucero)	935-1950	[illegible]
	[illegible] Ditch near Arroyo Seco New Mexico (from Rio Lucero)	934-1950	H
	[illegible]eco Ditch near Arroyo Seco New Mexico (from Rio Lucero)	934-1950	H
	Juan Manuel Ditch near Arroyo Seco New Mexico (from Rio Lucero)	935-950	H
	[illegible]rado Ditch near Arroyo Seco New Mexico (from Rio Lucero)	934-1950	H
	[illegible] Ditch near Penasco New Mexico	936-941	
08-2688	Tributary of Rio Grande near Arroyo Hondo New Mexico	1968-Present	[illegible]
*08-[illegible]	Tributary of Rio Grande at Rinconada New Mexico	1952-Present	[illegible]

Irrigation in Colorado

Table [illegible] Gaging Station Records Taos County Major Stations
Information obtained from U S Geological Survey

Number Assigned by U S G S	Name and Location of Station	Area (sq mi)	Period of Record (water year)	Average Flow Records (acre-feet/year)	CFS	1955-1974 (acre-feet/year)	1955-1974 (inches)	Footnotes
*25[illegible]	Rio Grande near Lobatos Co	760[a]	89-Present	[illegible]1 100		242 000	[illegible]6	A B C D E F
*[illegible]	Costilla Creek above Costilla Dam N M	[illegible]	937-Present	N/A		N/A	N/A	A D G
*2555	Costilla Creek near Costilla N M	195	936-Present	50 430		[illegible]6 750	[illegible]57	[illegible]
[illegible]	Latir Creek near Cerro N M	[illegible]	937-1970	4 820		N/A	N/A	
Above Red River [illegible]	Rio Grande near Cerro N M	5 500[a]	948-Present	[illegible]5 900	379	[illegible]8 800	[illegible]2	
2650	Red River near Questa N M	[illegible]	10-Present[b]	8 250	529	26 150	[illegible]3	C F
*2660	Cabresto Creek near Questa N M	56 [illegible]	943-Present	5 950		5 540	[illegible]4	[illegible]
*2670	Red River at Mouth near Questa N M	90	950-Present	56 220	77 8	54 770	[illegible] 40	[illegible]
*2675	Rio Hondo near La Lez N M	[illegible]	954-Present	[illegible]5 650		[illegible] 240	[illegible] 51	
*2685	Arroyo Hondo at Arroyo Hondo N M	[illegible]	910-Present[b]	[illegible]0 000		4 150	[illegible]	
*2690	Rio Pueblo de Taos near Taos N M	[illegible]	911-Present[b]	[illegible]0 850		N/A	N/A	
[illegible]710	Rio Lucero near Arroyo Seco N M	[illegible]	910-Present[b]	6 080		N/A	N/A	[illegible]
*[illegible]750	Rio Fernando de Taos near Taos N M	[illegible]	910-Present[b]	[illegible] 780		N/A	N/A	[illegible]
*[illegible]755	Rio Grande del Rancho near Talpa N M	[illegible]	952-Present[b]	14 [illegible]70		14 560	[illegible] 28	C
*[illegible]	Rio Chiquito near Talpa	[illegible]	[illegible]57-Present	5 550		N/A	N/A	
*[illegible]765	Rio Pueblo de Taos below Los Cordovas N M	[illegible]	957-Present	[illegible]4 920		N/A	N/A	C
Below 15-mile Target Dist Limit [illegible]765	Rio Grande below Taos Jct Bridge near Taos	[illegible]	925-Present	527 400	730	431 300	[illegible] 20	[illegible]
*[illegible]790	Embudo Creek at Dixon N M	[illegible]05	[illegible]-Present[b]	[illegible]7 090		N/A	N/A	C H
*[illegible]795	Rio Grande at Embudo N M	[illegible]460[a]	889-Present	[illegible]8 100		481 100	[illegible]2	C
*2890	Rio Dio Caliente at La Madera N M	[illegible]	952-Present	49 050		40 140	1 30	[illegible]

[a] area does not include [illegible] 40 square miles in a closed basin
[b] earlier records partial

Table 27 (continued)

LOCATION	OWNER OF RECORD RG PERMIT NUMBER AND YEAR COMPLETED	WELL DEPTH	WATER LEVELS	OTHER
27 12 Tr	John Davidson Ranchos de Taos RG27809 1976	D-75	25' 10/76	Y 1
27 13 13 000 (p)	Robert Peet RG26282 1972	D 57		
27 13 31 330	Lower Des Montes MDWCA RG16107		180' 1/68	Y 20 C
27 13 31 13	Frit Law ooc RG18190 1970	D 55	20' 11/70	
27 13 31 214	Frit Law ooc RG21163 1972	D 87	40' 7/72	C
27 13 32 Tr	Alejandro R Valdez Valdez RG9681 1961	D 76	26' [illegible]	
27 13 3[illegible] 12	Jose [illegible] ooc RG1[illegible] 1970	D 70	40 [illegible]	C
27 13 32 212	Joseph B Apodaca Valdez RG18052 1970	D 92	39' 10/70	
27 13 32 112	Charles R Pfeiffer Valdez RG18053 1970	D 55	20' 10/70	
27 13 32 212	Eva Martinez Valdez RG20535, 1972	D 95	45' 7/72	F
27 13 32 Tr	Peter Blake Arroyo Seco RG26143 1975	D 165	69' 10/75	Y [illegible]
27 13 33 Tr	Paul C Hunner ooc RG13539 1966	D 60	40'	
27 13 33 122	Mr & Mrs Cordon Wagner, ooc RG18051, 1970	D 100	70' 10/70	F

Table 27 (continued)

LOCATION	OWNER OF RECORD RG PERMIT NUMBER AND YEAR COMPLETED	WELL DEPTH	WATER LEVELS	OTHER
27 13 33 111	Tony P Valdez Valdez RG18120, 1970	D 81	27' 10/70	
27 13 3312	P Martinez* Taos Cerro Project DH Fil RG20046 1972	D=500	60 56' 3/72	S C
28 12 1 000	Manuel Ortega Questa RG123, 1956	D-65	43' 12/56	
28 12 1 100	Feliciano Rael Questa RG10696, 1965	D-175	84'	F
28 12 1 220	Felipe S Ortega Questa RG11021 1964	D 52	6' 8/64	U C
28 12 1 220	John W Cowart Questa RG17088 1969	D 115	40 11/69	C
28 12 1 420	Feliciano Vigil Questa RG17352 1970	D 200	40 [illegible]	F
28 12 2 422*	Louis B Ortiz[1] Questa RG10584 1964	D [illegible]	45' 6/64	C
28 12 2 422**	Louis B Ortiz Questa RG10585 1964	D-60	35' 6/64	C S
28 12 5 142	Alfredo Duran Questa RG13698, 1968	D-43	21' 4/66	C
28 12 24 111	Abran Ortega Questa RG149, 1957	D 300	Dry	
28 12 28 400	U S Forest Service Region #3, ooc RG22147, 1973	D 1183	887' 10/73	Y-2 (860 885) Y 1 (885 895) Y=15 (906-1008) Y 10 (1065-1183) F S

*Data obtained from special SEO file
**Location based on field check
[1]In addition, SEO files show two springs with water level at 7400'

These sections are immediately south of the with railing pads

able 37 (continued)

LOCATION	OWNER OF RECORD RG PERMIT NUMBER AND YEAR COMPLETED	WELL DEPTH	WATER LEVELS	OTHER
13 29	Telomeno Vigil Questa RC15727 1968	D 50	5' 6/68	
13 [illegible]	Agustin Rael Questa RC16937 1970	D 60	8' 9/70	
13 30 11		D 150	0'	
13 30 110	State Highway Dept Questa [illegible]	D-198	98' 10/61	F
13 [illegible] 333	Manuel D Ortega Questa [illegible]	D 5	10' /64	
13 [illegible]	[illegible] Board of Education [illegible]	D 210	[illegible] [illegible]	F C
13 30 110	Questa Baptist Mission Questa RC12 62 1965	D 00	[illegible] [illegible]	
13 30 1 11	Village of Questa RC10641 S	D 00	85' 7/64	Y [illegible] C U M
13 30 121	Robert C Bryant Questa RC10479 1969	D 50	165' 1/69	Y 30 U C C F
13 31 111	*	D 55	15'	
13 31 320	John H Yaple Questa RG1407 1960	D-103	80' 5/60	

ata obtained from special SEO file

Table 37 (continued)

LOCATION	OWNER OF RECORD RG PERMIT NUMBER AND YEAR COMPLETED	WELL DEPTH	WATER LEVELS	OTHER
29 13 31 323	*	D-180 200		
29 13 31 341	*	D-267	20'?	
29 13 31 343	*	D-35	33'	
29 13 31 410	*	D-35	16'	
29 13 31 411	Antonio J Trujillo Questa RC4781 1960	D=30	6' 6/60	
29 13 31 111	Selimo Rael Questa RC117 1957	D 136	95' 3/57	F
29 13 31 422	[illegible] J Valazquez Questa RC4781 1960	D-30	6' 6/60	
29 13 31 [illegible]33	Milaquias Rael Questa RC1070 1964	D 50	[illegible] [illegible] 64	C
29 13 31 422	Charles Gonzales Questa RC10722 1964	D 50	[illegible] [illegible] 64	
29 13 31 410	Eloisa V Cisneros Questa RG11271 1964	D-55	10' 6/64	
29 13 31 Tr	Carlos Martinez Cerro RC11552, 1964	D 50	8' 10/64	
29 13 31 400	Santiago Ortega Questa RG11156 1964	D=51	10' 6/64	U-C
29 13 31 Tr	Claudio Rael Questa RG13037 1966	D 62	35' 5/66	F

*Data obtained from special SEO file

Town of Questa located in 29.13.31

Table 4. Temperature - Taos County
(in °F.)

	Cerro			Red River				Taos			Tres Piedras		
	Mean Max	Mean Min	Mean	Mean Max	Mean Min	Mean	Mean Max	Mean Min	Mean	Mean Max	Mean Min	Mean
JANUARY	37	6	[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]	[illegible]	35	4	20
FEBRUARY	41	13	27	39	[illegible]	2	[illegible]	15	30	39	11	25
MARCH	49	20	35	53	13	29	53	21	37	46	19	32
APRIL	59	28	43	53	22	34	64	29	46	56	21	41
MAY	67	36	52	62	28	47	73	33	53	65	33	49
JUNE	78	44	61	73	36	54	84	44	64	76	41	58
JULY	81	49	65	76	40	58	87	49	68	79	47	63
AUGUST	80	48	64	75	40	57	85	50	67	78	46	62
SEPTEMBER	75	41	58	70	33	52	79	42	60	72	38	55
OCTOBER	64	30	47	59	25	42	67	32	49	61	28	45
NOVEMBER	50	19	35	46	12	29	54	18	35	48	17	32
DECEMBER	38	8	24	39	5	22	43	[illegible]	27	37	8	23
ANNUAL	60	29	45	56	22	39	64	30	47	58	26	42
RECORD HIGH		100(Jun)			94(Aug)			101(Jun,Jul)			93(Jul)	
RECORD LOW		-34(Jan)			-40(Jan)			-27(Feb)			-35(Feb)	
# DAYS MIN. LESS THAN 0		--			46			11			--	
PEOPLE HEATING DAYS (measure of need to heat a home)		7559			9530			6770			8280	

Min = minimum
Max = maximum

3 miles North of Questa, NM

Table 3. Mean monthly and annual precipitation, Taos County.
(all data in inches; summer = May-October; winter = November-April)

Station Period	Rio Caliente (1950-74)	Taos (1931-60)	Cerro (1931-60)	Penasco RS (1931-60)	Tres Piedras (1931-60)	Red River (1931-60)	Anchor Mine (1911-20)
January	0.59	0.92	0.64	1.04	0.85	1.07	1.91
February	0.34	0.72	0.60	1.02	0.86	1.10	2.53
March	0.54	0.79	0.58	1.20	0.76	1.35	3.27
April	0.47	0.92	0.97	1.14	0.85	1.60	3.91
May	0.70	1.20	1.34	1.37	1.11	1.80	2.75
June	0.52	0.76	0.87	0.99	0.69	1.24	1.97
July	1.48	1.34	1.20	1.98	1.93	2.56	5.78
August	1.98	1.27	1.92	2.10	2.32	3.07	3.84
September	1.00	1.21	1.33	1.34	1.36	1.49	2.14
October	1.11	1.13	1.19	1.12	1.05	1.47	2.30
November	0.59	0.71	0.61	0.87	0.59	0.98	1.44
December	0.48	0.62	0.61	0.82	0.80	0.93	2.32
Annual	9.70	12.09	12.46	15.19	13.17	18.66	34.16
Summer	6.79	7.35	8.45	9.10	9.46	11.63	18.78
% a Z	70	62	68	60	54	62	55
Winter	2.91	4.53	4.01	6.09	4.71	7.03	15.38
% a Z	30	38	32	40	36	38	45
Elevation	6,250'	6,945'	7,685'	7,900'	8,110'	8,676'	10,600'

3 miles North of Questa, NM

CATALOG
OF
INFORMATION
ON
WATER DATA

U S Department of the Interior
Geological Survey
Office of Water Data Coordination

Edition 1972

CONTENTS

	Page
Introduction	1
Station listings	2
Station-location maps	3
How to obtain additional information	3
Future procedures	4
Acknowledgments	4
PART A. - Streamflow and stage	
Explanation of major column headings	10
Station listing	12
PART B. - Quality of surface water	
Explanation of major column headings	46
Station listing	48
PART C. - Quality of ground water	
Explanation of major column headings	56
Station listing	58

TABLES

Table 1. Agencies that reported water data acquisition activities listed in this volume 5

2. List of water resources regions 6

3. Page index for OWDC map numbers and letters 7

4. Symbols used for States (and other areas), and county and independent city codes 8

ILLUSTRATIONS

Figure 1. Map of the United States showing OWDC map numbers and water resources regions. 11

EXHIBITS

Exhibit 1. Office of Management and Budget Circular A-67 IX

2. OWDC Form A-2, Inventory of Hydrologic Data Stations - Surface Water . . . X

3. OWDC Form A-4, Inventory of Hydrologic Data Stations - Quality of Water . . X

48	0	04252	08248500	SAN ANTONIO C AT M NR MANASSA COLO	371046	1055236	CO	021	STREAM	1923		*	*	*	*	*		
48	N	04253	08249000	CONEJOS R NR LA SAUSES COLO	371801	1054447	CO	021	STREAM	1921			*	*	*	*		
48	N	21330	08249400	CULEBRA C NR CHAMA COLO	371037	1051918	CO	023	STREAM	1967	1970		*	*	*			
48	N	04254	08250000	CULEBRA C AT SAN LUIS COLO	371101	1052531	CO	021	STREAM	1927			*	*	*	*		
48	1	04255	08251500	RIO GRANDE NR LOBATOS COLO	370442	1054522	CO	021	STREAM	1899			*	*	*	*		
48	1	20334	08-5074-5	LOBATOS BR COLO CN RIO GRANDE R	3705	10545	CO	023	STREAM	1941		*	*			*		
48	N	04256	08252000	RIO GRANDE AT COLO N MEX STATE LINE	370014	1054312	CO	023	STREAM	1953			*	*	*	*		
48	N	04570	08252500	COSTILLA C AB COSTILLA DAM N M	365352	1051516	NM	055	STREAM	1937			*					
48	N	04571	08253000	GARCIAS C NR COSTILLA N MEX	365348	1051535	NM	055	STREAM	1937			*					
48	N	04572	08253500	SANTISTEVAN C NR COSTILLA N MEX	365303	1051650	NM	055	STREAM	1937			*					
48	N	04707	08253900	COSTILLA RES NR COSTILLA N MEX	365232	1051645	NM	055	RESER	1922			*					
48	N	04573	08254000	COSTILLA C BL COSTILLA DAM N MEX	365226	1051647	NM	055	STREAM	1937			*					
48	N	04574	08254500	COSTILLA C NR AMALIA N MEX	365233	1052322	NM	055	STREAM	1949			*					
48	N	04575	08255000	COSTILLA NR C STILLA N MEX	365801	1053023	NM	055	STREAM	1936			*					
48	1	04[illegible]	08255[illegible]	ACEQUIA MADRE AT COSTILLA N MEX	365803	1053057	NM	055	CANAL	1944			*					
48	N	04702	08256500	GARCIA RES NR GARCIA COLO	365950	1053049	CO	023	CANAL	1944		*	*					
48	N	04703	08257500	CORDILLERA D AT GARCIA COLO	365941	1053139	NM	055	CANAL	1944			*					
48	1	04577	08258000	CERRO CA AT COSTILLA N MEX	365756	1053107	NM	055	CANAL	1944			*					
48	N	04578	08[illegible]500	ASSOCIATION C AT COSTILLA N MEX	365738	1053203	NM	055	STREAM	1955	1971		*					
48	1	04[illegible]	08[illegible]000	CERRO CA NR GARCIA COLO	365[illegible]	1053436	NM	055	CANAL	1944			*					
48	N	04579	08259500	C MEX B CERRO CA AB GARCIA COLO	365943	1053447	NM	055	CANAL	1944			*					
48	N	21117	08260500	COSTILLA C BL DIV D A COSTILLA M	365833	1053100	NM	055	STREAM	1952			*					
48	N	04701	08261000	COSTILLA C AT GARCIA COLO	365921	1053154	CO	023	STREAM	1944			*					
48	N	04580	08262000	CASTDALE NO 1 INTAK CA N MEX COLO	370225	1053615	CO	021	CANAL	1944			*					
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48	0	04583	08264500	RED R BL ZWERGLE DAMSI NR RED R N M	364025	1052245	NM	055	STREAM	1953			*		*			
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48	0	04587	08267000	RED R AT MOUTH NR QUESTA N MEX	363953	1054134	NM	055	STREAM	1950			*		*			
48	0	04588	08267500	RIO HONDO NR VALDEZ N MEX	363330	1053321	NM	055	STREAM	1934			*		*			
48	0	04589	08268200	RIO HONDO AT DAMSI AT VALDEZ N MEX	363207	1053607	NM	055	STREAM	1963	1966		*					
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48	0	04591	08269000	RIO GRANDE AB ARROYO HONDO N MEX	363234	1054234	NM	055	STREAM	1953			*		*			
48	0	25360	08269800	RIO GRANDE TR NR ARROYO HONDO NM	362939	1054305	NM	055	STREAM	1968			*					
48	0	04592	08270000	RIO PUEBLO DE TAOS NR TAOS N MEX	362622	1053011	NM	055	STREAM	1910		*	*		*			
48	0	04593	08271000	RIO LUCERO JR ARROYO SECO N MEX	363030	1053143	NM	055	STREAM	1910		*	*		*			
48	0	04594	08275000	RIO FERNANDO DE TAOS AB TAOS N M	362242	1053255	NM	055	STREAM	1910		*	*		*			
48	0	04595	08276[illegible]	RIO PUEBLO DE TAOS N RANCHITOS N M	362[illegible]	1053[illegible]	NM	055	STREAM	1957			*		*			

→ to p. 15

OWDC NUMBER	DRAINAGE AREA (SQUARE MILES)	TYPES OF FIELD MEASUREMENT: STAGE: FREQ	STAGE: FREQ	STAGE: TELEM	DISCHARGE FREQ	TYPES OF DATA: DA DISCHARGE	FEAT OTHER		TIOF												REPORTING
04252	1[illegible]7	1	*		5	*			*		*										GS
04253	887	1	*		5	*			*		*						*				GS
21330	7[illegible].1	1	*		5	*			*			*									GS
04254	[illegible]20	1	*		5	*			*												GS
04255	7700	1	*		5	*			*		*	*					*				GS
20334		2															*				NWS
04256		1	*		5	*			*												GS
04570	25.1	2	*		2	*	*										*				GS
04571	16.6	2	*		2	*	*										*				GS
04572	2.15	2	*		2	*	*										*				GS
04707	54.6	8															*		*	*	GS
04573	54.6	1	*		5	*	*										*				GS
04574	152	2	*		2	*	*										*				GS
04575	195	1	*		5	*	*					*					*				GS
04576		2	*		2		*														GS
04702		2	*		2	*	*														GS
04703		2	*		2	*	*														GS
04577		2	*		2	*															GS
04578		2	*		2	*															GS
04700		2	*		2	*															GS
04579		2	*		2	*															GS
21117	1[illegible]7	2	*		2	*											*				GS
04701	200	2	*		2	*	*										*				GS
04580		1	*		5	*											*				GS
04581	10.5	1	*		5	*	*										*				GS
04582	8440	1	*		5	*	*										*				GS
04583	25.7	1	*		5	*	*										*				GS
04584	113	1	*		5	*	*										*				GS
04585		1	*		5	*	*										*				GS
04586	36.7	1	*		5	*	*										*				GS
04587	190	1	*		5	*	*					*					*				GS
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04589	40.3	1	*		5	*	*										*				GS
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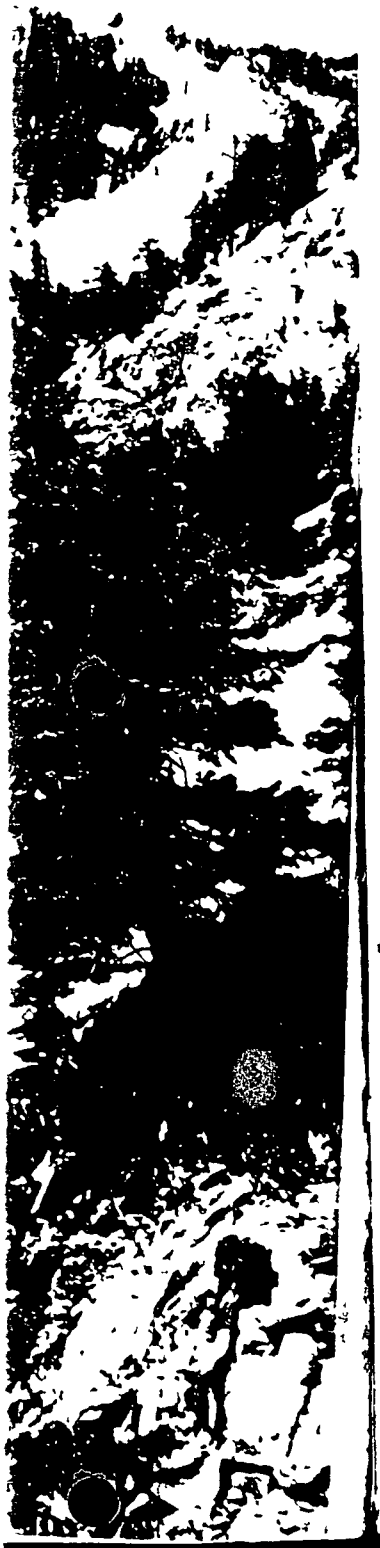
04591	8760	1	*		5	*	*										*				GS
25389	1.16	1	*		9		*				*				*						GS
04592	66.6	1	*		5	*	*										*				GS
04593	16.6	1	*		5	*	*										*				GS
04594	71.7	1	*		5	*	*										*				GS
04595	199	1	*		5	*	*										*				GS

BULLETIN 51



Geology of the Questa Molybdenum (Moly) Mine Area, Taos County, New Mexico

BY JOHN H SCHILLING

Local structure and stratigraphy, and detailed description of mineral deposits as related to regional geology, with guides to ore exploration in the surrounding area

1956

STATE BUREAU OF MINES AND MINERAL RESOURCES
NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY
CAMPUS STATION SOCORRO, NEW MEXICO

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FRONTISPIECE

View of Sulphur Gulch showing W level dump (lower left), landslide covering portals of Glory Hole workings (center), and the altered area — hydrothermal pipe — at the head of Sulphur Gulch (treeless area, upper right)

Contents

	Page
ABSTRACT	ix
INTRODUCTION	1
Purpose and Scope	1
Methods of Investigation	1
Previous Work	2
Acknowledgments	2
Geographic Features	4
Location and Accessibility	4
Physical Features	4
Climate	4
History and Production	6
Surface Plant and Mine	8
Mining Methods	8
Prospecting and Exploration	8
Development	9
Stoping	9
Transportation	10
Drainage and Ventilation	10
Milling Methods	10
GEOLOGIC SETTING	11
Descriptive Geology	11
Introduction	11
Precambrian	11
Amphibolite Complex	11
Cabresto Metaquartzite	16
Granite	18
Pegmatites	19
Diabase Dikes	19
Pennsylvanian-Permian (?) Sangre de Cristo (?) Formation	20
Tertiary	23
Volcanic Complex	23
Andesite and Rhyolite Intrusives	25
Soda Granite	26
Postgranite Dikes	30
Quaternary	30

	Page
Terrace Gravels	30
Cemented Gravels	31
Alluvium	31
Mud Flows	31
Cover	32
Structural Geology	33
Introduction	33
Regional Structures	33
Folds	33
Faults	34
Fractures	35
Brecciation	37
Foliation	37
Alteration	37
Introduction	37
Hydrothermal Pipes	38
Propylitic Alteration	39
Geologic History	40
MINERAL DEPOSITS	42
Introduction	42
Questa Molybdenum Mine Deposit	42
Introduction	42
Spacial Relation of Veins to Rock Units and Structure	42
Size and Form of Veins	46
Ore Shoots	51
Vein Mineralogy	51
Introduction	51
Ore Minerals	51
Molybdenite	51
Gangue Minerals	55
Apatite	55
Biotite	55
Calcite	55
Chalcopyrite	55
Chlorite	56
Ferrimolybdite	56
Fluorite	56
Galena	56
Gold	56
Graphite	56
Hubnerite	57
Limonite	57
Malachite	57
Orthoclase	57
Pyrite	57
Quartz	57
Rhodochrosite	58
Rhodonite	58
Silver	58
Sphalerite	58
Wall Rock and Gouge	58
Changes with Depth	58
Paragenesis	58
Wall Rock Alteration	59
Movements During Vein Formation	62
Genesis	62
Manner of Emplacement	62
Depositional Control	62
Physical Conditions	65
Source of the Ore Forming Solutions	65
Age	65
Summary of Vein Formation	65
Classification	66
Other Mineral Deposits	66
Bear Canyon (Horseshoe) Prospects	68
Log Cabin Canyon Prospects (Steve's Prospect ?)	68
Bernhardt Prospects	68
Horner Prospects	71
Hercules Prospects	71
BJB Prospects	71
Other Prospects in Hydrothermal Pipes	73
Silver Bell Prospect	73
Summary and Conclusions	73
Secondary Enrichment in Hydrothermal Pipes	74
Future Possibilities and Guides	75
High Grade Molybdenite Deposits	75

	Page
Questa Molybdenum Mine	75
Other Areas	76
Low Grade Molybdenite	77
Low Grade Copper	77
Other Types	78
Summary and Conclusions	78
REFERENCES	79
INDEX	83

Illustrations

		Page
TABLE		
1	Vein minerals of the Questa molybdenum mine	51
FIGURES		
1	Index map showing the location of the Questa molybdenum mine	Facing 1
2	Isometric diagram of the Questa molybdenum mine area	3
3	Climatic data for the Questa molybdenum mine area	5
4	Molybdenite concentrates produced from the Questa molybdenum mine	7
5	Generalized rock section of the Questa molybdenum mine area	13
6	Generalized geologic map of the Taos Range and Taos Plain	14
7	Precambrian rocks	17
8	Section of the Pennsylvanian-Permian (?) sediments north of State Highway 38, at the east edge of the mine camp	21
9	Soda granite	28
10	Generalized geologic map of the Questa molybdenum mine area	43
11	Cross section through No. 3, W, and Glory Hole levels of the Questa molybdenum mine showing veins pinching out as they extend into the granite stock	45
12	Cross section through No. 3, W, and Glory Hole levels of the Questa molybdenum mine showing en echelon veins paralleling contact	45
13	Cross section through No. 3, W, and Glory Hole levels of the Questa molybdenum mine showing vein cutting across irregularity of the contact	47
14	Cross section through No. 3, W, and Glory Hole levels of the Questa molybdenum mine showing a stope block, or large xenolith, and a vein	47

Page

15 Plan of a level in the Questa molybdenum mine showing en echelon veins, pinching of veins as they extend into the propylitized volcanics, and a vein offset by faulting 18

16 Plan of a level in the Questa molybdenum mine showing a vein pinching as it extends into the propylitized volcanics 48

17 Plan of a level in the Questa molybdenum mine showing a vein that divides into many small veins as it extends into the soda granite 49

18 Plan of a level in the Questa molybdenum mine showing a vein along a soda granite dike 19

19 Plan of a level in the Questa molybdenum mine showing a vein in the soda granite paralleling the contact 50

20 Plan of a level in the Questa molybdenum mine showing an ore shoot at the intersection of two veins 50

21 Cross section of two veins 51

22 Plan of a typical large stope in the Questa molybdenum mine 53

23 Paragenesis of the vein minerals of the Questa molybdenum mine 59

24 Drawings of polished sections of vein minerals 60

25 Formation of the open space in which the ore shoots occur 61

26 Geology of the area covered by reconnaissance mapping 67

27 Geology of the Bear Canyon (Horseshoe) prospect 69

28 Geology of the southern Bernhardt prospect 70

29 Geology of the Hawk tunnel, northernmost BJB prospect 72

PLATES

1 Block diagram of the Questa molybdenum mine, Taos County, New Mexico In pocket

2 Geologic map and sections, Questa molybdenum mine area, Taos County, New Mexico In pocket

3 View of Sulphur Gulch Frontispiece

4 Typical veins Opposite 56

5 Specimens of vein materials Opposite 57

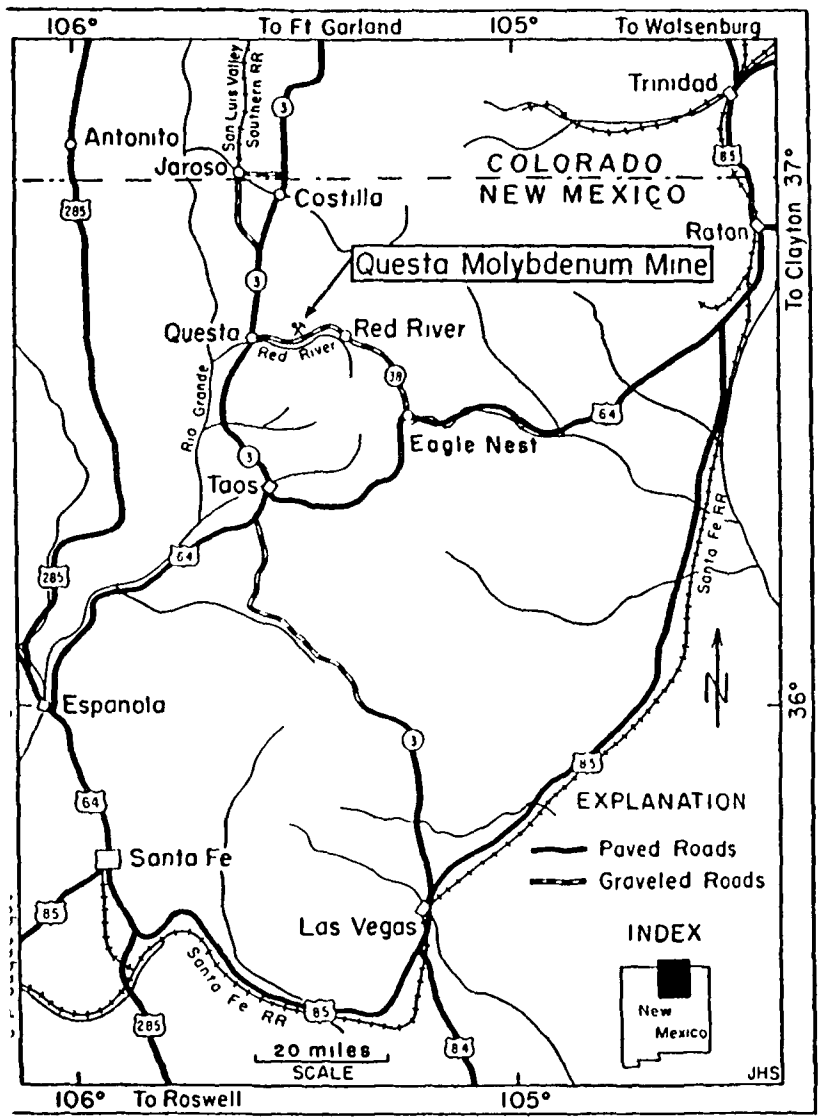
Abstract

The Questa molybdenum mine (known locally as the Moly mine), 6 miles east of Questa, in the Taos Range of the Sangre de Cristo Mountains, Taos County, New Mexico, is unique in containing high grade molybdenite ore in fissure veins, whereas in most other mines production is from low grade, disseminated deposits The true nature of the veins first was recognized in 1916 In 1920 the Molybdenum Corporation of America acquired the property, and the mine has been in almost continuous production since then Total production to Jan 1, 1956, was 18,095,000 pounds of molybdenite Mining is by overhand, horizontal slicing in stull supported stopes, concentration is by flotation

The Taos Range is made up chiefly of Precambrian metamorphic rocks overlain by Tertiary volcanic rocks In the vicinity of the mine, Precambrian amphibolites and quartz biotite schist of the amphibolite complex are overlain by Cabresto metaquartzite, and all these units are intruded by Precambrian granite Late Paleozoic and Mesozoic sediments crop out along the eastern edge of the range and in small scattered areas elsewhere in the range At the mine, conglomerates, arkosic gray wackes, siltstones, and limestones overlie the Precambrian and are correlated tentatively with the Pennsylvanian-Permian Sangre de Cristo formation A thick sequence of Miocene (?) volcanics (the volcanic complex) overlies the older rocks The lower series of this complex includes andesite and quartz latite flows, breccias, and tuffs (the andesitic series), these in turn are overlain by an upper series of rhyolite flows, breccias, and tuffs (the rhyolite series) Numerous dikes, sills, and small plugs of rhyolite and andesite may be the intrusive equivalents of this volcanic complex Late Tertiary soda granite stocks and dikes intrude the older rocks Quaternary alluvial gravels cover the valley bottoms and terraces, and mud flows form fans in Red River Canyon at the mouths of some of the side gulches

Folding is not an important structural feature of the Taos Range Faults are common, the majority being divisible into three systems (1) north trending thrust faults along the east edge of the range, active during late Cretaceous and early Tertiary time, with thrusting toward the east, (2) north to northwest trending high angle frontal faults along the west edge of the range and associated parallel faults throughout the range, active during late Tertiary and early Quaternary time, and (3) east to northeast trending high angle faults throughout the range, active during the Precambrian or Paleozoic, with later Tertiary and Quaternary movement along some faults Fractures parallel the east to northeast trending fault system The Precambrian rocks show foliation, which most commonly strikes N 50° E to N 70° E and dips vertically

Important local structures are superimposed on the regional structures of the Taos Range, forming the structural pattern in which the ore deposits occur The mine is located in a downfaulted zone several



INDEX MAP SHOWING THE LOCATION OF THE QUESTA MOLYBDENUM MINE

Figure 1

Introduction

PURPOSE AND SCOPE

The Questa molybdenum mine, known locally as the Moly mine, is unique in containing high grade molybdenite ore in large veins, whereas nearly all other production is from low grade, disseminated deposits This report describes the geology of the Questa molybdenum mine and the other nearby prospects in detail, relates this detailed picture to the regional geology, and discusses the possibilities of future mineral production in the surrounding area, offering practical guides thereto It is hoped that the ideas presented here will be useful also in locating and evaluating other mineral deposits with similar features

METHODS OF INVESTIGATION

The writer first became interested in the mine during the summer of 1950 while serving as an assistant to Philip McKinlay, of the New Mexico Bureau of Mines and Mineral Resources, who was mapping the Taos Range of the Sangre de Cristo Mountains

A total of 14 months was spent during the years 1951 55 examining the mine and surrounding area Accessible workings were mapped on a scale of 1 inch to 20 feet, the surface over the mine (area of pl 2) was mapped on a scale of 1 inch to 500 feet Maps of Molybdenum Corporation of America were used as bases

For the detailed surface mapping, a dividing line between outcrop and cover was set up arbitrarily The following rules were made and followed as closely as possible during mapping All outcrops over 50 by 50 feet in size were delineated All dikes over 1 foot wide also were mapped Smaller isolated outcrops that could not be shown on the map were included with the cover Locally small, isolated outcrops surrounded by a large area of cover (soil, talus, etc) or other rock types, but important to the overall geologic picture, are shown on the map and are exaggerated slightly in size A number of smaller outcrops spread over an area larger than 50 by 50 feet, but not more than 20 feet apart or covering less than 25 percent of the area, were mapped as one outcrop

An area of approximately 20 square miles in the vicinity of the mine (area of fig 26) was mapped on a scale of 1 inch to 1 mile by a series of reconnaissance traverses designed to outline the important geologic features Most of the prospects in the area were mapped by Brunton compass and tape

A large number of specimens of the different rock types and vein materials were collected, from which over 150 thinsections and 7 polished sections were made and examined The laboratory work, drafting, and writing were done in Socorro, with the aid of the facilities of the New Mexico Bureau of Mines and Mineral Resources

PREVIOUS WORK

The deposit was described initially in a brief paper by Larsen and Ross (1920) A more detailed study was made by Vanderwilt (1938), who spent 4 months at the mine, mostly in underground studies McKinlay (1956) mapped the geology of the Taos Range, in which the mine is located Vanderwilt's paper and McKinlay's work were the foundation for the more detailed investigation made for this report

ACKNOWLEDGMENTS

The writer is indebted to members of the Questa molybdenum mine staff who helped in so many ways to make this report possible, including Mr J B Carman, former general manager, Mr A L Greslin, general manager, Mr E William O'Toole, mine clerk, Mr Francis C Rowe, mining engineer, Mr Ben Horner, former mine foreman, and Mr Jose Varela, mine foreman

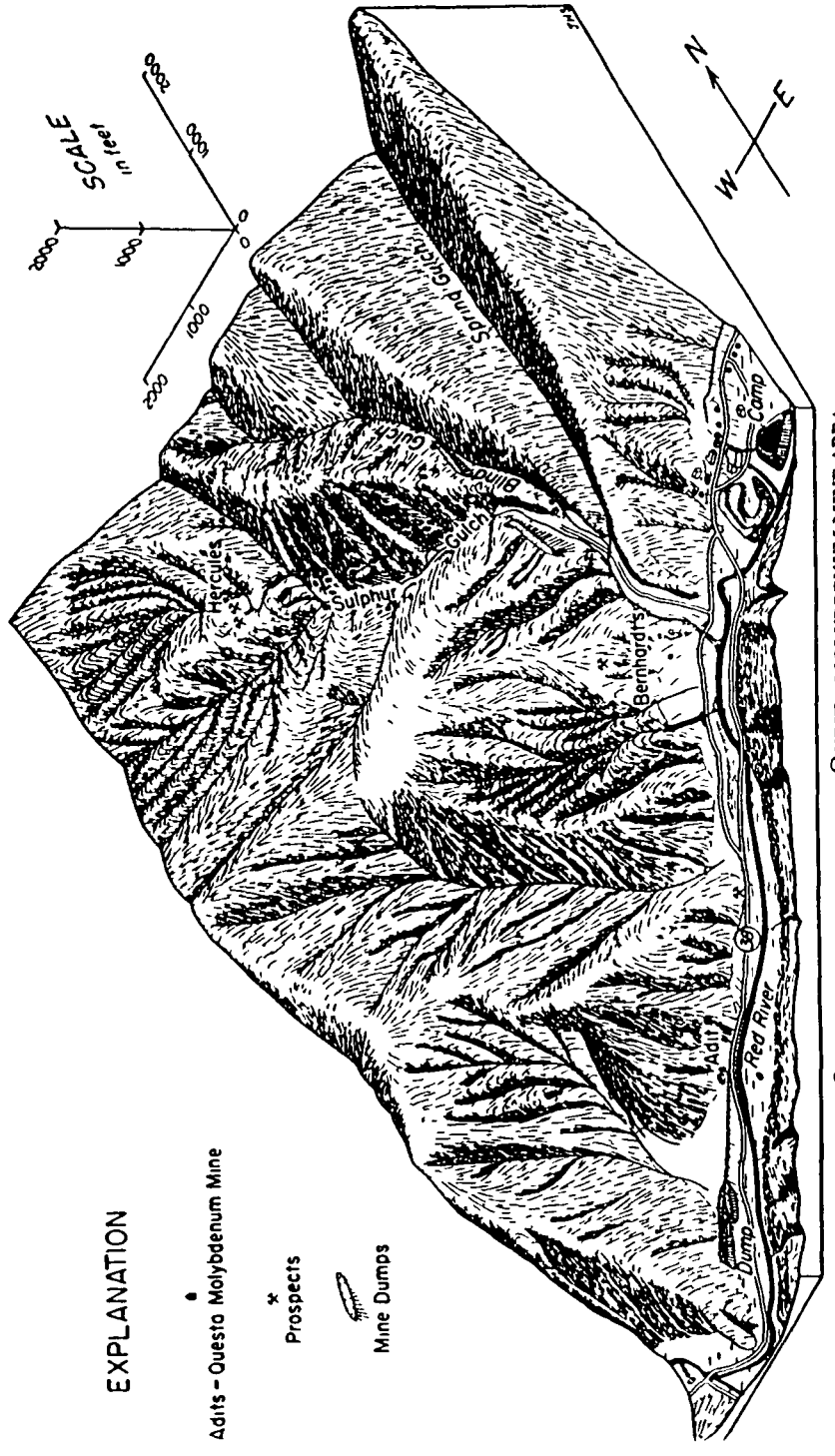
Sincere appreciation is due Dr Eugene Callaghan, director of the New Mexico Bureau of Mines and Mineral Resources, for his guidance and support, to Dr Edmund H Kase, Jr , Dr Robert H Weber, and Mr Max E Willard for critically reading the manuscript and making many helpful suggestions, and to Dr Brewster Baldwin for critically checking and making suggestions for Plate 2 Other members of the Bureau staff have checked various parts of the report and helped in many other ways

Mr Charles Treseder did all the photography necessary in preparing the figures and plates

Field expenses for two summers were paid by the Field Assistance Fellowship Fund of the New Mexico Bureau of Mines and Mineral Resources A grant from the Isadore Aaron Ettlinger Memorial Fund of Harvard University provided miscellaneous expenses for one summer

A special word of acknowledgment is due my wife Constance She was my field assistant, did all the necessary secretarial work, and has helped in so many other ways to make the completion of this study easier and more enjoyable

Space will not permit the mention by name of the many other individuals who helped make this report possible Their help is gratefully acknowledged



ISOMETRIC DIAGRAM OF THE QUESTA MOLYBDENUM MINE AREA
The main haulage adit (Molv tunnel) is labeled "adit"

GEOGRAPHIC FEATURES

Location and Accessibility

The Questa molybdenum mine is located on the western slope of the Taos Range of the Sangre de Cristo Mountains, Taos County, New Mexico (see fig 1) The various mine portals range in altitude from 8,000 to 9,000 feet The mill, camp, haulage adit, and dump are distributed along Red River Canyon, 5 6 miles east of Questa The adits to the older workings are along Sulphur Gulch, an intermittent tributary of the Red River (see fig 2)

State Highway 38, a graded gravel road, passes the mine and camp It follows Red River Canyon and connects the mine with Questa, 6 miles to the west, and with the town of Red River, 6 miles to the east (see fig 1) Paved highways lead from Questa to Taos, New Mexico (to the south), and Fort Garland, Colorado (to the north) East of Red River, State Highway 38 crosses Red River Pass and continues to Eagle Nest, a distance of 19 miles From Eagle Nest, paved highways lead to Taos and Raton, New Mexico (see fig 1) All other roads are primitive and in many places ungraded and badly washed

The nearest railroad is at Jarosa, Colorado, 25 miles north of Questa Jarosa is the southern terminal of the San Luis Valley Southern Railway, which connects with the Denver and Rio Grande Western Railroad at Blanca, Colorado (see fig 1) Only freight service is available

Physical Features

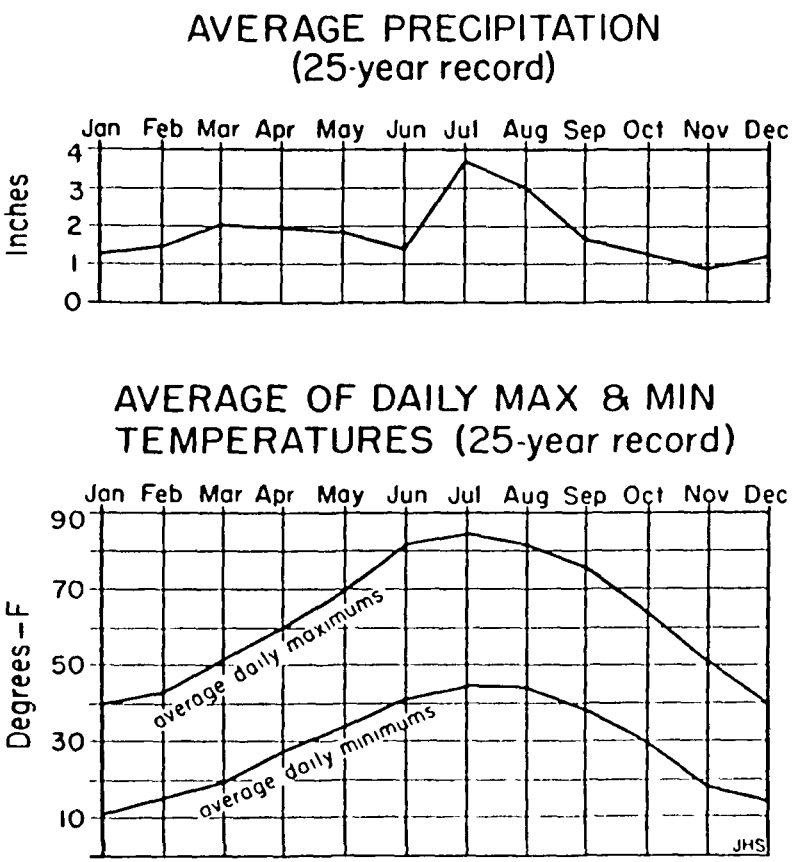
The Sangre de Cristo Mountains, in which the mine is located, are part of the Southern Rocky Mountains physiographic province The maximum relief in the Taos Range of these mountains is over 6,000 feet, local relief at the mine is over 3,500 feet Wheeler Peak (elevation 13,155 ft), which lies 10 miles southeast of the mine, is the highest point in New Mexico

The surface over the mine is drained by intermittent tributaries of the Red River (see fig 2), the largest of these is Sulphur Gulch The Red River (called the Rio Colorado or Colorado Creek in old reports) flows westward into the Rio Grande, 4 miles west of Questa Where the Red River passes the mine, it has an average gradient of 2 0 percent In comparison, the lower mile of Sulphur Gulch has an average gradient of 11 percent

Climate

The climate at the mine is similar to that of the Rocky Mountains of Colorado, but is modified by the semiarid plateau to the west (see fig 3)

Summer is characterized by hot days and cool nights The rainy season is during July and August, some rain occurring also in May and June Heavy, but localized, rains during July and August cause flash



CLIMATIC DATA FOR THE QUESTA MOLYBDENUM MINE AREA

(Rainfall from *Climate and Man*, 1941 Yearbook of Agriculture, U S Dept of Agriculture, temperatures from Molybdenum Corporation of America records)

Figure 3

floods and mud flows which often block the highway and occasionally damage the mine plant

Fall is a period of warm days and cold nights The first killing frost usually is in mid September, and occasional snows can be expected

Winters are mild, and the roads seldom are blocked by snow The heaviest snowfall is limited to the higher parts of the mountains Al though the winters are long, protracted periods of freezing weather are limited to December through February There are many sunny days, and the ground is often bare in areas exposed to the sun

Spring arrives in late May with warmer, windy weather Dust storms are common The last killing frost is in mid June The aspen, willow, and cottonwood trees leaf out in late May or early June

HISTORY AND PRODUCTION

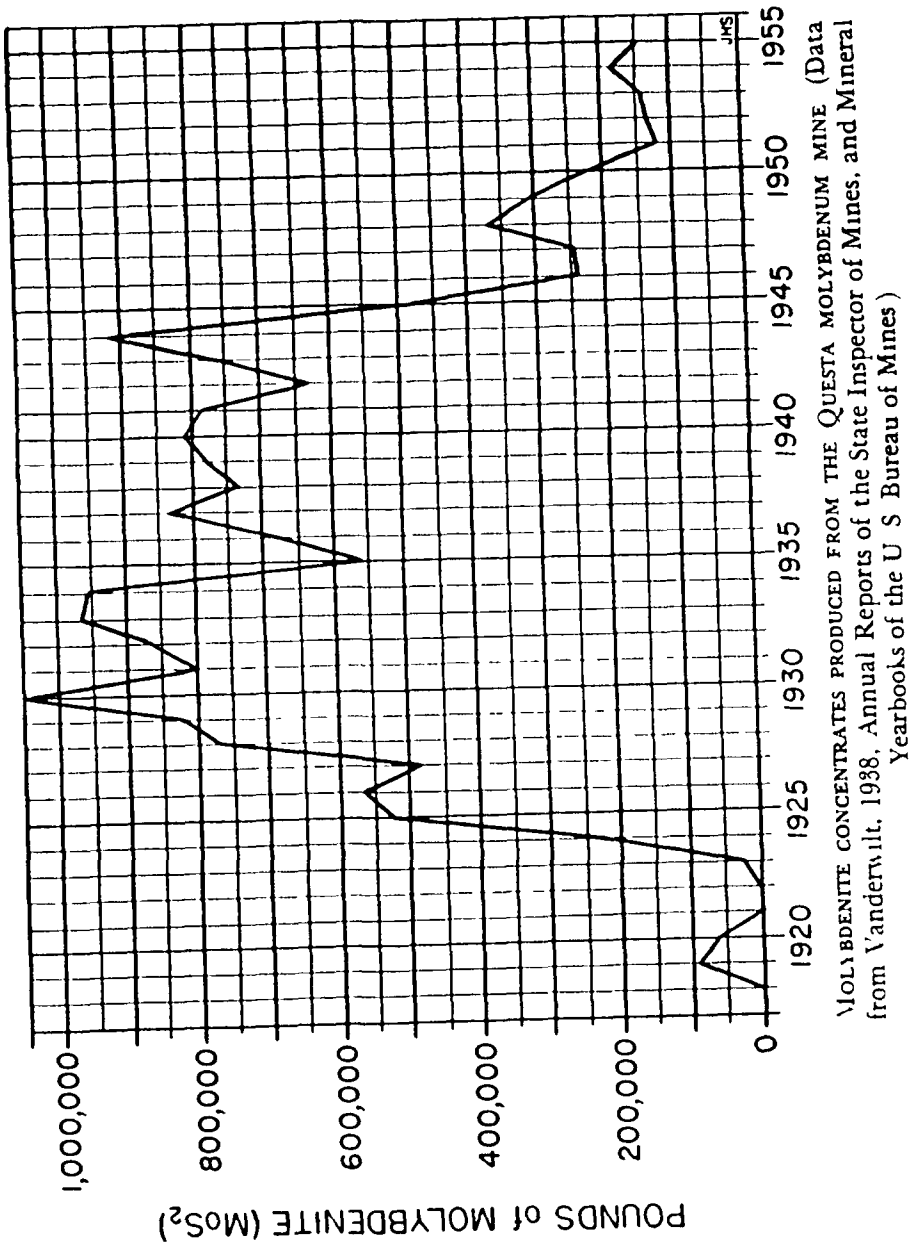
Prior to 1916 the bright yellow molybdic gossan at the outcrops of the veins was thought to be sulfur, giving the name Sulphur Gulch to the valley in which the outcrops occur The black molybdenite was mistaken for graphite, and the mineral was mixed with grease and used locally to lubricate wagon wheels It also served as a shiny shoe polish, which unfortunately rubbed off on everything

In 1916 or 1917 Jimmy Fay, a prospector having claims along Sulphur Gulch, sent a specimen of ore containing molybdenite to San Francisco to be assayed for gold and silver The beginning of World War I had greatly increased the demand for molybdenum, and assayers were becoming aware of the value of the mineral molybdenite When the assayer returned his report, he mentioned the presence of molybdenite and its value

Some claims were located during the war The Western Molybdenum Company, of La Jara, Colorado, was organized but did little to develop the claims In November 1918, the R and S (Rapp and Savery) Molybdenum Company, of Denver, was formed and took over seven claims of the Western Molybdenum Company, filing additional claims Development work was done throughout the winter of 1918 1919, production began in the spring The ore was treated at a converted gold mill on the Red River, about 4 miles above the mine

The Molybdenum Corporation of America was incorporated in 1920, in the same year acquiring the property of the R and S Molybdenum Company Mining was discontinued during the depression of 1921, however, development work was continued Operations were on a small scale until 1923, when a mill was built on the present mill site In 1929, this mill was rebuilt Because of the inaccessible location of the workings, burros were used to haul the ore from the portals to the bottom of Sulphur Gulch

By 1941 mining and exploratory work had extended to such distances below and to the west of the lowest adit, Z tunnel level, that the present haulage adit (Moly tunnel) was driven to facilitate transporta-



MOLYBDENITE CONCENTRATES PRODUCED FROM THE QUESTA MOLYBDENUM MINE (Data from Vanderwilt, 1938, Annual Reports of the State Inspector of Mines, and Mineral Yearbooks of the U S Bureau of Mines)

Figure 4

tion, ventilation, and drainage This adit was driven north from the Red River for 1 mile, where it joined the lowest level in the mine (8,000 ft elevation) The mill was rebuilt again at about the same time By 1955 the workings had reached a point 210 feet below the haulage adit

Total production to January 1, 1956, was 18,095,000 pounds of molybdenite (MoS_2) See Figure 4 for production by years

Other companies have attempted to mine molybdenite in the surrounding area, but with little success In 1924, the Hercules Molybdenum Corporation built a camp at the head of Sulphur Gulch Some development work was done, but apparently little ore was found, the company abandoned the camp the following year

More recently several adits, the BJB prospects, were driven by Bill Wilde along Goat Hill Gulch, 3 miles west of the mine Some ore was mined, but the prospects no longer are being worked

Dan Cisneros and Juan Aragon, of Questa, worked a group of claims, known as the Horseshoe or Ben Creek claims, for many years These claims are located along the south side of Red River Canyon where it meets Bear Canyon 4 miles west of the Questa molybdenum mine No ore has been milled, although a few tons have been stockpiled

The late Leroy Bernhardt had a group of claims along the lower part of Sulphur Gulch A good vein of silver ore was found, but proved to be limited in extent Only traces of molybdenite were present

SURFACE PLANT AND MINE

The present camp consists of an office building which also contains the warehouse and commissary, a mill, assay laboratory, cookhouse, bunkhouse, school, and houses for employees (see fig 2)

At the haulage adit portal 1 mile west of the camp, there is a building containing a lamp room, change room blacksmith shop, and the compressor and generating equipment Another small building is used for cutting mine timber Surface track from the adit continues a quarter of a mile down the canyon to the mine ore bins and dump (see fig 2)

The mine has over 35 miles of workings, with a vertical extent of 1,200 feet The mine is divided into three parts (1) the Sulphur Gulch north workings, located north of Sulphur Gulch (2) the Sulphur Gulch south workings, which include all workings south of Sulphur Gulch mined through adits on the gulch and (3) the Tunnel shaft workings, which include all workings mined through the Tunnel shaft (a vertical winze) and the Moly tunnel The relationship of the levels to each other and to the geology is shown by Plate 1 (in pocket)

MINING METHODS

Prospecting and Exploration

The veins do not form bold outcrops but are easily located by the bright canary yellow color of the ferrimolybdite in the gossan Underground exploration is carried on by drifting or raising along veins that have known ore shoots or appear favorable, and by crosscutting and raising to intersect known veins or explore new areas Diamond drilling is not used

These factors are used as guides (1) Most of the ore shoots are near or on the contact of the granite with the altered rocks (2) Ore grade mineralization is usually weak in the "tight" altered rocks and strong in the more "open" granite near the contact (3) Veins are usually thicker where the contact dips steeply (4) Most of the ore is found where the contact has an east-west trend and a south dip (5) Dikes of granite near the main granite mass often have good ore shoots

Electrical prospecting (Sunberg and Nordstrom) was tried in 1917 Good ore was found in several places indicated by the survey, but many of the indications turned out to be gouge zones containing water

Development

The mine is developed by adits, drifts, crosscuts, raises, and winze at intervals of 15 100 feet vertically There is no standard pattern because of the irregular vein systems Exploration openings are used wherever possible

Drifters are used to drill a 15 hole, bottom V cut round, this is loaded with a total of 45 sticks of 40 percent gelatin dynamite, and normally breaks 4½ feet Stopers are used to drill center V cuts when raising, there is no standard drilling pattern for a round Machine mucking is used in all easily accessible drifts, hand mucking is employed in drifts on intermediate levels inaccessible to mucking machines The rock, when granite, is moderately hard and usually stands well without timbering, the altered volcanics are usually soft and broken and require considerable timber

Stoping

Stoping methods are adapted to local conditions Most of the ore shoots are mined by overhand methods in open, stull supported stopes Where the hanging wall is weak, back filling or pillars are used for support Much of the stoping is done by hand drilling, which is possible because of the soft vein material This permits highly selective mining The ore occurs so irregularly in the veins that stoping practices often must be changed every round In narrow veins, the foot wall is broken away from the ore, and the ore shot down separately In wide veins, no breaking of the wall rock is needed, and light shooting or picking is used If the vein splits, the waste in between often is removed first There are numerous other variations Where the veins are more regular machine drilling is used

Reserves cannot be estimated, since mining closely follows exploration and development Only the Tunnel shaft workings are being mined actively

TRANSPORTATION

The ore and waste are hand trammed to the Tunnel shaft in 1 ton nd-dump cars, hoisted, and dumped into 3 ton rocker dump cars A torage-battery engine pulls these larger cars out the mile-long haulage dit and over the surface track to the dump and ore bins

DRAINAGE AND VENTILATION

Water from the levels above the haulage adit drains by gravity out he various adits Water from the workings below the haulage adit rains into a sump at the bottom of the Tunnel shaft, then it is pumped p the shaft and flows out the adit Ventilation is natural

MILLING METHODS

The present mill has a capacity of 50 tons of ore per day Two types f material are milled (1) ore from the mine, and (2) tailings from the lder of two tailing ponds Ore is trucked to the mill and stored in bins hich feed through a crusher into a ball mill The tailings are loaded nto trucks by a shovel, and then hauled a short distance to bins which eed directly into the ball mill The ball mill is run in a closed circuit ith a classifier, the overflow goes to the rougher flotation cells, which emove most of the waste as tailings The concentrates from the rough rs go to the regrind mill, which is in a closed circuit with a classifier, he overflow goes to the cleaner flotation cells, which remove most of he remaining waste The concentrates, averaging 85 percent MoS_2, are lewatered by a thickener tank, filter, and dryer, and then sacked and hipped to the company plant at Washington, Pennsylvania, where they re made into ferromolybdenum or calcium molybdate for use in alloys

Geologic Setting

DESCRIPTIVE GEOLOGY

INTRODUCTION

The Taos Range of the Sangre de Cristo Mountains is made up chiefly of Precambrian metamorphic (amphibolites, schists, and quartzites) and intrusive (granite) igneous rocks overlain by late Tertiary volcanic rocks (andesite, quartz latite, and rhyolite flows, breccias, and tuffs) and interbedded sediments Permian and Pennsylvanian sediments (arkosic sandstone and conglomerate, shale, and limestone) occur along the eastern edge of the range, also, a few poorly exposed outcrops of sedimentary rocks in other areas probably are late Paleozoic in age Tertiary granitic rocks intrude the older rocks (see figs 5 and 6)

All the rock types, except the sediments, are well represented in the vicinity of the Questa molybdenum mine (see fig 5) Sediments, probably of late Paleozoic age, are present, although evidence for their correlation and dating is poor None of the other rock units could be dated accurately because of the lack of fossil or other direct evidence of their age

PRECAMBRIAN

Because of the poor exposures and complex relationships of the Precambrian rocks, only the granite and quartzite were mapped as separate units, the other Precambrian rocks are predominantly amphibolites, and were mapped as a single unit, the amphibolite complex The metamorphic rocks are assigned tentatively to the Precambrian, but only because of their position below late Paleozoic (?) rocks, their metamorphic character, and their similarity to more accurately dated Precambrian rocks elsewhere in the Rocky Mountains It must be emphasized that metamorphism alone is not a good criterion for Precambrian age

Amphibolite Complex

The amphibolite complex covers large areas along the south side of Red River Canyon, both east and west of the mine camp (see pl 2) North of the Red River, these rocks are more limited in extent One area of outcrop, approximately 100 feet above the canyon floor, extends west from the mouth of Sulphur Gulch to the main haulage adit (Moly tunnel) In the mine, quartz biotite schist of the amphibolite complex is exposed in the main haulage adit (Moly tunnel) Rocks of this complex are found also in the long crosscuts extending south from the main drift of Z tunnel level, although here alteration by the Tertiary soda granite makes identification difficult (see pl 1) Vanderwilt (1938, p 610) reports that these rocks are exposed also above Z tunnel level in the east ends of No 3 and W levels, where the workings are now caved

The base of the complex is not exposed The total exposed thickness

n the vicinity of the mine is probably several thousand feet, although o accurate measurements could be made

The amphibolite complex includes many varieties of amphibolite nd interlayered quartz biotite schists The complex is not resistant to veathering, and areas underlain by these rocks usually are covered with ocky soil or talus At a distance, the few outcrops appear darker gray han any of the other rock types, except some of the andesitic volcanics Outcrops commonly are stained brown A few outcrops contain alternat ng layers of quartz biotite schist and amphibolite, these layers may epresent bedding No other primary structures were noted

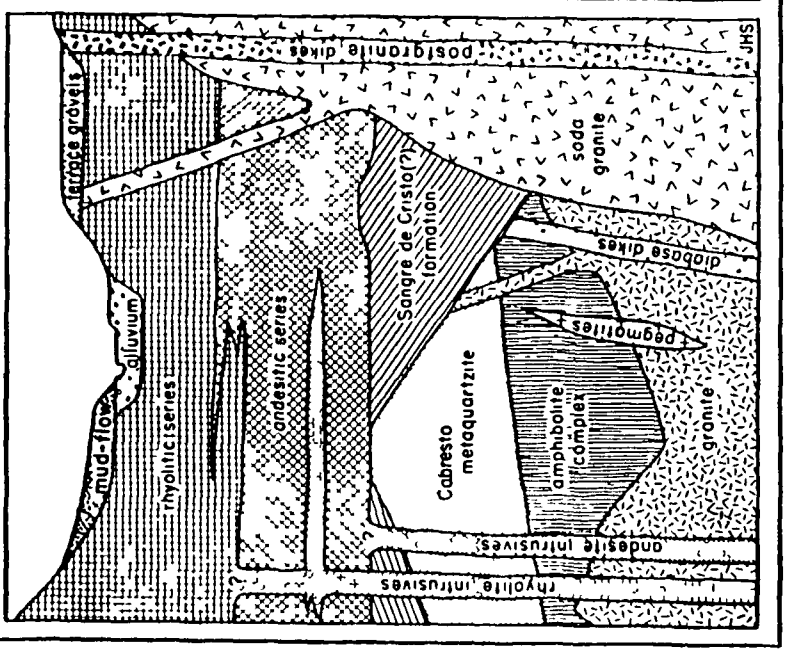
In hand specimen the rocks which have been grouped together in he amphibolite complex are massive to foliated, range from black to lark green, usually with specks or bands of white, and can be separated oughly into four varieties (1) massive, coarse grained, (2) massive, nedium grained, (3) gneiss, and (4) coarse grained schist

The massive, coarse grained amphibolites contain large, black horn blende crystals up to 3 cm across in a fine grained phaneritic ground nass of hornblende and andesine (?) In thinsection large, green, sub iedral crystals of hornblende, with no preferred orientation, are set in a groundmass of smaller hornblende crystals, cloudy andesine (?), and minor quartz Epidote, in clumps of small anhedral grains, replaces the iornblende, many of the larger hornblende crystals are poikiloblastic, with inclusions of epidote and magnetite The andesine (?) is highly altered to clay and sericite A typical thinsection contains 70 percent iornblende, 15 percent andesine (?), 10 percent epidote, 3 percent quartz, and 2 percent magnetite, by volume

The massive, medium grained amphibolites are equigranular aggre gates (average grain size 3 mm) of black hornblende and white plagio clase, closely resembling a diorite in appearance In thinsection (see fig 7) large, ragged, *unoriented, green hornblende in* groups or individual crystals is set in a groundmass of cloudy, lathlike to irregular aggregates of twinned andesine and small, irregular quartz grains Magnetite is scattered through the hornblende, commonly along the hornblende cleavage In some specimens, the hornblende is altered to chlorite and is accompanied by more abundant magnetite In some sections the hornblende is poikiloblastic, with inclusions of quartz (?) or plagioclase (?) The andesine is altered to clay and sericite Thinsections examined contain 45 60 percent hornblende, 30 40 percent andesine, 5 percent quartz, and 5 10 percent magnetite, by volume Epidote probably occurs in rock of this variety, but was not noted in the sections examined

The amphibolite gneisses are coarsely foliated with oriented trains of black hornblende and white plagioclase If the hornblende and plagioclase were not oriented, this rock type would resemble closely the massive, medium grained amphibolite In thinsection, small to medium sized, green, subhedral hornblende, paralleling the plane of foliation, is set in a cloudy, granular aggregate of smaller anhedral andesine (?) Quartz grains are scattered through the andesine (?) Although the

AGE	UNIT		LITHOLOGY
Quaternary	alluvium		gravel, sand, silt — valley fill
	mud-flow		unsorted gravel, sand, silt
	terrace gravels		gravel
Tertiary	postgranite dikes		porphyritic quartz monzonite to monzonite
	soda granite		mostly porphyritic to inequigranular quartz-orthoclase-albite-biotite granite, some aplitic and pegmatitic granite
	andesite and rhyolite intrusives		andesite and rhyolite of varying composition and texture
	volcanic complex	rhyolitic series	light-colored rhyolite flows, breccias, and tuffs
		andesitic series	dark-colored andesite flows, breccias, and tuffs
Pennsylvanian–Permian(?)	Sangre de Cristo(?) formation		massive, gray to grayish-red conglomerate, sandstone (arkosic graywacke), and siltstone usually gradational with one another; thin limestone lenses
Precambrian	diabase dikes		black with aphanitic walls and phaneritic centers of plagioclase and augite having an ophitic texture
	pegmatite dikes		coarse quartz, albite, and muscovite
	granite		gneiss, gnessic, or massive medium-grained quartz-microcline-plagioclase-biotite granite
	Cabresto metaquartzite		massive coarsely crystalline glassy to milky quartz
	amphibolite complex		amphibolite gneiss and schist of hornblende, andesine, quartz, and epidote; and quartz-biotite schist



GENERALIZED ROCK SECTION OF THE QUESTA MOLYBDENUM MINE AREA

Figure 5

Mineral Deposits

INTRODUCTION

The Questa molybdenum mine is the only mine in the area. Many other small deposits in the surrounding area have been prospected for molybdenum, gold, silver, copper, lead, or zinc, but always with unfavorable results. Nearly all these deposits, including that of the Questa molybdenum mine, apparently are late Tertiary in age and were formed by hydrothermal solutions emanating from the soda granite intrusives.

Oxidation and enrichment of the disseminated sulfides in the hydrothermal pipes may have formed minable copper deposits at depth, although the present scanty evidence is unfavorable. More detailed study is needed.

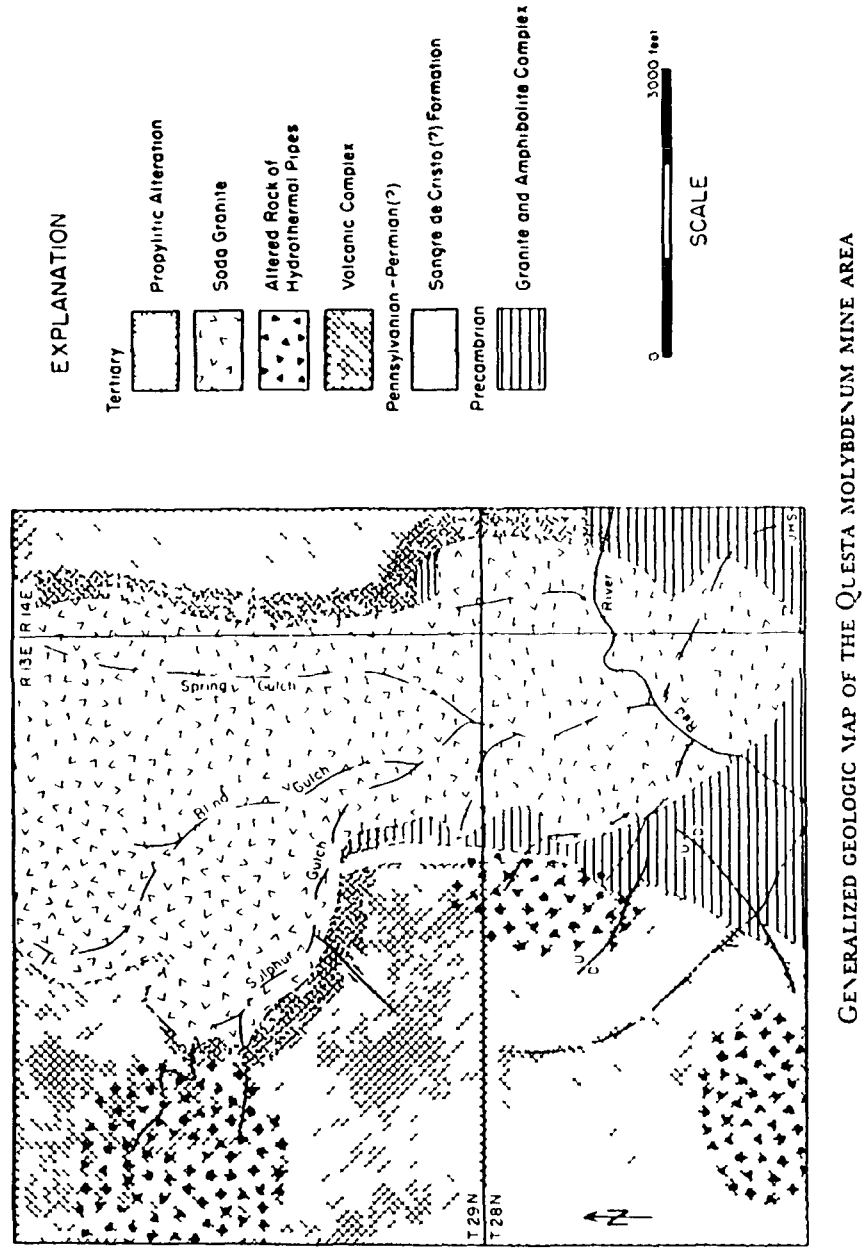
QUESTA MOLYBDENUM MINE DEPOSIT

Introduction

A group of molybdenite bearing veins form the mineral deposit in which the Questa molybdenum mine is located. This deposit is unique in containing high grade molybdenite ore in fissure veins, whereas most other production is from low grade disseminated deposits. The ore occurs in the Sulphur Gulch soda granite stock along a locally east striking, south dipping part of the contact with propylitized rocks. Most veins parallel the contact, range from less than 1 inch to over 7 feet in thickness, and are largely quartz and molybdenite, with locally abundant biotite, fluorite, pyrite, chalcopyrite, calcite, and rhodochrosite. The veins were deposited as cavity fillings during late Tertiary time soon after the soda granite was intruded. The upward force of intrusion apparently sheeted the granite along the contact, and hydrothermal solutions from the granite entered the sheeting to form the veins.

Spacial Relation of Veins to Rock Units and Structure

The veins of the ore deposit occur along the western side of the Sulphur Gulch soda granite stock where the north trending contact locally strikes east and dips to the south. To the east and west, where the contact swings north-south, very few veins are found. At the surface the east-west portion of the contact is over 1,500 feet long. The propylitized Tertiary andesitic series is in contact with the soda granite over much of the area where the veins occur. On the upper levels, at the east end of the deposit, the propylitized Pennsylvanian-Permian (?) sediments, dipping steeply to the west and striking northwest, are in contact with the soda granite. Last of these sediments Precambrian quartz-biotite schist is in contact with the soda granite where the contact begins to swing south. The Sulphur Gulch soda granite stock, in which the deposit is found, is in the downfaulted zone and near several hydrothermal pipes.



GENERALIZED GEOLOGIC MAP OF THE QUESTA MOLYBDENUM MINE AREA

Figure 10

ATTACHMENT I, PARAGRAPH 3
TAILS AREA GROUND WATER DISCHARGE PLAN APPLICATION
Item 16

MOLYCORP, INC.
QUESTA DIVISION

EXISTING TAILINGS DISPOSAL AREA

PLAN OF OPERATIONS

1. INTRODUCTION·

This Plan of Operations covers the operation and maintenance of Molycorp's Questa mine existing tailings facilities located in Sections 2/35/26 and 36/25, approximately one mile west of Questa, New Mexico.

2. LOCATION·

The attached Map No's 100 & 200 outlines the existing impoundment area

The site covering 2,132 acres, is located in Township 29N, Range 12E, Sections 2/25, 26/35 and 36 The property is made up of patented and fee simple land owned by Molycorp A location map, patented and fee simple land recordation information are available at the BLM State office in Santa Fe and at the Taos County courthouse.

Approximately 555 acres of the site are covered with tailings of which 390 acres of tails have been temporarily capped with a topsoil cover and reseeded Another 150 acres of tailings will be temporarily capped by July, 1993 Soil stabilizer has and will be sprayed on the remaining small area of tails sand

3 HISTORY:

A brief history of the development of the Questa mine tails storage area from the 1965 start of open-pit mining to placing the underground mine on standby in 1992 is as follows

Table I chronologically lists the construction sequences of dams shown on Map No.'s 100 & 200

In 1965, tails disposal was started by constructing starter Dam #1 in a large arroyo at the south end of Section 36. This dam was constructed of earthfill and incorporated an internal drain system. The upstream face of the dam was sealed with the slime fraction of the tailings The water clarification pond was at the dam face. Clarified water was piped via decant structures raised on the upstream dam face through culvert tunnels under the dam and then by ditch to the Red River

MOLYCORP, INC.
Questa Mine

TABLE I

TAILS STORAGE DEVELOPMENT

(Chronologically Listed)

YEAR	SECTION 36	SECTION 35
1964/65	Dam 1 to 7425' elevation (starter dam)	---
1966	Dam 1 to 7560' elevation	---
1967	Dam 1 to 7484' elevation	---
1968	Dam 1 to 7500' elevation	---
1969	Dam 1 to 7520' elevation Dam 2 to 7520' elevation	---
1970	-----	---
1971	Dam 1 to 7525' elevation	Dam 4 to 7440' elevation (starter dam)
1972	-----	Dam 4 to 7460' elevation
1973	-----	Dam 4 to 7478' elevation Dam 3A to 7532' elevation avg.
1974	East diversion ditch	West diversion ditch
1975	Dam 1C to 7560' elevation by cyclones Dam 1B, 2A to 7560' elev. Seepage barrier #1 below Dam 1	Dam 4 to 7505' elevation Seepage barrier #2 east of Dam 4
1976/79	-----	---
1980	Dam 2B to 7580' elevation by cyclones	Dam 4 to 7512' elevation
1981/82	Dam 1C, 1B, 2A, separator dike to 7584' elevation	Dam 4 to 7517' elevation
1983	-----	Ion exchange water treatment plant
1990	-----	Dam 5A to 7525' elevation

3 HISTORY (continued)

Dam #1 raises and operation continued in this fashion until 1969, when a small Dam #2 was constructed at the north end of Section 36 The clarification pond was then shifted to the north and the existing decant structures abandoned for a new overflow weir structure constructed in the bank along side the new Dam #2 Clarified water overflowed the weir and traveled down a decant ditch cut around the west side of Section 35 to a small holding pond named Pope Lake located at the south end of Section 35. From Pope Lake, the water flowed over a Parshall flume (later called Outfall 001) and on to the Red River

The final 7520 ft and 7525 ft. elevation raises in 1969 and 1971, on Dam #1, were shifted upstream of the existing dam west and constructed on tailings These lifts were of compacted earthfill.

In 1971, additional tails storage was created by constructing starter Dam #4 in the Section 35 arroyo, parallel to and just south of Section 36 and Dam #1 This dam and all its subsequent lifts were constructed of earthfill with internal drain systems. The upstream dam face was also covered with an asphalt or plastic membrane to ensure that the upstream face was impermeable. A decant weir was built to the north of the dam so that the clarification pond could be kept away from the dam face. Clarified water was released over the weir structure into the west ditch to Pope Lake and the Red River.

In 1973, Dam #3A was constructed north of Dam #4, inside the west ditch, in order to close off the north end of Section 35 for additional tails storage

In 1974, east and west diversion ditches were constructed around both tails storage areas in order to divert all natural drainage away from the impounded tailings Diverted water re-entered the watersned below the Dams 1 and 4

In 1975, seepage barriers were constructed below Dam #1, and to the east of the ridge separating Dam #4 and Dam #1 areas. These barriers were excavated to clay and sealed on the downstream side and filled with suitable drain material so that ground water from the tails storage ponds could be collected and diverted around the dwellings situated downstream of the tails storage area This water was then piped to the Red River througn Outfall 002.

HISTORY (Continued)

In the 1975 time period, new dam construction in Section 36 consisted of constructing a new structure approximately 1200 feet upstream of Dam #1 This dam was labeled Dam #1C and was constructed of cycloned tailings Dams #1B & 2A, were also constructed of earthfill and extended north from the east abutment of Dam #1C, to the far end of Section 36 These structures did not have internal drains and were sealed with tails slimes

In 1980, a cyclone berm was raised several hundred feet upstream of Dam #2A, and in 1981, new Dams #'s 1C, 1B & 2A, were raised to their present 7584 ft elevation.

These structures were constructed of earthfill with internal drain systems and upstream face plastic membranes. All structures were constructed downstream of their earlier counterparts. A separator dike was also constructed on the the ridge between Sections 35 & 36, extending north from the west abutment of Dan #1C.

In 1983, an ion exchange water treatment plant was constructed alongside Pope Lake. This plant processed all tails decant water before it was discharged into the Red River.

In 1990, Dam 5A was constructed in the old west decant channel on the north side of Dam 3A to an 7525 ft. elevation. The dam is designed to be raised to 7540 ft elevation at a later date.

4 DAM DESIGN PARAMETERS

The dams impounding the tailings are hydraulic structures of compacted earth fill with internal drains. Dams 1C and 4, have impermeable membranes installed on their upstream faces. Existing Dams 1C, 1B, 2A in Sections 36/25, have a common crest elevation of 7585 ft with design approval by the State Engineer to 7610 ft. elevation. Existing Dam 4, in Section 35, has a crest elevation of 7520 ft. with State Engineer approval to 7537 elevation. Dam 5A was designed with a rock downstream core in order to store water on both sides. State Engineer approval is to the 7540 ft. elevation. The existing dam crest is at 7525 ft elevation.

5. BASIC OPERATING SCHEME

Tailings are transported from the mill to the tails pond in two, 50,000 foot long, rubber lined tails lines in a slurry at 38% by weight solids

The tailings are discharged from spigot points located around the tails disposal area. After the tailings are discharged into the disposal area, the tails water is retained for a long enough period to allow the solids to settle out This retention time is governed by overflow weirs constructed at strategic points in the impoundment area. Water flow from the impoundment area is controlled by adding weir boards to the structures

After water overflows the final weir, west and north of the No. 4 dam, the tails water is conveyed by ditch and pipeline to the water treatment plant located below Dam No 4 After water treatment, the tails water is discharged into the Red River at Pope Lake (Outfall 001)

6 OPERATING PARAMETERS

The following tailings disposal operating philosophy is used.

a) Utilize pond areas efficiently in order to eliminate mill disruptions

b) Control tails disposal areas so that areas are either wet with tailings, under water in clarification phase, or tails sand covered with chemical stabilizer for short term dust control, or soil top cover for long term dust control.

c) Keep clarification ponds away from dam faces.

d) When introducing tailings into new areas not covered with tailings, initially establish tails beach against structure, or over natural ground to seal area against seepage.

e) Where feasible, minimize exposed tails sand areas by berming area with tails sand or controlling spigotting of tails to form ridges to attempt to isolate tails into cells

f) Adjust decant overflow weirs to maximize water clarification

7. FACILITIES MAINTENANCE AND INSPECTION

The following maintenance and inspection procedures are used.

a) When the mill is operating, Tails patrol over lines, pond areas and dams, 24 hours/day.

b) Daily recording of #002 seepage outflow and inspection of seep barrier No. 2 pipeline.

c) Monthly readings of piezometers in dam structures and visual inspection of all structures.

d) Continuous monitoring in mill control room of tails lines flow rates, pressure and sampling of tails to check density of slurry.

8. ENVIRONMENTAL

The following environmental controls are utilized.

a) Rainwater and snow melt diversion ditches have been constructed around the area in order to divert all material runoff away from the tails containment ponds.

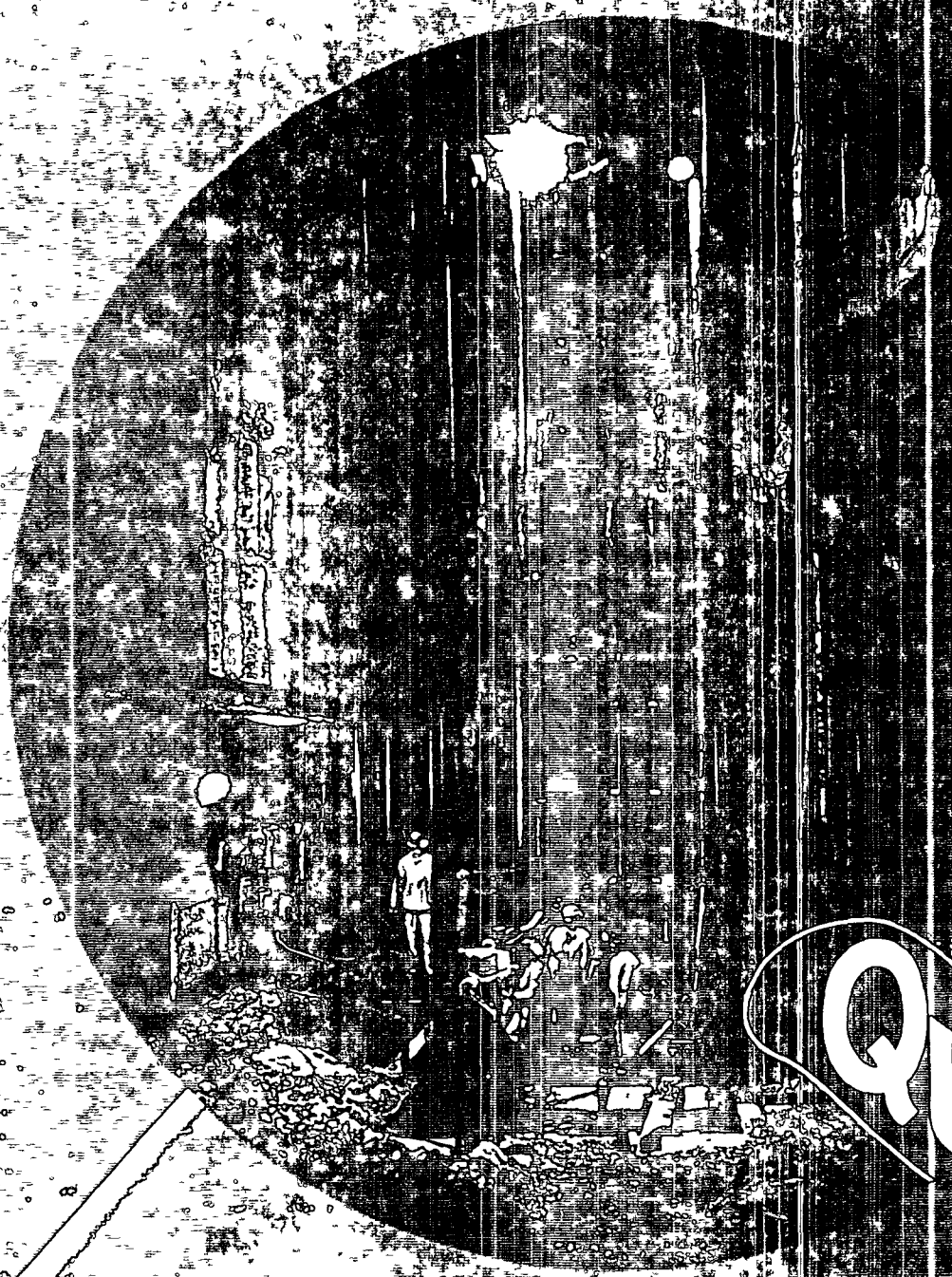
b) Two seepage barriers and drain systems have been constructed below No 1 Dam and adjacent ot No. 4 Dam to collect and divert seepage water to #002 Outfall.

c) Tails Dust Control Either by soil top cover and revegetation for long-term stabilization; or by coating exposed dry sand with chemical soil stabilizer for short-term.

d) Tails Decant Water Treatment: All clarified water from ponds is conveyed to a water treatment plant before final discharge into the Red River

e) Tails lines are rubber lined for their entire length in order to reduce pipeline wear.

molybdenum mining at Questa



by gravity block caving

This monolithic tower, near Goat Hill and the Red River, is the headframe of the mine's service shaft. It rises 206 feet above the 8000-foot level. The shaft is 24 feet across and 1385 feet deep, and contains a cage that can handle a 30-ton load or over 150 miners at one time.

OUR COVER PHOTOGRAPH: Taken inside the service shaft at the 7100-foot "grizzly" level during its early development, suggests the grand scale of underground mining at Questa.

Questa

New Mexico, U.S.A.

Questa is a town in the mountains of the great North American Southwest — halfway across the state of New Mexico in Taos County just below the Colorado line It lies on the Red River between the Rio Grande and the Sangre de Cristo Mountain Range

Questa is mineralogically special because deep under nearby Goat Hill and Sulfur Gulch lie enormous quantities of molybdenite ore that will supply molybdenum alloying ingredients to the iron and steelmakers of the world

Questa is economically important because the new mine and mill which these pages describe is creating 1 000 jobs and $35 million in payroll The mill can process 18 000 tons of ore daily to produce 20 million lb/yr of molybdenum in concentrate The operation comprises one of the great resources of

union 76 MOLYCORP

molybdenum was Molycorp's original product

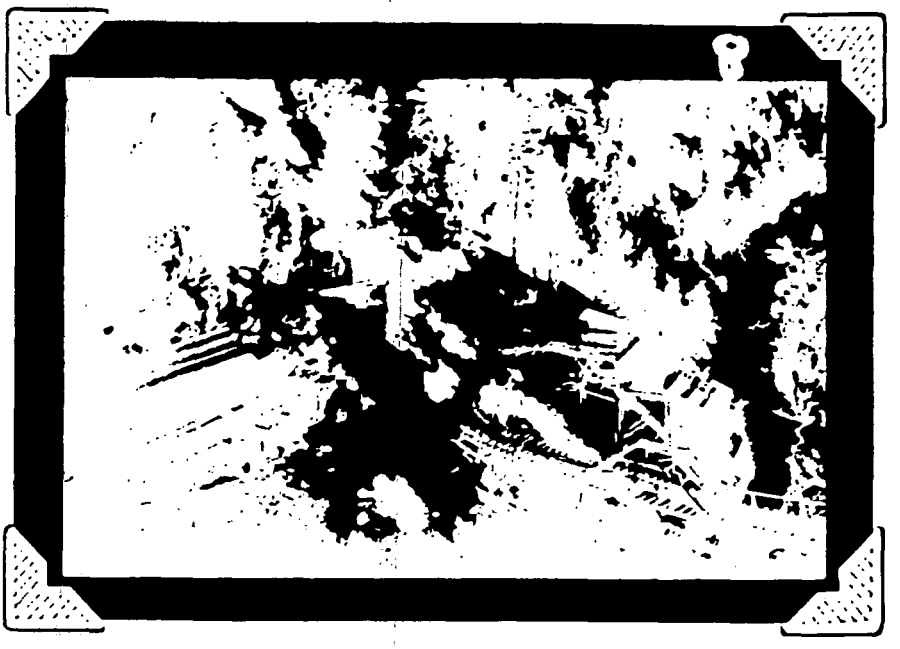
These snapshots recall the days when mules, muscle and water power were the only means of mining and milling molybdenum ore at Questa—before commercial electricity arrived in 1935.

Into the hills around Sulfur Gulch our miners followed greasy, gray molybdenite veins wherever they led. No test drillings or mineral surveys guided them. Originally, mules packed the ore to a converted gold mill five miles up the canyon for molybdenite extraction.

But in 1923 belt-driven mills and flotation cells were built at the mine site—and we began producing our own concentrate. Even so, the fickle flow of the Red River was our only power source, and 50 tons of ore per day was capacity.

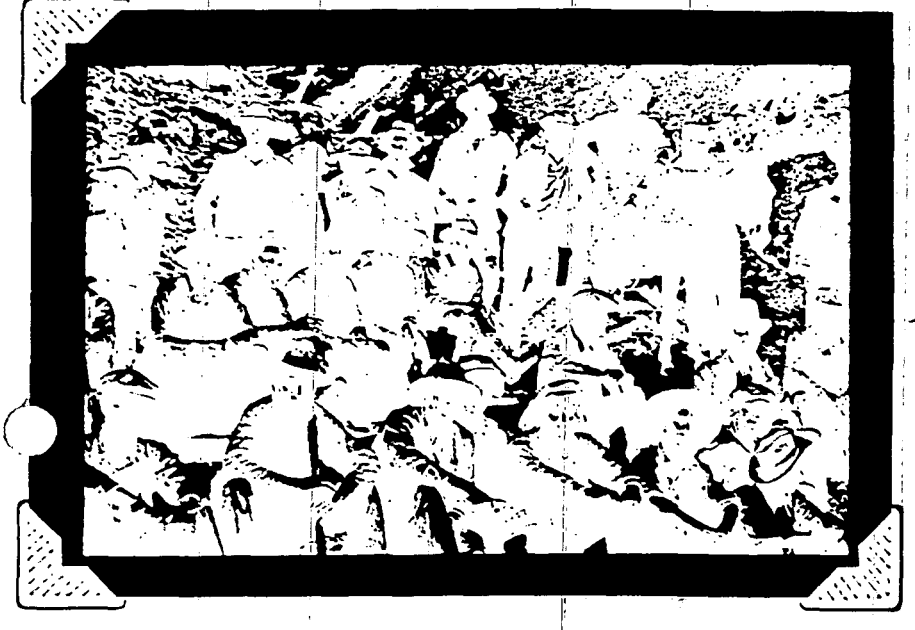
It was a romantic period, but the small, underground mine was unable to keep pace with new and growing markets for molybdenum metal to strengthen steel.

Metallurgy had brought "moly" to commodity status, which demanded new mining and milling technology.



1923

1935



during the 30's, 40's & 50's the moly market grew...

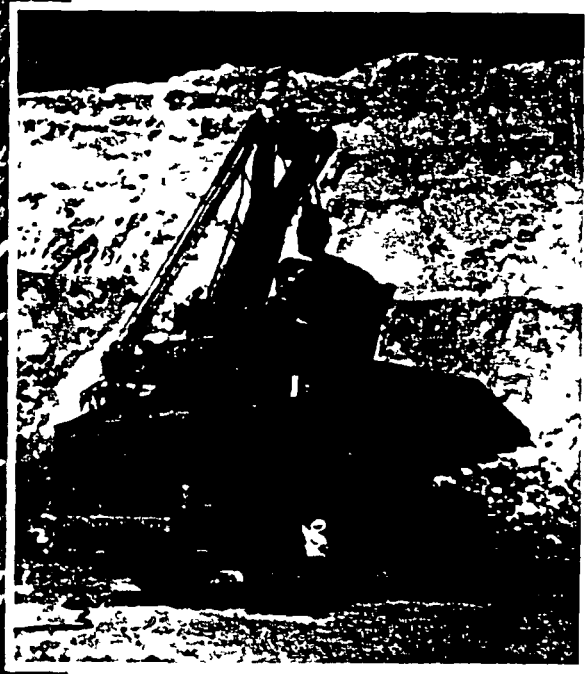
In the 30's molybdenum's usage grew beyond its early application for strengthening armor plate and automotive steels into uses for stainless steels cast irons and cast steels With the advent of war in the 40's and subsequent tungsten shortages, the increased need for high-speed tool steels and ship plate swelled moly's markets By the 50's molybdenum had become the essential steel-making commodity we know today, and annual world production (90% U S A) doubled during that decade from 30 to 60 million pounds of molybdenum metal

P. 9

...so we opened the pit & built a 15,000 tpd mill

It was in the late 50's that our geologists established the site and economics of an open pit operation for increased output, and in the early 60's that such mining began A modern mill was built to treat a whopping 10,000 tons of ore per day In 1969 it was expanded to 15,000 tpd capacity

In 1975 our exploratory drilling discovered a deep, high-grade deposit in the Southwest Zone that could be mined economically only by underground methods The improved economics of the higher grade deposit resulted in the decision to temporarily phase out open pit operations in favor of this new deposit The transition will be completed by 1985



AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. 1251 et. seq, the "Act"),

Molycorp, Inc
P. O. Box 469
Questa, New Mexico 87556

is authorized to discharge from a facility located at Questa, Taos County, New Mexico

to receiving waters named Red River, Waterbody Segment Code No. 2-119 of the Rio Grande Basin, from

Outfall 001 Latitude - N36°41'49"; Longitude - W105°37'53"
Outfall 002. Latitude - N36°41'29", Longitude - W105°37'53"
Outfall 004 Latitude - N36°41'08"; Longitude - W105°31'51"
Outfall 005 Latitude - N36°41'41", Longitude - W105°31'48"

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I (11 pages), II (8 pages), and III (7 pages) hereof

This permit supersedes and replaces NPDES Permit No. NM0022306 issued May 20, 1988

This permit shall become effective on October 15, 1993.

This permit and the authorization to discharge shall expire at midnight, October 14, 1998

Prepared by:

Frederick O Humke, P.E
Environmental Engineer
Industrial Permits Section (6W-PI)

Signed this 10thday of September 1993

Myron O. Knudson, P.E.
Director
Water Management Division (6W)

PART I
REQUIREMENTS FOR NPDES PERMITS

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

OUTFALL 001

During the period beginning the effective date and lasting through the expiration date, the permittee is authorized to discharge from Outfalls 001 - process water from milling operations and tailings disposal.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			
	MASS (LBS/DAY)		OTHER UNITS (mg/L UNLESS STATED)	
	DAILY AVG	DAILY MAX	DAILY AVG	DAILY MAX
Flow (MGD)	N/A	N/A	(*1)	(*1)
Chemical Oxygen Demand	(*1)	(*1)	60	90
Total Suspended Solids	(*1)	(*1)	20	30
Total Arsenic	(*1)	(*1)	0.5	1.0
Total Cadmium	(*1)	(*1)	0.05	0.05
Total Copper	(*1)	(*1)	0.15	0.30
Total Cyanide	(*1)	(*1)	0.025	0.05
Fluoride	(*1)	(*1)	3.0	3.0
Total Iron	(*1)	(*1)	0.6	0.6
Total Lead	(*1)	(*1)	0.3	0.6
Total Manganese	(*1)	(*1)	1.0	1.5
Total Mercury	(*1)	(*1)	0.001	0.002
Total Molybdenum	(*1)	(*1)	1.0	2.0
Total Zinc	(*1)	(*1)	0.2	0.2
Total Aluminum	(*1)	(*1)	(*1)	(*1)
Total Cobalt	(*1)	(*1)	(*1)	(*1)
Total Selenium	(*1)	(*1)	(*1)	(*1)
Total Vanadium	(*1)	(*1)	(*1)	(*1)
Total Beryllium	(*1)	(*1)	(*1)	(*1)
Total Silver	(*1)	(*1)	(*1)	(*1)
Chlordane	(*1)	(*1)	(*1)	(*1)
Total Residual Chlorine	(*1)	(*1)	(*1)	(*1)
Temperature	N/A	N/A	(*1)°F	(*1)°F
Biomonitoring	N/A	N/A	N/A	N/A

EFFLUENT CHARACTERISTIC	MONITORING REQUIREMENTS	
	MEASUREMENT FREQUENCY	SAMPLE TYPE
Flow (MGD)	(*2)	Record
Chemical Oxygen Demand	1/Week	Composite(*3)
Total Suspended Solids	1/Week	Composite(*3)
Total Arsenic(*5)	1/Week	Composite(*3)
Total Cadmium(*5)	1/Week	Composite(*3)
Total Copper(*5)	1/Week	Composite(*3)
Total Cyanide(*5)	1/Week	Composite(*3)
Fluoride	1/Week	Composite(*3)
Total Iron	1/Week	Composite(*3)
Total Lead(*5)	1/Week	Composite(*3)
Total Manganese	1/Week	Composite(*3)
Total Mercury(*5)	1/Week	Composite(*3)
Total Molybdenum	1/Week	Composite(*3)

Total Zinc(*5)	1/Week	Composite(*3)
Total Aluminum	1/Month	Composite(*3)
Total Cobalt	1/Month	Composite(*3)
Total Selenium(*5)	1/Month	Composite(*3)
Total Vanadium	1/Month	Composite(*3)
Total Beryllium(*5)	1/Month	Composite(*3)
Total Silver(*5)	1/Month	Composite(*3)
Chlordane(*5)	1/Month	Composite(*3)
Total Residual Chlorine(*5)	1/Month	Composite(*3)
Temperature	1/Week	Grab
Biomonitoring	1/Quarter	(*4)

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/Week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Outfall 001, which is the discharge spillway from Pope Lake.

FOOTNOTES

(*1) Report.
(*2) Continuous and totalized monitoring.
(*3) See Part II, Paragraph A.
(*4) See Part II, Paragrapn E.
(*5) See Part II, Paragrapn D.

OUTFALLS 002

During the period beginning the effective date and lasting through the expiration date, the permittee is authorized to discharge from Outfall 002 - seepage from tailings impoundment.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			
	MASS (LBS/DAY)		OTHER UNITS (mg/L UNLESS STATED)	
	DAILY AVG	DAILY MAX	DAILY AVG	DAILY MAX
Flow (MGD)	N/A	N/A	(*1)	(*1)
Chemical Oxygen Demand	(*1)	(*1)	60	90
Total Suspended Solids	(*1)	(*1)	20	30
Total Arsenic	(*1)	(*1)	0.5	1.0
Total Cadmium	(*1)	(*1)	0.05	0.05
Total Copper	(*1)	(*1)	0.15	0.30
Total Cyanide	(*1)	(*1)	0.025	0.05
Fluoride	(*1)	(*1)	3.0	3.0
Total Iron	(*1)	(*1)	0.6	0.6
Total Lead	(*1)	(*1)	0.3	0.6
Total Manganese	(*1)	(*1)	(*1)	(*1)
Total Mercury	(*1)	(*1)	0.001	0.002
Total Molybdenum	(*1)	(*1)	(*1)	(*1)
Total Zinc	(*1)	(*1)	0.2	0.2
Total Aluminum	(*1)	(*1)	(*1)	(*1)
Total Cobalt	(*1)	(*1)	(*1)	(*1)
Total Selenium	(*1)	(*1)	(*1)	(*1)
Total Vanadium	(*1)	(*1)	(*1)	(*1)
Total Beryllium	(*1)	(*1)	(*1)	(*1)
Total Silver	(*1)	(*1)	(*1)	(*1)
Chlordane	(*1)	(*1)	(*1)	(*1)
Total Residual Chlorine	(*1)	(*1)	(*1)	(*1)
Temperature	N/A	N/A	(*1)°F	(*1)°F
Biomonitoring	N/A	N/A	N/A	N/A

EFFLUENT CHARACTERISTIC	MONITORING REQUIREMENTS	
	MEASUREMENT FREQUENCY	SAMPLE TYPE
Flow (MGD)	(*2)	Record
Chemical Oxygen Demand	1/Week	Composite(*3)
Total Suspended Solids	1/Week	Composite(*3)
Total Arsenic(*5)	1/Week	Composite(*3)
Total Cadmium(*5)	1/Week	Composite(*3)
Total Copper(*5)	1/Week	Composite(*3)
Total Cyanide(*5)	1/Week	Composite(*3)
Fluoride	1/Week	Composite(*3)
Total Iron	1/Week	Composite(*3)
Total Lead(*5)	1/Week	Composite(*3)
Total Manganese	1/Week	Composite(*3)
Total Mercury(*5)	1/Week	Composite(*3)
Total Molybdenum	1/Week	Composite(*3)
Total Zinc(*5)	1/Week	Composite(*3)
Total Aluminum	1/Month	Composite(*3)
Total Cobalt	1/Month	Composite(*3)
Total Selenium(*5)	1/Month	Composite(*3)
Total Vanadium	1/Month	Composite(*3)

Total Beryllium(*5)	1/Month	Composite(*3)
Total Silver(*5)	1/Month	Composite(*3)
Chlordane(*5)	1/Month	Composite(*3)
Total Residual Chlorine(*5)	1/Month	Composite(*3)
Total Zinc(*5)	1/Week	Composite(*3)
Temperature	1/Week	Grab
Biomonitoring	1/Quarter	(*4)

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/Week by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Outfall 002, which is the collected and combined seepage from the tailings impoundment.

FOOTNOTES

(*1) Report.
(*2) By gauging on a daily basis.
(*3) See Part II, Paragraph A.
(*4) See Part II, Paragraph E.
(*5) See Part II, Paragraph D.

OUTFALLS 004 and 005

During the period beginning the effective date and lasting through the expiration date, the permittee is authorized to discharge individually from Outfalls 004 and 005 - periodic mine drainage consisting only of all mine contacted surface stormwater runoff.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			
	MASS (LBS/DAY)		OTHER UNITS (mg/L UNLESS STATED)	
CONVENTIONAL	DAILY AVG	DAILY MAX	DAILY AVG	DAILY MAX
Flow (MGD)	----	----	(*1)	(*1)
Total Suspended Solids	(*1)(*2)	(*1)	20	30
Chemical Oxygen Demand	N/A	N/A	125	125
Total Arsenic	N/A	N/A	(*1)	(*1)
Total Cadmium	(*1)(*2)	(*1)	0.05	0.10
Total Copper	(*1)(*2)	(*1)	0.15	0.30
Total Zinc	(*1)(*2)	(*1)	0.75	1.5
Total Lead	(*1)(*2)	(*1)	0.3	0.6
Total Mercury	(*1)(*2)	(*1)	0.001	0.002
Total Aluminum	(*1)(*2)	(*1)	(*1)	(*1)
Total Cobalt	(*1)(*2)	(*1)	(*1)	(*1)
Total Selenium	(*1)(*2)	(*1)	(*1)	(*1)
Total Vanadium	(*1)(*2)	(*1)	(*1)	(*1)
Total Beryllium	(*1)(*2)	(*1)	(*1)	(*1)
Total Silver	(*1)(*2)	(*1)	(*1)	(*1)
Chlordane	(*1)(*2)	(*1)	(*1)	(*1)
Total Residual Chlorine	(*1)(*2)	(*1)	(*1)	(*1)
Biomonitoring	N/A	N/A	N/A	N/A

EFFLUENT CHARACTERISTIC	MONITORING REQUIREMENTS	
	MEASUREMENT	SAMPLE
CONVENTIONAL	FREQUENCY	TYPE
Flow (MGD)	1/Day(*3)	Measure(*7)
Total Suspended Solids	1/Day(*3)	Composite(*6)
Chemical Oxygen Demand	1/Day(*3)	Composite(*6)
Total Arsenic(*5)	1/Day(*3)	Composite(*6)
Total Cadmium(*5)	1/Day(*3)	Composite(*6)
Total Copper(*5)	1/Day(*3)	Composite(*6)
Total Zinc(*5)	1/Day(*3)	Composite(*6)
Total Lead(*5)	1/Day(*3)	Composite(*6)
Total Mercury(*5)	1/Day(*3)	Composite(*6)
Total Aluminum	1/Month(*3)	Composite(*6)
Total Cobalt	1/Month(*3)	Composite(*6)
Total Selenium(*5)	1/Month(*3)	Composite(*6)
Total Vanadium	1/Month(*3)	Composite(*6)
Total Beryllium(*5)	1/Month(*3)	Composite(*6)
Total Silver(*5)	1/Month(*3)	Composite(*6)
Chlordane(*5)	1/Month(*3)	Composite(*6)
Total Residual Chlorine(*5)	1/Month(*3)	Composite(*6)
Biomonitoring	1/Quarter	(*4)

The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/day(*1) by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Prior to discharge from the settling basins.

FOOTNOTES

(*1) Report
(*2) Daily discharges averaged over the number of days in the monthly period.
(*3) During periods of discharge.
(*4) See Part II, Paragrapn E.
(*5) See Part II, Paragraph D.
(*6) See Part II, Paragraph A.
(*7) By calibrated weir.

INTERIM LIMITATIONS SUM1

During the period beginning the effective date and lasting through June 30, 1996, the permittee is authorized to discharge combined loads, SUM1 - Sum total of Outfalls 001 and 002 (technology levels) for the month.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			
	MASS (LBS/DAY)		OTHER UNITS (mg/L UNLESS STATED)	
	DAILY AVG (*2)	DAILY MAX	DAILY AVG	DAILY MAX
Chemical Oxygen Demand	2364	N/A	N/A	N/A
Total Suspended Solids	788	N/A	N/A	N/A
Total Arsenic	19.6	N/A	N/A	N/A
Total Cadmium	2.00	N/A	N/A	N/A
Total Copper	5.88	N/A	N/A	N/A
Total Cyanide	0.98	N/A	N/A	N/A
Flouride	118	N/A	N/A	N/A
Total Iron	23.6	N/A	N/A	N/A
Total Lead	11.8	N/A	N/A	N/A
Total Manganese	39.4	N/A	N/A	N/A
Total Mercury	0.04	N/A	N/A	N/A
Total Molybdenum	25.0(*1)	N/A	N/A	N/A
Total Zinc	7 84	N/A	N/A	N/A

EFFLUENT CHARACTERISTIC	MONITORING REQUIREMENTS	
	MEASUREMENT FREQUENCY	SAMPLE TYPE
Chemical Oxygen Demand	1/Month	Calculate
Total Suspended Solids	1/Month	Calculate
Total Arsenic	1/Month	Calculate
Total Cadmium	1/Month	Calculate
Total Copper	1/Month	Calculate
Total Cyanide	1/Month	Calculate
Flouride	1/Month	Calculate
Total Iron	1/Month	Calculate
Total Lead	1/Month	Calculate
Total Manganese	1/Month	Calculate
Total Mercury	1/Month	Calculate
Total Molybdenum	1/Month	Calculate
Total Zinc	1/Month	Calculate

FOOTNOTES

(*1) Calculate the average of monthly reported daily averages for Outfall 001 for six months preceeding the reporting period end date, then calculate the average of monthly reported daily averages for Outfall 002 for six months preceeding the reporting period end date. The stated discharge limitation applies to the sum total of these two calculated values.

(*2) Sum total of daily average mass loads for Outfalls 001 and 002.

FINAL LIMITATIONS SUM1

During the period beginning July 1, 1996, and lasting through the expiration date, the permittee is authorized to discharge combined loads, SUM1 - Sum total of Outfalls 001 and 002 (technology levels) for the month.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			
	MASS (LBS/DAY)		OTHER UNITS (mg/L UNLESS STATED)	
	DAILY AVG (*2)	DAILY MAX	DAILY AVG	DAILY MAX
Chemical Oxygen Demand	2364	N/A	N/A	N/A
Total Suspended Solids	788	N/A	N/A	N/A
Total Arsenic	19.6	N/A	N/A	N/A
Total Cyanide	0.98	N/A	N/A	N/A
Flouride	118	N/A	N/A	N/A
Total Iron	23.6	N/A	N/A	N/A
Total Manganese	39.4	N/A	N/A	N/A
Total Mercury	0.04	N/A	N/A	N/A
Total Molybdenum	25.0(*1)	N/A	N/A	N/A
Total Zinc	7.84	N/A	N/A	N/A

EFFLUENT CHARACTERISTIC	MONITORING REQUIREMENTS	
	MEASUREMENT FREQUENCY	SAMPLE TYPE
Chemical Oxygen Demand	1/Month	Calculate
Total Suspended Solids	1/Month	Calculate
Total Arsenic	1/Month	Calculate
Total Cyanide	1/Month	Calculate
Flouride	1/Month	Calculate
Total Iron	1/Month	Calculate
Total Mercury	1/Month	Calculate
Total Manganese	1/Month	Calculate
Total Molybdenum	1/Month	Calculate
Total Zinc	1/Month	Calculate

FOOTNOTES

(*1) Calculate the average of monthly reported daily averages for Outfall 001 for six months preceeding the reporting period end date, then calculate the average of monthly reported daily averages for Outfall 002 for six months preceeding the reporting period end date. The stated discharge limitation applies to the sum total of these two calculated values.

(*2) Sum total of daily average mass loads for Outfalls 001 and 002.

INTERIM LIMITATIONS SUM2

During the period beginning the effective date and lasting through June 30, 1996, the permittee is authorized to discharge combined loads, SUM2 - Sum total of Outfalls 001, 002, 004 and 005 (water quality standard levels)) for the month.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			
	MASS (LBS/DAY)		OTHER UNITS (mg/L UNLESS STATED)	
	DAILY AVG (*2)	DAILY MAX (*3)	DAILY AVG	DAILY MAX
Total Cadmium	(*1)	(*1)	N/A	N/A
Total Copper	(*1)	(*1)	N/A	N/A
Total Lead	(*1)	(*1)	N/A	N/A
Total Silver	(*1)	(*1)	N/A	N/A
Total Residual Chlorine	(*1)	(*1)	N/A	N/A
Total Aluminum	(*1)	(*1)	N/A	N/A
Chlordane	(*1)	(*1)	N/A	N/A

EFFLUENT CHARACTERISTIC	MONITORING REQUIREMENTS	
	MEASUREMENT FREQUENCY	SAMPLE TYPE
Total Cadmium	1/Month	Calculate
Total Copper	1/Month	Calculate
Total Lead	1/Month	Calculate
Total Silver	1/Month	Calculate
Total Residual Chlorine	1/Month	Calculate
Total Aluminum	1/Month	Calculate
Chlordane	1/Month	Calculate

FOOTNOTES

(*1) Report.
(*2) Sum total of daily average mass loads for Outfalls 001, 002, 003 and 004.
(*3) Sum total of maximum daily mass loads for Outfalls 001, 002. 003 and 004.

FINAL LIMITATIONS SUM2

During the period beginning July 1, 1996, and lasting through the expiration date, the permittee is authorized to discharge combined loads, SUM2 - Sum total of Outfalls 001, 002, 004 and 005 (water quality standard levels) for the month.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			
	MASS (LBS/DAY)		OTHER UNITS (mg/L UNLESS STATED)	
	DAILY AVG (*2)	DAILY MAX (*3)	DAILY AVG	DAILY MAX
Total Cadmium	(*1)	0.90	N/A	N/A
Total Copper	(*1)	4.39	N/A	N/A
Total Lead	(*1)	4.63	N/A	N/A
Total Silver	(*1)	0.005	N/A	N/A
Total Residual Chlorine	(*1)	0.35	N/A	N/A
Total Aluminum	(*1)	4.31	N/A	N/A
Chlordane	(*1)	0.0008	N/A	N/A

EFFLUENT CHARACTERISTIC	MONITORING REQUIREMENTS	
	MEASUREMENT FREQUENCY	SAMPLE TYPE
Total Cadmium	1/Month	Calculate
Total Copper	1/Month	Calculate
Total Lead	1/Month	Calculate
Total Silver	1/Month	Calculate
Total Residual Chlorine	1/Month	Calculate
Total Aluminum	1/Month	Calculate
Chlordane	1/Month	Calculate

FOOTNOTES

(*1) Report.
(*2) Sum of daily average mass loads for Outfalls 001, 002, 003 and 004.
(*3) Sum of daily maximum mass loads for Outfalls 001, 002, 003 and 004.

B. SCHEDULE OF COMPLIANCE

The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

Mass limitations for SUM1 and SUM2

Status Report	12/31/93
Status Report	3/31/94
Status Report	6/30/94
Status Report	9/30/94
Status Report	12/31/94
Status Report	3/31/95
Status Report	6/30/95
Status Report	9/30/95
Status Report	12/31/95
Status Report	3/31/96
Achieve Compliance	7/01/96

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

C. REPORTING OF MONITORING RESULTS

Monitoring results shall be reported in accordance with the provisions of Part III.D.4 of the permit. Monitoring results obtained during the previous month shall be summarized and reported on a Discharge Monitoring Report form postmarked no later than the 15th day of the month following the completed reporting period.

The first report is due on November 15, 1993 .

PART II
OTHER CONDITIONS

A. The term "composite sample" means a sample consisting of a minimum of two grab samples of effluent collected not less than four hours apart over a normal eight hour operating day and combined proportional to flow or a sample continuously collected proportional to flow over a normal eight hour operating day. All such samples shall be typical and representative of effluent generated during the period since the last sample was collected.

B. The Molycorp thiocyanate colorimetric method is approved for the analysis of molybdenum unless susequently determined to be inappropriate by the NMED or EPA.

C. As soon as practicable after the arrival of Molycorp's environmental staff at the site of a tailings spill that reaches the Red River, but no later than two (2) hours after arrival at the site, water quality sampling shall commence. Samples shall be taken at three sites:

(1) Approximately 100 feet above the point where tailings enter the river;

(2) Approximately 100 feet below the point where tailings enter the river; and

(3) Approximately one-half mile below the point where tailings enter the river.

All samples shall be properly preserved and analyzed for:

Chemical Oxygen Demand
Total Suspended Solids
Total Arsenic
Total Cadmium
Total Copper
Total Cyanide
Fluoride
Total Iron
Total Lead
Total Manganese
Total Mercury
Total Molybdenum
Total Zinc
Total Aluminum
Total Boron
Total Chromium
Total Cobalt
Total Selenium
Total Vanadium
Total Beryllium
Total Nickel
Total Silver
Un-ionized Ammonia (as N)
Total Residual Chlorine
Temperature
pH

The results of the analysis shall be submitted to the EPA Water Division Enforcement Branch (6W-EA) and the NMED within 30 days following a tailings spill.

Consistent with the procedures described in the Preventative Maintenance and Surveillance Plan and the Contingency Action and Reporting Plan (June 1975), a written report containing the following information will be sent to the EPA (6E) and the NMED within ten (10) days following any spill:

(1) Date of Spill.

(2) Time when the spill was observed and time when tailings flow into the river was stopped.

(3) Location (pipe or coupling number).

(4) Estimated amount of tailings that entered the river.

(5) Sketch and dimension of size of hole or failure that caused the spill.

(6) Position of failure in the pipe or coupling.

(7) Copy of the latest computer printout covering the pipe or coupling which failed.

(8) Comments, if required for clarification.

D. MINIMUM QUANTIFICATION LEVELS

If any individual analytical test result is less than the minimum quantification level (MQL), a value of zero (0) may be reported for that individual result for the Discharge Monitoring Report (DMR) calculation and reporting requirements.

PARAMETER	MQL
Total Arsenic	0.01 mg/l
Total Beryllium	0.005 mg/l
Total Cadmium	0.001 mg/l
Total Chromium	0.01 mg/l
Total Copper	0.01 mg/l
Total Lead	0.005 mg/l
Total Mercury	0.0002 mg/l
Total Selenium	0.005 mg/l
Total Zinc	0.02 mg/l
Total Cyanide	0.01 mg/l
Total Nickel	0.04 mg/l
Total Silver	0.002 mg/l
Chlordane	0.0002 mg/l
Total Residual Chlorine	0.011 mg/l

This permit may be reopened if MQLs change during the term of the permit.

E. **WHOLE EFFLUENT TOXICITY TESTING REQUIREMENTS (Chronic, Freshwater)**

1. SCOPE, FREQUENCY AND METHODOLOGY

a. The provisions of this section are individually applicable to Outfall(s) 001, 002, 004 and 005 for whole effluent toxicity.

b. The permittee shall test the effluent for toxicity in accordance with the provisions in this section. This testing will determine if an appropriately dilute effluent sample adversely affects the survival, reproduction or growth of the test organism.

c. The permittee shall complete the first toxicity test for each species within sixty (60) days of the effective date of the permit.

d. The permittee shall implement all toxicity tests utilizing the test organisms, procedures and quality assurance requirements specified in this section of the permit and in accordance with the EPA manual, "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms", EPA/600/4-89/001, or the most recent update thereof. The permittee shall repeat a test, including the control and all effluent dilutions, if the procedures and quality assurance requirements defined in the test methods or in this permit are not satisfied. A repeat test shall be conducted within the required reporting period of any test determined to be invalid.

e The permittee shall utilize the Ceriodaphnia dubia chronic static renewal survival and reproduction test (Method 1002.0 or the most recent publication) This test should be terminated when 60% of the surviving females in the control produce three broods. The permittee shall conduct the Ceriodaphnia dubia toxicity test at a frequency of once per quarter.

f The permittee shall utilize the fathead minnow (Pimephales promelas) chronic static renewal 7-day larval survival and growth test (Method 1000.0 or the most recent publication) A minimum of five (5) replicates with eight (8) organisms per replicate must be used for this test. The permittee shall conduct the fathead minnow toxicity test at a frequency of once per quarter.

g. The permittee shall use five effluent dilution concentrations in addition to a control (0% effluent) in each toxicity test. These additional effluent concentrations shall be 9%, 12%, 17%, 22%, and 29%. The low-flow effluent concentration (critical dilution) is defined as the 22% effluent.

h. The NOEC (No Observed Effect Concentration) is defined as the greatest effluent dilution which does not elicit lethality that is statistically different from the control (0% effluent) at the 95% confidence level.

i. This permit may be reopened to require whole effluent toxicity limits, chemical specific effluent limits, additional testing, and/or other appropriate actions to address toxicity

2. PERSISTENT LETHALITY

If the testing frequency in item 1 is monthly for a species, the permittee shall initiate the Toxicity Reduction Evaluation requirements as specified under Part II, Section F of this permit when any two of three consecutive monthly toxicity tests exhibit significant lethal effects at the 22% effluent concentration.

3. REQUIRED TOXICITY TESTING CONDITIONS

a. Test Acceptance

The permittee shall repeat any toxicity test, including the control and all effluent dilutions, which fails to meet any of the following criteria:

i. The toxicity test control (0% effluent) must have survival equal to or greater than 80%.

ii. The mean number of Ceriodaphnia dubia neonates produced per surviving female in the control (0% effluent) must be 15 or more.

iii. The minimum mean dry weight of surviving fathead minnow larvae at the end of the 7 days in the control (0% effluent) must be 0.25 mg per larva or greater.

iv. The percent coefficient of variation between replicates shall be 40% or less in the control (0% effluent) for: the young of surviving females in the Ceriodaphnia dubia reproduction test; fathead minnow growth test; and fathead minnow survival test.

v. The percent coefficient of variation between replicates shall be 40% or less in the 22% effluent concentration, unless significant lethal or nonlethal effects are exhibited for the young of surviving females in the Ceriodaphnia dubia reproduction test; fathead minnow growth test; and fathead minnow survival test.

b. Statistical Interpretation

i. For the Ceriodaphnia dubia survival test, the statistical analyses used to determine if there is a significant difference between the control and the low flow (critical dilution) shall be Fisher's Exact Test as described in the "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms", EPA/600/4-89/001, or the most recent update thereof.

ii. For the Ceriodaphnia dubia reproduction test and the fathead minnow larval survival and growth test, the statistical analyses used to determine if there is a significant difference between the control and the low flow (critical dilution) effluent concentration shall be in accordance with the methods for determining the No Observed Effect Concentration (NOEC) as described in the "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms", EPA/600/4-89/001, or the most recent update thereof.

c. Dilution Water

i. Dilution water used in the toxicity tests will be receiving water from the Red River collected as close to the point of discharge as possible but unaffected by the discharge. The permittee shall substitute synthetic dilution water of similar pH, hardness and alkalinity to the closest downstream perennial water for;

A. toxicity tests conducted on effluent discharges to receiving water classified as intermittent streams; and

B. toxicity tests conducted on effluent discharges where no receiving water is available due to zero flow conditions.

ii. If the receiving water is unsatisfactory as a result of preexisting instream toxicity (fails to fulfill the test acceptance criteria of item 3.a.), the permittee may substitute synthetic dilution water for the receiving water in all subsequent tests provided the unacceptable receiving water test met the following stipulations:

A. a synthetic dilution water control which fulfills the test acceptance requirements of item 3.a. was run in addition to the receiving water control;

B. the test indicating receiving water toxicity has been carried out to completion (i.e., 7 days);

C. the permittee includes all test results indicating receiving water toxicity with the full report and information required by item 4 below; and

D the synthetic dilution water shall have a pH, hardness and alkalinity similar to that of the receiving water or closest downstream perennial water not adversely affected by the discharge, provided the magnitude of these parameters will not cause toxicity in the synthetic dilution water.

d Samples and Composites

i. The permittee shall collect a minimum of three flow-weighted 24-hour composite samples each from Outfall(s) **001, 002, 004 and 005.** A 24-hour composite sample consists of a minimum of four effluent portions collected at equal time intervals representative of a 24-hour operating day and combined proportional to flow or a sample continuously collected proportional to flow over a 24-hour operating day.

ii. The permittee shall collect second and third 24-hour composite samples for use during 24-hour renewals of each dilution concentration for each test. The permittee must collect the 24-hour composite samples such that the effluent samples are representative of any periodic episode of chlorination, biocide usage or other potentially toxic substance discharged on an intermittent basis.

iii. The permittee must collect the 24-hour composite samples so that the maximum holding time for any effluent sample shall not exceed 72 hours. The permittee must have initiated the toxicity test within 36 hours after the collection of the last portion of the first 24-hour composite sample. Samples shall be chilled to 4 degrees Centigrade during collection, shipping and/or storage.

iv If the flow from the outfall(s) being tested ceases during the collection of effluent samples, the requirements for the minimum number of effluent samples, the minimum number of effluent portions and the sample holding time are waived during that sampling period. However, the permittee must collect an effluent composite sample volume during the period of discharge that is sufficient to complete the required toxicity tests with daily renewal of effluent. When possible, the effluent samples used for the toxicity tests shall be collected on separate days if the discharge occurs over multiple days. The effluent composite sample collection duration and the static renewal protocol associated with the

abbreviated sample collection must be documented in the full report required in item 4. of this section.

4. REPORTING

a. The permittee shall prepare a full report of the results of all tests conducted pursuant to this section in accordance with the Report Preparation Section of "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms", EPA/600/4-89/001, or the most current publication, for every valid or invalid toxicity test initiated whether carried to completion or not. The permittee shall retain each full report pursuant to the provisions of Part III C. of this permit. The permittee shall submit full reports only upon the specific request of the Agency.

b. The permittee shall submit the results of each valid toxicity test on the subsequent monthly DMR for that reporting period in accordance with Part III. D. of this permit, as follows:

Pimephales promelas (Fathead Minnow)

i. If the Fathead minnow No Observed Effect Concentration (NOEC) for survival is less than the 22% effluent dilution, enter a "1"; otherwise, enter a "0". Parameter No. TLP6C.

ii. Report the Fathead minnow NOEC value for survival, Parameter No. TOP6C.

iii. Report the Fathead minnow NOEC value for growth, Parameter No TPP6C

iv. Report the % coefficient of variation (Largest of low flow and control dilutions), Parameter No. TQP6C.

Ceriodaphnia dubia

i. If the Ceriodaphnia dubia NOEC for survival is less than the 22% effluent dilution, enter a "1"; otherwise, enter a "0". Parameter No TLP3B

ii. Report the Ceriodaphnia dubia NOEC value for survival, Parameter No. TOP3B.

iii. Report the Ceriodaphnia dubia NOEC value for reproduction, Parameter No. TPP3B.

iv. Report the % coefficient of variation (Largest of low flow and control dilutions), Parameter No. TQP3B.

F. TOXICITY REDUCTION EVALUATION

1. Within ninety (90) days OF CONFIRMING LETHALITY IN THE RETESTS, the permittee shall submit a **TRE Action Plan and Schedule** for conducting a Toxicity Reduction Evaluation (TRE). The **TRE Action Plan** shall specify the approach and methodology to be used in performing the TRE. A

Toxicity Reduction Evaluation is an investigation intended to determine those actions necessary to achieve compliance with water quality-based effluent limits by reducing an effluent's toxicity to an acceptable level. A TRE is defined as a step-wise process which combines toxicity testing and analyses of the physical and chemical characteristics of a toxic effluent to identify the constituents causing effluent toxicity and/or treatment methods which will reduce the effluent toxicity. The **TRE Action Plan** shall lead to the successful elimination of effluent toxicity at the low flow dilution and include the following:

a Specific Activities. The plan shall detail the specific approach the permittee intends to utilize in conducting the TRE. The approach may include toxicity characterizations, identifications and confirmation activities, source evaluation, treatability studies, or alternative approaches. When the permittee conducts Toxicity Characterization Procedures the permittee shall perform multiple characterizations and follow the procedures specified in the documents **"Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures" (EPA-600/6-91/003)** and **"Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I" (EPA-600/6-91/005)**, or alternate procedures When the permittee conducts Toxicity Identification Evaluations and Confirmations, the permittee shall perform multiple identifications and follow the methods specified in the documents **"Methods for Aquatic Toxicity Identification Evaluations, Phase II Toxicity Identification Procedures" (EPA/60-0/3-88/035)** and **"Methods for Aquatic Toxicity Identification Evaluations, Phase III Toxicity Confirmation Procedures" (EPA/600-/3-88/036)**, as appropriate;
The documents referenced above may be obtained through the National Technical Information Service (NTIS) by phone at (703) 487-4650, or by writing:

U S Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, Va. 22161

b. Sampling Plan (e.g., locations, methods, holding times, chain of custody, preservation, etc.). The effluent sample volume collected for all tests shall be adequate to perform the toxicity test, toxicity characterization, identification and confirmation procedures, and conduct chemical specific analyses when a probable toxicant has been identified;

Where the permittee has identified or suspects specific pollutant(s) and/or source(s) of effluent toxicity, the permittee shall conduct, concurrent with toxicity testing, chemical specific analyses for the identified and/or suspected pollutant(s) and/or source(s) of effluent toxicity. Where lethality was demonstrated within 48 hours of test initiation, each 24 hour composite sample shall be analyzed independently. Otherwise the permittee may substitute a composite sample, comprised of equal portions of the individual 24 hour composite samples, for the chemical specific analysis;

c. Quality Assurance Plan (e.g., QA/QC implementation, corrective actions, etc.), and

d. Project Organization (e g., project staff, project manager, consulting services, etc.).

2. The permittee shall initiate the **TRE Action Plan** within thirty (30) days of plan and schedule submittal. The permittee shall assume all risks for failure to achieve the required toxicity reduction.

3. The permittee shall submit a quarterly **TRE Activities Report**, with the Discharge Monitoring Report in the months of January, April, July and October, containing information on toxicity reduction evaluation activities including:

   a. any data and/or substantiating documentation which identifies the pollutant(s) and/or source(s) of effluent toxicity;

   b. any studies/evaluations and results on the treatability of the facility's effluent toxicity; and

   c. any data which identifies effluent toxicity control mechanisms that will reduce effluent toxicity to the level necessary to meet no lethality at the critical low flow effluent concentration.

   A copy of the **TRE Activities Report** shall be also be submitted to the **New Mexico Environment Department.**

4. The permittee shall submit a **Final Report on Toxicity Reduction Evaluation Activities** no later than twenty-eight (28) months from confirming lethality in the retests, which provides information pertaining to the specific control mechanism selected that will, when implemented, result in reduction of effluent toxicity to no lethality at the critical low flow effluent concentration. The report will also provide a specific corrective action schedule for implementing the selected control mechanism.

   A copy of the **Final Report on Toxicity Reduction Evaluation Activities** shall also be submitted to the **New Mexico Environment Department.**

SANTA FE

INSIDE
MOVIES/TV B-3
TIME OUT B-5
COMICS B-6

THURSDAY, SEPTEMBER 7, 1995 SECTION B

pitol marred with graffiti

veied the graffiti with a white
Wednesday morning and will ap-
v stucco
graffiti included obscenities and
s denouncing Gov Gary Johnson,
ving of a mushroom and the
"Legalize hemp," and the phrase
a Fiesta"
Capitol normally has security of-
on duty through mid-evening and
is a maintenance worker in the
g through the night Stuart Blue-
stone of the Legislative Council Service, which runs the building, said that in response to the graffiti, the Capitol will be protected with around the-clock security at least through this weekend's Fiesta de Santa Fe celebration

"And we're going to continue to assess what to do from here on out," Bluestone said

One of the phrases sprayed on the building was, "Death to the gov Ha ha" A state police spokesman said investigators take all possible threats against the governor seriously and that the graffiti incident will be investigated, but that there would be no change in operations of the governor's security detail

The anti Johnson slogans coupled with the reference to Fiesta produced speculation around the Roundhouse that the vandalism may have been a reaction to Johnson's decision to break tradition and not allow state workers the afternoon off on Friday, the first day of Fiesta weekend, or complaints that he is not attending enough Fiesta events

A spokeswoman for Johnson said the governor was appalled by the graffiti but "doesn't believe in any way that a state employee would be responsible" Johnson did not see the graffiti before it was covered, his staff said The governor's office has received a few calls on his cancellation of state workers' time off for Fiesta, with most of them against Johnson's move, the staff said

URCE OF GLOOM

U.S. agency eased policy to OK bridge

By KEITH EASTHOUSE
The New Mexican

A 1994 U.S. Fish and Wildlife

this month A hearing is scheduled before Judge Martha Vasquez today in Santa Fe

The coalition believes the 800-foot long bridge to be built

all the evil, gloom, doom and misery went into one man, Dr Vincent Zozobra

His hair turned orange, he grew as tall as a 10-story building, and when he spoke, his voice was deafening

Wherever he went he spread gloom and doom, there was panic in the streets

Finally they forced him out of town So Dr Zozobra went away to Santa Fe, New Mexico What he didn't know was that his "friends" had warned the New Mexicans that he was coming They hid with their torches and all manner of weaponry When he entered the town they ambushed him from every side He was tied, staked, and burned to the ground All gloom and doom left them for that year!

So now, every year we make a replica of Zozobra and burn it to celebrate the end of Dr Vincent Zozobra

By Amy Applewhite

Long ago, at the beginning of this century, a child was born He was cheerful, quick and constantly laughing His face was framed with auburn curls and his deep blue eyes were always twinkling It was said there was never such a beautiful baby His parents loved him dearly and provided for him well He grew up to be a delightful child He worked hard in school and was loved by both his teachers and classmates

One day the boy was seen sitting in a tree talking to a woman below It as said that she suffered from leprosy underneath the heavy veil around her head No one knows quite what she told the boy, but some say she cast an evil spell on him Others say she told him a dreadful story Some people deny they even spoke and uphold the theory that she

Please see **ZOZOBRA**, Page B 3

Allison V Smith/The New Mexican

Jim Iplotis spray paints the 1995 Zozobra's lips Wednesday night at the 4-H warehouse Zozobra will be burned Friday at dusk in a celebration at Ft Marcy Park

Julie Graber/The New Mexican

Ray Valdez, left, president of Zozobra Inc , works earlier this week with Karla Niemi to stuff the body of this year's Old Man Gloom

Questa molybdenum mine may reopen

By CATHERINE WALSH
For The New Mexican

TAOS — By mid-1996, Molycorp Inc in Questa could be employing 225 to 250 people and meeting an annual payroll of $10 million, according to David Shoemaker, the company's line manager

Sixteen Molycorp employees and 40 contract workers are currently working at the molybdenum mine "to gain access to underground mining areas and do repairs," Shoemaker said Wednesday Molybdenum is an alloy used for hardening steel

Molycorp's plans for reopening the mine and reclaiming the land around it will be discussed during a public hearing at the Questa Village Council Chambers, at 5 30 p m today The purpose of the hearing is to allow public comment on Molycorp's request for an operating permit But an environmental group dedicated to protecting New Mexico's rivers said it will challenge Molycorp's plans Amigos Bravos blames Molycorp for turning the Red River into "a dead river "

"The Red River was once a blue ribbon trout fishery," said Brian Shields, co director of Amigos Bravos "The fish disappeared during the same 10 years that the mine ex-

Please see **MINE**, Page B 3

charg motel

By GREG TOPP
The New Mexica

A San Juan Pueblo
Tuesday night from a si
shot wound to the ches
Española man was bein
Santa Fe County Deten
ter, charged with his mu

Ted Martinez, 28,
Tuesday at the Wester
Motel on U S 84-285 in
Police say Gilbert Ohle
Martinez when he an
others attacked motel
Kenneth Sharp

The criminal complai
the case states that
police the incident bega
bunch of guys jumpe
guy on the north side
tel " It goes on to say
male, who said the ma
boyfriend, ran to the d
motel office and yelle
to call the police

Sharp went outside a
group to leave, the
and several of the men
him

At that point, Ohlen,
motel employee wh
room there with his
and son, came out of
with Sharp's 357 M
volver He told the a
leave Sharp alone, and
didn't, he fired a sh
Martinez in the left up

Sharp concurred w
account, and added t
struck with a beer
then hea the
Martinez

Accordi
Ohlen "cam

... completely empty of his belongings He had run away

Two years later, he appeared in the small town of Santa Fe When questioned about his background he answered only that his name was Zozobra

He walked the streets of Santa Fe at night, wailing with sorrow When the sun rose, he would retreat to his small house to hide from the people of the town Some curious children would peek through the shutters of the house but there wasn't much to see The rooms were empty and dusty There were streaks on the ming pool and swam for hours. He went and showered at the swimming pool, put shampoo in his hair and put what he thought was conditioner. When he looked at the bottle it said chlorine

His mother picked him up and said, "what happened to your hair?" He said, "nothing, why?" She said "look in the mirror."

When he got home he looked in the mirror and his hair had turned green. He did not want to go to school because he knew that the kids would make fun of him, but his mother made him go to school So he took a hat to wear ... hair would turn a diff... color.

He finally came o... rity and started cha... and jumping all ove... Almost everything ... fire. With every step he took, the earth would shake, and suddenly he started on fire. He moaned and groaned and screamed until he fell to pieces. There were only about 100 people to tell the tale.

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MINE

Continued from Page B-1

panded — between the late '60s and the late '70s."

Without pressure put on Molycorp, the mine "could weasel out of the reclamation required by New Mexico's mining law," said Sawnie Morris, co-director of Amigos Bravos.

The mine which once employed 800 people at its peak could now use its resources to reclaim 3,200 acres of disturbed land, Morris said. "A lot of jobs could be provided if Molycorp would employ people to clean up its mess," she said.

But Shoemaker said problems with the Red River have existed for "thousands and millions of years.

"They're not just attributable to the mine," he said.

Molycorp will work with the local community and the environmental community on these issues, Shoemaker said.

The closing of Molycorp mine in December 1991 was devastating to the Taos County economy. The skeleton crew that worked at the closed mine could do little to prevent the flooding that occurred in the mine over the last few years. In December Molycorp announced that it had installed additional pumping equipment underground.

"We wanted to hasten the removal of water in case we decided to re-open the mine," said Art Bentley, a spokesperson for Unocal, the Los Angeles-based parent company of Molycorp.

In early August, Unocal confirmed that it was continuing start-up activities at Molycorp and that it hoped to reopen the mine sometime in 1996.

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THURSDAY EVENING TE

	5:00	5:30	6
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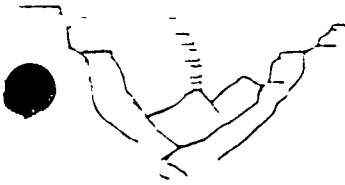

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PROGRESS REPORT ON THE GEOLOGY, HYDROGEOLOGY, AND WATER QUALITY OF THE MINE AREA
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Taos County, New Mexico

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MAY 11 1995
GROUND WATER BUREAU

April 21, 1995

Progress Report on the Geology, Hydrogeology, And Water Quality of the Mine Area

TABLE OF CONTENTS

	Page
LIST OF APPENDICES	ii
LIST OF FIGURES	ii
LIST OF TABLES	ii
1.0 INTRODUCTION AND SUMMARY	**1**
1.1 INTRODUCTION	1
1.2 SUMMARY OF FALL 1994 AND PREVIOUS INVESTIGATIONS	2
2.0 GEOLOGY AND HYDROGEOLOGY	**4**
2.1 GENERAL GEOLOGIC SETTING	4
2.2 MINE AREA GEOLOGY AND HYDROGEOLOGY	4
3.0 RESULTS AND DISCUSSION OF SPRI SUMMER/FALL 1994 FIELD ACTIVITIES	**7**
3.1 WELL EMPLACEMENTS	7
3.2 WATER LEVELS AND HYDRAULIC CONNECTIONS	8
3.3 AQUIFER TESTING	12
3.4 WATER QUALITY	13
4.0 RECOMMENDED WORK	**14**
4.1 SURFACE GEOPHYSICAL SURVEYS	14
4.2 MONITOR AND EXTRACTION WELLS	14
4.3 WATER-QUALITY MONITORING	15
4.4 BASIC DATA COLLECTION	16
5.0 REFERENCES	**18**

LIST OF APPENDICES

Appendix A Discussion of Mine Area Geology
Appendix B Discussion of Mine Area Hydrogeology
Appendix C Mine Area Borehole Logs (from Fall 1994 Field Investigation)
Appendix D Mine Area 1994 Water-Quality Results
Appendix E Data from Mine Area Aquifer Drawdown and Recovery Tests

LIST OF FIGURES

Figure 1 Regional Location Map
Figure 2 Mine Area Site Map
Figure 3 Geologic Cross-Section A-A'
Figure 4 Fan Delta and Mine Waste-Rock Locations
Figure 5 Hydrogeologic Cross-Section Sugar Shack South
Figure 6 Hydrogeologic Cross-Section Sugar Shack West
Figure 7 Hydrogeologic Cross-Section Capulin Canyon
Figure 8 Ground-Water Contours for Bedrock Wells
Figure 9 Schematic of Water-Level Changes in Area of the Underground Mine
Figure 10 Existing and Proposed Monitor Well Locations

LIST OF TABLES

Table 1 1994 Monitor Well Water-Quality Data for Mine Area
Table 2 Comparison of Water-Quality Data for Sugar Shack-South and Portal Springs

1.0 INTRODUCTION AND SUMMARY

1.1 INTRODUCTION

The Molycorp molybdenum mine is located on the western slope of the Taos Range of the Sangre de Cristo Mountains, Taos County in north-central New Mexico (Figure 1) The Mine Area lies north of the Red River and State Highway 38 which connects the mine area with the Town of Red River (6 miles to the east) and the Town of Questa (6 miles to the west) For the purposes of this report the study area has been defined as the ***Mine Area,*** which consists of extraction, processing, and rock-waste deposition activities The significant features associated with the Mine Area are shown on Figure 2

Mining for molybdenum began in the Questa area between 1916 to 1920 The nature of mining activities progressed form the original underground workings to open-pit operations (beginning in 1964-65) and back to the more recent underground mining (beginning in 1979-1983) Mine waste-rock dumps were emplaced during the 1970s and 1980s when the open pit was excavated The mine went on temporary standby status in 1986 until economic conditions improve for the molybdenum market Mine dewatering resumed in July 1994 in anticipation of potential reactivation of mining activities

The Molycorp mining operations have been both extractive in nature (the Mine Area) and simultaneously depositional (the Mine Area waste-rock dumps and the Tailings Area) Large-scale extractive or depositional activities normally will have an impact on a natural environment Molycorp has been both proactive and responsive to examination of the environmental impacts resulting from their activities In the Mine Area, any adverse water-quality impacts are exacerbated if not exceeded, by natural impacts (e g -acid runoff from hydrothermal scars) Water-quality data from several sources, including the Red River sewage treatment plant well Hanson Creek and Hot-N-Tot Creek indicate significant natural contributions to surface-water and ground-water quality degradation

In 1989, Molycorp retained the services of South Pass Resources, Inc. (*SPRI*) to evaluate impacts of past and present Molycorp operations on ground-water and surface-water quality The dominant environmental concerns are two-fold

- What impacts, if any, have mining operations had on surface-water (Red River) or ground-water quality?
- What percentage of any surface-water or ground-water quality degradation is from natural (versus mining-related) sources?

These issues are under study by consultants currently retained by Molycorp (including SPRI Vail Engineering, and Steffen Robertson & Kirsten) Previous studies by SPRI, Dames and Moore Harding-Lawson, Water Resource Associates Geocon, Vail and Associates, ENSR and others have focused on definition of the geologic, hydrogeologic, water quality, and hydrologic characteristics in and about the Molycorp facilities Of particular emphasis has been definition of those naturally-occurring physical and chemical parameters that control real or potential contaminant migration pathways and concentrations

SPRI's most recent (Summer and Fall 1994) activities have involved the design, installation, and testing of 12 new monitor wells in the Mine Area This report presents a detailed discussion of the results of the 1994 investigation, and of previous investigations, and an evaluation of recent geologic, hydrogeologic, and water-quality data

1.2 SUMMARY OF FALL 1994 AND PREVIOUS INVESTIGATIONS

Beginning on July 11, 1994, SPRI overviewed the design, installation, and testing of 12 new monitor/extraction wells in the Mine Area The purpose of this investigation was to

- characterize the water quality of naturally occurring ground water and seeps and compare these data to seepage from mining activities and
- characterize the geologic controls on fluid movement

In addition the drawdown associated with the cone of depression from dewatering of the mine is being monitored within the newly-installed wells It will take a year or more of monitoring before drawdown rates can be quantified some additional monitor wells may be required

The wells that were installed during the 1994 investigation, and the details of their installation and testing, are summarized below The locations of these wells and other wells installed in the Mine Area are shown on Figure 2

Monitor/Extraction Wells Installed in Mine Area July/August 1994			
Well No.	**Total Depth (feet)**	**Screened Interval (feet)**	**Well Completed In**
MMW-2	68	38 - 58	mudflow
MMW-3	145	65 - 115	andesite bedrock
MMW-7	161	86 - 161	andesite bedrock
MMW-8A	161	125 - 161	andesite bedrock
MMW-8B	129	67 - 117	mudflow
MMW-10A	144	79 - 130	alluvial gravel/ sand overlying quartz monzonite bedrock
MMW-10B	189	133 - 189	quartz monzonite bedrock
MMW-10C	50	31 5 - 50	mudflow
MMW-11	185	145 - 185	quartz monzonite bedrock
MMW-13	148	105 - 148	sandy gravel, gravelly sand overlying quartz monzonite
MMW-14	75	48 - 75	sandy gravel gravelly sand
MMW-16	98	45 - 98	sandy gravel gravelly sand overlying light grey granite

A partial listing of the other monitor and extraction wells in the Mine Area that pre-date SPRI field activities are summarized below (Note a complete list of all wells located in the study area is unknown at this time)

Other Wells Located in the Mine Area (Partial Listing)		
Well No.	**Total Depth (feet)**	**Year Installed**
Mill Well 1A-1	176	1977
Mill Well No 1	150	1962
Columbine No 1	89	1965
Columbine No 2	140	1965
Columbine No 1 redrill	153	1971

2.0 GEOLOGY AND HYDROGEOLOGY

2.1 GENERAL GEOLOGIC SETTING

The major sources of geologic data for the Questa Mine area are Schilling (1956), Rehrig (1969) Lipman (1981), Bookstrom (1981) and numerous unpublished maps, cross-sections and reports by Molycorp geologists A common thread to all of these geologic studies is that the mineralization at Questa was related to Tertiary magnetism and hydrothermal solutions focused along an east- to northeast-trending structural zone This structural zone is variously interpreted as part of a graben (Schilling, 1956), as a zone of intense faulting (called the Red River Structural Zone by Rehrig, 1969), and the southern part of the outer ring fracture zone that formed the outer wall of the Questa caldera (Lipmann, 1981 Bookstrom, 1981)

The development of the caldera and the associated volcanic and intrusive rocks was a late Oligocene to Middle Miocene event (27 2 to 22 million years before present) that was concurrent to and overlapped the regional rifting associated with the Rio Grande Rift System The range-bounding high-angle fault along the west side of the Sangre de Cristo Mountains (about 5 miles west of the mine) is related to regional extension across the Rio Grande Rift and the uplift of the range in Mid-Tertiary time At least the later movements along this range-front fault are younger than the caldera structure because the outer ring fracture zone is truncated by the range-front fault

2.2 MINE AREA GEOLOGY AND HYDROGEOLOGY

Geology

The Mine Area is composed of Pre-Cambrian igneous, metasedimentary, metavolcanic, and other metamorphic rocks, overlain by a thick sequence of Tertiary ashflow tuffs and andesitic lava flows These rock types have been intruded by granitic rocks, forming dikes, and elongated intrusions Mineralized quartz veins in the Mine Aplite (i e , finely crystalline granite) and in the adjacent intruded volcanics were formed during a late magmatic, post-caldera hydrothermal stage The Mine Area is within a northeast- to east-trending structural rift zone that forms the south side of the Questa caldera This structural rift zone contains numerous dikes and mineral veins Fractures and fault discontinuities are widely varied, as illustrated on a geologic cross-section (Figure 3), and include

- high-angle faults and joints,
- low-angle faults, and

- contact-zone fractures between different rock units

The mined ore deposits consist of molybdenite-bearing quartz veins

Hydrogeology

In the Mine Area, the most significant controls to fluid movement appear to be preferred channels within mud flows location and degree of geologic discontinuities (faults joints fractures), man-made fluctuations of the water table north of the Red River, and hydraulic conductivity differences between mine waste-rock, bedrock, and valley-fill (mudflow or alluvium) Water-quality degradation of the Red River in the Mine Area has been found to be heavily controlled by natural processes and is influenced locally from byproducts of mining

Hydrogeologic units include a basement (Pre-Cambrian) aquitard overlain by volcanics and sedimentary rock aquifers and/or valley-fill mudflow and alluvial valley-fill aquifers Hydrothermal scar materials of low hydraulic conductivity are scattered over the area Mine waste dumps contain perched aquifers

The natural ground-water gradients are toward the Red River Mine dewatering operations have created a cone of depression around the underground mine workings The primary hydrologic linkage between up-gradient sources and the river is the fan delta deposits at the mouths of tributary canyons at Capulin Canyon and Sugar Shack South The 12 monitor/extraction wells installed by SPRI in Fall 1994 were screened in fan delta and bedrock aquifers and were constructed at sites near the mouths of tributary canyons to evaluate these linkages Water-quality sampling and water-level measurements were made in cooperation with the New Mexico Environmental Improvement Department (EID) in November 1994

In the Mine Area, low pH, high total dissolved solids (TDS), and high sulfate characterize the natural springs and seeps as well as surface water in drainages crossing hydrothermal scar areas Analytical results of water quality sampling along and adjacent to the Red River indicates both natural and mine-related seepage affect the water quality of the Red River Deep underground mine water has a slightly alkaline pH plus slightly elevated levels of TDS and sulfate

Water in the unsaturated zone water in the perched-water zones, and ground water move from sources to discharge points Sources of this water are both natural and mine-related infiltration, surface run-off, and seepage from natural springs and mine-constructed waste-rock piles The discharge points consist of the deep underground mine, the Red River, and (via slurry line) the Tailings Area ponds Water that arrives at the discharge points

consists of natural acidic drainage mixed with varying amounts of waste-rock dump-related water

Naturally acidic waters have been in transit through the same system excluding seepage barriers for thousands of years as is evident from limonite-cemented alluvial and mudflow deposits

Perched water can form near the base of the waste-rock dumps Perched water can also form in zones of fractured bedrock above the main water table and above clay intervals in the valley-fill Bedrock seeps such as the seeps at Cabin Springs near the river, may be from a perched bedrock zone

Dewatering of the new underground mine (1979 to 1992 and resumed in July 1994) has created a cone of depression that appears to extend in some places to the Red River The original cone of depression may have captured much of the natural and mine-related discharge However, Capulin Canyon appears to lie outside the zone of influence of dewatering Also, the Cabin Spring seepage (which may be perched) may not be impacted by the dewatering cone of depression

The impact of the current mine dewatering on recharge of mine-related seepage to the Red River cannot be properly evaluated until after at least one year of data collection including monthly water-level measurements and quarterly water-quality analysis (similar to data collection of November 1994) Bladder pumps were used to collect water-quality samples at all of the mine monitor/extraction wells because (with some exception) the wells appear to be low yield (less than a few gallons per minute) The known exceptions are MMW-11 (bedrock well in a fracture zone), which pumped at a rate of more than 60 gpm, and MMW-10A (valley-fill well) which pumped at 140 gpm with 3 feet of drawdown Because the existing extraction wells in the Mine Area tend to be low-yield wells, their capacity to control seepage by pumping is limited

Appendices A and B contain more detailed discussions of the Mine Area geology and hydrogeology Appendix C contains geologic logs for wells emplaced during SPRI's 1994 investigation Appendix D contains data and discussions on water quality

3.0 RESULTS AND DISCUSSION OF SPRI SUMMER/FALL 1994 FIELD ACTIVITIES

3.1 WELL EMPLACEMENTS

To identify and evaluate the presence of potential hydrogeologic connections between the waste-rock dumps, down-gradient aquifers, and the Red River, aerial photographs were used to locate the monitor/extraction wells as close as possible to the pre-1963 valley bottom [In a number of areas, waste-rock dumps and/or mine cut-and-fill operations have subsequently covered these drainages The fan delta deposits (alluvial sediments and mudflow deposits, collectively called the *valley-fill aquifer*) occur at the mouths of tributary valleys to the Red River (see Figure 4)]

The equipment used to drill the monitor/extraction wells consisted of a casing drive system using 8-inch and 12-inch inside diameter (ID) threaded drive casing A casing drive shoe was attached to the base of the casing driver and remained at the bottom of the cased hole after hydraulic jacks extracted the drive casing Well construction and placement of annular materials were accomplished inside the drive casing, limiting the well casing to 8 inches or less inside the 12-inch drive casing and 6 inches or less inside the 8-inch drive casing A downhole air hammer and hammer bit were used to drill through boulders and bedrock The drill equipment consisted of a 15W Gardner Denver Tophead drive chain pulldown drill rig, water truck pipe truck air compressor truck (primary), tag-along air compressor (secondary), and hydraulic jacks truck

All wells that had water in the borehole were developed by either pneumatic downhole bladder pump, bailing, or electric submersible pump Low-yield wells were pumped using the pneumatic bladder pumps (for their design protections against pump burnup) The medium-yield wells were pumped by continuous bailing with an 18-gallon bailer The bailing operation used a hydraulic powered 5T Smeal pump truck to raise and lower the bailer Bailing rates were adjusted to fit each well s yield so as to allow for baildown without undue interruption of the extraction rate High-yield wells were pumped with either one horsepower (hp) or 5 hp electric submersible well pumps The actual high-end pumping rate varied with head considerations, but the 5 hp pump would usually pump up to 50 gallons per minute

When the locations of the monitor wells were established and surveyed for elevation by Molycorp staff, elevations for wells with protruding casing vaults were taken at the top of the casing and elevations for wells with flush-mounted vaults were taken at the top of the cement pad All measuring point elevations have been corrected to read from the top of the cement pad

3.2 WATER LEVELS AND HYDRAULIC CONNECTIONS

SPRI overviewed the installation of 12 new monitor wells during the 1994 investigation (refer to Figures 2 and 10 for locations) These wells and their hydrologic characteristics are described below

Wells MMW-14 and MMW-16

These wells, which are located in the fan delta or valley-fill deposits and the immediately underlying bedrock opposite the Sulphur Gulch and Spring Gulch area, are dry The open pit (Sulphur Gulch) and the decline that passes under lower Sulphur Gulch may capture most of the discharge from the drainage basin (These wells are not deep enough to intersect the cone of depression if it extends into this area)

Well MMW-13

This well was drilled opposite the Middle Dump and extended initially into bedrock (25 feet) it was completed as a valley-fill well since the bedrock was dry It is difficult to distinguish reworked valley-fill from in-situ valley-fill by drill cuttings alone Berms were constructed across the lower parts of some tributary valleys prior to dump construction Using elevations for the pre-berm surface from the 1963 USGS topographic map (Questa NM 7 5 Minute Quadrangle Map) and more recent mine topographic maps, the upper 50 to 70 feet of sandy gravel at MMW-13 appear to be berm material The lower 15 feet of the valley-fill was saturated The water-level elevation at this well is low (7 963 feet) when compared to the stream bed elevation opposite the well (7 990 to 8 000 feet) This water-level elevation has changed less than 1 0 foot over the five-month period since construction The water level will continue to be monitored for evidence of additional drawdown related to the mine cone of depression

Wells MMW-10A, B, C

These wells are located below the toe of Sugar Shack South Dump The elevation of the Red River opposite these wells is between 7,910 and 7,920 feet. The water quality of Portal Springs (a series of river bank seeps along the north side of the river) is commensurate with natural acidic sources and/or waste-rock dumps The eastern most seep (located just west of the MMW-10 wells) has an estimated elevation of 7,915 feet As discussed later in this section, these seeps are believed to represent the top of the potentiometric surface at the river Water-level elevations at the three MMW-10 wells are slightly above 7,917 feet

Monitor well MMW-10A is screened in the lower part of the valley-fill, immediately above bedrock The borehole log indicates that the fill here is a mixture of fluvial sands and gravel and mudflow deposits Clay beds interbedded in the valley-fill probably resulted from deposition in lakes formed behind contemporaneous mudflows that blocked the Red River Valley The aquifer test results discussed in Section 3 3 indicate that this well, if fully stressed, may produce several hundred gallons per minute from the saturated sands and gravels

MMW-10B is screened in bedrock just below the valley-fill, but the water-level elevation (7 917 feet) is 112 feet above the contact, indicative of a strong upward gradient This water-level elevation is close to that of the two valley-fill wells which, since the bedrock is highly fractured below the fill, could also be interpreted to mean that the fill and the shallow bedrock are in hydraulic continuity As discussed in Section 3 3, the aquifer test at MMW-10A established some hydraulic connection between the valley-fill aquifer and the underlying bedrock aquifer (MMW-10B) because both wells gave drawdown effects during the test The head relationship between the valley-fill and the bedrock aquifers may have a seasonal component with higher heads in the bedrock during spring recharge

MMW-10C is screened in the upper part of the valley-fill, just above a thick clay bed It is conceivable that MMW-10C intercepts a perched zone, and the configuration of the perched water table is not dependent on the main water table A more likely explanation is that the clay beds (just below the total depth for MMW-10C) retarded vertical flow and because of the short duration of the aquifer test (100 minutes) there was very little drawdown at MMW-10C An interpretation is that MMW-10C and MMW-10A are part of a continuous zone of saturation and that the clay bed is the cause of the lack of response during the aquifer test

Well MMW-11

MMW-11 was completed in the upper part of the bedrock aquifer, just south of the toe of Sugar Shack South Dump During the drilling of this well, the lower part of the dump material was described as moist, but free water (described as dark turbid water) did not appear until 93 feet This description corresponds with the base of the dump material Immediately underlying the dump material is a thin sandy gravel followed by 10 feet of gravelly clay Small amounts of water [a few gallons per minute (gpm)] were reportedly produced throughout the valley-fill, but because a mixture of foam and water was being injected during drilling, the extent of saturation in the valley-fill is unknown It is possible that the water at 93 feet infiltrated from the overlying dump material and represents a thin perched zone The water-level elevation for the bedrock aquifer at MMW-11 is 7,915 feet, or 58 feet above the valley-fill and

bedrock contact This indicates a strong upward gradient which would be expected near the zone of discharge in the Red River valley The water-level elevation for the valley-fill aquifer at MMW-11 is not known

During the development (using air lift) of MMW-11, the bedrock aquifer had a pumping rate (Q) of 60 gpm with less than one (1) foot of drawdown (s) According to Huntley et al (1992), the use of specific capacity formulas based on alluvial aquifer studies can be used to estimate transmissivity (T) for fractured rock Using the equation

$$T = K\left(\frac{Q}{s}\right)^{1.18}$$

where Q = 60 gpm
s = 1 foot, and
K = 38 9 [a conversion factor from Table 1 (Huntley et al , 1992), NOTE This K is not equal to permeability]

a transmissivity (T) of 4 877 ft^2/day (36 479 gpd/ft) was calculated (NOTE The factor to convert from ft^2/day to gpd ft is 7 48 gallons/foot) This value contrasts with 90 000 gpd/ft based on the standard alluvial equation estimate

$$T = \left(\frac{Q}{s}\right)1500$$

It is difficult to estimate hydraulic conductivity since the actual thickness of the aquifer is not known If the thickness of bedrock aquifer open to the screen (40 feet) is used, a maximum value for K would be 912 gpd/ft^2 This value is close to the upper limit for fractured igneous rock (Freeze and Cherry, 1979) and could be a significant overestimation

MMW-11 may be located near the outer edge of the cone of depression Over the last five months, corresponding with dewatering of the underground mine, the water level at this well has shown fluctuations of less than 0 5 foot

Figure 5 is a cross-section illustrating hydrogeologic relationships in the area of Sugar Shack South

Wells MMW-8A and -8B

Monitor well MMW-8A (screened in bedrock) and MMW-8B (screened in alley-fill) are located on a fan delta deposit that filled an unnamed tributary valley in the area of Shaft No 1 These wells are close to the river (within 250 feet) Water-level elevations for both wells are within the contour interval (10 feet) along the Red River opposite the well It is not clear that the MMW-8 wells are within the cone of depression Recharge from ground water beneath the river may balance discharge to the dewatering center keeping water levels at about the same elevation Additional monthly water-level measurements may help resolve the issue The bedrock well (MMW-8A) has a slightly higher water level than the valley-fill well (MMW-8B), indicating a weak upward gradient

Well MMW-7

This well (north of Shaft No 1) was drilled to a depth of 161 feet and screened in bedrock The water level here is 8 029 feet, which is approximately 550 feet or more above the current cone of depression This well is screened in andesitic flow rock characterized by a series of low-angle north-dipping faults (Figure 3) Drill cuttings and drilling conditions indicated that the andesite is highly fractured The potentiometric water level here is above the valley-fill/bedrock contacts Valley-fill appeared to be unsaturated at MMW-7 and no perched zone within the fill was noted MMW-7 appeared to have intercepted a perched zone within bedrock This perched zone is confined to an interval of fractured rocks apparently associated with a series of low-angle structures Figure 6 is a cross-section illustrating hydrogeological relationships at the MMW-7 and MMW-8 wells

Upper Goathill Gulch drainage flows into the caved area With the level of dewatering maintained below the elevation of the Red River, no monitor wells were constructed in the lower part of Goathill Gulch

Wells MMW-2 and MMW-3

Well MMW-2 (in valley-fill) and MMW-3 (in bedrock) were drilled in the fan delta area in lower Capulin Canyon Figure 7 is a cross-section illustrating the hydrogeologic relationships at MMW-2 and -3 Water-level elevations of these two wells are 90 to 100 feet above the level of the Red River at the mouth of the canyon These elevations, if connected to a stream bed elevation farther upstream, are indicative of gaining conditions along the Red River Based on the number of springs and seeps issuing from cutbanks along the river, the water table is likely to be at the stream bed. There is a weak upward gradient from the bedrock to the valley-fill, however, the

water quality of the valley-fill ground water at MMW-2 is much closer to that of the surface flow in lower Capulin Canyon than to the water quality of the bedrock ground water It also appears that the seeps near the confluence of Capulin with the Red River contain water that is chemically more similar to the valley-fill than the bedrock Lower Capulin Canyon may be outside the influence of the dewatering at the mine

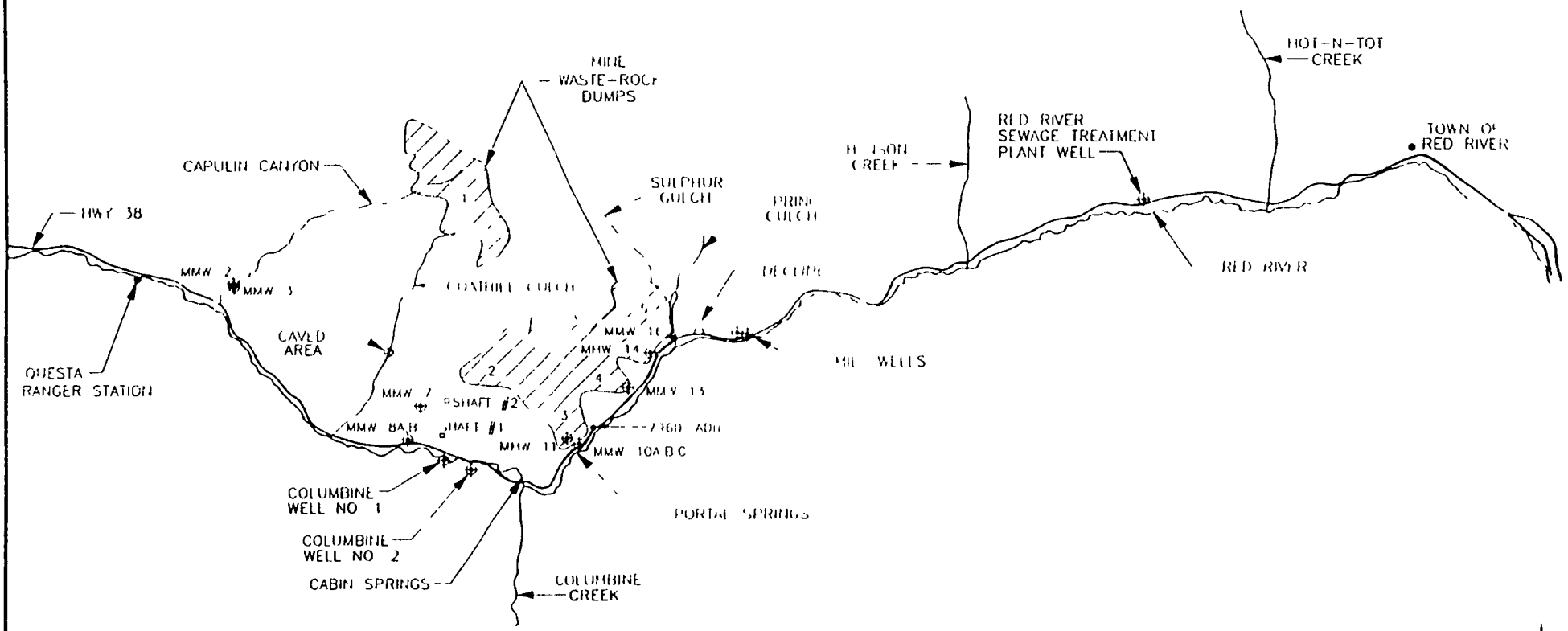
Water Levels and the Red River

A number of the monitor wells show water-level elevations at or slightly below the elevation of the river opposite the well Construction of a water-level contour map using data collected in November 1994 from both the valley-fill and bedrock wells (head elevations are very close for paired bedrock and valley-fill wells) revealed a cone of depression configuration that included MMW-8A and -8B, MMW-11, and MMW-13 Monitor wells MMW-10A, -10B, and -10C were considered to be outside the cone and related to a water table at or very close to the elevation of the stream bed

A preliminary potentiometric water-level map (Figure 8) shows a cone of depression centered above the underground mine (The southern edge of this cone is being monitored by the newly constructed wells) A schematic of water-level changes in the area of the underground mine is shown on Figure 9

3.3 AQUIFER TESTING

An aquifer test was conducted at MMW-10A at a pumping rate of 140 gpm (the pump was not capable of a higher rate) Although drawdown and recovery tests were completed at this rate the valley-fill aquifer was not stressed The drawdown leveled out after 10 minutes of pumping at 10 5 feet, indicating recharge balanced discharge Transmissivity calculated from the aquifer test was considerably higher (123,200 gallons per day per foot - gpd/ft) than that calculated from the recovery test (32,139 1 gpd/ft) Recharge during the aquifer test strongly reduced the drawdown The hydraulic conductivity from the recovery results is about 300 gallons per day per square foot (gpd/ft^2) which is in the range of values reported for sandy gravel During the aquifer tests, water levels were monitored at MMW-10B and MMW-10C Water level declined 6 0 feet in the bedrock well (MMW-10B), which suggests that the fractured bedrock below the valley-fill is in hydraulic continuity with the fill accounting for a common water level The continuity between the water-level at MMW-10C and the other wells was thought to indicate continuous saturation from MMW-10C (total depth 58 feet) and the deeper wells MMW-10C did appear to experience some drawdown (less than 1 foot), and it is possible that the change in depth-to-water at MMW-10C was a function of changes in barometric pressure A perched zone above a clay unit may underlie MMW-10C (with a water table independent of the deeper saturated zone) However, the clay may have



WASTE-ROCK DUMP AREAS

1	CAPULIN/GOATHILL
2	SUGAR SHACK WEST
3	SUGAR SHACK SOUTH
4	MIDDLE
5	SULPHUR/SPRING

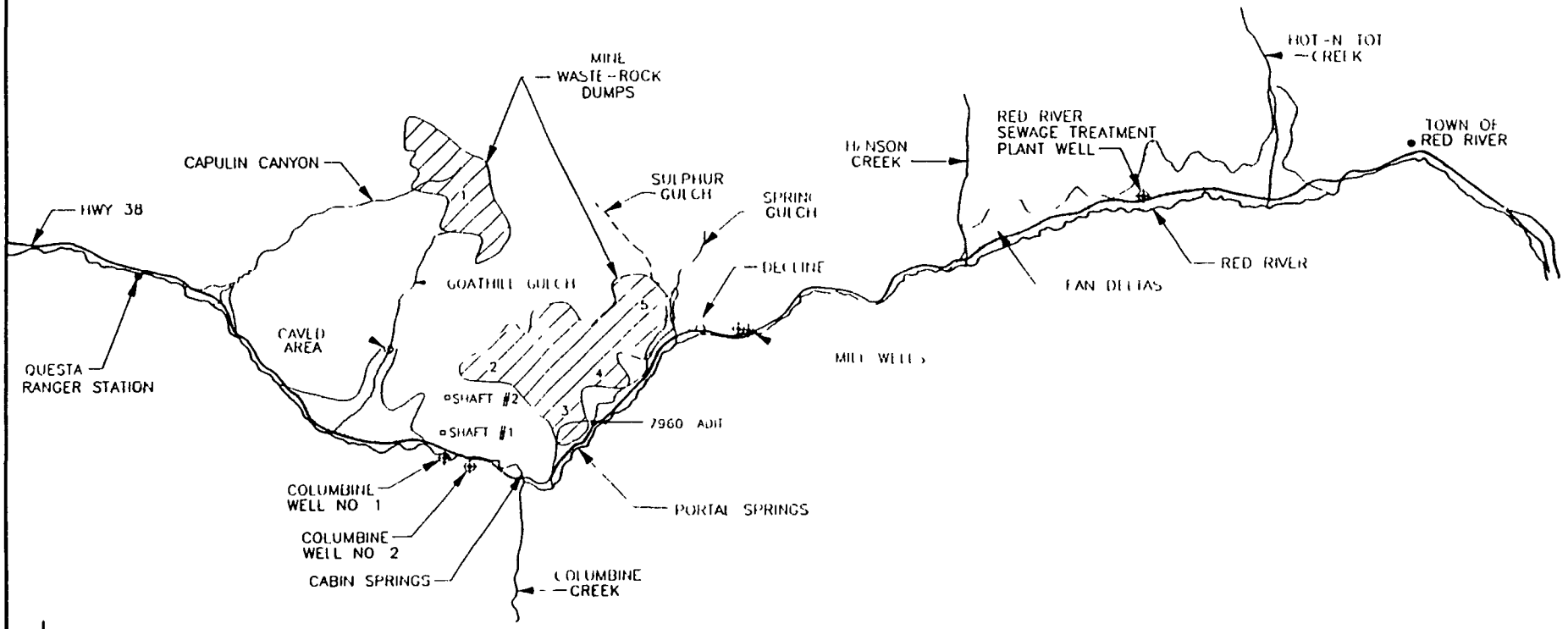
FIGURE 2

SOUTH PASS RESOURCES, Inc

PROJECT No	DATE	CORR	DRAWN BY
001 06	4/13/95	TCT	MCM

MINE AREA SITE MAP

Molycorp, Inc
Questa, New Mexico



N

0 0.5 1.0 1.5 2.0

SCALE IN MILES

EXPLANATION

- FAN DELTA
- WASTE ROCK DUMP AREAS
  - 1 CAPULIN/GOATHILL
  - 2 SUGAR SHACK WEST
  - 3 SUGAR SHACK SOUTH
  - 4 MIDDLE
  - 5 SULPHUR/SPRING

FIGURE 4

SOUTH PASS RESOURCES, Inc

PROJECT No	DATE	AUTHOR	DRAWN BY
001-06	4/13/95	JCK	MOM

FAN DELTA AND MINE WASTE-ROCK LOCATIONS

Molycorp, Inc
Questa, New Mexico

SUGAR SHACK AREA SOUTH
NOVEMBER 1994 DATA

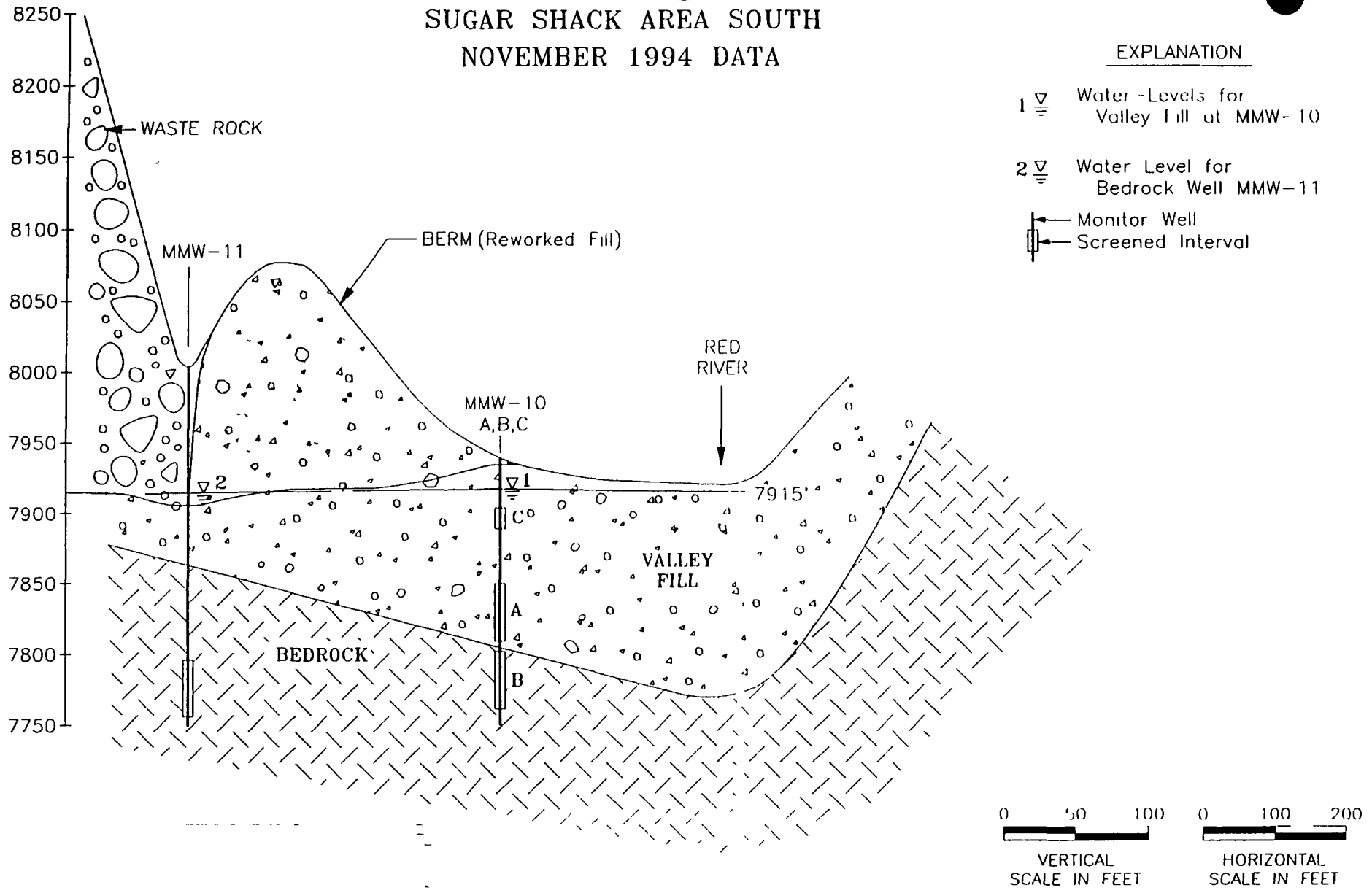


FIGURE 5	SOUTH PASS RESOURCES, Inc				HYDROGEOLOGIC CROSS-SECTION, SUGAR SHACK SOUTH
	PROJECT No	DATE	AUTHOR	DRAWN BY	Mine Area – Molycorp, Inc
	001-06	4/13/95		M O M	Questa, New Mexico

normally carry some disseminated pyrite Most of the ore mineralization was in the aplite and the andesite Mine waste-rock ranges from fresh weakly altered rock to rock consisting largely of quartz clay and pyrite (or its oxidized equivalent) Occasionally, rock fragments at the toe of the dump will disintegrate very easily because of the growth of intergranular gypsum precipitated from dump waters Qualitative observation of waste-rock piles indicates that dump material ranges from clay to boulder sizes The dump material shows "angle of repose" layering resulting from variations in time of the size fragments excavated Downward flow of water in this unsaturated environment should be enhanced by the angle of repose layering

B.2 GROUND-WATER RECHARGE

Factors to be evaluated in preparing estimates of ground-water recharge include topography (elevation, degree of slope), surface material (outcrop, soil sediment), permeability and run-off characteristics of surface material, bedrock conditions in terms of infiltration characteristics, porosity, and hydraulic conductivity and climate (temperature, precipitation, evaporation) Many of these parameters are not well defined in the Red River drainage area, but there are sufficient data to make some estimates of a hydraulic connection between ground water and the Red River

The mine operations are located north of the Red River Valley where elevations range from 7 581 feet on the Red River opposite Capulin Canyon to 10,812 feet at the ridge north of the open pit, resulting in a relief of 3 221 feet Excluding the relatively narrow flat to gently rolling valley floor most of the topography is composed of steep to very steep slopes that are conducive to high rates of runoff Major tributary canyons in the Mine Area have gradients on the order of 600 to 800 feet per mile

The U S Soil Conservation Service (1982) defined four soil map units (as part of their soil survey of Taos County) in the Mine Area north of the Red River

- Two of the soil units (Rock Outcrop/Ustorthentis Complex and Marosa Soil/Rock Outcrop Complex) are described as gravelly and/or sandy loams These soils are characterized by rapid to moderate run-off with high erosion potential Infiltration (number of inches per hour that water percolates downward in the soil) ranges from 0 6 to 6 inches The soil units are described as complex because a significant percentage of the map area consists of outcrops of igneous and metamorphic rocks Vegetative cover consists of Douglas fir, Engelmann spruce, and Ponderosa pine with an understory of Gambel oak, mountain brome, kinnikinnick, Kentucky bluegrass, Arizona fescue, and whortleberry

- The third soil unit (Rock Outcrop/Badland Type) is associated with the hydrothermal scars and underlies much of the area north of the Red River

(Appendix A) This soil is described as extremely acidic (pH <4 5) It occurs along portions of all of the major drainages (Capulin, Goathill, Spring & Sulphur Gulch) Typically slopes are steep and are nearly barren of vegetation The Soil Conservation Service characterizes this unit as a soil that generates increasing sediment loads to tributary drainage as precipitation increases (very high run-off and erosion potential) Drainages that intersect the hydrothermal scar areas typically have mudflow deposits near their confluence with the Red River

- The fourth soil unit (Cumulii Hoplobenolls) covers parts of the main valley floor It generally consists of stratified gravelly sandy loams and gravelly clays Infiltration of the soil is slow to moderate (0 2 to 2 inches per hour) Periodic flooding is the chief hazard here

Rainfall estimates related to elevation and soil units in the Mine Area were prepared by the U S Soil Conservation Service (1982) For the lower elevation, below 9,000 feet, the annual precipitation is 18 inches, between 9,000 to 11 000 feet, annual precipitation is 35 inches In its report the U S Soil Conservation Service indicates that annual snowfall can exceed 100 inches in the mountains Schilling (1956) had estimated 21 inches of annual precipitation for the same area The bulk of the precipitation is winter snowfall with some thunderstorm contribution during the summer months The average annual temperature is 40° to 42° Fahrenheit

Several authors have attempted to estimate the distribution of precipitation among run-off evapotranspiration, and ground-water recharge Wilson and Associates (1978) estimated that in the mountainous areas of northern New Mexico 3 to 10 inches of the precipitation contributed to run-off and the balance was distributed between evapotranspiration and recharge to ground water Vail Engineering (1989) measured the areas of drainage basins for the major tributary to the Rio Grande including the Red River and calculated basin discharges from an equation based on drainage basin area and average annual winter precipitation For the lower Red River basin (Zwergle Dam east of the Town of Red River to the Questa Ranger Station stream gauge), Vail calculated a discharge of 38 2 cubic feet per second (cfs) A review of flow discharges measured over a 12-year period [U S Geological Survey (USGS) data in Molycorp files for 1943 to 1955] shows that discharge ranges from 7 74 cfs to 262 5 cfs In general, the higher flow rates occur in the April through July period and the lower rates over the balance of the year Overall, this section of the Red River between the dam and the Ranger Station appears to be a gaining stream with substantially higher flow discharge at the downstream station

River accretion studies by the USGS (in October 1965 and in 1988) were referenced by Smolka and Tague (1988) in their water quality survey of the Red River between Zwergle Dam and the Fish Hatchery After correcting for tributary and diversion flows, they estimate

that the net gains from ground water were 9 0 cfs (1965) and 9 1 cfs (1988) between Zwergle Dam and the Ranger Station gauge east of Questa The Molycorp mill was not in operation in 1965 or 1988 and was not a factor in the diversion calculations A review of the 1943-1955 flow data (Molycorp files) for these two gauges indicate that base flow (ground-water recharge) conditions ranged from 7 74 cfs to 13 9 cfs (an average of 11 04 cfs) This data set also shows that base flow conditions are typically in December and January, and Smolka and Tague's estimate for net gain to ground water may be too high Vail (1989) used USGS stream flow data to estimate accretion to the Red River at nine locations from the Zwergle Dam site to the Bear Canyon area (near the Questa Ranger Station gauge) The segment from the Molycorp mill downstream to Bear Canyon is estimated to have an accretion of 6 6 cfs Of this, 5 0 cfs comes from Columbine Creek, which leaves 1 6 cfs related to recharge from intermittent tributary drainages, seeps and springs along both sides of the rivers

Another approach to estimating drainage basin recharge to ground water utilizes the Maxey and Eakien (1949) approach Their method estimates that 25 percent of the annual precipitation over the Mine Area drainage basin could contribute to recharge Vail Engineering (1989) calculated areas for the Red River drainage basin and for the lower Red River basin (from Zwergle Dam to the Ranger Station) Using an area of 83 24 square miles at 25 percent of 21 inches annual precipitation (Schilling, 1956), the entire basin would contribute 32 25 cfs to ground water That part of the entire drainage basin in the Mine Area represents about 6 percent of the total drainage basin On the assumption of a uniform distribution of ground-water recharge (as an approximation), 1 94 cfs would be recharged to the ground water Using Vail s (1989) estimate of the square miles for discrete elevation zones and 25 percent of the annual precipitation for each zone as recharge results in a higher estimate of 2 56 cfs ground-water recharge for the Mine Area drainage basin SPRI (1993b), using a similar approach for the Mine Area drainage basin (Capulin Canyon to Spring & Sulphur Gulch), calculated a ground-water recharge of 1 45 cfs If a water balance is assumed, this recharge equals accretion to the Red River

A final approach to estimating recharge from ground water is to use the average of the baseflow from the 1943 to 1955 flow data (11 04 cfs) as an estimate of the total ground-water recharge for the basin Again, with the assumption of an uniform distribution of recharge throughout the basin, the Mine Area portion of the drainage basin (6 percent of total area) would have contributed 0 66 cfs This value is considerably lower than the precipitation-based estimates The lower recharge values will be used here because there may be less error for a recharge estimate based on actual flow data than for estimates based on a precipitation approximation

Vail Engineering's (1989) accretion study results in an estimate of 1 6 cfs of ground-water recharge in the river from both sides of the segment opposite the mine This would

result in about 0 8 cfs from the north (mine side) of the river which is in fairly good agreement with the base flow estimate

Molycorp records indicate when the deep underground mine was being developed, dewatering required between 250 and 500 gpm (0 57 to 1 14 cfs) The Smolka and Tague (1988) accretion study during the time of mine development shows a net accretion to the river from ground water of 9 0 cfs similar to the pre-mine accretion of 9 1 cfs in 1965 Taken at face value, this suggests that the mine was dewatered from the deeper part of the ground-water flow system and did not appreciably, if at all reduce accretion to the river from ground water The explanation for this is that most of the ground-water recharge to the river may have come from the upper part of the ground-water system In other words, the deep mine was not directly in the recharge zone Schilling (1956), in his description of fracturing in the Sulphur Gulch area, indicated that many of the fractures (particularly sheeting type of fracturing related to contacts) tend to die out with depth More water was probably in storage in the shallow, more open, and better interconnected fracture system close to the water table, and mineralization combined with lithostatic pressure effectively sealed much of the deeper level fractures With lower hydraulic conductivity conditions at depth, a cone of depression (probably steep-sided) would develop over the deep mine SPRI (1993b, 1994) concluded that the cone probably did not extend to the river

The stability of the water levels in the monitor wells over the last five months, despite continuous dewatering of the underground mine (several hundred feet decline over the same period), supports the interpretation that a steep cone of depression occurs over the mine, and that the edge of the cone is north of the river The wells close to the river could possibly be recharged at a rate which balances any loss (discharge) due to dewatering Water-quality data from 1994 sampling of the river and of the monitor wells, in terms of dilution affect, is inconclusive because there is no historical water-quality data Concentrations of sulfate in well water ranges from 700 to 1,300 mg/L while river water is typically less than 20 mg/L. As water-quality samples are taken over the next year, it may be possible to evaluate dilution affects, if any

B.3 PRE-MINE WATER-TABLE CONFIGURATION

Based on Molycorp data (obtained in 1993), dewatering inflow for the older underground workings and for the open pit ranged from 15 to 30 gpm, which are very low flow rates However, anecdotal evidence from mine workers active at the open pit indicate that an extensive water control program was in operation during the development of the pit and that these rates may be low If these areas were below the water table, such rates could only be explained by very tight rock conditions in which virtually all the fractures were sealed

Schilling s (1956) and Rehrig's (1969) descriptions of the fracture systems and field examination of rock exposures in the same area indicate that open fractures exist (some fracturing can be related to mine activities) It is also likely that these low flow rates can be attributed to perched fracture water above a regional water table The deeper underground workings dewatered at 250 to 500 gpm [For comparison, Newmont's Gold Quarry Mine in Nevada is in fractured sedimentary rock and dewaters at 50 000 gpm (Carrillo, 1993)] However if the fractures in a mineralized zone were partly sealed by mineralization/clay gouge and/or poorly interconnected, then 500 gpm, even below the water table, would not be unreasonable It is possible that the open pit and most of the older underground workings near Sulphur Gulch (down to 7,800 to 7,900 feet) were above the regional water table and that the inflows were from perched water Currently, this inflow from the open pit and the older underground mine drains though a borehole into the deeper mine workings

If the gaining stream model is used with the equipotential lines (contours of equal water-level elevation) nearly normal to the flow direction of the river, such a contour surface would allow for most of the old workings and the pit to be relatively dry and above the regional water table The Moly Tunnel (7 960 adit) would be at the water table at an elevation of 8 000 feet Construction of the 7,960 adit did not produce much water and, therefore, the 8 000-foot water-level contour might have curved more to the north This water-table surface would have a southwesterly gradient of 0 036 foot/foot in this very simplified configuration If the equipotential lines were parallel to the river most of the old workings and part of the open pit would have been below the pre-mine water table

A simplified water-table surface with the equipotential lines at a right angle to the river can be used to estimate the elevation of the water table in various areas of the underground workings For example, the water level would continue to rise in the caved area above the underground workings in the Goathill Gulch area to an elevation of approximately 7,840 feet At Shaft No 1, the elevation would be about 7 820 feet and at Shaft No 2, it would be closer to 7,850 feet With respect to the old Moly Tunnel (7,960 adit), a conservative position would place it just below the water table at about 8 000 feet

Another element in the water-table surface configuration is the additional recharge from seepage barriers to the mine through the caved area This recharge currently amounts to about 70 gpm captured by the seepage barriers constructed on Capulin and Goathill Gulches An additional 30 gpm drains from the open pit through a borehole in the old underground mine to the deeper workings This amount of seepage water is occasionally strongly augmented by surface water related to storm discharge and snow melt such that recharge to the caved area can exceed several hundred gpm How much of this water actually reaches the caved area is unknown since it is a surface discharge and a certain amount must be lost to evaporation or infiltration to the vadose zone (In the vadose zone, the water would be bound by surface

tension in intergranular voids or micro-fractures) It is possible that the additional recharge might cause some mounding of the water table surface particularly in the caved area, and locally a slightly steeper gradient A concern here is that water-level mound in the caved area might extend to the valley-fill in Goathill Gulch from which it could more easily reach the river

Rate of Rise for the Water Table

On May 19, 1994, the water level in the mine workings was at 7,600 feet According to Molycorp records, the caved area began to fill by October 20, 1992 Using the elevation of the bottom of the caved area (7,226 feet) and the time since filling began (549 days), the rate of rewatering is 0 68 foot/day The actual daily rate values range from less than 0 68 to as much as 2 0 feet/day, depending on seasonal recharge conditions However, if the 0 68 foot/day is used as the rate, it would take 147 days (from May 1994) for the water level to rise to the down-gradient elevation (7,700 feet) of the Red River (This assumes a southwestern gradient based on the normal contour configuration in the caved area at Goathill Gulch) In other words, after 147 days (0 4 year) from May 1994, there would be a slight gradient from the cave area toward the river Using the same rate of 0 68 foot/day, it would take 0 97 year to reach the postulated water-table elevation of 7,840 feet in the caved area However, as noted in the previous paragraph localized high recharge rates in the caved area could cause mounding and water would be higher and at an earlier date than the 0 68 foot/day rate predicts In the case of the Moly tunnel (7 960 feet), it would require 1 61 years for the water level to reach 8 000 feet and begin to flow down to the adit

Monitor wells constructed in 1994 were designed to capture tributary discharges to the valley-fill and bedrock aquifers Not enough wells were sited in a single aquifer to evaluate flow directions or hydraulic gradients

B.4 AQUIFER TESTS

An aquifer test conducted in the valley-fill at MMW-10A resulted in a calculated transmissivity of 123,200 gallons per day per foot (gpd/ft) and a hydraulic conductivity of 1,141 gpd/ft^2 (based on an aquifer thickness of 108 feet) These are reasonable values for the coarse sand and gravel encountered in this well However, the maximum pump yield was 140 gpm and the aquifer was not stressed

Almost all of the bedrock wells went dry during development (air-lift) Bladder pumps were utilized in sampling these wells, and yields were typically a few gallons per minute or less The exception to the low yield during development was MMW-11, which yielded 60 gpm with less than one (1) foot of drawdown The high yield probably resulted from this well

being located close to a north-south fracture zone An estimate for transmissivity based on the specific capacity

$$\left(\frac{Q}{s}\right) = \left(\frac{60 gpm}{1 foot}\right)$$

and utilizing an equation developed by Huntley et al (1992) for fractured rock

$T = K\left(\frac{Q}{s}\right)^{1.18}$ where K is a conversion factor from their Table 1

resulted in a transmissivity of 4,877 ft^2/d or 36,481 gpd/ft (Note The factor to convert from ft^2/d to gpd/ft is 7 48)

The thickness of the bedrock aquifer is unknown Using the saturated thickness at the well (58 feet), an estimated hydraulic conductivity (K) is 629 gpd/ft^2 This is probably close to a maximum value (thickness is too small) but still lies within the upper range of K values for fractured igneous rock (Freeze and Cherry 1979, Table 2 2).

Another approach to estimating hydraulic conductivity uses the decline in water level at the underground mine during the current dewatering phase and dates of measurement on a time-drawdown plot Data were plotted on semi-log pager and the Cooper-Jacobs equation was used to calculate transmissivity

$$T = \left(\frac{264Q}{\Delta s}\right)$$

This calculation resulted in a transmissivity of 2,424 gpd/ft and a hydraulic conductivity of 5 09 gpd/ft^2 (the latter is based on a thickness of 476 feet or the difference between the pre-dewatering water-level and the top of the Grizzly level at the underground mine) The Cooper-Jacobs equation was developed for porous media Its application to bedrock data assumes that over a large enough volume of rock ("large enough" is not specified), fractured rock can be approximated by a porous media formula

The two values for hydraulic conductivity reported here are at best rough estimates These results suggest that hydraulic conductivity ranges over two orders of magnitude from fairly tight rock to permeable fracture zones A compilation of flow velocity based on simple analytical equations using single hydraulic conductivity values does not lead to reliable estimates for travel time Even if the estimate was close to a true travel time, open fault zones at an angle to the regional gradient can move ground water more rapidly and in a different

direction from the regional flow direction Estimates of flow velocity and travel time, based on water quality (from known sources) and isotopic data may have more validity (when the data from such studies become available) than hydrogeological approximations

B.5 GROUND-WATER TRANSPORT

With the currently available information it is not possible to make meaningful quantitative estimates for the velocity of ground water through the fractured bedrock Tracer tests in sets of nearby boreholes would probably allow for an estimate of ground-water velocity through fractures For these tests the distances between boreholes and their relationship to mapped fractured systems would have to be considered However, as indicated in previous sections, water chemistry combined with isotope data might lead to better estimates for velocity

Seepage velocity formulas are based on advection in granular material, not fractured rock Moreover, conceptual models for fracture flow include an equivalent porous media model that treats fractured rock as if it were a granular porous medium The rationale is that if the fracture spacing is small (compared to the scale of the system being studied), the model leads to a reasonable estimate of regional flow The model is not an accurate representation of local conditions (e g , an open fault that diverts flow at some angle to the regional system)

Using the caved area (located on Goathill Gulch) above the deep underground workings as a source and published values for hydraulic conductivity and porosity for fractured rock (Freeze and Cherry 1979), rough estimates of travel time from the mine to the river can be made According to Freeze and Cherry (1979) the range of hydraulic conductivity for fractured igneous and metamorphic rocks is 10^{-1} to 10^{3} gallons/day/ft^2 and for permeable basalt 1 to 10^{5} gallons/day/ft^2 The porosity range for fractured crystalline rock is 0 to 10 percent and for fractured basalt 5 to 50 percent

The seepage velocity formula is

$$V = \frac{Ki}{7.48 n_e}$$

where V = seepage velocity, in feet/day,
K = hydraulic conductivity, in gallons/day/square foot,
i = hydraulic gradient, in feet/feet,
n_e = porosity, as a percent, and
7 48 = gallons per cubic foot

D.4 Tritium Isotope Analyses

Tritium is the heavy isotope of hydrogen (^3H) that disintegrates radioactively to helium (^3He) at a half-life of 12.3 years (Mazor, 1991). After 12.3 years, half of the initial amount of tritium has decayed to helium. The concentration of tritium in water is expressed in tritium units (TU), which is a ratio of tritium to hydrogen atoms. The T/H ratio of 10^{-18} is defined as one TU.

Tritium is produced naturally in the atmosphere by the radioactive decay of nitrogen (^{15}N). Tritium atoms are oxidized to water, become mixed with precipitation, and eventually enter the ground-water system. Natural production of tritium introduces about 5 TU to precipitation and surface water. In the saturated zone, water is isolated from the atmosphere and the tritium concentration drops due to radioactive decay.

Using a measured value for tritium and a half-life curve (tritium concentration as a function of time), however, does not lead to a precise age for the ground water. As a consequence of recharge, water accumulates and mixes over time in the aquifer such that the age obtained from tritium data is an average or effective age (Mazor, 1991). Smith and Wheatcraft (1993) refer to this 'ground-water age' as an estimate of the subsurface residence time of ground water since it was isolated from the atmosphere and soil gas.

Hydrogen bomb tests which began in 1952 in the northern hemisphere added large amounts of tritium to the atmosphere, completely masking the natural tritium input. The peak of man-made tritium production was in 1963, which was the same year that atmospheric testing was halted by international treaty. Since this testing stopped, the tritium content of precipitation has been declining. The tritium content of precipitation has been measured at a worldwide network of stations since the end of testing. These data are normally presented as concentration curves of the annual weighted average of tritium since 1961. Concentration curves from the network show:

- values in the northern hemisphere that are much higher than those in the southern,
- summer peaks and winter lows related to the annual redistribution of tritium in the atmosphere, and
- significant variance from one station to another in terms of the tritium concentrations.

As noted earlier, due to mixing of recharge waters in the aquifer over time, the age of a ground-water sample is an effective age. Further estimates of an effective age are only valid if it is known that the water is derived from a single source/single aquifer system. If older

ground water from a bedrock aquifer were to mix with younger water from an adjacent shallow aquifer, the effective age would only reflect dilution If the appropriate concentration curve is available (i e from a geographically nearby station) and if the sample was collected from a single source/aquifer unit then an effective age can be assigned According to Mazor (1991) water that has zero tritium (in practice <0 5 TU) has a pre-1952 age Water that has significant tritium concentrations (in practice >10 TU) is of post-1952 age Water that has concentrations between 0 5 and 10 TU seems to be a mixture of pre- and post-1952 water

Water samples for tritium analyses were collected in 1-liter brown glass bottles No head space was allowed in these samples Six samples were collected in May 1994 and three in November 1994 All samples were sent to Chempet Research Corporation in Moorpark, California for analysis The enriched tritium procedure allows for a precision of 0 8 TU The results of the tritium analyses for the May 1994 sample are presented below (The results of the November 1994 analyses are discussed in Section 4 0 of the main text of this report)

Results of Tritium Analyses

Sample No.	Site Description	TU ± 2σ
CCS-1	seepage from the base of the Capulin Canyon mine waste-rock dump	15 1 ± 2 2
CCS-2	fresh water spring, west side of Capulin Canyon	12 3 ± 1 8
CCS-3	bedrock seep in an adit west side of Capulin Canyon	8 0 ± 1 4
GHS-1	seepage from the base of the Goathill Gulch waste-rock dump	16 7 ± 2 4
GHS-3	bedrock seep on the divide near the head of Goathill Gulch	8 5 ± 1 4
Cabin Springs	seeps on the north bank of the river behind the Cabins	17 5 ± 0 6
MMW-11	bedrock well near Sugar Shack South waste-rock dump	16 9 ± 0 6
MMW-3	bedrock well in lower Capulin Canyon	4 38 ± 0 14

Given that the open pit operation (which was the source of the dump material) began in the late 1960s, the tritium data, supported by water chemistry, indicates most, if not all, of the water collected from the dump seepage at the head of Capulin and Goathill Canyons is derived from the dumps The values greater than 10 TU for the two waste dump samples indicate

post-1952 water Without the appropriate tritium concentration curve a more precise effective age cannot be made

Water from the freshwater spring that flows at 12 gallons per minute (gpm) may also be post-1952, but considering the standard deviation it could be a mixture of older perched water and post-1952 water The two bedrock seeps appear to be a mixture of pre- and post-1952 water In the case of the Goathill Gulch sample, the seep lies several hundred feet below the Capulin/Goathill mine waste-rock dumps and may include older perched water and dump leachate that has infiltrated the bedrock Likewise the adit sample may include water from pre- and post-adit fractures (caused by excavation of the adit) The tritium values for these bedrock samples reflect dilution rather than effective age

The average tritium concentrations for precipitation per year have been collected at various world-wire weather stations since 1961 The weather station closest to the Red River area is Flagstaff Arizona, however, telephone calls to the Flagstatf weather station and several hydrologists who use tritium data failed to locate such a database Mazor (1991) illustrates plots of TU against years for several different stations The nearest station in terms of similar latitude is Hatteras, North Carolina, on the east coast Although the average tritium concentration curves from the northern hemisphere stations are similar (peaks and troughs roughly correspond and their slopes are similar) the absolute value for TU in any one year varies by an order of magnitude or less depending on station location These absolute values are related to atmospheric circulation patterns To obtain a reliable estimate of the significance of the TU values for the mine samples a station about the same latitude but in the western United States would be preferable

As an example of the application of tritium results, using the Hatteras data from Mazor (1991) precipitation infiltrating the ground in 1970 would have contained about 75 TU In the intervening 24 years (1970 to 1994), the tritium would have radioactively decayed, leaving about 22 percent (Mazor, 1991, Figure 10 1) of the tritium retained in a 1994 water sample Assuming no mixing of older and younger water, there should be about 16 5 TU left in the sample This value is within the range of the "young" water samples collected in the Mine Area (e g CCS-1, GHS-1, Cabin Springs, and MMW-11) If the Hatteras data can be applied here, these results, combined with the water chemistry of these samples, indicate water stored in the waste-rock dumps (constructed in the 1970s) could be a source However, with the limited amount of site-specific hydrogeological data available, a natural acidic seepage source following a short flow path (from recharge to discharge zone) or traveling parallel to a highly permeable zone (short travel time) can not be entirely ruled out The relatively high TU value for the spring at CCS-2 may be an example of a short flow path

Pre-1952 ground water contained about 5 TU In the intervening 42 years (1952 to 1994), approximately 8 percent of the tritium would be retained which corresponds to 0 4 TU.

If ground water was recharged with pre-1952 water without any subsequent mixing, it should contain about 0 4 TU Samples such as MMW-3 CCS-3, and GHS-3 or those with results in the 0 5 to 10 TU range are mixtures of young (post-1952) and older (pre-1952) water (e g an average value for a mixture of 16 5 TU and 0 4 TU water is 8 45 TU)

D.5 Stable Isotope (Lead and Strontium) Study

Eight water samples from the Mine Area (four from Capulin Canyon, two from Goathill Gulch, one from the Red River, and one from Hot-N-Tot Canyon) were analyzed for lead and strontium isotopic composition (Chempet 1994) The limited objective of this study was to evaluate if any isotopic differences between natural acidic ground water and acidic mine drainages could be detected To demonstrate statistically significant differences, a much larger number of samples taken at different times of the year to assess seasonal effects and from varied geologic settings, would need to be collected Furthermore, isotopic analyses of bedrock dump, and alluvial source materials would have to be made to evaluate water/rock interactions and causes for any detected differences

Both strontium and lead consist of radiogenic and non-radiogenic isotopes In general, the result of radioactive decay of the parent element the radiogenic component increases with time However the ratio of radiogenic to non-radiogenic isotopes in any given sample containing lead or strontium is not a fixed value The value depends on the history of the sample how much of the radioactive precursor was present in the sample originally and how much of the radioactive element of strontium or lead has been removed from or added to the sample at a later time

Three stable isotopes of lead (Pb) -- 206 Pb 207 Pb and 208 Pb -- are radiogenic and are derived by radioactive decay of 238 uranium 235 uranium, and 232 thorium, respectively Another stable isotope, 204 Pb, is non-radiogenic and is used as a reference isotope in the lead system Strontium (Sr) has four naturally occurring stable isotopes -- 88 Sr, 87 Sr, 86 Sr, and 84 Sr Only one of these (87 Sr) is radiogenic It is derived from the radioactive decay of 87 rubidium The reference isotope is the non-radiogenic 86 Sr, and the ratio of 87 Sr to 86 Sr (87 Sr / 86 Sr) is used in evaluating biogeological processes The purpose of both lead and strontium isotope studies, other than age of the sample, has been to identify probable source material(s), mixing of water from multiple sources, and, from this, flow paths in a ground-water system

Isotopic studies which focus on a particular mineral (such as galena from an ore deposit) may result in a very narrow range of ratios (age) which are statistically indistinct. However, when ground water or surface water which has reacted with a greater variety of rock types of different ages and different histories is examined isotopically, the range of values widens and isotopic distinctions may be evident At Questa, Oligocene to Miocene

TABLE D1
1994 MONITOR WELL WATER QUALITY DATA FOR MINE AREA
MOLYCORP INC - QUESTA, NEW MEXICO

MONITOR WELL	SAMPLE DATE 1994	WELL TD (feet)	Corrected DEPTH TO WATER (feet)	DEPTH TO PUMP INTAKE (feet)	pH (1)	CONDUCTIVITY (1) (uhmos)	TEMP (1) (°C)	CARBONATE (mg/l)	BICARBONATE (mg/l)	HYDROXIDE (mg/l)	TOTAL ALK (mg/l)	CHLORIDE (mg/l)	FLUORIDE (mg/l)	SULFATE (mg/l)
MMW-2	8-Nov	68	31 69	50	4 90	3 680	7 9	<1	<1	<1	<1	6 8	24 0	2 100
MMW-3	7-Nov	140	27 76	80	7 50	3 970	10 9	<1	222	<1	222	5 8	2 59	1,700
MMW-7	7-Nov	161	61 11	120	4 40	9,490	17 2	<1	<1	<1	<1	21	1 12	10 400
DUP-11A (2)	7-Nov	NA	NA	NA	NA	NA	NA	<1	<1	<1	<1	21	0 98	10,500
MMW-8A	8-Nov	178	96 77	140	7 00	2 860	8 1	<1	165	<1	165	8 7	2 72	1 300
MMW-8B	8-Nov	129	96 03	112	6 40	1,780	7 1	<1	19	<1	19	5 6	1 83	730
MMW-10A	8-Nov	144	21 70	100	5 80	2,400	7 8	<1	<1	<1	<1	27	11 2	1,100
DUP-12B (3)	8-Nov	NA	NA	NA	NA	NA	NA	<1	<1	<1	<1	26	7 96	1,100
MMW-10A (4)	19-Nov	NA	NA	NA	NA	NA	NA	<1	<1	<1	<1	26	8 28	1,200
MMW-10B	7-Nov	189	21 57	140	7 90	2 250	10 1	10	<1	66	76	28	12 2	1 100
MMW-10C	8-Nov	50	21 80	40	4 70	2,000	11 8	<1	<1	<1	<1	20	15 4	880
MMW-11	7-Nov	184	86 71	150	5 60	2,450	15 7	<1	<1	<1	<1	22	17 6	1,300
MMW-13	8-Nov	145	105 98	130	7 90	2 280	8 9	<1	200	<1	200	14	1 67	770

NOTES

(1) pH, CONDUCTIVITY AND TEMPERATURE WERE RECORDED WHEN SAMPLED

(2) - Dup 11A = DUPLICATE SAMPLE FOR MMW-7

(3) - Dup 12B = DUPLICATE SAMPLE FOR MMW 10A

(4) - SAMPLED AFTER AQUIFER TEST

NA - Not Available

SOURCE SAMPLES TAKEN BY SPRI ANALYTICAL RESULTS FROM MOLYCORP

TABLE D1
1994 MONITOR WELL WATER QUALITY DATA FOR MINE AREA
MOLYCORP, INC - QUESTA, NEW MEXICO

MONITOR WELL	TDS (mg/L)	SILVER (mg/L)	ALUMINUM (mg/l)	ARSENIC (mg/L)	BARIUM (mg/l)	BERYLLIUM (mg/l)	CALCIUM (mg/l)	CADMIUM (mg/L)	COBALT (mg/L)	CHROMIUM (mg/l)	COPPER (mg/L)	IRON (mg/L)	MERCURY (mg/l)
MMW-2	3,400	<0 10	63 5	<0 005	<0 010	0 015	501	0 024	0 280	<0 010	0 088	50 8	<0 0002
MMW-3	2,900	<0 10	0 75	<0 005	0 047	<0 004	567	0 0024	0 089	<0 010	<0 010	0 076	<0 0002
MMW-7	16,000	<0 50	943	<0 05	0 108	0 104	544	0 096	4 91	0 193	4 84	384	<0 0002
DUP-11A (2)	16,000	<0 50	961	<0 05	0 071	0 122	534	0 092	4 99	0 17	5 04	375	<0 0002
MMW-8A	2,200	<0 10	<0 05	<0 005	0 103	<0 004	466	0 002	<0 010	<0 010	<0 010	2 84	<0 0002
MMW-8B	1,100	<0 10	0 44	<0 005	0 016	<0 004	206	<0 0005	<0 010	<0 010	<0 010	<0 050	<0 0002
MMW-10A	1,700	<0 10	33 4	<0 005	<0 010	0 008	275	0 028	0 148	<0 010	0 558	<0 050	<0 0002
DUP-12B (3)	1,700	<0 10	34 2	<0 005	<0 010	0 008	270	0 024	0 137	<0 010	0 58	<0 050	<0 0002
MMW-10A (4)	1,700	<0 010	31 6	<0 005	<0 010	0 006	245	0 0224	0 141	<0 010	0 534	0 086	<0 0002
MMW-10B	1,800	<0 10	8 74	<0 005	0 034	0 007	347	0 025	0 074	<0 010	0 179	0 101	<0 0002
MMW-10C	1,400	<0 10	31 1	<0 005	0 014	0 007	204	0 026	0 106	<0 010	0 38	<0 050	<0 0002
MMW-11	2,000	<0 10	56 3	<0 005	0 016	0 013	276	0 036	0 266	0 036	0 919	0 129	<0 0002
MMW-13	1,400	<0 10	<0 05	<0 005	0 036	<0 004	316	<0 0005	0 013	<0 010	<0 010	0 198	<0 0002

NOTES

(1) pH, CONDUCTIVITY AND TEMPERATURE WERE RECORDED WHEN SAMPLED

(2) - Dup 11A = DUPLICATE SAMPLE FOR MMW-7

(3) - Dup 12B = DUPLICATE SAMPLE FOR MMW 10A

(4) - SAMPLED AFTER PUMP TEST

SOURCE SAMPLES TAKEN BY SPRI, ANALYTICAL RESULTS FROM MOLYCORP

Values used in Fig. C-3

TABLE D1
1994 MONITOR WELL WATER QUALITY DATA FOR MINE AREA
MOLYCORP, INC. - QUESTA, NEW MEXICO
(Page 3 of 3)

MONITOR WELL	POTASSIUM (mg/L)	MAGNESIUM (mg/L)	MANGANESE (mg/L)	MOLYBDENUM (mg/L)	SODIUM (mg/L)	NICKEL (mg/L)	LEAD (mg/L)	ANTIMONY (mg/L)	SELENIUM (mg/L)	SILICON (mg/L)	THALLIUM (mg/L)	VANADIUM (mg/L)	ZINC (mg/L)
MMW-2	10.8	137	52.1	<0.02	64.6	0.61	<0.002	<0.05	<0.05	20.3	<0.005	<0.010	9.48
MMW-3	7.5	96.2	34.5	<0.02	103	0.236	<0.002	<0.05	<0.005	7.6	<0.005	<0.010	1.36
MMW-7	12.0	1250	72.1	<0.10	175	10.5	0.10	<0.25	<0.025	22.7	<0.005	0.104	11.7
DUP-11A (2)	12.1	1230	73.3	<0.10	178	10.7	0.06	<0.25	<0.025	22.6	<0.005	0.106	11.9
MMW-8A	3.8	85.6	7.15	<0.02	41.5	<0.020	<0.002	<0.05	<0.005	11.1	<0.005	<0.010	<0.050
MMW-8B	2.9	55.5	0.202	<0.02	33.9	0.059	<0.002	<0.05	<0.005	17.3	<0.005	<0.010	0.211
MMW-10A	2.8	77.9	13.8	<0.02	26.5	0.325	<0.002	<0.05	<0.005	14.3	<0.005	<0.010	2.29
DUP-12B (3)	2.5	76.7	12.8	<0.02	26.4	0.293	<0.002	<0.05	<0.005	14.0	<0.005	<0.010	2.07
MMW-10A (4)	3.7	69.7	13.1	<0.02	25.6	0.279	0.004	<0.05	<0.005	14.1	<0.005	<0.010	2.08
MMW-10B	3.5	80.3	8.55	<0.02	25.8	0.201	0.021	<0.05	<0.05	12.8	<0.005	<0.010	1.5
MMW-10C	2.8	75.2	16.3	<0.02	20.2	0.0347	<0.002	<0.05	<0.005	9.9	<0.005	<0.010	3.2
MMW-11	3.4	133	31.7	<0.02	25.5	0.593	0.086	<0.05	<0.005	14.2	<0.005	<0.010	5.0
MMW-13	5.4	38.7	1.02	0.05	30	<0.020	<0.002	<0.05	<0.005	8.8	<0.005	<0.010	0.222

NOTES
(1) Ph, CONDUCTIVITY AND TEMPERATURE WERE RECORDED WHEN SAMPLED
(2) - Dup 11A = DUPLICATE SAMPLE FOR MMW-7
(3) - Dup 12B = DUPLICATE SAMPLE FOR MMW 10A
(4) - SAMPLED AFTER PUMP TEST
SOURCE SAMPLES TAKEN BY SPRI, ANALYTICAL RESULTS FROM MOLYCORP

These values used in calculating slopes in Fig C-3

TABLE D4
WATER QUALITY OF MINE WATER
MOLYCORP, INC - QUESTA, NEW MEXICO

Sample Location	Shaft No 1 Shallow	Shaft No 1 Deep (mg/L)	Shaft No 1 Top (mg/L)	Shaft No 1 1000 ft (mg/L)	Shaft No 2 (mg/L)	Decline (mg/L)	Decline (mg/L)	Open Pit (mg/L)
Date	NA	NA	10/94	10/94	NA	NA	10/94	10/94
pH	6 9	7 7	6 96	6 96	7 2	7 5	6 7	3 1
Aluminum	NA	NA	0 5	0 5	<0 5	1 2	1 0	303 0
Sulfate	1,455	1,480	1,665	1,720	1,345	1,004	1,720	11,561
TDS	3,072	3,386	3 276	3,584	3,164	2,468	3,507	24 420
Fluoride	NA	13 1	NA	NA	5 0	7 10	NA	NA
Cadmium	<0 005	0 01	<0 01	<0 01	<0 005	<0 005	<0 01	0 304
Lead	<0 10	<0 10	<0 10	<0 10	<0 10	<0 1	<0 10	<0 10
Iron	0 30	<0 05	50 0*	46 2*	<0 05	<0 05	39	164 0
Manganese	8 6	15 5	11 5	12 0	5 10	1 20	13 30	408 0
Zinc	1 3	0 30	0 283	1 54	2 70	2 80	1 52	70 1
Copper	<0 01	0 02	0 03	0 03	<0 01	<0 01	0	6 7
Molybdenum	2 70	2 20	2 22	2 22	1 80	1 20	2 44	0 41
Arsenic	<0 01	<0 01	NA	NA	<0 01	<0 01	NA	NA
Mercury	<0 20	<0 20	NA	NA	<0 20	<0 20	NA	NA

* Total Iron

A
WATER QUALITY SURVEY
RED RIVER OF THE RIO GRANDE
NEW MEXICO

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Federal Water Pollution Control Administration
Robert S. Kerr Water Research Center
Ada, Oklahoma

JANUARY 1966

A WATER QUALITY SURVEY

RED RIVER OF THE RIO GRANDE

NEW MEXICO

Prepared for

NEW MEXICO DEPARTMENT OF PUBLIC HEALTH

Santa Fe, New Mexico

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
ROBERT S. KERR WATER RESEARCH CENTER
ADA, OKLAHOMA

JANUARY 1966

TABLE OF CONTENTS

	Page
LIST OF TABLES	iii
LIST OF FIGURES	iv
I. INTRODUCTION	
Authority	I-1
Purpose and Scope	I-1
Acknowledgments	I-1
II. SUMMARY AND CONCLUSIONS	
Summary	II-1
Conclusions	II-1
III. DESCRIPTION OF THE PROJECT	
Location	III-1
Characteristics of the Drainage Area	III-1
Geological Factors	III-2
Streamflow Characteristics	III-3
IV. DESCRIPTION OF ANALYTICAL METHODS	
Chemical Methods - Laboratory	IV-1
Chemical Methods - Field	IV-2
Microbiological Methods	IV-3
Biological Methods	IV-4
V. PRESENTATION OF DATA	
Chemical Quality	V-1
Microbiological Quality	V-10
Biological Quality	V-12

TABLE OF CONTENTS (Continued)

Page

Groundwater Characteristics V-23

U. S. Geological Survey Flow Data V-26

Water Quality V-28

VI. BIBLIOGRAPHY

LIST OF TABLES

		Page
Table V-1.	Water Quality Summary Sheet	V-2
V-2.	Chemical Quality - Station 2	V-3
V-3.	Chemical Quality - Station 3	V-4
V-4.	Chemical Quality - Station 4	V-5
V-5.	Chemical Quality - Station 5	V-6
V-6.	Chemical Quality - Station 6	V-7
V-7.	Chemical Quality - Station 7	V-8
V-8.	Chemical Quality - Station 8	V-9
V-9.	Bacteriological Results	V-11
V-10.	Biological Summary	V-13
V-11.	Biological Data, Station T	V-14
V-12.	Biological Data, Station 2	V-15
V-13.	Biological Data, Station 2-A	V-16
V-14.	Biological Data, Station 3	V-17
V-15.	Biological Data, Station 4	V-18
V-16.	Biological Data, Station 5	V-19
V-17.	Biological Data, Station 6	V-20
V-18.	Biological Data, Station 7	V-21
V-19.	Biological Data, Station 8	V-22
V-20.	Description of Groundwater Sampling Points	V-24
V-21.	Groundwater Analysis	V-25
V-22.	Red River Flow Data	V-27

LIST OF FIGURES

		Following Page
Figure III-1.	Location Map	VI-1
III-2.	Flow Frequency Analysis of Red River . . .	III-3
V-1.	Chemical Analysis Versus River Stations . .	V-1

I. INTRODUCTION

Authority

In a letter dated September 24, 1965, the New Mexico Department of Public Health requested that the Robert S. Kerr Water Research Center ". . . perform a stream survey on the Red River of the Rio Grande to determine the present quality of the stream."

This study was made under the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 466 et seq.).

Purpose and Scope

The results of this stream survey will serve as water quality background information for the purpose of determining the extent of any water quality degradation that might come as a result of increased activity along the watershed of the Red River.

Historically, the drainage basin for the Red River has been a lightly populated, mountain resort area. Heavy industry has been absent from the basin. At present the most significant water users are an exploratory molybdenum mine and mill, a State fish hatchery, and a small amount of irrigation (800 acres).

In the near future Red River Basin activities are expected to intensify. Presently, a molybdenum mine, mill, and tailings pond are under construction. These operations, together with the people employed by the construction contractor and mining company, have the potential to incur a significant pollutional problem to the water resources of the basin.

Realizing that Red River Basin activities will intensify, the State of New Mexico desires to initiate a surveillance program for the area. This water quality survey will provide the necessary background for that program.

Acknowledgments

The cooperation of many people and several agencies was necessary in this study. The efforts of the following are especially appreciated:

New Mexico Department of Public Health
New Mexico Fish and Wildlife Department
United States Geological Survey

II. SUMMARY AND CONCLUSIONS

Summary

The New Mexico Department of Public Health requested the U S Public Health Service to conduct a water quality study on the Red River near Questa, New Mexico.

In accordance with this request, personnel from the Robert S. Kerr Water Research Center, assisted by State personnel, investigated seven major sampling stations and seven minor spring and well stations along the main stem of the Red River from above the town of Red River to below the State fish hatchery near Questa.

The facilities of the New Mexico State Public Health Laboratory in Albuquerque were used during the study where some 80 water samples were analyzed.

A field biological and bacteriological laboratory was set up at the State fish hatchery near Questa, New Mexico, where the samples from all major stations were assayed.

Basic water quality measurements were made at each sampling station on two-hour intervals for three 8-hour sample days and one 24-hour sample day. Measurements were made using portable instruments.

The river flow was gauged near each of the seven main stem stations by the U S. Geological Survey during the period of investigation.

Conclusions

1. The chemical quality of the Red River water is exceptional. The water is suitable for a wide range of beneficial uses--domestic, industrial, and recreational, including the propagation of trout.

2. Microbiological quality of the river is generally good. Marginal fecal coliform pollution is indicated at Stations 2 and 7.

3. Biological conditions in the river are good. A biotic index of 11 or greater is indicated at all stations. A clean stream is described as a stream with a biotic index of 10 or greater.

4. Groundwater resources of the area are of high quality. Groundwater quality is comparable with the surface water, with the exception that total solids and chlorides are slightly higher.

5. The effect of even a small amount of untreated or inadequately treated waste would seriously degrade the water quality of the Red River due to its low average annual flow rate. Waste treatment must become a part of basin growth in order to preserve its high quality water. Surveillance of basic parameters at stations near the tailings pond and near Questa and Red River are desirable to detect water quality degradation as basin activities intensify.

V. PRESENTATION OF DATA

Chemical Quality

A chemical analysis of the water from all survey stations in the Red River Basin indicates that the water is of exceptional quality. All chemical constituents analyzed were well within the U S. Public Health Service drinking water standards for raw water supply.

Figure V-1 illustrates the variation of the more significant chemical parameters between sampling points. Sample station numbers have been located at their respective stream mileage for convenience. It can be seen from the graph that there is little variation in the parameters as the stream traverses its course. The most significant variation is in total dissolved solids, sulfates, conductivity, and turbidity. These are shown to increase moderately from Station 8 through Station 3. The slight improvement in quality between Station 3 and Station 2 is indicative of the dilutional effect of the waters from the springs which enter the river between these two stations. Also entering the Red River between Stations 2 and 3 is the effluent from the State fish hatchery. Fresh water supply for the fish hatchery comes via pipeline from springs just below Station 3 and is discharged to the river above Station 2.

Table V-1 is a water quality summary sheet which lists the averages for each station for comparison. Tables V-2 through V-8 list the complete chemical analysis of all stations sampled throughout the survey.

TABLE V-1
WATER QUALITY SUMMARY SHEET

	STATION #8	STATION #7	STATION #6	STATION #5	STATION #4	STATION #3	STATION #2
CHEMICAL ANALYSES							
CONDUCTIVITY, micromhos	185	205	235	240	255	260	265
pH	8.5	8.3	8.3	8.2	8.1	8.1	8.2
DISSOLVED OXYGEN, ppm	8.7	8.8	9.1	9.2	9.2	9.1	8.5
PERCENT OXYGEN SATURATION	93	96	95	95	95	95	98
TURBIDITY, turbidity units	2.6	2.4	3	3.8	5.6	8.6	5.6
COLOR, color units	<5	<5	<5	<5	<5	<5	<5
ODOR, threshold no.	1	1	1	1	1	1	1
B.O.D., mg/l	1.6	1.2	1.7	1.4	1.6	1.8	1.7
C.O.D., mg/l	12.2	38.7	17.8	7.9	5.5	7.1	3.9
TOTAL DISSOLVED SOLIDS, mg/l	130	139	164	173	186	181	179
SUSPENDED SOLIDS, mg/l	8	8	8	8	25	13	11
TOTAL SOLIDS, mg/l	138	147	172	181	211	194	190
ALKALINITY as $CaCO_3$, mg/l	79.4	73.7	62.1	60.4	56.3	57.4	74.6
Cl^-, mg/l	6	1.6	1.2	1.7	1.3	1.3	4.8
SO_4^{--}, mg/l	5.3	20.3	46.8	50.5	63.5	65.5	41.9
Ca^{++}, mg/l	28.9	29.8	32.5	33.4	34.4	35.7	32
Mg^{++}, mg/l	4.9	7.4	5.8	11.5	9	9.7	6.6
Fe^{+++}, mg/l	<.02	<.02	<.02	<.02	<.02	<.02	<.02
NO_3^-, mg/l	<1	<1	<1	<1	<1	<1	<1
As, mg/l	<.01	<.01	<.01	<.01	<.01	<.01	<.01
Pb, mg/l	<.02	<.02	<.02	<.02	<.02	<.02	<.02
Zn, mg/l	<1	<1	<1	<1	<1	<1	<1
HARDNESS as $CaCO_3$, mg/l	91.3	103.3	105	130	121.7	128.3	103.3

Upstream

↑ Abv Molycorp

↑ Questa Station (USFS)

Downstream

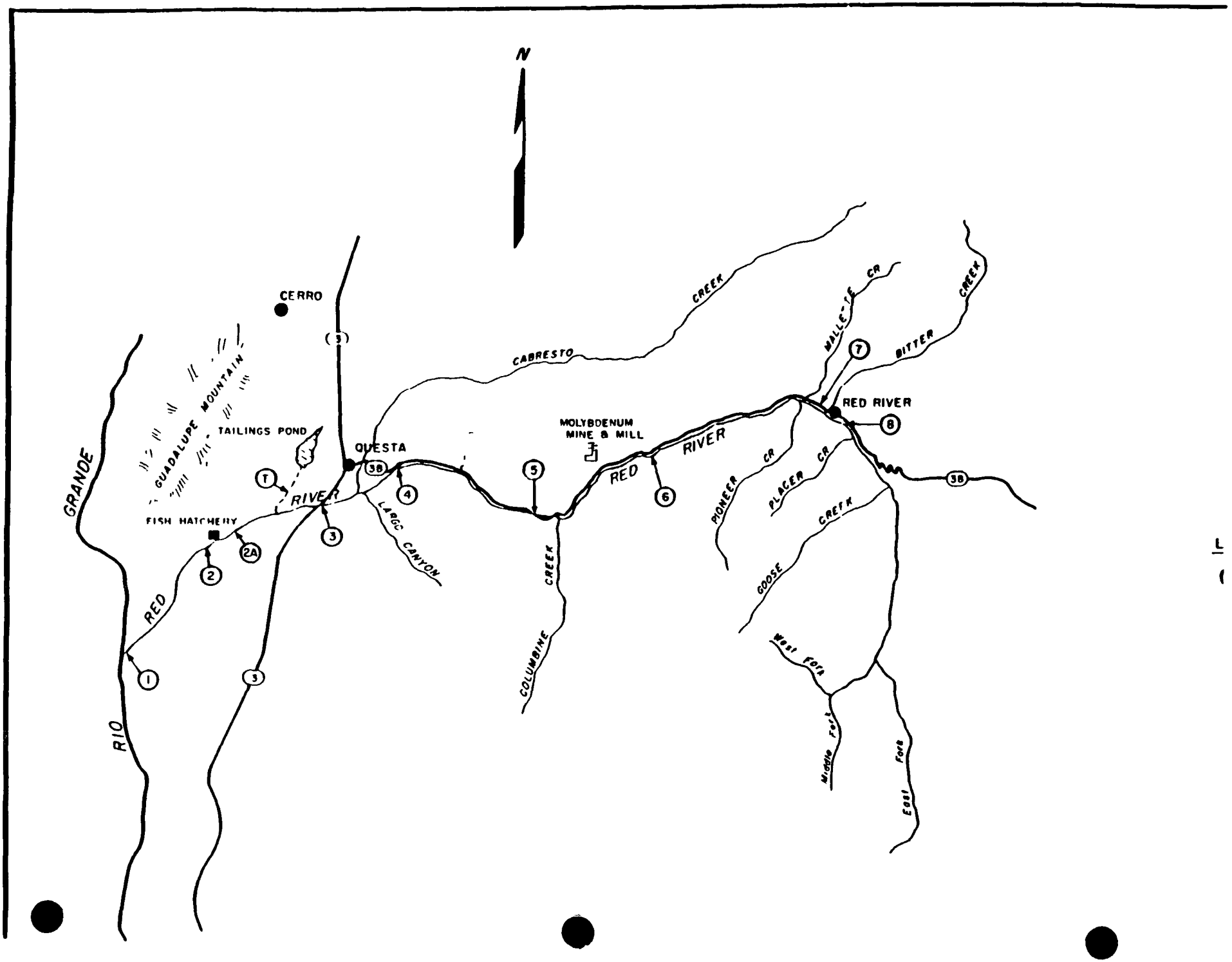
Microbiological Quality

Based upon the parameters used and the limited number of samples tested, the data indicate that the microbiological quality was suitable for recreational uses and as a raw water supply. Of the seven sampling stations only two Stations 2 and 7, showed what may be considered high coliform counts. Sampling points Station 2 located directly below the fish hatchery and Station 7 just below the town of Red River, gave average coliform counts of 770 coliforms/100 ml and 1300/100 ml, respectively. Station 3 had an average of 176/100 ml. Stations 4, 5 and 6 had averages of 131, 304, and 230/100 ml, respectively. Counts of less than 100/100 ml were observed only from Station 8 where the count averaged 4/100 ml. The coliform count at this station ranged from 2 to 6/100 ml.

It is apparent that both the town of Red River and the fish hatchery are contributing some pollution to the Red River. The amount however, remains quite small. The results of both the fecal coliform test and the fecal streptococci test indicate an insignificant amount of pollution. Station 7 showed only 20 fecal coliforms/100 ml and less than two fecal streptococci/100 ml. Station 2 had the highest fecal streptococci count with 74/100 ml but only four fecal coliforms/100 ml.

These data indicate that the type of pollution emanating from the town of Red River was more of the human type, whereas that stemming from the fish hatchery was more of the animal type. It is very doubtful if the fish are contributing to either the fecal coliform or fecal streptococci count, although perhaps further testing would be desirable.

Bacteriological results for all stations are presented in Table V-9.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GUADALUPE MOUNTAIN
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GRANDE
RIO
RED
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FISH HATCHERY
QUESTA
LARGO CANYON
CABRESTO
CREEK
MOLYBDENUM
MINE & MILL
COLUMBINE
CREEK
RED
RIVER
RED RIVER
MALLE-IE CR
BITTER
CREEK
PIONEER CR
PLACER CR
GOOSE
CREEK
West Fork
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EIA - Water Quality

WATER QUALITY SURVEY

RED RIVER AND RIO GRANDE

NEW MEXICO

Prepared by
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
In Cooperation with
NEW MEXICO DEPARTMENT OF GAME AND FISH
and
NEW MEXICO ENVIRONMENTAL IMPROVEMENT AGENCY

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
Region VI
Surveillance and Analysis Division
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TABLE OF CONTENTS

		Page
LIST OF TABLES		ii
LIST OF FIGURES		iii
I.	INTRODUCTION	
	Authority	1
	Background, Purpose, and Scope	1
	Acknowledgments	2
II.	SUMMARY AND CONCLUSIONS	
	Summary	2
	Conclusions	3
III.	DESCRIPTION OF THE PROJECT	
	Location	5
	Characteristics of the Drainage Area	5
IV.	DESCRIPTION OF ANALYTICAL METHODS	
	Chemical Methods - Laboratory	6
	Chemical Methods - Field	8
	Bacteriological Methods	9
	Biological Methods	10
V.	PRESENTATION OF DATA	
	Chemical Quality	11
	Biological Quality	13
	Bacteriological Quality	16
	Water Quality	16
VI.	BIBLIOGRAPHY	50

LIST OF TABLES

Table		Page
1	Station Description and Location	18
2	Water Quality Summary Sheet	19
3	Chemical Quality - Station 2	20
4	Chemical Quality - Station 3	21
5	Chemical Quality - Station 4	22
6	Chemical Quality - Station 5	23
7	Chemical Quality - Station 6	24
8	Chemical Quality - Station 7	25
9	Chemical Quality - Station 8	26
10	Tailings Pond Discharge - Metals	27
11	Tailings Pond Seepage - Metals	28
12	Bacteriological Results	29
13	Biological Data Summary, Red River	30
14	Biological Data Summary, Rio Grande	31
15	Red River Flow Data	32

LIST OF FIGURES

Figure		Page
1	Location Map (Red River)	33
2	Location Map (Rio Grande)	34
3	Data Comparison Graph - Rate of Flow	33
4	Data Comparison Graph - Dissolved Oxygen	34
5	Data Comparison Graph - Turbidity	35
6	Data Comparison Graph - Conductivity	36
7	Data Comparison Graph - Total Solids	37
8	Data Comparison Graph - Total Dissolved Solids	38
9	Data Comparison Graph - Hardness as $CaCO_3$	39
10	Data Comparison Graph - Ca^{++}	40
11	Data Comparison Graph - SO_4^{--}	41
12	Data Comparison Graph - pH	42
13	Data Comparison Graph - C.O.D.	43
14	Data Comparison Graph - Alkalinity as $CaCO_3$	44
15	Biological Comparison Graph - No. of Organisms Per Sample and No. of Kinds Per Sample - Red River	45
16	Biological Comparison Graph - Organism Groups - Red River	46
17	Biotic Index - Red River	47
18	Biological Comparison Graph - No. of Organisms Per Sample and No. of Kinds Per Sample - Rio Grande	48
19	Biotic Index - Rio Grande	49

I INTRODUCTION

Authority

In a letter dated December 17, 1969, the New Mexico Department of Game and Fish requested that the Environmental Protection Agency (EPA) perform a stream survey on the Red River of the Rio Grande to determine the present quality of the stream.

This study was made under the provisions of the Federal Water Pollution Control Act, as amended (33 U.S.C. 466 et seq.).

Background, Purpose, and Scope

Prior to operation of the Molybdenum Corporation of America's (MCA) mine and mill between Questa and Red River, New Mexico, the New Mexico Department of Public Health, anticipating possible future stream degradation, requested that a water quality study be made of the Red River. Chemical, bacteriological, and biological studies were made in November 1965 by EPA's predecessor agency, the Federal Water Pollution Control Administration (1), in cooperation with the State of New Mexico agencies. Follow-up biological studies were made on the Rio Grande and Red River in October 1966 in that stretch of the river immediately above and below the mouth of the Red River (2).

The results of the 1970 stream survey were to serve primarily as comparison data for the purpose of determining the extent of any water quality degradation that might have come as a result of increased activity along the watershed of the Red River since the study in 1965. These operations, along with the increased

number of people employed by the construction contractors and mining company, have the potential to incur a significant pollution problem to the water resources of the basin.

At the present time, the most significant water users are the molybdenum mine and mill, a State fish hatchery, and a small amount of irrigation (some 800 acres).

Acknowledgments

The cooperation of many people and several agencies was necessary in this study. The efforts of the following are especially appreciated: New Mexico Department of Public Health and New Mexico Department of Game and Fish.

II. SUMMARY AND CONCLUSIONS

Summary

The New Mexico Department of Game and Fish requested the EPA to conduct a water quality study on the Red River near Questa, New Mexico.

In accordance with this request, personnel from the EPA, Surveillance and Analysis Division, Ada Facility, assisted by State personnel, investigated seven major sampling stations along the main stem of the Red River from above the town of Red River to below the State fish hatchery near Questa and collected additional biological samples at four stations on the Rio Grande.

The facilities of the New Mexico State Public Health Laboratory in Albuquerque were used during the study where some 55

water samples were analyzed, including seven bacteriological samples.

The biological samples taken during the sampling period were analyzed at the EPA facility, Ada, Oklahoma. Biological samples were taken at the seven chemical sampling stations and two additional stations (1 and 2A) along the Red River and four stations on the Rio Grande.

Basic water quality measurements were made at each sampling station on 2-hour intervals for three, 8-hour sample days and one, 24-hour sample day. Measurements were made using portable instruments.

The river flow was gauged near each of the seven main stem stations by State and Federal field personnel during the period of the investigation.

Conclusions

1. The chemical quality of the Red River water remains very good. The water is suitable for a wide range of beneficial uses such as domestic, industrial, and recreation, including the propagation of trout.

2. Microbiological quality of the river is good, as indicated by the data.

3. Biological conditions in the river are good. A biotic index of 10 or greater is indicated at all stations. A clean stream is described as a stream with a biotic index of 10 or greater at all stations.

4

4. The slurry from the MCA mine and mill is currently being pumped through a pipeline along the Red River to a tailings pond located just west of Questa. Occasional breaks in the line are causing some degradation in stream quality and biota. Some of the settleable material coats the stream bed which damages the stream's biological elements.

5. The effluent from the MCA tailings pond exerts a fertilizing effect on the Red River by the addition of minerals.

6. The State fish hatchery, located on the Red River some three or four stream miles above its mouth, is contributing to degradation of that portion of the stream and, consequently, to the Rio Grande. This degradation is increased when fish ponds are drained and cleaned for restocking. This discharge contains organics and solids and also has a fertilizing effect by the addition of nutrients.

7. The town of Red River, mobile homes, and tourist camps located along the river are contributing to degradation of the river, primarily due to septic tank drainage and other untreated waste making its way into the stream. An oxidation pond was being constructed at the time of the study to provide waste treatment for the town of Red River.

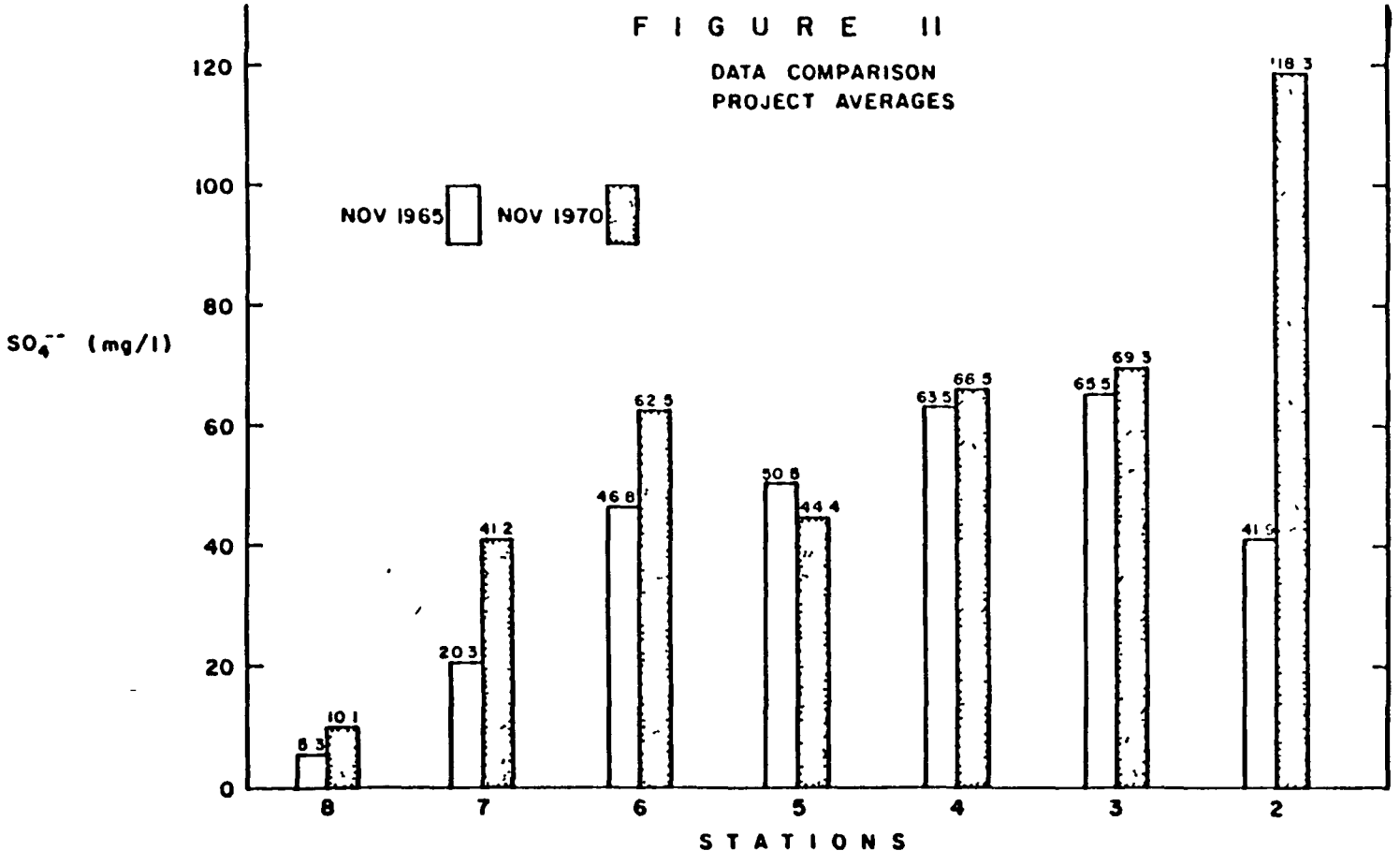
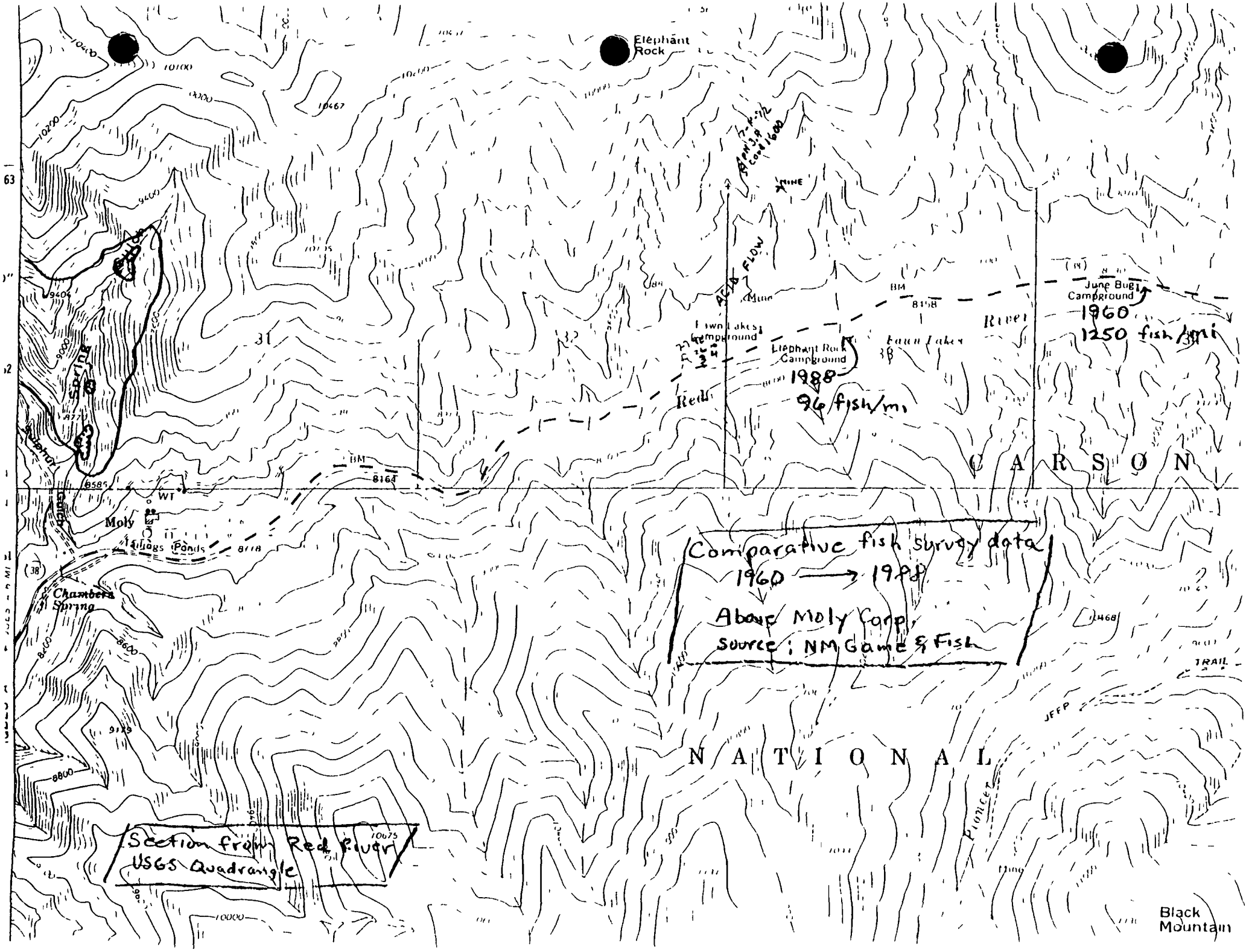
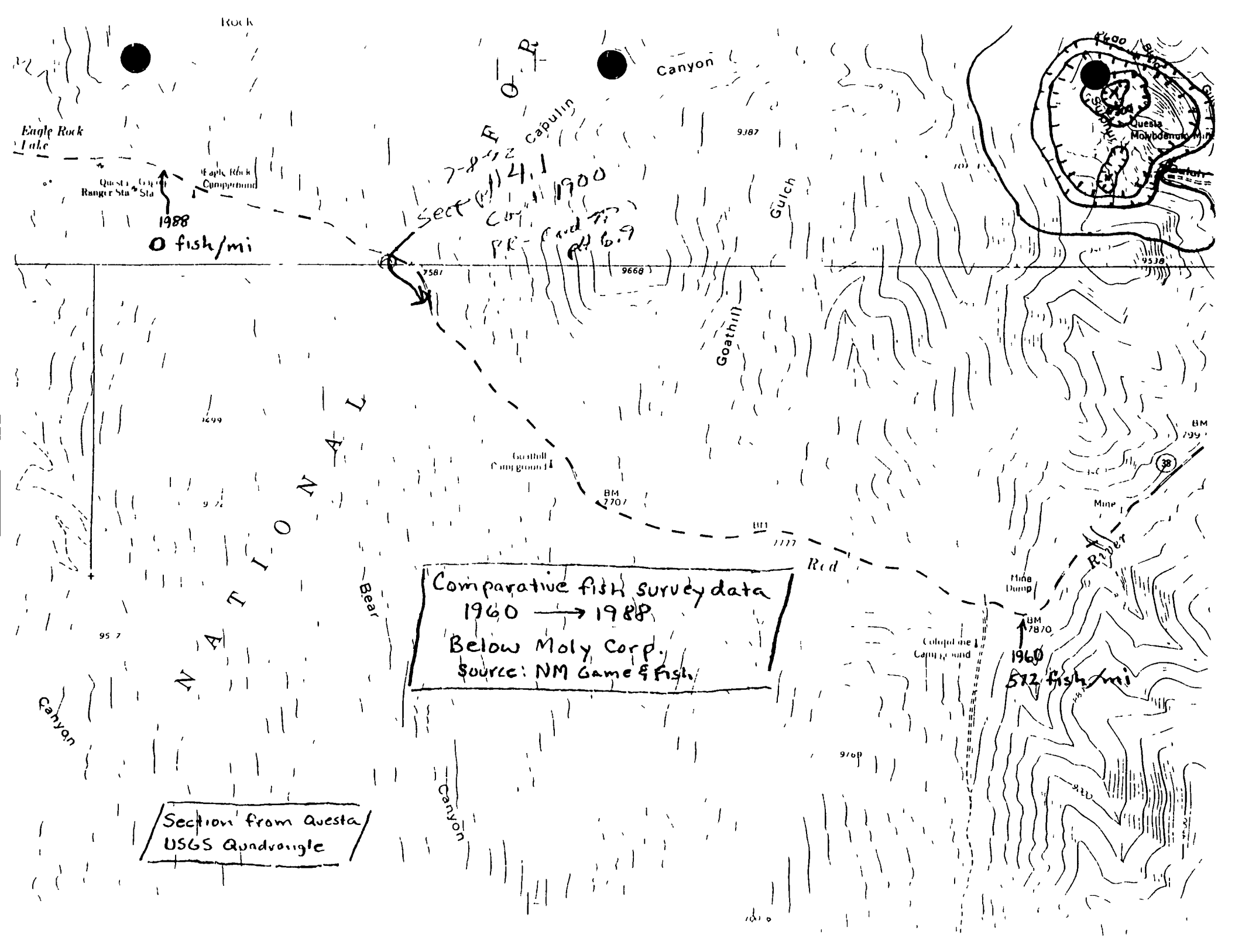


FIGURE II
DATA COMPARISON
PROJECT AVERAGES
NOV 1965
NOV 1970
SO_4^{--} (mg/l)
120
100
80
60
40
20
0
8.3
10.1
20.3
41.2
46.8
62.5
50.8
44.4
63.5
66.5
65.5
69.3
41.9
118.3
8
7
6
5
4
3
2
STATIONS


Elephant Rock
Elephant Rock Campground
1988
96 fish/mi
June Bug Campground
1960
1250 fish/mi
Fawn Lakes Campground
Fawn Lakes
Red River
Moly
Tailings Ponds
Chambers Spring
Spring
Sulphur Gulch
CARSON
NATIONAL
Black Mountain
Pioneer
TRAIL
JEEP
Comparative fish survey data
1960 → 1988
Above Moly Corp.
Source: NM Game & Fish
Section from Red River
USGS Quadrangle


Rock
Canyon
Capulin
Eagle Rock Lake
Questa Ranger Sta
Eagle Rock Campground
1988
0 fish/mi
7-8-92
Sect (pH) 4.1
Cond 1900
PR - Cond 7
pH 6.9
9387
Gulch
7581
9668
9538
Goathill
Goathill Campground
BM 7707
BM 7777
Red
River
Mine
Mine Dump
BM 7870
Colquhoune Campground
1960
572 fish/mi
Bear
Canyon
Canyon
NATIONAL
Questa Molybdenum Mine
Comparative fish survey data
1960 → 1988
Below Moly Corp.
Source: NM Game & Fish
Section from Questa
USGS Quadrangle

Bob Patterson

L. Rue

MEMORANDUM

DEPARTMENT OF GAME AND FISH

September 8, 1976

TO Red River File

FROM Bob Parish

SUBJECT Electrofishing Lower Red River

On September 7, 1976, myself and four forest service personnel electrofished five locations, 1/20 mile each, for approximately two miles below the hatchery. Each location was approximately 1/2 mile apart The following is the results:

(75% observation factor)

Station #1	Rainbow	Brown	Total
Less 3"	3	1	4
3-5"	5		5
5-7"	6	2	8
7-9"	7	1	8
9-12"	1	2	3
12-15"	5	2	7
greater 15"		2	2
Totals	27	10	37

Station #2			
Less 3"	3	2	5
3-5"	3		3
5-7"	4	3	7
7-9"		2	2
9-12"	6	9	15
12-15"		1	1
greater 15"	2		2
Totals	18	17	35

Station #3			
Less 3"	2	1	3
3-5"	7	7	14
5-7"	5	5	10
7-9"	4	2	6
9-12"		16	16
12-15"		4	4
greater 15"			
Totals	18	35	53

: Red River file - OK 9-13-76 jl

Station #4	Rainbow	Brown	Total
Less 3"	1	1	2
3-5"	2	2	4
3-7"	17	8	25
7-9"	7	6	13
9-12"		5	5
12-15"		5	5
greater 15"		1	1
Totals	27	28	55

Station #5 - Campground below hatchery

Less 3"	1		1
3-5"	13	5	18
5-7"	7	6	13
7-9"		3	3
9-12"	2	11	13
12-15"	1	5	6
greater 15"		1	1
Totals	24	31	55

Grand Totals	Rainbow	Brown	Total
Less 3"	10	5	15
3-5"	30	14	44
5-7"	39	24	63
7-9"	18	14	32
9-12"	9	43	52
12-15"	6	17	23
greater 15"	2	4	6
Totals	114	121	235

All of us managed a refreshing dip at least once and some got a first hand experience of the electrical field produced in the water The flow was estimated at 30 cfs and if it had been much more, we could not have handled it.

Using the 75% observation factor for the 1/4 mile electrofished we can take the actual observation of 114 rainbow and 121 brown trout and expand it for a population of 608 rainbow and 644 brown trout per mile with a total trout population of 1252 trout per mile. These figures should be fairly representative of the trout population from the hatchery to the mouth of the Red River.

cc Jim Yarbrough
Lee Cordova
Bob Patterson
George Edwards, USFS, Questa
Ron Elliott - A I file

MEMORANDUM

DEPARTMENT OF GAME AND FISH

December 17, 1975

Red R File
"New" USFS Min Flow

TO: Warren J. McNall

FROM: Bob Parish BP

SUBJECT: Red River Minimum Flows

The following are the results of basic survey work done in 1960 by Jim Harrison on the Red River:

Location: one-half mile upstream from Red River Fish Hatchery
Pools: 15%
Bottom type: 75% rocks, 5% gravel, 20% sand
Fish Population Study: 10-21-60 one hundred feet of stream at 20% efficiency
Brown Trout - 6 Estimated 1,667/mile

Location: June-Bug Campground
Pools: 50% 70% during low water
Bottom type: gravel and rock
Fish Population Study: 10-6-60 170 feet of stream at less than 50% efficiency
Rainbow Trout - 13 Estimated 812/mile
Brown Trout - 7 Estimated 438/mile

Six miles east of Questa
8-5-60 300 feet of stream was sampled.
Rainbow Trout - 11 Estimated 393/mile
Brown Trout - 5 Estimated 179/mile

Surface water records for the Red River near Questa for 1974 show a minimum discharge of 2.6 cubic feet/second on February 5. An average discharge for the last twenty years is 36.1 cubic feet/second.

I'm not sure what all is involved in minimum flows but I would not like to see less than 10 cubic feet/second during the summer months.

I can not seem to locate any other data that would be pertinent to the situation. If you have any ideas let me know.

P.S. I hardly believe we can use the expanded fish per mile estimates from Harrison's surveys.

MEMORANDUM

DEPARTMENT OF GAME AND FISH

November 29, 1988

TO: Michael Hatch

FROM: Robert F. Akroyd Jr. RFA

SUBJECT: 1988 Surveys of Red River

On September 26, 27, 29 and 30, 1988, electroshocking surveys were conducted on four 1/10 mile stations on the Red River downstream from the Red River Hatchery. Surveys were also conducted on 200-foot sections both upstream and downstream from the Red River Hatchery diversion. In cooperation with N.M.E.I.D., three 100-meter stations above the town of Questa were also sampled during this time period. Fish specimens were also collected and preserved from the area above Elephant Rock campground for further analysis pursuant to our annual whirling disease surveys. Listed below are the results of all of the above surveys:

Station	Size Class	Species		
		Brown	Rainbow	Unknown
Just below hatchery	<3"	27		2
9-28-88	3-6"	38	8	4
Conductivity 320 µmhos	6-9"	13	3	2
Water temp. 13°C.	9-12"	14	3	
	>12"	16		
Estimated no./mile based on 50% visibility		2,160	280	160

Station	Size Class	Species		
		Brown	Rainbow	Unknown
One mile below hatchery	<3"	46		
9-30-88	3-6"	37		1
Conductivity 260 µmhos	6-9"	9		
Water temp. 9.5°C.	9-12"	15		
	>12"	14		
Estimated no./mile based on 50% visibility		2,420	0	20

Station	Size Class	Species Brown	Rainbow	Unknown
Two miles below hatchery	<3"	30		
9-30-88	3-6"	41		1
Conductivity 250 µmhos	6-9"	14		
Water temp. 9°C.	9-12"	18		
	>12"	17		
Estimated no./mile based on 50% visibility		2,400	0	20

Station	Size Class	Species Brown	Rainbow	Unknown
One mile above La Junta	<3"	28		
Point (El Aujae area)	3-6"	36		1
9-28-88	6-9"	26		2
Conductivity 300 µmhos	9-12"	16		1
Water temp. 11°C.	>12"	15	1	
Estimated no./mile based on 50% visibility		2,420	20	80
Combined estimated no./mile based on 50%		2,350	75	70

Stations above and below hatchery diversion at 200 feet each (1988):

Station	Size Class	Species Brown	Rainbow
Above diversion	<3"	6	5
	3-6"	18	4
	6-9"	8	3
	9-12"	2	1
	>12"	2	
Below diversion	<3"	16	9
	3-6"	10	
	6-9"	6	9
	9-12"	9	5
	>12"	6	1

Conditions were good this year with lower water levels and good water clarity in the lower Red River. Listed below is a comparison of estimated number of trout per mile from yearly survey results 1981 through 1988.

Number of Stations	Date	Species	
		Browns	Rainbows
5 stations	June 1981	356	416
5 stations	September 1984	528	132
5 stations	August 1985	324	16
4 stations	November 1986	2,000	640
4 stations	September 1987	960	195
4 stations	September 1988	2,350	75

All of the above surveys were conducted using the Northeast Area's 110 volt generator.

Additional surveys were conducted on the Red River this year with the following results:

Station - Upstream from irrigation diversion located just above the Questa Ranger Station, U.S.F.S., station length 100 meters, average stream width 8.14 meters.

Survey type: 3 pass regression
Conductivity: 350 µmhos Water temperature: 8°C.
Date: 9-26-88 Time: 11:15 a.m.
Equipment used: Smith Root back-pack unit

First Pass	Second Pass	Third Pass
(472 sec)	(485 sec)	(455 sec)
0 fish	0 fish	0 fish

Population estimate (100 meters): 0 trout
Kilograms/hectare trout sp. = 0

Station - Just above Elephant Rock campground, station length 100 meters, average stream width 5.4 meters.

Survey type: 3 pass regression
Conductivity: 210 µmhos Water temperature: 11°C.
Date: 9-26-88 Time: 1:30 p.m.
Equipment used: Smith Root back-pack unit

1st Pass (628 sec)			2nd Pass (501 sec)	3rd Pass (470 sec)
Species	LG(mm)	WT(gr)		
Br	194	75	0 fish	0 fish
Br	140	28		
Br	170	52		
Br	80	4		
Br	134	23		
Rb	199	74		

Br = brown trout
Rb = rainbow trout
Rgct = Rio Grande cutthroat
Bk = brook trout

Population estimate (100 meters) = 6 trout
Kilograms/hectare trout sp = .256 kilograms/.0540 hectares
= 4.74 kilograms/hectare

Station - From old Zwergel gauge (above town of Red River and confluence of Goose Creek) upstream 100 meters, average stream width 6.258 meters.

Survey type: 3 pass regression
Conductivity: 112 Umhos Water temperature: 9.5°C.
Date: 9-27-88 Time: 12:30 p.m.
Equipment used: Smith Root back-pack unit

1st Pass (1051 sec)

Species	LG(mm)	WT(gr)
Rb	226	130
Rb	175	57
Rb	233	134
Rb	237	134
Rb	240	160
Rb	169	51
Rb	243	166
Rb	192	84
Rb	226	130
Rb	210	106
Rb	241	170
Rb	193	74
Rb	196	76
Rb	191	72
Rb	141	30
Rb	178	62
Rgct	245	168
Rgct	182	66
Rgct	149	25
Rgct	146	30
Rgct	144	30
Rgct	84	6
Rgct	87	6

2nd Pass (1136 sec)

Species	LG(mm)	WT(gr)
Rb	233	154
Rb	230	136
Rb	188	82
Rb	379	512
Rb	197	98
Rb	231	142
Rb	202	104
Rb	230	144
Rb	203	82
Rb	198	78
Rb	208	118
Bk	182	60
Rgct	196	82

3rd Pass (1195 sec)

Species	LG(mm)	WT(gr)
Rb	210	104
Rb	214	118
Rb	217	110
Rgct	176	63
Rgct	153	38

Population estimate (100 meters) = 45 trout sp.
Kilograms/hectare trout = 4.192 kilograms/.0626 hectares
= 66.96 kilograms/hectare

ec

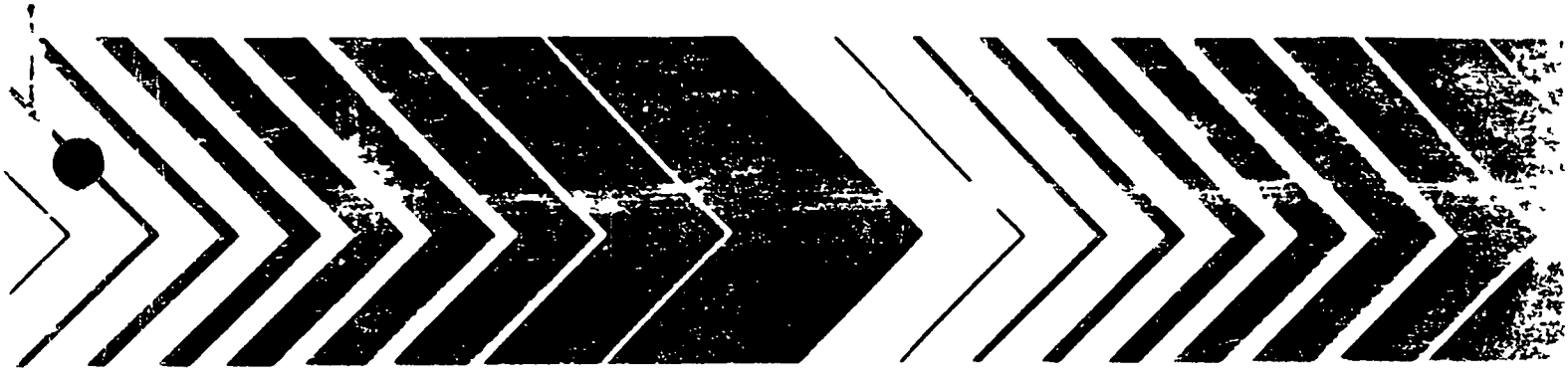
cc: Stephen Henry
Joanna Prukop Lackey
Jim Grasmick
Ernest Jaquez
Tod Stevenson
Brian Gleadle
Red River File
A-1 File
D-1 File

Environmental Protection Agency
Environmental Monitoring Systems Laboratory
P.O. Box 15027
Las Vegas NV 89114

Research and Development

Site Specific Water Quality Assessment: Red River, New Mexico

NM ENVIRONMENTAL IMPROVEMENT DIVISION LIBRARY



SITE SPECIFIC WATER QUALITY ASSESSMENT

Red River, New Mexico

by

Susan M. S. Melancon, Linda S. Blakey, and Jeffrey J. Janik
Department of Biological Sciences
University of Nevada, Las Vegas
Las Vegas, Nevada 89154

Cooperative Agreement No. CR808529

Wesley L. Kinney, Project Officer
Advanced Monitoring Systems Division
Environmental Monitoring Systems Laboratory
Las Vegas, NV 89114

ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89114

IV. CONCLUSIONS

1. Concentrations of ambient total arsenic, cadmium, and silver exceeded EPA-recommended acute criteria at stations in Red River. However, detection limits problems were also reported for cadmium and silver at some Red River sites.

2. "Control" stations (051 and 056) upstream from known point sources in Red River contained higher concentrations of all metal except zinc than did some of the downstream "impact" sites. It is not known whether these elevated concentrations are a result of background geologic conditions in the study area, or upstream nonpoint, mining-related, discharges to the river. Comparison studies with less disturbed streams in the locale would assist in determining the validity of these zone designations.

3. Macroinvertebrate communities in the Red River study area impacted by runoff from the molybdenum mine and mill were similar to those populations in the upstream "control" zone. Mean total counts were significantly higher in the control zone and downstream recovery sites than elsewhere in the river, and significantly lower at one impact station. It is not known whether these differences reflect changes in chemical conditions in the river or other factors, such as elevation change or physical characteristic differences among sites.

4. Fish species reported sensitive to metal pollution effects (e.g., rainbow, brook, and brown trout) were collected at sites where acute aquatic life criteria for arsenic, cadmium, and silver were exceeded.

5. Bioassay results from tests with Red River water suggested some biological toxic response may be occurring in Red River. However, data do not indicate that metals are the sole factor contributing to the observed response. Thus, further testing is needed to understand the interaction between potentially toxic metal concentrations in Red River and its resident biological communities.

Hydrologic Report 7

New Mexico Bureau of Mines & Mineral Resources

A DIVISION OF
NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY

Selected papers on water quality and pollution in New Mexico

Proceedings of a Symposium on
Water Quality and Pollution in New Mexico
April 12, 1984, Socorro, NM

Compiled by William J. Stone
New Mexico Bureau of Mines and Mineral Resources

Sponsored by
Water Pollution Control Bureau, New Mexico Environmental Improvement Division
New Mexico Bureau of Mines and Mineral Resources
Geophysical Research Center, Research and Development Division
New Mexico Institute of Mining and Technology

SOCORRO 1984

SPATIAL AND TEMPORAL VARIATIONS IN WATER QUALITY OF THE RIO GRANDE - RED RIVER WILD AND SCENIC RIVER, TAOS COUNTY, NEW MEXICO

Herbert S Garn
Bureau of Land Management, Santa Fe, New Mexico

ABSTRACT

The upper Rio Grande in New Mexico and the lower 4 miles (6.4 km) of the Red River, both in Taos County, were designated as "instant" components of the National Wild and Scenic Rivers System. Almost no water quality data existed at the time these rivers were designated wild and scenic. The BLM initiated a water quality study of these rivers in 1978 to evaluate the current water quality conditions and to identify and evaluate the nature, importance, sources, and effects of existing or potential pollutants. Since the major impact to the wild and scenic river is due to mining and related activities in the Red River drainage, emphasis was placed on monitoring water quality of this river.

Variations in water quality of the upper Rio Grande and Red River are presented. A downstream increase in concentrations of various constituents, at times approaching or exceeding water quality standards, occurs due to leaching of natural ore bodies, permitted discharges from molybdenum mill tailings ponds, and discharges from wastewater treatment plants and individual sewage treatment systems. Nonpoint sources are a major cause of elevated trace element concentrations. Relationships among water quality variables and flow conditions are also investigated.

INTRODUCTION

The lower 4 miles (6.4 km) of the Red River in New Mexico as well as 48 miles (77.3 km) of the Rio Grande downstream from the Colorado State line were designated as one of the "instant" components of the National Wild and Scenic Rivers System by the Wild and Scenic Rivers Act of 1968. The Bureau of Land Management (BLM) is the managing agency of the wild and scenic river. Almost no water quality data existed at the time these rivers were designated to define base-line water quality conditions. Such data are necessary for the administration of the rivers and for the protection of their outstanding scenic, recreational, and fisheries values (which are closely related to water quality). A water quality monitoring program of these rivers was initiated by the BLM in October 1978. Under the provisions of the Wild and Scenic Rivers Act, the BLM is directed to administer a component of the national wild and scenic rivers system under its control in such a manner as to protect and enhance the values which caused it to be included in the system.

SELECTION: ** SPECIAL **
SEQUENCE: STATE, SITE NAME

EVENTS: ALL

EPA ID NO.	SITE NAME / ST FEE / CITY / COUNTY CODE AND NAME	STATE / CONG DIST.	ZIP	OPRBLE UNIT	EVENT TYPE	EVENT QUAL	ACTUAL START DATE	ACTUAL COMPL DATE	CURRENT EVENT LEAD
NMDC[illegible]2899[illegible]94	MOLYCORP INC, QUESTA DIVISION			00	DS1			02/01/80	EPA (FUND)
	NM HWY 38 RED RIVER CANYON				PA1	NO FURTHER REMDL ACT PLND	05/01/80	05/01/80	EPA (FUND)
	QUESTA	NM	87556		SI1	LOWER PRIORITY	06/01/81	06/01/81	EPA (FUND)
	055 TAOS		NM-01						
NM21423304 4	MONTEREY CONSTRUCTION COMPANY			00	DS1			10/20/90	FED. FAC.
	P. O. BOX 2248								
	CARLSBAD	NM	88220						
	1[illegible] EDDY		NM 02						
NMD98[illegible]74[illegible]37	MORTON BROTHERS			00	DS1			11/01/79	EPA (FUND)
	2 MI W ON HWY 70 W				PA1	NO FURTHER REMDL ACT PLND	09/01/80	09/01/80	EPA (FUND)
	LAS CRUCE	NM	88001						
	013 DONA ANA		NM 02						
NMD980750061	MOSQUERO CITY OF DUMP			00	DS1			09/01/81	EPA (FUND)
	2 MI E OFF HWY 65				PA1	NO FURTHER REMDL ACT PLND	08/01/81	08/01/81	EPA (FUND)
	MOSQUERO	NM	87733						
	021 HARDING		NM 01						
NMD000804229	MOTOROLA CERAMIC PRODUCTS			00	DS1			04/12/90	OTHER
	9733 COORS RD. NW				PA1	DEFERRED TO RCRA OR NRC		10/02/91	EPA (FUND)
	ALBUQUERQUE	NM	87114						
	001 BERNALILLO		NM 01						
NMD981523855	MOUNTAINVIEW SUBDIVISION			00	DS1			10/01/86	STATE(FUND)
	ST RT 47, 3 MI N INTST HWY 25				PA1	LOWER PRIORITY	10/01/86	10/01/86	STATE(FUND)
	ALBUQUERQUE	NM	87105		SI1	LOWER PRIORITY	03/01/87	03/01/87	STATE(FUND)
	001 BERNALILLO		NM-03						
NMDC979667[illegible]5	MRI CORPORATION			00	DS1			02/01/80	EPA (FUND)
	WEST 2ND ST				PA1	NO FURTHER REMDL ACT PLND	06/01/80	06/01/80	EPA (FUND)
	DEMING	NM	88030						
	029 LUNA		NM-02						

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS TEXAS 75270

FEB 1 0 1985

Rob Lowy
PA/SI Program
New Mexico Environmental
Improvement Division
P.O. Box 968
Santa Fe, New Mexico 87504

Dear Rob:

Enclosed for your information is a copy of the site inspection and tentative disposition completed by EPA on NM00558, Molycorp, Inc. The site inspection was originally conducted by Ecology and Environment, Inc., on May 18, 1983. Please call me if you have any questions.

Sincerely,

Jo K. Johnson-Ballard

Jo K. Johnson-Ballard
PA/SI Program Coordinator

Enclosure

...OUS WASTE SITE
...VE DISPOSITION | NM 558 | 2

...aste Log File and submit a copy to U S Environmental Protection Agency, Site Tracking ...ent Task Force (EN-335), 401 M St., SW Washington, DC 20460.

I SITE IDENTIFICATION

A. NAME	B. STREET	
Molycorp Inc Questa Division	N.W. Hwy 58 4mi East of Questa	
C. CITY: Questa	D. STATE: NM	E. ZIP CODE: 87556

II TENTATIVE DISPOSITION

Indicate the recommended action(s) and agency(ies) that should be involved by marking 'X' in the appropriate boxes.

RECOMMENDATION	MARK X	ACTION AGENCY: EPA	STATE	LOCAL	PRIVATE
A. NO ACTION NEEDED – NO HAZARD					
B. INVESTIGATIVE ACTION(S) NEEDED (If yes, complete Section III.)		X			
C. REMEDIAL ACTION NEEDED (If yes, complete Section IV.)					
D. ENFORCEMENT ACTION NEEDED (If yes, specify in Part E whether the case will be primarily managed by the EPA or the State and what type of enforcement action is anticipated.)					

E. RATIONALE FOR DISPOSITION: THE SITE IS AN ACTIVE MINE & MILLING PROCESS PLANT. THE FACILITY HAS, IN THE PAST, EXPERIENCED PROBLEMS WITH A 44 MILE PIPELINE CAUSING SPILLS. APPROX. 4 MILLION GALS OF FLOW PER DAY GOES THROUGH THE PIPELINE. RECENTLY A NEW, STRONGER PIPELINE HAS BEEN PUT INTO PLACE. THE COMPANY HAS A LANDFILL (25T. 8 TONS OF MINING WASTES – INORGANICS & SOLVENTS) WHICH WAS NOT ADDRESSED IN THE LAST SITE INSPECTION.

F. INDICATE THE ESTIMATED DATE OF FINAL DISPOSITION (mo., day, & yr.)	G. IF A CASE DEVELOPMENT PLAN IS NECESSARY INDICATE THE ESTIMATED DATE ON WHICH THE PLAN WILL BE DEVELOPED (mo., day, & yr.)

H. PREPARER INFORMATION

1. NAME	2. TELEPHONE NUMBER	3. DATE (mo., day, & yr.)
D. B. Landy	(214) 767-6421	12/20/84

III. INVESTIGATIVE ACTIVITY NEEDED

A. IDENTIFY ADDITIONAL INFORMATION NEEDED TO ACHIEVE A FINAL DISPOSITION.

① INSPECT THE PIPELINE, AND SAMPLE THE AREAS WHERE ALLEGED SPILLS OCCURRED AND SAMPLE THE PUMP STATIONS.

② ADDRESS THE LANDFILL (INACTIVE) WHICH WAS PART OF THE LAST TDD (SAMPLE)

B. PROPOSED INVESTIGATIVE ACTIVITY (Detailed Information)

1. METHOD FOR OBTAINING NEEDED ADDITIONAL INFO.	2. SCHEDULED DATE OF ACTION (mo., day, & yr.)	3. TO BE PERFORMED BY (EPA Contractor, State, etc.)	4. ESTIMATED MANHOURS	5. REMARKS
a. TYPE OF SITE INSPECTION				
(1) SAMPLING	1985	FIT		SOIL & WATER SAMPLING
(2)				
(3)				
b. TYPE OF MONITORING				
(1)				
c. TYPE OF SAMPLING				
(1)				
(2)				

EPA Form T2070-4 (10-79)

Continue On Reverse

8303-12 3

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT

REGION | SITE NUMBER (To be assigned by HQ)
6 | NM 00558

GENERAL INSTRUCTIONS Complete Sections I and III through XV of this form as completely as possible. Then use the information on this form to develop a Tentative Disposition (Section II). File this form in its entirety in the regional Hazardous Waste Log File. Be sure to include all appropriate Supplemental Reports in the file. Submit a copy of the forms to U.S. Environmental Protection Agency Site Tracking System Hazardous Waste Enforcement Task Force (EN-335) 401 M St., SW Washington, DC 20460.

SITE IDENTIFICATION

A. SITE NAME: Molycorp, Inc , Questa Division
B. STREET (or other identifier): NM Hwy 38, ~ mi east of Questa
C. CITY: Questa
D. STATE: NM
E. ZIP CODE: 87556
F. COUNTY NAME: Taos

G. SITE OPERATOR INFORMATION
1. NAME: C R Sacrison, Plant Manager
Molycorp, Inc., Questa Division
2. TELEPHONE NUMBER: 505/586-0212
3. STREET: Hwy 38
4. CITY: Questa
5. STATE: NM
6. ZIP CODE: 87556

H. REAL OWNER INFORMATION (If different from operator of site)
1. NAME: Same
2. TELEPHONE NUMBER
3. CITY
4. STATE
5. ZIP CODE

I. SITE DESCRIPTION
Active molybdenum mine and mill (See attachment A).

J. TYPE OF OWNERSHIP
☐ 1. FEDERAL ☐ 2. STATE ☐ 3. COUNTY ☐ 4. MUNICIPAL ☒ 5. PRIVATE

II. TENTATIVE DISPOSITION (complete this section last)

A. ESTIMATE DATE OF TENTATIVE DISPOSITION (mo., day, & yr.)
B. APPARENT SERIOUSNESS OF PROBLEM
☐ 1. HIGH ☐ 2. MEDIUM ☒ 3. LOW ☐ 4. NONE

C. PREPARER INFORMATION
1. NAME: J Paul Oxer
2. TELEPHONE NUMBER: 214/742-6601
3. DATE (mo., day, & yr.): 8/19/83

III. INSPECTION INFORMATION

A. PRINCIPAL INSPECTOR INFORMATION
1. NAME: J. Paul Oxer
2. TITLE: FIT - Civil Engineer
3. ORGANIZATION: Ecology and Environment, Inc , 1509 Main St , Dallas, TX 75201
4. TELEPHONE NO. (area code & no.): 214/742-6601

B. INSPECTION PARTICIPANTS

1. NAME	2. ORGANIZATION	3. TELEPHONE NO.
D Vaughn	Ecology and Environment, Inc	214/742-4521
Steve Mellon	Ecology and Environment, Inc.	214/742-4521
Jim Trusley	Ecology and Environment, Inc	214/742-4521

C. SITE REPRESENTATIVES INTERVIEWED (Corporate officials, workers, residents)

1. NAME	2. TITLE & TELEPHONE NO.	3. ADDRESS
Cindy Stark	Envr Coordinator 505/586-0212	Molycorp, Inc., Questa Div. Hwy 38, Questa, NM 87556
John Stribling	Environmental Scientist 505/586-9212	Molycorp, Inc., Questa Div. Hwy 38, Questa, NM 87556

ATTACHMENT A

-4

POTENTIAL HAZARDOUS WASTE SITE
SITE INSPECTION REPORT SUPPLEMENT SHEET

Instruction - This sheet is provided to give additional information in explanation of a question on the form T2070-3.

Corresponding number on form	Additional Remark and/or Explanation
	Sample Locations, 5-18-83 1. Spring Gulch up-gradient of rubble pile. (soil) 2 Spring Gulch down gradient of rubble pile (soil) 3. Red River upstream of Molycorp mill (sediment, water) 4. Molycorp well up gradient of mill. (water) 5. Molycorp well at Columbine campground. (water) 6 Residential well of Mr Roger Herrera. (water) 7. Red River downstream of Molycorp mill. (sediment, water) 8. 002 leacnate discharge point from tailings pond. (water) Points on the proposed sampling plan which were not sampled were 1 Well at Kachina Hotel in Questa, well inaccessible. 2. Tailings pond slurry pipeline discharge, mill shut down, pipeline not operating
VII.	Molybdenum mill tailings are abrasive and can be toxic. The only "wastes" defined as hazardous were unrinsed reagent drums (pine oil, methyl isobutyl carbinol, etc.) disposed in Spring Gulch landfill area (onsite, Molycorp, Inc. property). This "landfill" is actually a mine rubble pile over 100' thick, in the upper elevations of Spring Gulch. The area gets little rainfall, humidity is very low Top of this area has been leveled and is used as the company "bone yard:, for discarded equipment and mechanical parts. This gulch drains directly into a lift of the main mine pit. Opportunity for surface or groundwater contamination is very low. Now, all drums are triple rinsed before disposal. Chloroethane and oils used in the flotation process are reclaimed by a New Mexico - registered recycler/reclaimer in Albuquerque.

POTENTIAL HAZARDOUS WASTE SITE TENTATIVE DISPOSITION

EPA

REGION ISITE NUMBER: VI NMD002899094

(1)

Form in the regional Hazardous Waste Log File and submit a copy to U S. Environmental Protection Agency; Site Tracking Hazardous Waste Enforcement Task Force (EN-335); 401 M St., SW, Washington, DC 20460.

I SITE IDENTIFICATION NM HWY 38, 4 mi. E of Questa

A NAME	B STREET	
Molycorp, Inc Questa Mine	Sec 35+36, T29N, R12E	
C TY	D STATE	E. ZIP CODE
Questa (Taos County)	NM	87556

II TENTATIVE DISPOSITION

Indicate the recommended action(s) and agency(ies) that should be involved by marking 'X' in the appropriate boxes.

RECOMMENDATION	MARK X	ACTION AGENCY: EPA	STATE	LOCAL	PRIVATE
A NO ACTION NEEDED – NO HAZARD					
B INVESTIGATIVE ACTION(S) NEEDED (If yes complete Section III.)		X	(RCRA) jurisdiction		
C REMEDIAL ACTION NEEDED (If yes, complete Section IV.)					
D ENFORCEMENT ACTION NEEDED (If yes, specify in Part E whether the case will be primarily managed by the EPA or the State and what type of enforcement action is anticipated.)					

E RATIONALE FOR DISPOSITION: This is an active molybdenum mining and milling facility, whose area is approx. 3500 acres. A 9-mile slurry pipeline transports tailings to a large landfill area west of the facility. A break in the slurry pipeline reportedly was responsible for a major fish kill at the Red River Fish Hatchery 2 miles SW of Questa. Other spills have been reported by the Carson National Forest Service. The pipeline reportedly has been replaced. Drinking water wells should be resampled due to the presence of 111-trichloroethane (Columbine well). Another landfill located at the headwaters of Spring Gulch Creek near the mine area appears to be contributing to the elevated concentrations of organics and inorganics downstream. Spring Gulch Creek flows into the Red River. Since contaminants appear to be migrating off-site, further investigation is recommended.

F INDICATE THE ESTIMATED DATE OF FINAL DISPOSITION (mo., day, & yr.)

G IF A CASE DEVELOPMENT PLAN IS NECESSARY INDICATE THE ESTIMATED DATE ON WHICH THE PLAN WILL BE DEVELOPED (mo., day, & yr.): 9/25/84

H PREPARER INFORMATION

I NAME	TELEPHONE NUMBER	J DATE (mo., day, & yr.)
J De Carlo Cecil 6 H-ES	(214) 767-9702	9/24/86

III. INVESTIGATIVE ACTIVITY NEEDED

A IDENTIFY ADDITIONAL INFORMATION NEEDED TO ACHIEVE A FINAL DISPOSITION.

Transcribed, this says the following (in Part):

Another landfill located at the headwaters of Spring Gulch Creek near the mine area appears to be contributing to the elevated contribution of organics and inorganics downstream.....Since contaminants appear to be migrating off-site, further investigation is recommended.

(2)

ECOLOGY AND ENVIRONMENT INC.,

REGION VI

MEMORANDUM

TO: Keith Bradley, RPO, EPA Region VI

FROM: Jairo Guevara, FIT Chemical Engineer

PRELIMINARY REPORT
This does not constitute
final opinion of EPA

THRU: K.H. Malone Jr., FIT RPM

DATE: June 4, 1986

SUBJ: Sampling Inspection at Molycorp Inc., Questa, N.M. (NM558)
TDD# R6-8510-06

A six person FIT (Team Leader J. Guevara and Team Members D. Hall, D. Smith, D. Tanksley, K. Dodd and M. Pike) sampled Molycorp Inc. on December 4, 1985. This sampling inspection was conducted as a follow up to the May 18, 1983 FIT sampling inspection of the site.

A total of ten liquid and eight soil/sediment samples were collected and analyzed for organics - base/neutral/acid (BNA's) and volatiles (VOA's); and inorganics - metals (including molybdenum) and cyanides. Five of the locations which were sampled were specified by the EPA task request. These sample locations were the slurry pipeline discharge, the Molycorp Columbine well, the Roger Herrera well, the NPDES outfall 002 and the Red River at the Questa fish hatchery. Other locations were sampled to obtain additional information in order to address all TDD requirements.

The FIT was accompanied during the inspection by Mr. John Stribling, Molycorp Environmental Coordinator. Split samples were collected for Molycorp. Most of the split samples were to be analyzed by Molycorp only for VOA's.

During this sampling inspection a small oil spill was observed on the ground near some drums which had been discarded on the Molycorp landfill. This location was not sampled. Mr. John Stribling, the Molycorp representative, stated that dumping of oily waste in the landfill was not company policy. Based on FIT observations, it appears that this landfill is still active as a dump area for the disposal of empty drums and old equipment parts.

The exact location of the sample which was collected downstream of the landfill during the FIT sampling inspection of May 18, 1983 could not be precisely determined. The collection of an upstream sample in Spring Gulch Creek (Station 01) was judged impractical because the creek starts where some landfill waste has been dumped in the past.

The sample collected from Spring Gulch Creek downstream of the Molycorp landfill (Station 02A) showed the highest levels of inorganic and organic contamination of all samples collected (see organic and inorganic summary tables attached). The inorganic compounds detected at significant levels in this sample were cadmium, calcium, copper, iron, lead, nickel, molybdenum, sodium and zinc. Significant organic contaminants found at this location included hexadecane, heptadecane, pentadecane 2,6,10,14 tetramethyl, other alkanes and unknowns.

Low levels of contaminants were found at the other sampling locations as follows:

Stations 03A and 04A (Sediment samples, Red River upstream from the mill)-heptane dimethyl and organic unknowns. The concentrations of these compounds were much lower than those found at Station 02A.

Station 05A (Sediment sample at the Red River downstream from the Molycorp Mill and Spring Gulch Creek)-eight organic unknowns were detected at concentrations higher than the levels of the same compounds found at Stations 03A and 04A. Six of these unknowns were also detected in the background sample collected at the Carson Ranger Station (Station 12A). The levels of these compounds at Station 12A were lower than those found in Station 05A. Twelve other organics, most of them unknowns, were also detected in this background sample.

Station 05 (Liquid sample at same location of sample 05A)-molybdenum.

Station 10A - (Red River where old pipeline crosses Red River near Eagle Rock Lake) and Station 11A (Red River fish hatchery) showed six to seven unknown organics. Five of these compounds were detected at lower concentrations than the background sample from the Carson Ranger Station.

Stations 10 and 11 (Liquid samples at the same locations as samples 10A and 11A) - cyclopentanol 2 methyl in both samples, an unknown organic compound in sample 10, manganese in sample 10 and molybdenum in sample 11.

Station 09A (Discharge of slurry pipeline - solid phase) - Two unknown organics, calcium and molybdenum.

Station 09 (Liquid phase at the same location as sample 09A) - Four unknown organics. No liquid phase was analyzed for inorganics.

Station 06 (Molycorp Columbine well - Liquid samples) - calcium, magnesium and nickel.

Station 07 (Molycorp NPDES 002 - Liquid sample) - calcium, magnesium, manganese, sodium and molybdenum.

Station 08 (Roger Herrera well - Liquid sample) - calcium, magnesium, sodium and molybdenum.

Organic contamination of the site downstream sediment samples at the Red River (Stations 04A, 05A, 10A and 11A) is inconclusive. This is due to the

anic contamination in the two Red River upstream sediment samples (Stations 03A and 04A) and the soil background sample (Stations 12A).

The TDD task also requested further characterization of chlorocyclohexane which was detected in the sediment samples collected by the FIT during the May 18, 1983 inspection at the following locations (see attachment):

a) Landfill upstream
b) Red River one mile upstream of the mill, and
c) Red River fish hatchery.

No chlorocyclohexane was detected in any of the samples collected during the December 4, 1985 FIT inspection.

Another item discussed in the May 18, 1983 FIT sampling analyses results was the contamination of the Columbine well with 1,1,1 trichloroethane. This compound was again detected in the Columbine well sample collected in the December 4, 1985 FIT inspection (Station 06) at an estimated concentration (below the instrument detection limit) of 3.6 ppb. However this compound was also found in the field rinsate blank, at an estimated concentration (below the detection limit) of 2.3 ppb. Therefore, the presence of this compound in the Columbine well is not verified. The possibility exists that traces of this compound in the well could have resulted from Molycorp employees servicing the well motor or/and pump.

Toluene, another contaminant found in samples collected by the FIT on May 18, 1983, i.e. in the Roger Herrera well (less than 5 ppb), at a location downstream of the landfill disposal area (less than 5 ppb) and at the Molycorp NPDES outfall 002 (11 ppb), was also found in all the samples but one collected by the FIT on December 4, 1985. However it was determined that its presence was due to lab contamination.

Based on the analytical results and field observations, FIT recommends that a RCRA inspection be conducted at the site landfill/dump. This inspection should attempt to determine if the surface soil contamination detected during the FIT inspection downstream from the landfill dump area is due to the dumping of residual amounts of wastes or products from drums which have been deposited on the landfill.

The organic contamination detected in the Red River samples collected upstream and downstream of Molycorp could be due to past discharges (1971 - 1983) of poorly treated effluent from the town of Red River waste water treatment plant which is located upstream of the Molycorp facilities. Also past discharges from the town of Questa septic tanks into the Red River could contribute to the organic contamination found in the Red River fish hatchery sample. The problesm with the discharges from these two towns apparently have been resolved. See attached report "Intensive Survey of the Red River in the vicinity of the Red River and Questa wastewater treatment facilities and the Molycorp complex, Taos County, New Mexico, January 25-27, 1984 by Gerald Z. Jacobi and Larry R. Smolka, Surface Water Quality Bureau of the Environmental Improvement Division, New Mexico Health and Environment Department, June 1984".

Also attached to this report are a listing of sample locations and descriptions and the chain of custody documentation for this effort.

SAMPLING LOCATIONS

STATION 02 - Spring Gulch downstream of landfill, on-site soil/sediment.

STATION 03 - On Red River about 1 1/4 mile upstream of mill gate, off-site soil/sediment & liquid.

STATION 04 - On Red River about 1 mile upstream of mill gate, off-site soil/sediment & liquid.

STATION 05 - On Red River downstream of mill Spring Gulch Creek, off-site soil/sediment & water.

STATION 06 - Columbine well, on-site property, water.

STATION 07 - Molycorp NPDES outfall 002, on-site water.

STATION 08 - Roger Herrera well, off-site water.

STATION 09 - Discharge of slurry pipeline or sample of tailing ponds, on-site liquid and soil phases.

STATION 10 - On Red River where old pipeline crosses Red River near Eagle Rock Lake, off-site soil/sediment & water.

STATION 11 - On Red River at fish hatchery, off-site soil/sediment & water.

STATION 12 - Background soil, off-site at Carson Ranger Station.

STATION 13 - Field rinsate blank, water.

NOTE: Water samples have the same designation as the station number. Soil/sediment samples are identified by the station number followed by the letter A.

NOTE: STATION 01 Upstream of landfill on Spring Gulch Creek was not taken because the creek starts where some landfill waste has been dumped in the past.

2
NM

EPA POTENTIAL HAZARDOUS WASTE SITE
TENTATIVE DISPOSITION EPA

REGION	SITE NUMBER
VI	NMD002899094

File this form in the regional Hazardous Waste Log File and submit a copy to U S Environmental Protection Agency, Site Tracking System Hazardous Waste Enforcement Task Force *(EN-335)*, 401 M St., SW, Washington, DC 20460

I SITE IDENTIFICATION NM HWY 38, 4 mi. E of Questa

A SITE NAME	B STREET	
Molycorp, Inc. Questa Mine	Sec 35+36, T29N, R12E	
C CITY	**D STATE**	**E ZIP CODE**
Questa (Taos County)	NM	87556

II TENTATIVE DISPOSITION

Indicate the recommended action(s) and agency(ies) that should be involved by marking 'X' in the appropriate boxes

RECOMMENDATION	MARK X	ACTION AGENCY: EPA	STATE	LOCAL	PRIVATE
A NO ACTION NEEDED -- NO HAZARD					
B INVESTIGATIVE ACTION(S) NEEDED *(If yes, complete Section III.)*		X	(RCRA jurisdiction)		
C REMEDIAL ACTION NEEDED *(If yes, complete Section IV.)*					
D ENFORCEMENT ACTION NEEDED *(if yes, specify in Part E whether the case will be primarily managed by the EPA or the State and what type of enforcement action is anticipated)*					

E RATIONALE FOR DISPOSITION This is an active molybdenum mining and milling facility, whose area is approx. 3500 acres. A 9-mile slurry pipeline transports tailings to a large landfill area west on the facility. A break in the slurry pipeline reportedly was responsible for a major fish kill at the Red River Fish Hatchery 2 miles SW of Questa. Other spills have been reported by the Carson National Forest Service. The pipeline reportedly has been replaced. Drinking water wells should be resampled due to the presence of 111-trichlorethane (Columbine well). Another landfill located at the headwaters of Spring Gulch Creek near the mine appear to be contributing to the elevated concentration of organics and inorganics downstream. Spring Gulch Creek flows into the Red River. Since contaminants appear to be migrating off-site, further investigation is recommended.

F INDICATE THE ESTIMATED DATE OF FINAL DISPOSITION *(mo , day, & yr)*	G IF A CASE DEVELOPMENT PLAN IS NECESSARY INDICATE THE ESTIMATED DATE ON WHICH THE PLAN WILL BE DEVELOPED *(mo., day, & yr.)*

H PREPARER INFORMATION

1 NAME	2 TELEPHONE NUMBER	3 DATE *(mo., day & yr.)*
J De Carlo Ciccel 6H-ES	(214) 767-9702	9/24/86

9/23/86

III INVESTIGATIVE ACTIVITY NEEDED

A IDENTIFY ADDITIONAL INFORMATION NEEDED TO ACHIEVE A FINAL DISPOSITION

B PROPOSED INVESTIGATIVE ACTIVITY *(Detailed Information)*

1 METHOD FOR OBTAINING NEEDED ADDITIONAL INFO	2 SCHEDULED DATE OF ACTION *(mo, day, & yr)*	3 TO BE PERFORMED BY *(EPA Contractor, State, etc.)*	4 ESTIMATED MANHOURS	5 REMARKS
a TYPE OF SITE INSPECTION				
(1)				
(2)				
(3)				
b TYPE OF MONITORING				
(1)				
(2)				
c TYPE OF SAMPLING				
(1)				
(2)				

EPA Form T2070-4 (10-79) Continue On Reverse

CC 6H-CE

STATE OF NEW MEXICO
ENVIRONMENT DEPARTMENT

June 1, 1993

David R. Shoemaker
Mine Manager
Molycorp, Inc.
P.O. Box 469
Questa, New Mexico 87556

Dear Mr. Shoemaker:

This letter is in reference to your request of January 27, 1993, for an exemption under Section 108.C, for on-site disposal of construction and demolition waste generated at the Molycorp Site.

The Department accepts your claim for exemption of this solid waste under Section 108.C of the Solid Waste Management Regulations, provided the waste does not infringe upon the Goathill Gulch and Spring Gulch drainage systems.

Please let me know if you have any questions or need additional information regarding this matter.

Sincerely,

J. David Duran
Program Manager, Permitting & Compliance Section
Solid Waste Bureau

cc. Earnie Gutierrez, District II, Santa Fe

Bruce King
Governor

Judith M Espinosa
Secretary

Ron Curry
Deputy Secretary

Harold Runnels Building
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502
505/827-2850
FAX (505) 827-2836

Molycorp Inc
- Unocal Company
Questa Division
P O Box 469
Questa New Mexico 87556
Telephone (505) 586 02 2

UNOCAL 76
MOLYCORP

State of New Mexico
Environment Department
Solid Waste Bureau
1190 St. Francis Drive
Santa Fe, NM 87503

January 27, 1993

Attention: J. David Duran
Program Manager,
Permits & Compliance

Reference: NMED Form for On-Site
Disposal of Construction
& Demolition Debris

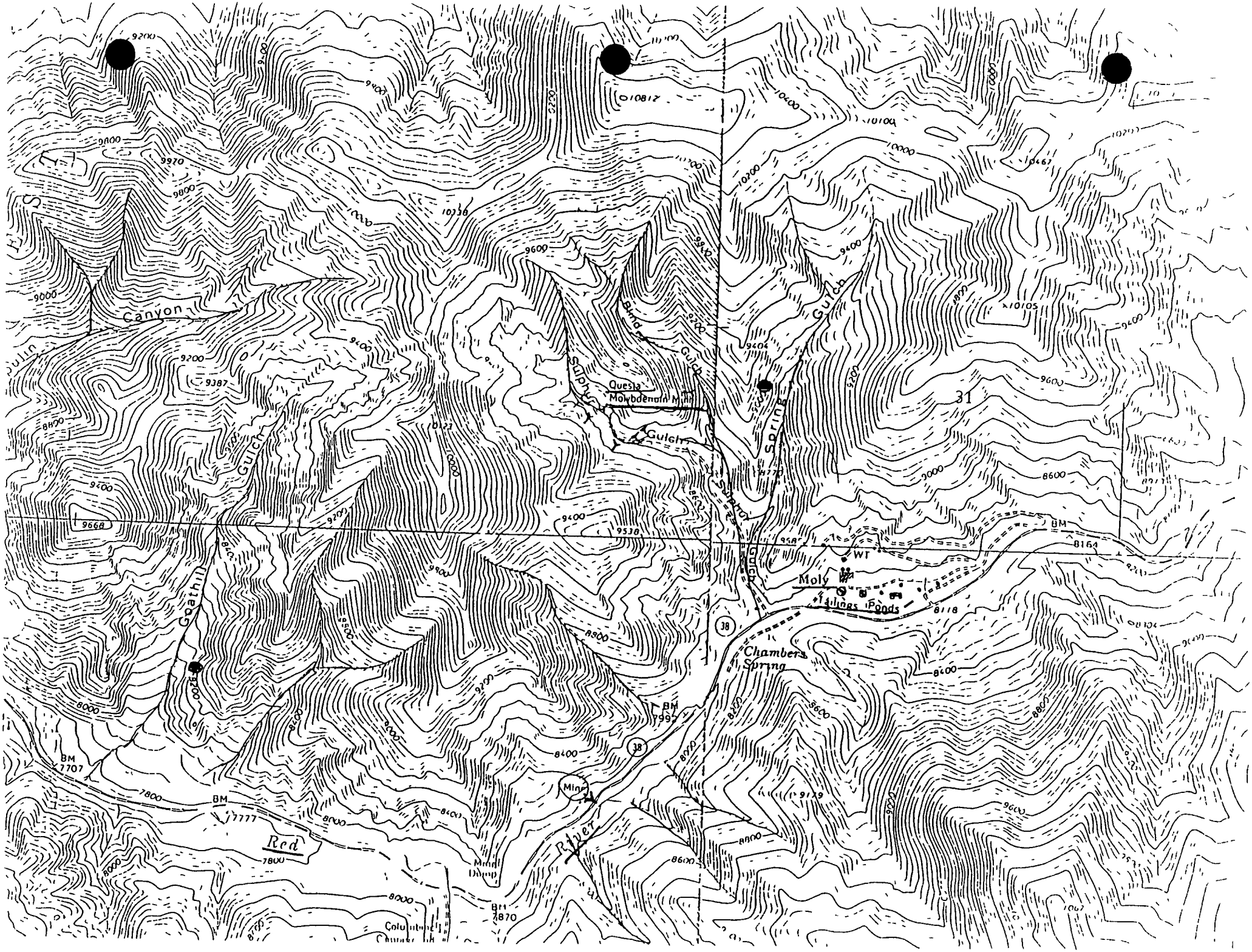
Dear Sir:

With the enclosed and completed referenced form, Molycorp is requesting that it be exempted from the State of NM Solid Waste Management Regulations under Section 108 Part C since the Questa mine now only places "construction and demolition debris" in its landfills All lunchroom garbage and office paper waste are disposed of through a private contractor SANCO; and waste oil and cleaning solvent are handled by licensed EPA approved contractors The two on-site landfills listed on the referenced form have been capped with dirt overburden.

Your consideration of this request is appreciated. If you have any questions please phone me at 586-7601.
586-0212 3001
3013
3017 = Bill Renison

David R. Shoemaker

David R. Shoemaker
Mine Manager



Canyon
Goathill
Gulch
Sulphur
Gulch
Blind
Gulch
Questa
Molybdenum Mine
Gulch
Spring
Gulch
Sulphur
Gulch
Moly
Tailings Ponds
Chambers
Spring
Mine
River
Red
Mine
Dump
31
38
38
BM
7707
BM
7777
BM
7992
BM
7870
BM
8164
WT
9668
9538
9387
10812
10338
10105
10467
9404
9179
8118

NMED/SWQ-92/1

WATER QUALITY AND WATER POLLUTION CONTROL IN NEW MEXICO 1992

A Report Prepared for Submission to the
Congress of the United States
by the
State of New Mexico
Pursuant to Section 305(b) of the
Federal Clean Water Act

New Mexico Water Quality Control Commission

P.O. Box 26110
Santa Fe, New Mexico 87502

May 1992

Tables

1. Criteria for Determination of Designated and Overall Use Support. 35

2. New Mexico Fishing Use Protection Numeric Water Quality Standards for Toxicants. 37

3. Overall Use Support in Assessed Rivers: Miles. 39

4. Individual Use Support Summary for New Mexico Rivers: Miles. 40

5. Overall Use Support in Assessed Lakes: Acres. 42

6. Individual Use Support in New Mexico Lakes: Acres. 44

7. Total River Miles not Fully Supporting Designated or Attainable Uses by Cause Category. 49

8. Total River Miles not Fully Supporting Designated or Attainable Uses by Source Category. 51

9. Total Lake Acres not Fully Supporting Designated or Attainable Uses by Cause Category. 52

10. Total Lake Acres not Fully Supporting Designated or Attainable Uses by Source Category. 53

11. Fish Kills in New Mexico, 1990-91. 56

12. Toxic Pollutant Concerns in New Mexico Waters: Area by Toxicant. 58

13. Intensive Stream Surveys 1990-91. 151

14. Lake and Reservoir Surveys 1990-91. 151

15. Hazardous Waste Program Off-Site Contamination Data. 176

destabilization

Table 1 Assessed River Reaches Not Fully Supporting Designated or Attainable Uses

Water Body (Basin, segment)	Uses Not Fully Supported[a] (see Table 3a)	Probable Cause of Nonsupport	Toxics at Acute Levels[b]	Toxics at Chronic Levels[b]	Probable Sources of Nonsupport (see Table 3b)	Total Size Affected (Miles)
Red River from Zwergle Dam to confluence of East and West Forks of Red River (Rio Grande, 2-120)	HQCWF	Siltation, reduction of riparian vegetation, streambank destabilization			Construction (3200) Recreation (8700, 8703)	3 9
Red River from Placer Creek to Zwergle Dam (Rio Grande, 2-120)	HQCWF	Metals, total phosphorus, siltation		Fe, Al	Resource extraction (5100) Construction (3200)	1 6
Red River from mouth on Rio Grande to Placer Creek (Rio Grande, 2-119)	CWF[c], L&WW[c], IRR[c]	Metals, turbidity, pathogens, siltation, priority organics	Al, Cu, Zn, Pb, Cd	Ag	Resource extraction (5600, 5700, 5900) Agriculture (1500) Land disposal (6800)	20 2
Bitter Creek from mouth on Red River to headwaters (Rio Grande, 2-120)	HQCWF[c]	Metals, turbidity, total phosphorus, pH, siltation, reduction of riparian vegetation, streambank destabilization	Cu	Al, Fe	Resource extraction (5300, 5700) Road runoff (8300) Recreation (8700)	7 6
Cabresto Creek from mouth on Red River to headwaters (Rio Grande, 2-120)	HQCWF	Metals		Al	Resource extraction (5100)	13 4
Rio Hondo from South Fork of Rio Hondo up to Taos ski area (Rio Grande, 2-120)	HQCWF	Metals, total phosphorus, total inorganic nitrogen, oil & grease, siltation		Pb, Ag	Recreation (8700, 8701, 8704) Construction (3200) Domestic point sources (0201)	3 5
Rio Hondo from mouth on Rio Grande to South Fork of Rio Hondo (Rio Grande, 2-120)	HQCWF	Metals, siltation, reduction of riparian vegetation, streambank destabilization		Al	Recreation (8700, 8701) Construction (3200) Agriculture (1201, 1500) Road maintenance	13 0

Includes Molycorp Mine

COMP
BOOK
Mobil corp.
80 SHEETS 9 3/4 x 7 3/4 • COLLEGE & MARGIN 43-461
0 73333 43461 3
DENNISON STATIONERY PRODUCTS CO.
FRAMINGHAM, MA 01701 0344
Made in USA

SK

3-15-93

Attendance Bob Saltor (1)
Larry Smolka
Mary Ann Mercury
Karen McCormack
Stuart Kent

- Bob S - only [illegible] below [illegible]
No on public water

outfall #002 - only [illegible]
NPDES

photo 11 seeps below 002
12 outflow 002 + dam upstream

contam in stream Al, Cu, Zn accord to BS + LS

C [illegible]
[illegible] to [illegible]

Red R at Ranger station -
milky (ph 13+14)

photo 15 - [illegible] exposed
S rocks

- Tailing pipeline being dismantled

- seeps along Red River (Northwest)
- ph 16-17 Al 0 de 15 ppt Fe Oxide ppt
1 [illegible]

[Downgrad from pt]

SK

- the rate contamination in water sheet problem

[illegible] ppt

Goat Hill
- Forested on 63 map

[illegible] 22 West Rock

[illegible]

[illegible] 23 Bulkhead at end of
Moly Tunnel (~1 m long
1% [illegible])

Bloody Lake [illegible]
w/ exposed [illegible]

[illegible]

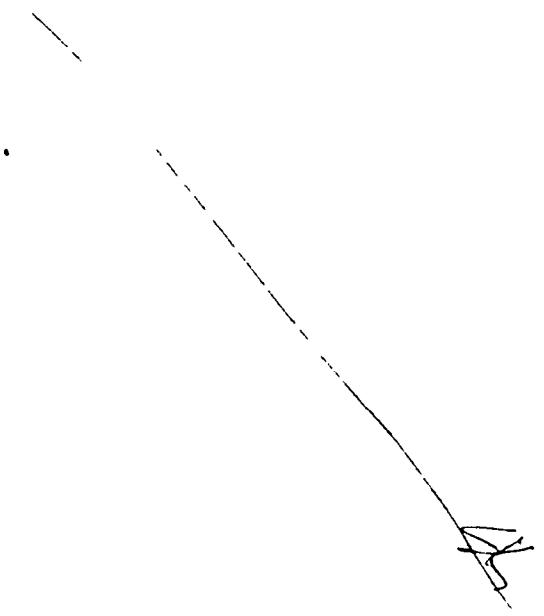
Mine working (?)
Oxidation of sulfides or "Natural [illegible]

(3)

[illegible]

[illegible]

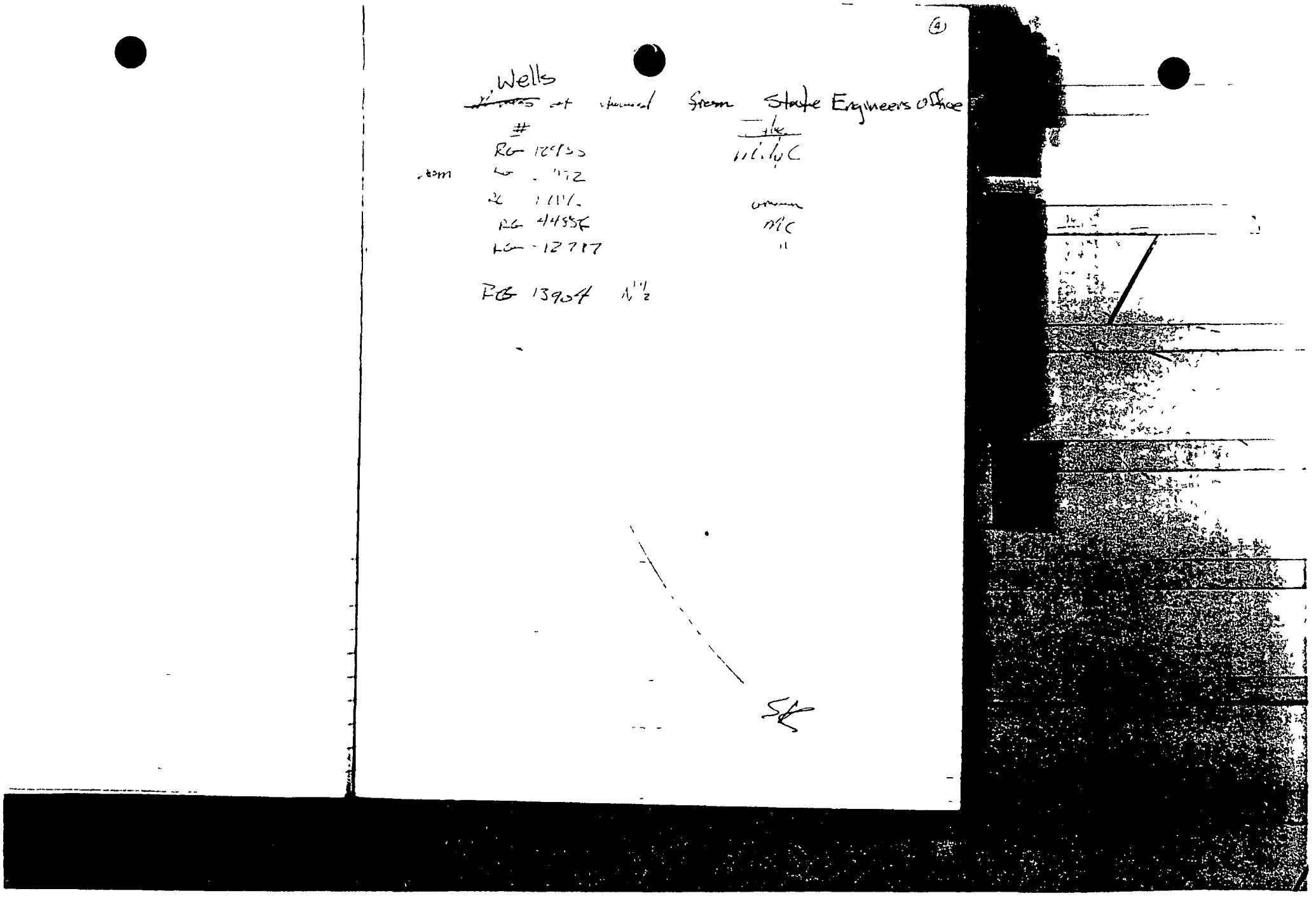
[illegible]



(4)

Wells ~~[illegible]~~ at [illegible] from State Engineers Office

#	File
RG 12955	[illegible]
[illegible]	
[illegible]	[illegible]
RG 44556	MC
RG-12717	"
RG 13904 N½	



SK

(5)

Surface Area Calculations of Waste Sources at Molycorp using planimeter (transcribed)

1 mi^2 (from topo) · planimeter units
1) 3596264
2) 3604608
$\bar{X}$ = 3600436

Dam #1 (Pond #1)
1) 1335040
2) "
$\bar{X}$ = 1335040

Dam #4 (Pond #4)
1) 1335040
2) "
$\bar{X}$ = 1335040

Pond #1 = Pond #4 = 1335040 / 3600436 = .3708 mi^2
= 10,300,000 sq ft

Total = 20,600,000 sq ft

Open Pit + Wst Rock : 1) 7175840 } $\bar{X}$ = 7159152
2) 7142464 }

Surface Area = 7159152 / 3600436 = 1.988 sq m

Trees : 367136 = .102 sq m

Open Pit + Wst Rock = 1.89 sq m = 1988 - 102
= 5.26×10^7 sq ft
Open Pit = 1.26×10^7 sq ft

Waste Rock = 4.0×10^7 sq ft

SK

(5)

Transcribed

Surface Area Calculations via Planimeter

1 sq. m.
1 3612952
2 3579576
3 3604608

3596264
3604608
$\bar{X}$ = [illegible]

Dam 1
1 1343384
2 1335054

1335040
"

Dam 4
1. 1335040
2. 1368416
3 1335040

1209880
1485732
1481856
1893704

1785616
1835680

Pond 1 Pond 4 = .3[illegible]
[illegible] 0,300 [illegible] sq ft

Mne + WstRk
1 7175840 x [illegible]
2 7142464
= 1.988 sq m

Trees. 367136 102 sq m

Pt 1693832
1568622
~~1246632~~
1627080

Total Surface Area = (Wst Rk + P) - trees 1.87 [illegible]
= 5.21×10^7 ft^2

Pit = 12[illegible] ft^2

Wst Rk = 39.5×10^6 ft^2

05

Average Diam of Pit

(40 + 55 mm)/2 - 47 mm

Surface Area Wst Rock = 40×10^6 ft^2

Average Depth of wst Rock is approx 30 as stated by David Shoemaker during site visit on Apr 23 1993

Volume of Wst Rock is approximated by Surface Area (by planimeter) x Average Depth

40×10^6 ft^2 x 30' - 120×10^7 ft^3

$= 44 \times 10^7$ yd^3

From HRS Table 2 5

Wst Qnty Value for Source 1 (Waste Rock) is

44×10^7 yd^3 / 25 $= 176 \times 10^7$ (using volume)

or

40×10^6 ft^2 / 13 $= 308 \times 10^6$ (using area)

Wst Qnty Value for Wst Source II is

(2 x 10,300,000) sq. ft / 13 $= 158 \times 10^6$

Since volume of tailings pond cannot be accurately determined using readily available information, source waste quantity is determined using surface area.

Surface Area = 20.6×10^6 ft^2

Wst quantity value (from Table 2-5) is 20.6×10^6 ft^2 / 13 = 1.58×10^6

Transcribed

Date 4-23 93 Present: Karen McCormick - NMED
Stuart Kent - NMED
David Shoemaker - Molycorp site Mngr

Mining Info.

Ore bodies near contact btwn aplite granite & volcanics (aplite intruding volcanics)

Record to DS

Waste Rock is mostly aplite

Volcanics
- consists of rhyolite / andesite
- yellow & causes erosional scars
- contains sulphides which cause acid drainage
  → Acid drainage is all natural

Aplite
- gray
- located beneath volcanics in the wst piles
- provides buffering capacity (carbonate ? in the rock)
- placed over scars in some areas

4-27 93 1978. Unocal purchases Mobil. Corp America
or changes name to Molycorp

Slurry transport Lines (pipe lines)
- trouble w/ spills in the past
1983 — lines double-lined w/ rubber
in upper reaches + No spills since
- sections are currently dismantled
for Hwy widening
+ replaced by late summer

- sections presently buried will by
replaced w/ above ground pipes
+ This helps w/ maintenance

Employees

Maximum ~ 1100
1989 → '92 ~ 200
Currently 11

photos 12-14 Tailings pond - looking south
dam SH (smaller) on right

#15 Revegetation on West side of
16 tailings ponds - Natural reveget.
"Works better than our reseeding" D.S.

Transfer out

4-27-93

Photo #17. Ion exchange plant from Dam #4 - looking south

WINDY on Dam #4 - hard hat flies
↳ ~ 30 mph

Photo 18. Soil Cap on Dam (or Part) #4 - little dust considering the wind.

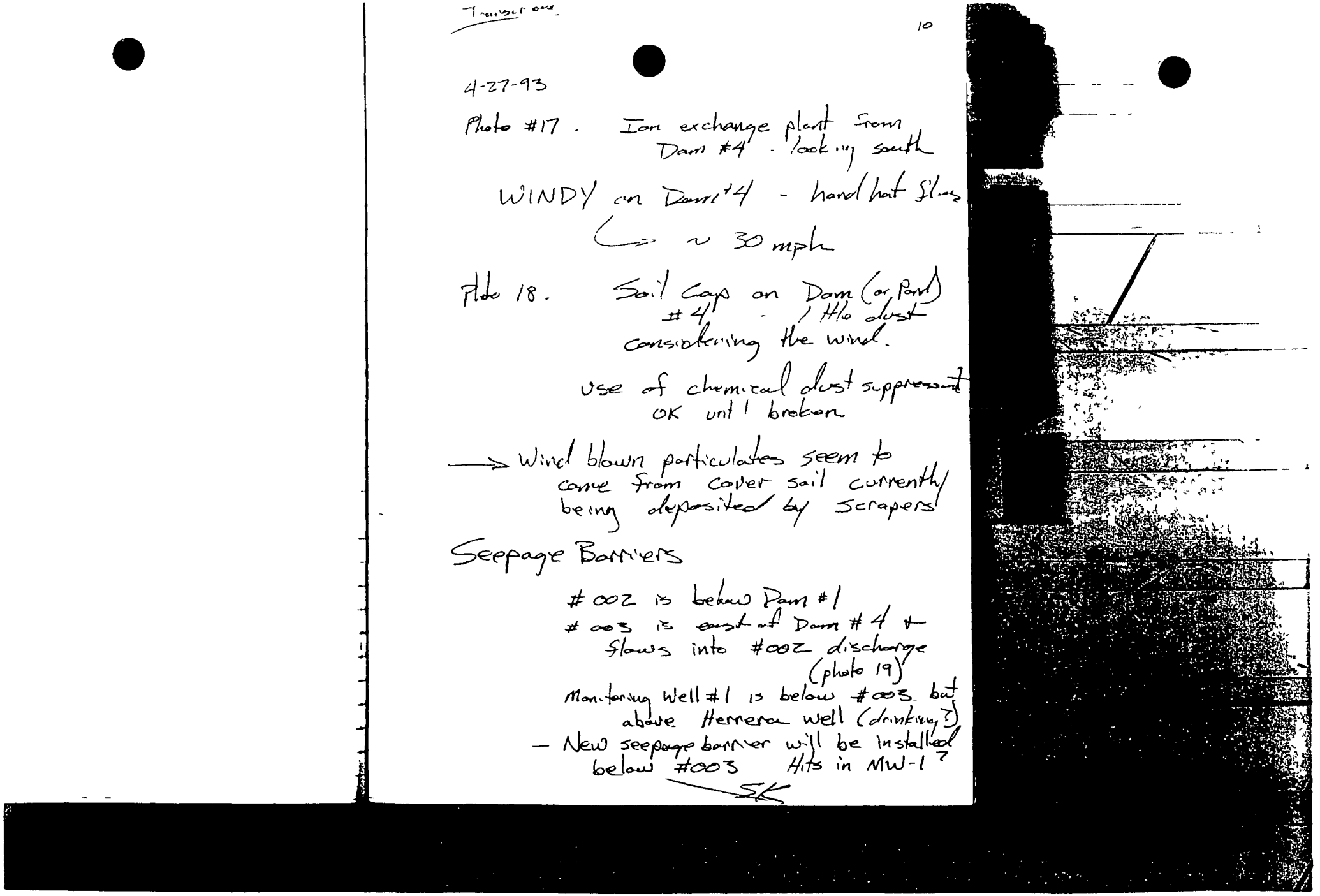
use of chemical dust suppressant OK until broken

→ Wind blown particulates seem to come from cover soil currently being deposited by scrapers

Seepage Barriers

#002 is below Dam #1
#003 is east of Dam #4 & flows into #002 discharge (photo 19)
Monitoring Well #1 is below #003 but above Herrera well (drinking?)
- New seepage barrier will be installed below #003 Hits in MW-1?

SK



Transverse bend

427

Along Red River

- ∃ several dump sumps
  + used to temporarily hold tailings slurry while repairs are made on pipelines.

According to D.S
- Acid drainage to Red River is from Natural scars

photo #20 Culvert ~~from~~ sk conveying drainage from natural scar
— CORRODED!

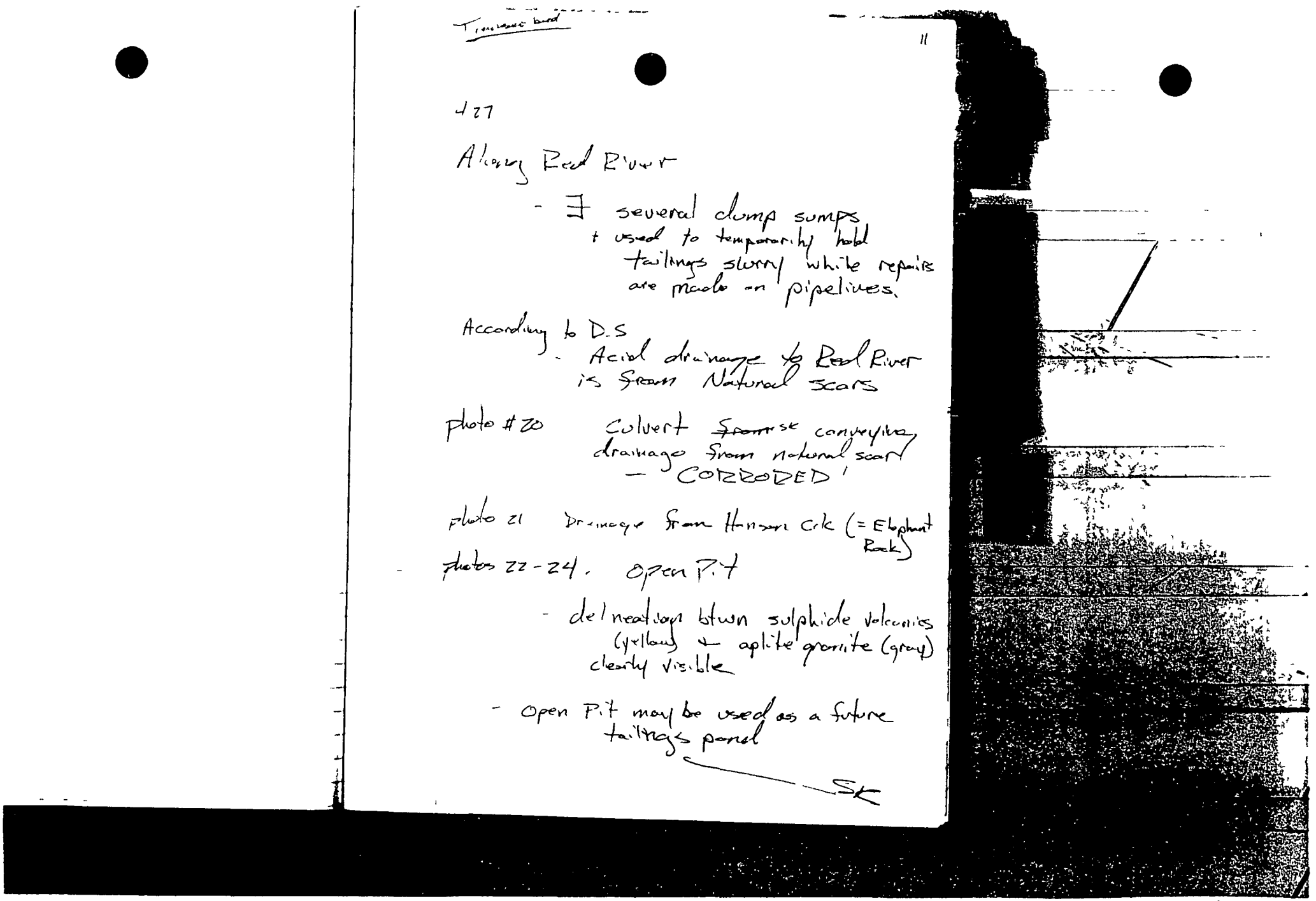
photo 21 Drainage from Hanson Crk (= Elephant Rock)

photos 22-24. Open Pit

- delineation btwn sulphide volcanics (yellow) + aplite granite (gray) clearly visible

- Open Pit may be used as a future tailings pond

SK



Transx bed

4-27-93

Open Pit (cont'n)

- Dewatering Necessary
- Surrounding rock drains necess
  + prevents runon from entering underground mine

Run-on is purposely funneled into pit & down to new underground workings

- aplite supposedly neutral as

Surface run-off to Red River (outside open pit)

- minimized by reseeding on benches (photos # 25, 26)

- waste rock is non-homogeneous
  - hard crust develops (promotes run-off)

Goathill Gulch (photos 27 28)

- ~~collects~~ * bore hole to new underground workings (~700')
- collects H_2O (natural & waste wtr) & conveys to mine (below Red River)

SK

4/27-93

Accord to D Shumpaker

Run-off (both natural + from open pit area) drains to groundwater (below Red River) via open pit or bore hole in Goathill Gulch

- Water is near neutral due to buffering of aplite.

∴ Molycorp mine actually reduces acid drainage which would otherwise be naturally occurring

- Water level in new underground mine is rising
  - 6 months of pumping 1st before mining resumes
  - Water ↓ will be pumped to tailings ponds.

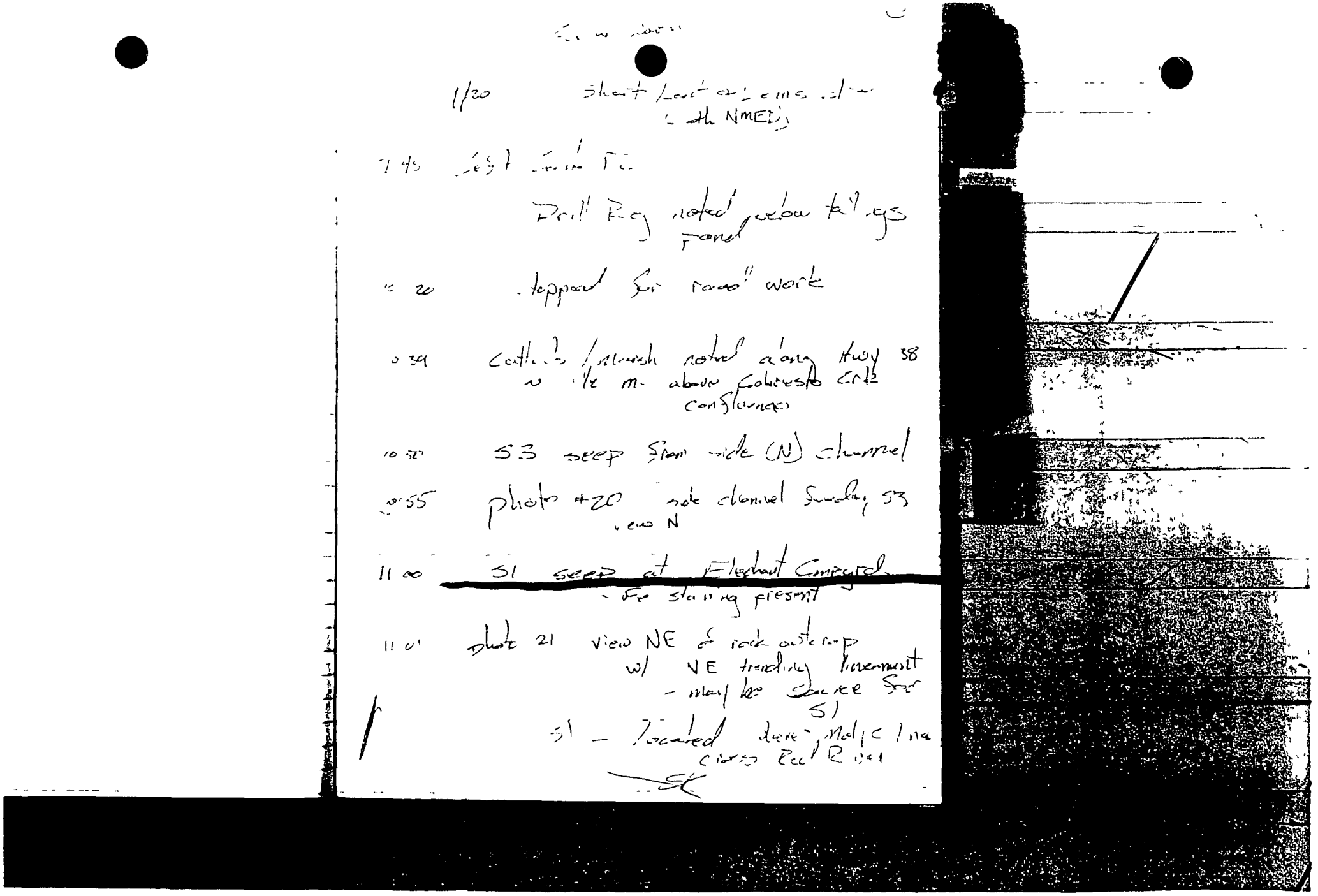
Transcribed

4-27-93

Red River WWTP

- located in Hotentot drainage
- pH ~ 2.6 (above Molycorp)
  - ↳ according to DS
- higher in metals than Hanson Crk (also above Molycorp)

Hanson Crk = Elephant Rk Drainage



[illegible]

1/20 Start [illegible] (with NMED)

7 45 Left [illegible]

Drill Rig noted below tailings pond

10 20 stopped for road work

10 39 Cattails / marsh noted along Hwy 38 w 1/2 mi above Cabresto Crk confluence

10 50 S3 seep from side (N) channel

10 55 photo #20 side channel feeding S3 view N

11 00 S1 seep at Elephant Campgrd - Fe staining present

11 01 photo 21 view NE of rock outcrop w/ NE trending lineament - may be source for S1

S1 - located where Mal[illegible] line crosses Red River

SK

11:20 ph 22 culvert + side channel above (+ North) at S1
culvert at bottom
- hydrothermal scar above
(looking NNW)

Question - Is S1 from side channel or rock outcrop lineament?

Road work stopped for four days along Hwy 35 due to falcon

12:20 Sampled seep approx 200 yds E of S2 and S3, on N bank of river where road fill enters river. Despite significant dilution by river, the seep water is.
cond = 1140 @ 12°C, pH = 4.20
River water here (above seep) is
cond = 250 @ 12°C, pH = 6.70
Within a distance of 2 feet the water cond. varies from 4a to 1100

photo 23 view W, downstream of [illegible]
- General seep area below Capulin Canyon but above S3
~ 50 long of white ppt.

- This seep area is opposite a rock face (ie No drainages)

1:30 seep exposed by Hwy crew on north side at Hwy 38 just below Capulin Canyon
- "seep" is now a pond
conduct = 2450 [illegible]
Temp = 16.9°C

ph 24 - seep/pond w/ culvert 6' x 15'

ph. 25: view NE
Capulin Canyon in background
seep/pond in foreground

ph 26, 27 – This hole of seep/pond is being filled w/ concrete.

According to crew mngr, water table is consistently seen when digging along Red River

2:10 sampled 1 L cubitainer S-8

ph 28 – Fishing line along Red River near ~~of~~ SE Capulin Canyon

ph. 29 seep water flowing in ditch (near Capulin Canyon) which parallels the River
– Fe is noticeable (ph #30)

25' wide
10' deep
>100 yrds long

pH = 3.5 – 4 (paper)
Cond = 1800 umhos/cm
Temp = 20°C
pH = 3.35 (meter)

– Potential for digging a well by backhoe is high
– by hand auger

Large seep area at Capulin Can
– Need to seep mine wst rock, drainage from it + Molycorp collection system?

3:40 S-10 Seep above Capulin Canyon

3:45 ph 30 seep / Red River + ppt
– Fe ppt 1st
– then Al cuz closer white ppt to River

pH = 3.78
Cond = 1670 umhos/cm
Temp = 14°C

3:50 seep sampled – S-10

S-11 Btwn Capulin Canyon + Goathill Canyon
3/10 mile below (west) entrance road to mine/office

pH = 4.50
Cond = 850 umhos/cm
Temp = 13°

4:20 seep sampled

SP

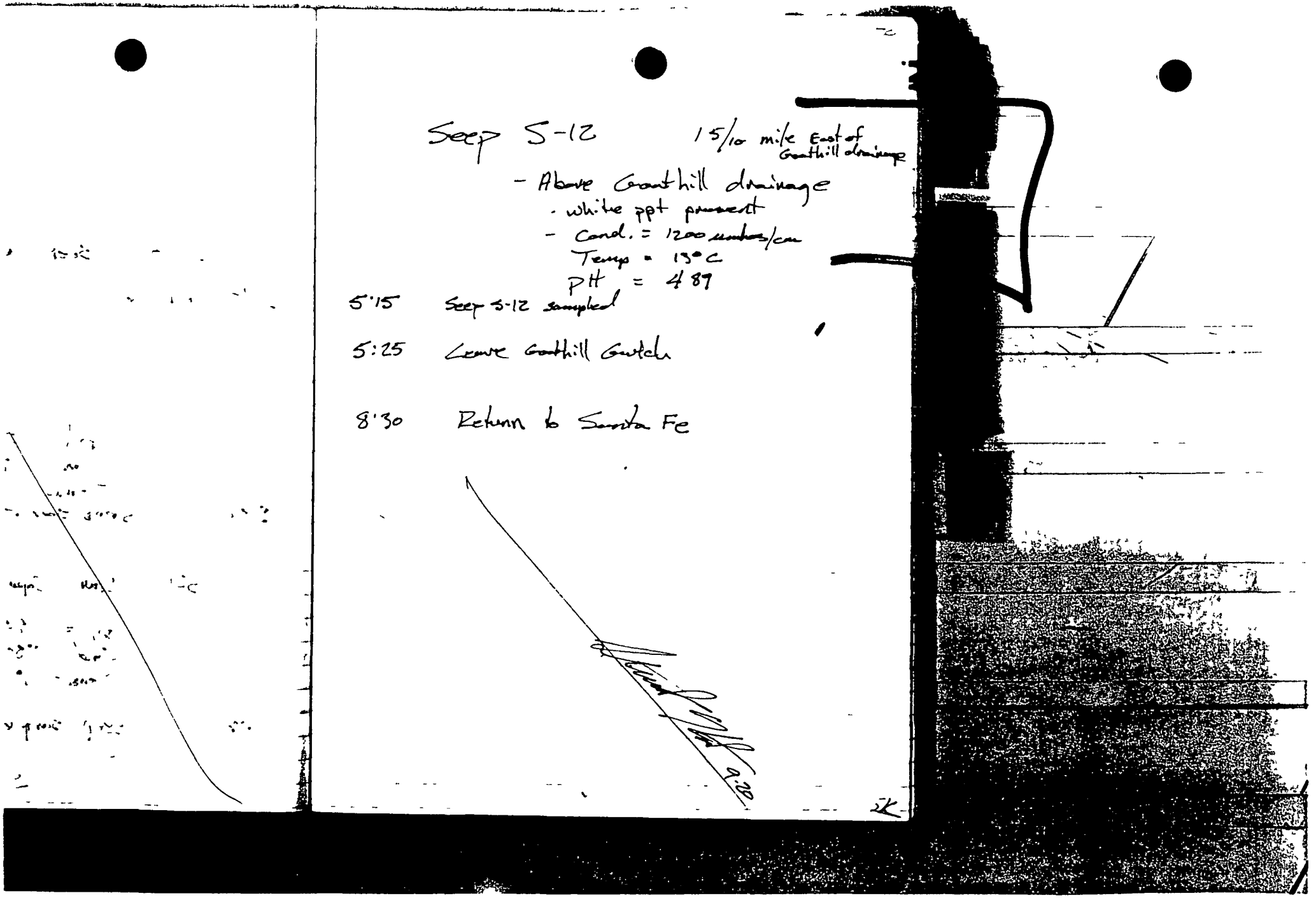
Seep S-12 1 5/10 mile East of Gonthill drainage

- Above Gonthill drainage
  - white ppt present
  - Cond. = 1200 [illegible]/cm
  - Temp = 13°C
  - PH = 4.89

5:15 Seep S-12 sampled

5:25 Leave Gonthill Gulch

8:30 Return to Santa Fe



10-28-93 Left Santa Fe 11:15
for mtg w/ Concerned Citizens
about Nacke (CCN)

Sunny, clear, crisp

1300 met w/ Juan Martez - CCN
Jon Cisneros - CCN
Roger Herrera - resident below tailings pond
Ray (?) - Superfund Program Mngr - Northern Pueblos
(Ray here for other business)

1330 J Martez + J Cisneros emphatically
- stated displeasure w/ NMED due to inaction
- said CNN (national news) was up last Thurs (10-21) to do a story on Molycorp & effects

14:00 R. Herrera discusses his interaction w/ Molycorp & espec. his well:
- 5 people in family who used well
- used well until 1988
- '86-'88: Herreras lived in Carlsbad but returned every 2 wks. SK

14 45 R Herrera (cont)

- Molycorp paid for new water main to residents below tailings pond (1976)
- Home owners had to pay for hookup
- Molycorp explanation for requesting water supply switch: Fear of contamination
- All homes switched except R. Herrera who dug new well in early 1970's
  - well → steel casing
    - Closed 5-6 yrs ago

by Cynthia Ardilito
NMED - grd water?

15:30 Black-footed ferret may exist
- Forest service controls access

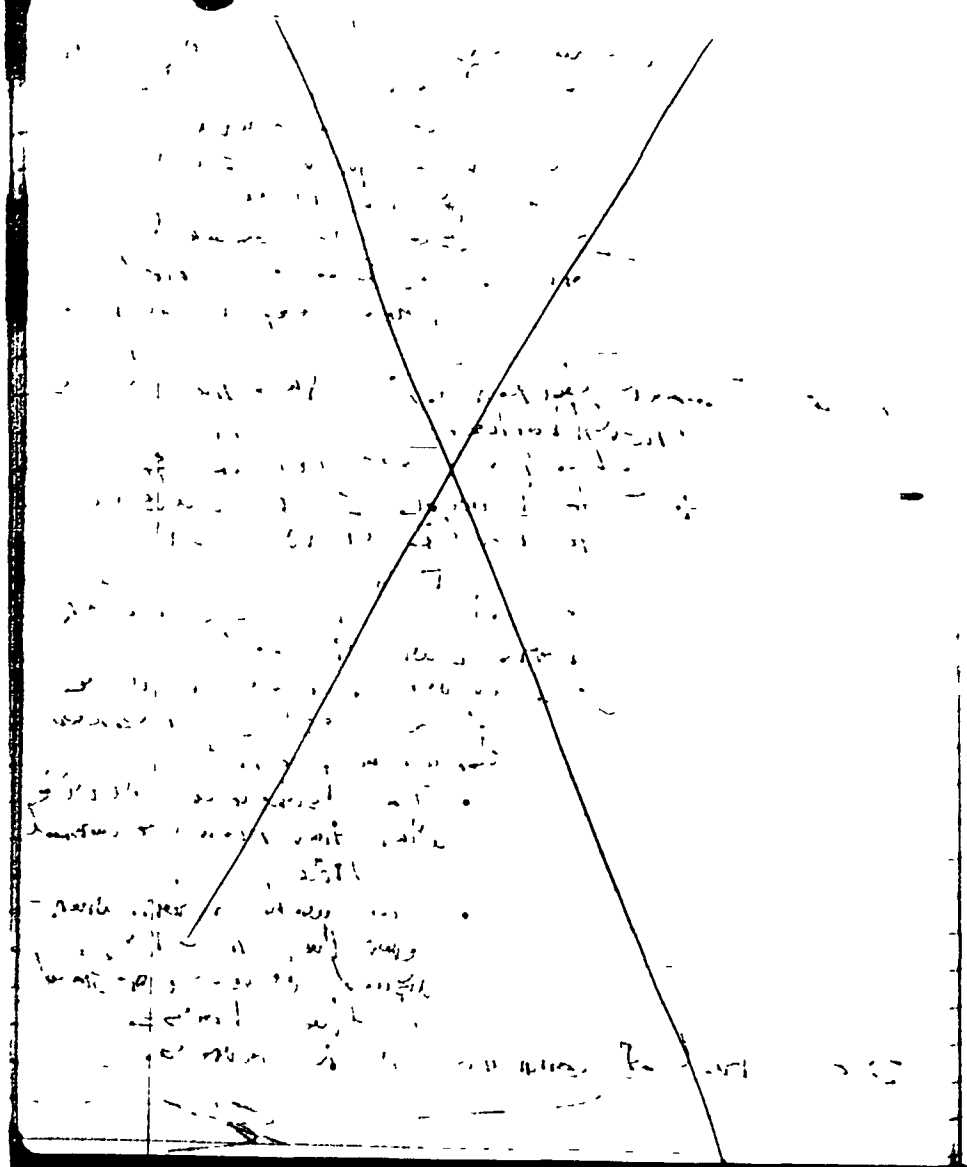
Other sensitive environments?
- Molyc. tried stocking tailings pond "Turquoise Lake" but fish died before opening to public

SK

— other fish kills occurred in Red River & in RR fish hatchery
This prompted switch to spring water. Year?
— spills also noticeable on Leroy Boel's land
- knee deep in tailings

16:20 Roger Herrera drives me to his neighborhood
— identifies neighbors
+ Tito Duran seen walking to Red River w/ fishing rod
— tells of his 3 children born btwn 1961 + '66
— Daughter Charlotte & wife Gloria most experienced stomache pains
• Pain subsided in wife when they moved to Carlsbad in 1986
• Pain would return whenever they (Mr + Mrs) visited Questa & stayed at their house.

17:10 End of communic. w/ R. Herrera



10-29 Snowing a cold

8.00 Miscell Notes about yesterdays Mtg w/ Concerned Citiz. del Norte

— Spoke of Mary Harrison the Nurse at the school district Apparently She has kept some kinda record about health symptoms stemming from air release of tailings

— Driller for many of the wells is named Dyer. He now lives in Springer

— Spoke of Mima ——, owner of Singing River Ranch in Cabresto Crk whose well went dry supposedly due to Molycorp mining

SK

Transcribed

10-29-93 Mtg w/ Molycorp (MC)

Attendants

Dave Shoemaker, MC site manager
Fred Martinez, Lab + field scientist
Bob King, Mgr of Unocal Superfund Programs

10 30 I stated superfund process in purpose

MC expressed (via D. Shoemaker) extreme displeasure w/ superfund

- felt blindsided
- "Witch Hunt" { since MC was apart from process, ∃ secret agenda of superfund
- Superfund unnecessary since work was progressing with other state agencies (eg NMED - Groundwater program) to improve conditions
  - Groundwater discharge plan
  - Own remedial action or mitigative measures taken
    - capping of tailings
    - different water supply provided to people below tailings ponds

SK

10 29

- MC expressed concern about appropriate background location for groundwater at the mine site

Perched water
- Fault controlled
- Stationary due to cementing of fractures + faults by mineralization + weathering to clays

[: perched water not acidic (?) + none of it is moving?]

MC feels that a proper background
- may not exist
- may closely resembles:
  - Acid drainage from natural scars
  - Alluvial seeps from upgradient / upstream in Red River channel
  - Groundwater from Red River WWTP (ie POTW)

SK

29

MC stated that mine waste rock.
- provides > surface Area for oxidation

BUT

- drains to the deep aqu for located below Red River via new mine workings

[Q: what % of drainage from mine waste rock does NOT drain to deep aqu for?
Zero?
This is a big question to answer]

Additional Points
- Tailings are low in acids + metals 'cuz ore body is in granite, NOT the oxidized, sulphur rich lithologies.
  - No cadmium or lead detected in downgradient wells

SK

2

[How does this statement compare with 1987 Molycorp report which shows a mean Pb concentration in the P-1 well (Herrera well) of ~ 0.06 ppm ?

- Truly exist ?
  + Due to MC or
  + Bad well since steel casing
- Artifact of averaging ~~detect~~ detection limits ?]

This report (data compilation) shows $\bar{x}$ = 0.056 ppm Pb
Max = 0.12 ppm
Min = 0.01 ppm

[0.1 ppm appears to be detection limit often used by MC for lead

SK

- A rock drain was constructed at the toe of the mine waste rock located in sulphur gulch (adjacent to Hwy) to keep or convey water away from "dam" (ie waste rock piles)

- An old landfill ∃ in Spring Gulch which has only empty (+ cleaned) barrels + rubbish; Waste oil not dumped
  - Waste oil recycled.

[Q: Would flow in Spring Gulch still follow original drainage through filled in by landfill (+ wst rock) ?]

- MW-4 showed high SO_4^- + TDS but results not included in ~~tasks~~ latest gidwtr report

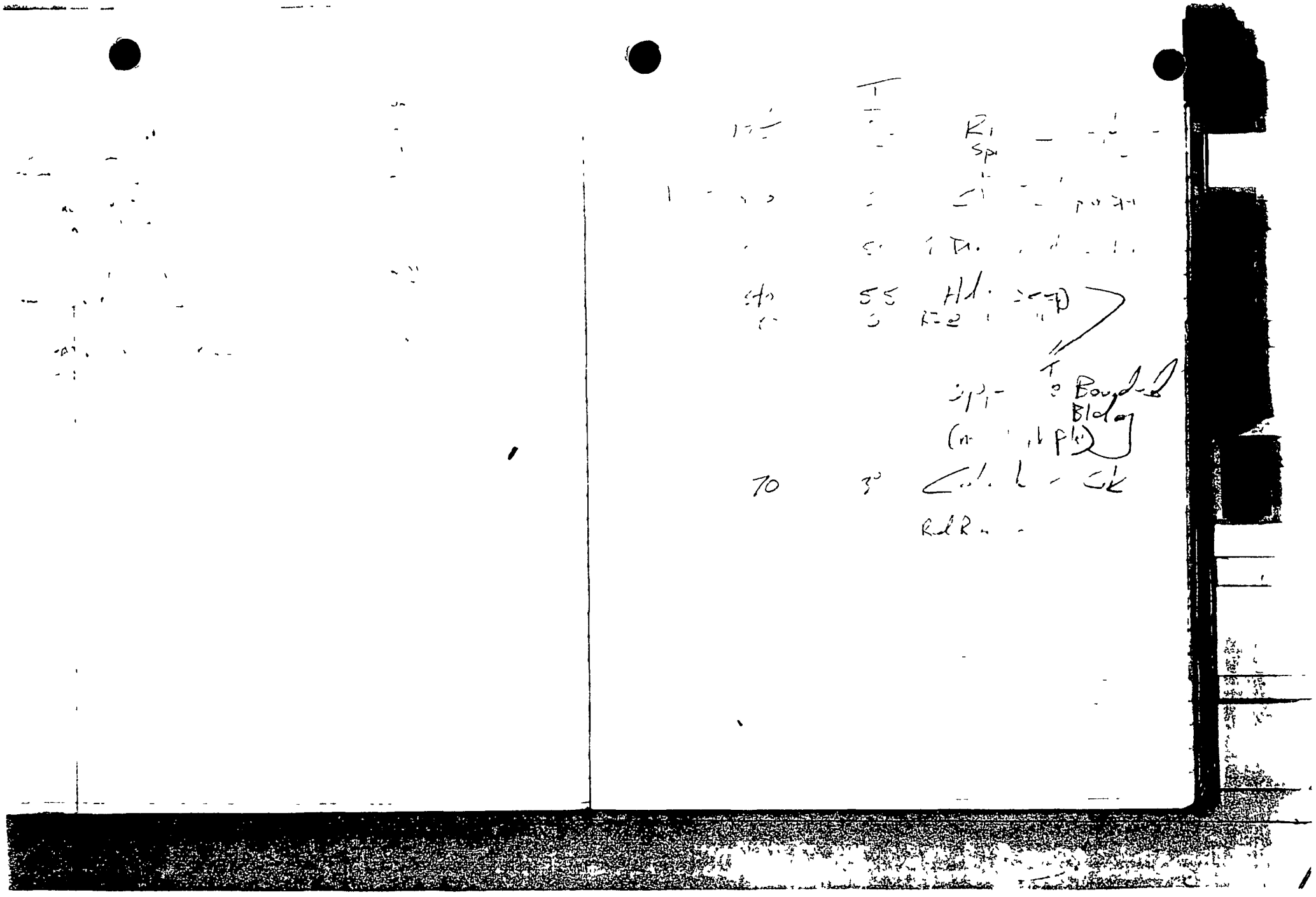
SK

7 11 94 Travel w/ Randy Mortimer Nat Res. Trustee
[illegible] 7:00 AM
[illegible] R4 — F[illegible]
[illegible]

[illegible]

	Temp		Location
325	7°		10 soap near 6B Spr
265	10	(3)	3
			↳ wtr missed by cold [illegible]
650	15°	(4)	4
270	8		~~6A~~
430	4		Field drainage [illegible] channel L near 002 [east]
1250	9° 002		
600	8°,	(7)	6B (west of 002 pipe)
1000	13.5	(19)	50' west of 002
500	6°		Big Spr
700	10°		12' west of Big Spr. Pipe of Big Spr

Cond	T	
1100	14°	4 West
450	17°	4 East = 10 from [illegible]
1000	11	[illegible] 4 West (near Embargo Rd)
1200	10	Moly Culvert [into 4 west @ Embargo]
850°	11°	Irrig. Ditch - Abe's Lane
100	5	Millette Crk @ RR
100	3	RE abv RR
150	9	B Hwy Crk [illegible]
1[illegible]	4	RR @ B Hwy Crk
140	5.5	RR @ June Bay
	No Flow	Hard N Tent
150	5.5	[illegible]
		[illegible]
		Hass Scar accessible
[illegible] 440	1	Hanson Crk @ Culvert



[illegible] Breezy

[illegible] w/ [illegible] [illegible] [illegible] [illegible] [illegible]
on SW side of where Hwy 5 & RR [illegible]
Allowed access (w/ notification of soil sampling)

11 a Met w/ [illegible] Regan & Juan Martinez - CCUN
12 [illegible] w/ Reg
Can I use 3 x Mo concentrations
as a release & apply listed
CERCLA Hz Subst for scoring?

Sample sediments at arroyos
[illegible] in Cupola & Goathill

[illegible] new photos & [illegible] all [illegible]

Ramiro Martinez #59 Abra Rd
Yellow Trailer - Southwest
west

Ramiro Sen - 31 Abra Rd
[illegible]

Arch Trujillo [illegible] cement [illegible]; Red [illegible]
South of Abra Rd

Roger ~~[illegible]~~ - Brn Hse up North
Carillo

[illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]

Dan [illegible] [illegible] [illegible]
(586 1405) #52

Roberto Vigil Vigil St 586 0202

5 15 Spoke of [illegible] (has 4 boys [illegible])
[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] [illegible] them

Mike Brown [illegible] name
[illegible] [illegible] [illegible]

4 kids seen fishing
like [illegible] as Laguna

Wk of 4-18
Send 33 Wtr + 20 Soils Sen TAL
to ETS

4-18 Maura, Mary Ann, Darren, Stuart
(NMED)
Lv. Santa Fe 7 10

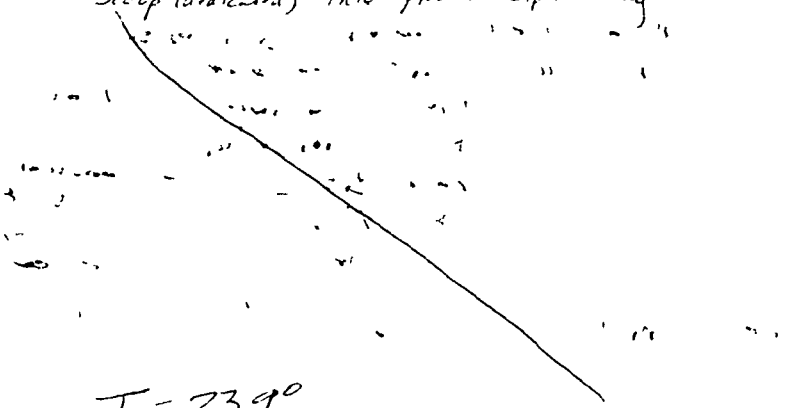
9 40 Hrv at Moly headqtrs Bill Renison
met w/ Dave Shoemaker } Molyc
Fred Martinez
Jeff Erenzeller } Woodward Clyde
Craig Beth
Jeff Mohn
Nick Longo - Unocal

11:00 Arrive at Dam Pond #1

11 00 Started Standard Operating Check on XRF at
11 45 Ran Fe standard and energy calibration
was fine Jeff Mohn of Woodward-Clyde is
observing XRF operation Presently running tailing
sample for background check

11 20 Energy calibration is off Will recheck XRF
Molycorp, NMED, et al have started setting
up at location S-12, Dam Pond #1 ...
Three XRF locations will be shot for each sample
location S-12 XRF locations are
XRF #1 - S 50°W, 350 yds → from center line of road
- ~~tail~~ depth to tailings is 7-9"
XRF #2 - 300 west of XRF #1
- depth to tailings is 19"
XRF #3 - 300' north of XRF #2
depth to tailings is 14"

11 38 Stuart Wright is collecting sample from XRF #1 Depth is 0-6" starting at top of tailings Sample is being collected with plastic scoop (dedicated) into plastic Zip Ice bag



T = 239°

11 53 Collected sample from XRF #2 into a plastic bag Depth is 0-6 starting at top of tailings

12 00 XRF #2 sample was collected with stainless steel auger Following collection the auger was decontaminated with deionized water and a clean brush Craig Barth of Woodward Clyde questioned as to if Alconox was being used not used since contaminants of potential concern are metals and DI water should be sufficient

mm 4/18/94

12 10 Maura Henning is still working on calibrating XRF. XRF now appears to be working XRF Sample #3 was collected at 12 01 Sample was collected with a stainless steel auger from 0-6" from top of tailings Auger was decontaminated with a brush and

mm 4/18/94

DI water

12 20 XRF readings were collected from each S12 location

	XRF #1	XRF #2	XRF #3
Copper	Below SD*	Below SD	Below SD
Iron	10,600	11,740	11,630
Molybdenum	271	243	156
Barium	617	608	747

* SD = Standard Deviation

TAL metals sample will be XRF #2 based on high iron. Molycorp collected split sample from bagging S12 CLP Sample # MFT923 collected at 11 50 CLP Tag # 6-031839.

12 58 Broke for lunch

13 50 Arrived back at Molycorp tailings site Drove back to Dim Pond #1 to collect sample S13 S13 sample locations are:

XRF #1 N 40 W to northernmost point of pond
XRF #2 S 70 W to the overflow from XRF #1 N 6 W (100 yds)
XRF #3 - from XRF #1 due west 115 yds

Samples will be collected from uncapped area

1 07 Collected XRF #1 into plastic bag Sample was collected 0-3" mm 4/18/94

1412 Collected S13 XRF #2 (S13-2) into plastic bag Sample was collected 0-3"

1418 Collected S13-3 (XRF #3) into plastic bag Sample was collected 0-3"

14 25 XRF readings for S13

	S13 1	S13 2	S13 3
iron	10,180	14,110	5860
Molybdenum	265	528	152
barium	391	571	271

Changed battery in XRF before reading S13 (battery) died. TAL metals sample is S13-2, S13 sample #MFT924, Tag # 6-031840

1435 Proceeded to Dam Pnd #2, S14 sample locations are:

XRF #1 - From #2 due north 50 yds
XRF #2 From #3 due east 55 yds
XRF #3 - From dogleg intersection N35°E 55 yds

Cap is approximately 3 thick at XRF #1

1500 Collected sample for XRF #1.
1505 Collected sample for XRF #2
1510 Collected sample for XRF #3 XRF readings

	S14-1	S14-2	S14-3
iron	11,270	8,020	11,640
moly	241	664	146
barium	382	419	452

Cadmium 272

S14 sample #1 is moist with lots of fines
Cadmium was detected at 272 ppm in S14-2 (almost 3x background)
Samples from Dam Pond #2 are collected from root zone

1520 TAL metals sample selected is S14-2 due to cadmium detected S14 CLP # MFT925, Tag # 6-031841

1530 Proceeded to Dam 5A pond (sample location S10)

XRF readings will be taken directly on ground surface without collecting into a baggie. The top 4 inches were homogenized prior to taking XRF reading

S10 ~~XRF locations are~~
From #2 to eastern portion of dike (across center)
XRF #1 N 44° E
XRF #2 N65°W from XRF #1 50 yds.
XRF #3 due west of #2 55 yds
From XRF #2 to location in hill (end of dam 3) S 30°W

1545 XRF readings are as follows.

	S10 1	S10-2	S10-3
iron	12,850	13,520	14,390
molybdenum	105	115	158
barium	631	701	690
zinc	below SD	155	Below SD
lead	Below SD	57 (SD-22)	below SD

1605 Collected sample S-10 from the S-10-2 location
- collected a duplicate sample from this location
S10 CLP # is MFT926 S10 duplicate will be labeled S105 (sample collection time 1610), CLP # MFT927
S10 Tag # 6-031842 S-105 Tag # 6-031843.

1625 Proceeded to Dam 4 Pond First sample location will be S11 (north end of pond) No XRF screening will be performed for sample S11
S11 location is - from ~~sample point to~~ MM 4/18/94 decant structure to sample point S 50°E 60 yards
MM 4/18/94
- Decant structure is at south end of Dam 3A

16 37 S11 CLP # is MFT928. Tag # 6-031844
Sample is wet and V fine grained - The sample was collected using a hand auger The hand auger was decontaminated with DI water following sampling

1650 Proceeded to location S-8 at south end of Dam 4 Pond Will take XRF readings at 3 locations prior to sampling S 8 XRF locations are as follows. From S8-1 & east d 3 log S 36°E
XRF #1 (S8-1) From S8-1 to #1 west log S 33°W
XRF #2 (S8 2) From #1 to #2 N15°W 100 yds
XRF #3 (S8-3) From #2 to #3 N14°W 200 yds

XRF readings are as follows.

	S8-1	S8-2	S8-3
iron	12,290	16,780	14 840
molybdenum	77	150	109
barium	580	787	672
zinc	Below D	183	139
lead	" "	67 (almost 3x 3 standard)	

Readings were taken directly on ground as there was no dip in this area

17 36 Collected sample for TAL metals from S8-2 based on highest metal concentrations S-8 CLP # is MFT929 Tag # 6-031845

17 45 Proceeded to sample location S-9 in Dam 4 pond No XRF readings will be taken at this location since prior readings have been fairly consistent

1810 Collected sample at location S-9 S-9 CLP # is MFT930 Tag # 6-031846
Location: From road intersection W 5° S, 200 yds

Dip is 7' thick at S-1 location The tailings are sandy and moist

18 45 Proceeded to Oneida Jr High School to select samples S 26 and S 27
To select sample locations XRF screening will be conducted at 3 locations, and 2 locations will be selected based on screening levels XRF readings will be taken at ground surface (School-1, School 2, School 3)
XRF locations are as follows.

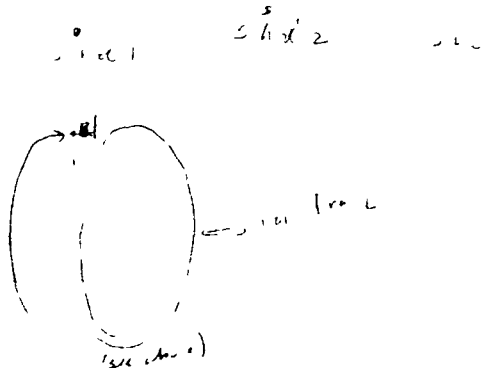
School - 1
School - 2
School - 3
} see next page

Samples at each location are being collected from the top 1' of the ground surface and homogenized in a plastic baggie

18 45 Collected sample school-1 into baggie
XRF readings are as follows

	School 1	School-2	School-3
iron	26,410	24,660	23,780
molybdenum	15	55	-
barium	640	520	541

18 47 Collected sample school-2 into baggie
1901 Collected sample School-3 into baggie
School-2 is selected for sample S-26
S 26 is CLP # MFT931 Tag # 6-031847
School-3 is S 27 and S 27 5 (duplicate)
S-27 is CLP # MFT932 Tag # 6 031848
S 27 5 is CLP # MFT933 Tag # 6-031849



From point #1 (see above) School-1 is S10°E 70
School-2 is S50°W 130
School-3 is W10°S 130 yds

19 25 Left Jr High School for Red River
20 00 Arrive at motel - unpick XRF + brought in all soil samples collected today
20 15 Washed plastic soil scoops using the following method - Rinsed in hot tap water
- washed with hot soap + tap water w/ brush
- rinsed in hot tap water
- rinsed in DI water - air dry

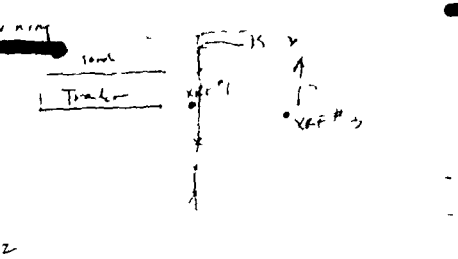
4-19-94 At motel
7.45 Performed XRF Standard operating check w/ Fe & Teflon standards Energy checked out as did background (Ba was only metal > 3x standard deviation, which is normal deviation for Ba)
8.15 Stuart & MaryAnn leave motel for change house at Molycorp
8.20 Maura & Darren leave motel for same ↑
8.30 Stuart & MA arrive
8.40 Maura + Darren arrive
9.10 Start today's sampling program Stuart completed discussion of todays planned sampling MaryAnn will stay in change building + will residential property owners about sampling soil from their properties
Today the following are present during sampling
- Maura Henning, Stuart Kent Darren Padilla, MaryAnn Menetrey - all NMED Superfund
- Ralp Vail
- Jeff Mohn, Craig Bath - Woodward Clyde
9 20 will collect 3 XRF samples from near change house well
S23-Pt 1 16 yards due North of Change House well -
S23 Pt 2 - from Pt 1 to Pt 2 57 yards, South 30 E
S23 Pt 3 - from Pt 2 to Pt 3 40 yards, West 7°S
All samples will be collected from top 2 inches of soil + placed in plastic bag w/ a dedicated plastic scoop Samples will then be analyzed w/ XRF and one will be used for collection of the laboratory samples
9 27 Collecting S23-1, using procedure described above - Stuart is trying to remove organic materials and large stones. This sample was only 1" depth.
9 30 Shooting S23-1 Will continue to use live time of 60 30 30 seconds for Cd, Fe, Am sources, respectively
9 34 Collected S23-2 - followed procedures used above
9 38 Collected S23-3 - As above
9 41 Shooting S23-2
9 46 Shooting S23-3 Stuart says that samples 1-3 were all collected from 0-1" depth

XRF Results

	S23-1	S23-2	S23-3
Fe	18100	21050	23200
Mo	14 <3 std	249 (67 std)	32 (74 std)
Ba	438	540	786

9 50 Will collect S23-3 as the sample
S23 is CLP# MFT934 TAG#6-031850
9 57 Finished tagging sample + putting on chain-of-cust tape + placed sample on ice
10 00 Leaving well house + returning to change house to check on Mary Ann.
10 05 Leaving Molycorp site
10 10 Arrived at ~~Jerry Cisneros~~ Arch Trujillo MM 4/19/94 residence No one is home Decided to collect sample without screening with XRF
Sample will be S-23a CLP# MFT935
Tag #6-031851
Sample was collected from top 1" of the ground surface. Sample location is approx 10 yds west of southwestern corner of property (3' from fence line)
10 14 Collected sample S-23a Property is South of Abra Road House #14
Permission for sampling was from Jerry Cisneros
Appears as if some mineralized fill material has been introduced to ground surface in yard
Photograph taken at Arch Trujillo residence - View to west showing sample location and tailings in background

10 [illegible] Left Trujillo residence for Reinaldo Martinez residence
10 [illegible] arrived at Martinez residence Will collect 3 samples for XRF screening



Sample location is S 24 XRF screening locations are
XRF #1 17 yds from Southwest corner of property and 1' east of fence 12 west of residence
XRF #2 - 70 SE corner of trailer 52 yds S 42 W
- Samples were collected from top 1 of ground surface w/ plastic scoop
10 38 Collected S 24 XRF #1 sample is from lawn area high organic matter content
XRF readings are as follows

	S 24-1	S 24-2	S-24-3
iron	22,410	23,990	23,300
molly	20	24	15.1 (not SX standard)
barium	365	524	469
zinc	below SD	237	Below SD

10 42 MM 4/19/94 Collected S-24 XRF #2 sample is from (back) north portion of property in fairly undisturbed area
Soil is moist silt loam type soil - high OM
S 24 sample is XRF #2
CLP# MFT936, Tag# 6-031852
- Location of XRF #3 - From NW corner of trailer W 10 N 28 yds
10 50 Collected S-24 XRF #3. Sample is a little sandier than #1

11 09 Left Martinez residence Will attempt to find a sample location for S 25

11 12 Arrives at Questa Municipal office to ask permission to sample yard area in office vicinity
Will sample at west end of lot
No XRF screening will be conducted at this location
Decided not to sample since area is very disturbed Will attempt to find another S 25 sampling location later
Informed Municipal Offices we would not sample.
Left municipal offices and proceeded south of tailing ponds

11 30 Proceeded to Delmira ~~Martin~~ mm 4/19/99 Medina residence
No one home Will proceed to Feliciano Rael residence

11 45 Received permission to sample Rael residence Will screen 3 samples using the XRF prior to selecting sample location
Sample location will be S 21
S-21 sample locations are as follows
S 21 #1 - 32 yds to SW corner of house - From XRF #1 to SW corner is S70°E
S-21 #2 - To NE corner of house is 24 yds, S 35°E
S-21 #3 - 38 yds to SE corner of house, S 10°E
S-21 #1 location surface is gravelly to cobbly Soil is slightly moist silt loam
S-21 #2 location is less gravelly at surface.
Photo - From XRF #3 to residence.

S-21 XRF reading are as follows

	S-21 1	S-21-2	S-21-3
iron	25,140	19,110	21,290
moly	not detected	—	—
barium	645	615	585
zinc	—	148 (S 0-42)	—

- Rael residence has alot of junk around the house including
- S-21 sample will be S-21-2 based on zinc readings
- S 21-2 sample time is 12 02 pm CLP# MFT937
Tag# 6-031853

12 15 Left Rael residence Proceeded to Herrera residence
No one home Will collect a sample into ziploc baggie No XRF screening will be performed
Sample location is 20A CLP# MFT938,
Tag# 6-031854
Residence is owned by Roger Herrera

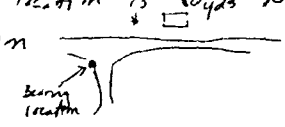
12 42 Collected sample 20A Sample is being collected from approximately 0-1" Ground surface is fairly gravelly - soil is brown sandy silt
Sample location is northwest of house in undisturbed location approx 5' west of driveway. 77 yds to NE corner of Roger Herreras house, S 60°E to corner Also 48 yds due N to NW corner of Sons House
Photo taken looking toward new house (son in-law)

13 00 Left Herrera residence. Returned to Medina residence.
No one home Will break for lunch.

14 00 Returned to Medina residence No one home will try to find another sample location

14 10 Will sample Cecil ~~Glinds~~ Clines 4/14/94 residence - Aaron street from Lickety Split Auto Service Permission to sample granted by Mr ~~Glinds~~ Clines 4/14/94 S-22 is sample location
S-22 CLP # is MFT937, Tag #s 6-031855, 56

14 15 Collected sample S 22 Ground surface is gravelly Brown silty sand - slightly moist
S-22 sample location is 80 yds N 30 E from road intersection



To residence is 21 yds E 10° S

14 35 Left residence Will proceed to locate background sample locations will collect 3 background samples from SED soil association (as described in Taos County soil survey). Sample #s will be S-15, S-16, and S-17 for SED background locations

3 17 SED lb soil sampling
- taken on Forest Service Land
SE of Ortega property
1st sampling location, S15 was determined by following method
a) start at intersection of USFS boundary & USFS Road 493 (ie middle of road)
150 feet at N 70°W = S15 location

15 30 Collecting Sample S-15 from SED location
S-15 location is N 70°W

- Soil surface is a cobbly loam - moist CLP sample # MFT940
Tag # 6-031857, 58
- Collected sample from 0-1"

15 15 Collected sample S 16 from SED soil association
Sample location is 300 west of intersection of USFS boundary and USFS Road 193 (along road) and 40 line north
Sample is ~~very~~ 4/14/94 cobbly at ground surface - loam
S-16 CLP sample # is MFT941, Tag #s 6-031859, 60

16 00 The Sample location for S 17 is N ~~70~~ 72°W ~~50~~ 45 yds from location S-16 The sample soil is a cobbly fine sandy loam
No XRF screening is being conducted for the background locations
CLP Sample # MFT942 Tag #s 6-031861, 62

16 39 Collected Background sample S-18 Sample was collected from FaC soil type (based on Taos County Soil Survey)
Sample location is approximately 300 feet east of USFS property boundary, 6 feet south of fence line
CLP # MFT943, Tag # 6-031863-64

16 40 Dave Shumaker of Molycorp arrived at S-17 location
Argued that this area does not appear to be an appropriate sample location for background and that we need to find a more appropriate location for background, especially regarding the school
Agreed to screen S-18 location using the XRF to determine if mineralogy is similar

17 10 Collected background sample S-19 Sample location is 400' east along fence line from S 18 Ground surface is cobbly loam, moist

CLP Sample # MFT944, Tag #s 6-031865, 66

Note More mafic volcanic rock types are noticed in this area than where residence samples were collected where rocks were more granitic

Proceeded to area north of Jr High school approximately 1/4 mile north of school to collect an additional soil that might be representative of background for soil type SmB

17 52 Arrived at location S-20 north of Jr High School Soil type looks similar to that observed at Jr High School Will XRF screen this sample

17 58 Running XRF screen on sample S-18

XRF results: iron 11,090
moly —
barium 573

Will also XRF screen S-19

XRF results: iron 14,740
moly —
barium 935

17 57 Collected sample S-20 Soil surface is gravelly loam. Sample location from center of road intersection is 66 yds, S65°E (first road west of main road

XRF readings iron 19,710
zinc 127
moly —
Barium 471

S20 CLP sample # is MFT945 Tag # 6-031868

1 2 NMED returned to Red River

4-26-94 FU Blk from Susan Morris DI (7000) (Red River)

0870 NMED personnel left mobile in Red River for Questa fish hatchery

0830 Arrived at fish hatchery Met Susan Morris of NMED

08 45 Met with Molycorp, Unocal, & Westward Ohyde personnel. Will collect samples W-13 and W-14 at fish hatchery NMED agreed to filter samples for Molycorp.
- W 13 will be from warm spring
- W 14 will be from cold spring

09 13 Collected UF samples from W-13
Took pH reading using pH paper - pH of 7

09 30 Collected samples from W-14
- Took photo of Stuart sampling cold spring
- pH paper indicates pH of ~6.5 for cold spring

0945 Completed sampling fish hatchery springs
Proceeded up the Red River from fish hatchery to sample seeps if exposed Decided not to collect samples from Red River since flow is so high - will wait until flow is lower

10 10 Discussed not sampling river w/ Molycorp and possibility of resampling any seeps that are sampled today at a later time

10 45 Collected conductivity sample from seep 50 east of end of dirt road Conductivity reading of 385 µmhos Temperature is 15.5°C pH paper indicates pH 6

At this location the river is 8°C and conductivity of 175 µmhos

This seep location is point A (points are based on distance from end of road)

11 00 - Collected conductivity sample from point #B

Conductivity reading is 305 µmhos

Temperature is 14°C

11 5 Collected conductivity sample from point #C

Temp is 145°C, Conductivity is 320 µmhos

pH of 6 0

11 10 Collected conductivity sample from point #D

Temp is 15°C Conductivity is 345 µmhos

(pH of 6 0 -)

12 11 14 Collected conductivity sample from point #E

Temp is 16°C Conductivity is 340 µmhos

pH paper reads 6 0

- Decided to sample based on conductivity (higher), temp and enough flow Will sample

point A : W-15

point D . W-16

point E W-17

* (In work plan #s W-15 and W-17 were identified as river samples)

11 25 Returned to vehicle (State Suburban) to filter and acidity samples

W-13 - TAL metals CLP # MFT946 (UF) Tag # 6-031869

MFT 947 (F) Tag # 6-031870

Wet Chem CLP # SF1369 Tag #s 6-031871, 72

up preserved

W-14 - TAL metals CLP # MFT948 (UF)

Tag # 6-031873

MFT949 (F) Tag # 6 031874

Wet Chemistry CLP # SF1370 Tag # 6 031875 (UF)

preserved Tag # 6 031876

11 30 Collected sample W 17 (Point E along river)

rem 1x/94

W 17 - TAL metals CLP # MFT950 (UF) Tag # 6-031888

[illegible] Tag # 6-031889

Wet Chemistry CLP # SF1371

Tag # 6-031890 (unpreserved)

6-031891 (preserved)

12 05 Collected Sample W-16 (Point D)

W-16 - TAL metals CLP # MFT952 (UF) Tag # 6 031877

MFT953 (F) # 6-031878

Wet Chemistry CLP # SF1372

Tag # [illegible]31879 (unpreserved)

6-031880 (preserved w/ H_2SO_4)

12 13 Started collecting Sample W-15 (Point A)

W-15 - TAL metals CLP # MFT954 (UF) # 6-031881

MFT955 (F) Tag # 6-031882

Wet Chemistry CLP # SF1373

6-031883 (unpreserved)

6-031884 (H_2SO_4)

13 50 Finished sampling and filtering seep samples Left site (hatchery) for lunch

Sample locations for W-15, W-16, and W-17 were measured from the 3 large boulders at the end of the fish hatchery road. W-15 : 30 yards, W-16 - 195 yds, W-17 : 230 yards

pH readings were taken from each location following filtering very extra sample.

Location	pH
W-14	7.57
W-13	8.21
W-15	7.62
W-16	7.77
W-17	7.90

- Samples had been sitting in plastic containers for at least 1 hr.

15 30 Set up near Embargo Rd and collection system 002. Will sample 002 seep & irrigation ditch up & downstream of seep outfall

15 35 Took conductivity & temp of 002 seep (culvert under Embargo Rd) pH 6 Temp 19.5°
Conductivity - 1450

15 40 Sample locations will be
W-18 002 seep
W-19 Ditch upstream of seep (This will be double volume sample)
W 20 Ditch downstream of seep
W-21 ~~Duplicate of W-20~~ 002 outfall

16 11 Collected Sample W-20 4/12/94 (002 seep)
W-~~18~~ 20 - TAL Metals CLP # MFT956 (UF) Tag # 6-031897
MFT957 (F) Tag # 6-031898
Wet Chemistry CLP # SF1374
Tag # 6-031899 (no preserv)
6-031900 (H_2SO_4)

W-20 is 15' below confluence of culvert seep
pH is 6.5

16 05 Collected Sample W-18 (002 seep)
W-18 - TAL Metals CLP # MFT958 (UF) Tag # 6-031872
MFT959 (F) Tag # 6-031873
Wet Chemistry CLP # SF1375
Tag # 6-031874 (no preserv)
Tag # 6-031875 (H_2SO_4)

16 23 Collected Sample W-19 (upstream of seep)
W-19 - TAL Metals CLP # MFT960 (UF) Tag # 6-031672
MFT961 (F) Tag # 6-031673
Wet Chemistry CLP # SF1376
Tag # 6-031674 (no preserv)
6-031675 (H_2SO_4)

17 11 Collected Sample W-21
W-21 - TAL Metals CLP # MFT962 (UF) Tag # 6-031676
[outfall-002] MFT963, F, Tag # 6-031677
Wet Chemistry CLP # SF1377
Tag # 6-031678 (no preserv)
Tag # 6-031679 (H_2SO_4)

17 15 Collected Sample W-22
W-22 - TAL Metals CLP # MFT964 (UF) Tag # 6-031680
[Spring 50' West of 002] MFT965, F, Tag # 6-031681
Wet Chemistry CLP # SF1378
Tag # 6-031682 (no preserv)
6-031683 (H_2SO_4)

17 43 Collected Sample W-23
W-23 - TAL Metals CLP # MFT966 (UF) Tag # 6-031684
MFT967 (F) Tag # 6-031685
Wet Chemistry CLP # SF1379 # 6-031686 (no preserv)
6-031687 (H_2SO_4)
[Pipe outfall west of old, cold spring collecting - Fish Hatchery]

18 50 Left Questa for Red River

Transcribed

Distances from end of road (1st bulb) [illegible]
big rocks are located → sampling points
30 yds → W-15 photo taken by DP
195 yds → W 16
230 yds → W-17 photo taken by DP

4-21-94

0800 NMED left motel in Red River for Questa
Days activities will include sampling residential wells and Molycorp monitoring wells NMED staff will include Stuart Kent, Susan Morris, Darren Padilla, and Mary Ann Menetrey of Superfund Section

0830 Met up with Robert Martinez and Ralph Vail R Martinez is with Molycorp & will help with pumping wells

0900 Stuart, Robert & Ralph went to MW-4 to start setting up to pump well Mary Ann and Susan are setting up area to filter and label water samples

0752 Collected MW 4 sample (W 2)
W 2 - TAL Metals CLP# MFT969 (UF) Tag# 6-031688
MFT970 (F) Tag# 6 031681
Wet Chemistry CLP# SF1368
Tag# 6 031690 (unpreserved)
Tag# 6-031691 (H_2SO_4)

11 00 Packaging samples collected 4 18 94 to 4 20-94 for Fed Ex to be shipped from Taos

10 42 Collected MW 2 sample (W-8)
W-8 - TAL Metals CLP# MFT971 (UF) Tag# 6 031692
MFT972 (F) Tag# 6 031693
Wet Chemistry CLP# SF1380
Tag# 6-031694 (unpreserved)
6-031695 (H_2SO_4)

11 32 Collected MW-C (W-9) - This is a double volume sample
W 9 - TAL Metals CLP# MFT973 (UF) 6-031601 1602
MFT974 (F) 6-031603
Wet Chemistry CLP# SF1381

604 } Hot
605 } [illegible]
606 } Pres

~~W-1 TAL Metals CLP # MFT~~

12 41 Collected MW 1 sample (W 7)
This is duplicate sample (W-75) at 12 41
W-7 CLP Sample # MFT975 (UF) Tag # 6-031608
MFT976 (F) Tag # 6-031609
Wet Chemistry CLP # SF1382
Tag # 6-031610 (unpreserved)
6-031611 (H_2SO_4)

W-75 CLP Sample # MFT977 (UF) Tag # 6 031612
MFT978 (F) " 6-031613
Wet Chemistry CLP # SF1383
Tag # 6-031614 (not preserved)
6-031615 (H_2SO_4)

14 28 Collected MW-3 (Sample W-6)
W-6 CLP # MFT979 (UF) metals 6-031617
MFT980 (F) metals " 618
Wet Chemistry CLP # SF1384 Tag # 6-031619 unpres
" 620 pres

15 13 Collected sample W-65 (P-1)
W-65 Metals CLP # MFT981 (UF) Tag # 6 031621
MFT982 (F) # 6-031622
Wet Chemistry CLP # SF1385
Tag # 6-031623 (unpreserved)
6-031624 (H_2SO_4)

15 49 Collected sample W-1 (change in the well)
W-1 metals CLP # MFT995 (UF), Tag # 6 031625
MFT996 (F), Tag # 6 031626
Wet Chemistry CLP # SF1386
Tag # 6 031627 (unpreserved)
Tag # 6-031628 (H_2SO_4)

16 00 Collected sample W-5 (Rinse well) Well is 110 ft
W 5 metals CLP # MFT997 (UF), Tag # 6-031629
MFT998 (F), Tag # 6-031630
Wet Chemistry # SF1387
Tag # 6-031631 (unpreserved)
6-031632 (H_2SO_4)

This sample collected from top

17 00 Finished sampling wells for the day.
Will pack up static vehicles and head back to Santa Fe

Transmittal Notice

from pH measurements on night of 4-20-94

Sample	W-18	-19	-20	-21	-22	-23
20 30 pH	8 14	8 10	8 02	8 16	7 40	7 93

from 4-19 94

Sample	W2-13	-14	-15	-16	-17
Temp °C	29 4	28 8	19.9	29 8	27 7
pH	8 21	7 57	7 62	7 77	7 90

10 30 Sample SS 5 collect
homogenized 15" x [illegible]
[illegible] upper crust [illegible]
[illegible]
[illegible]
[illegible]
[illegible]
SS 5 ~ 15' SE [illegible]

[illegible] Sample [illegible]
of [illegible] dump [illegible]
[illegible] 15m [illegible] [illegible] [illegible]
[illegible] sandy between [illegible] dumps
+ [illegible]
[illegible]
[illegible] dumpy, [illegible]
Material [illegible] [illegible]

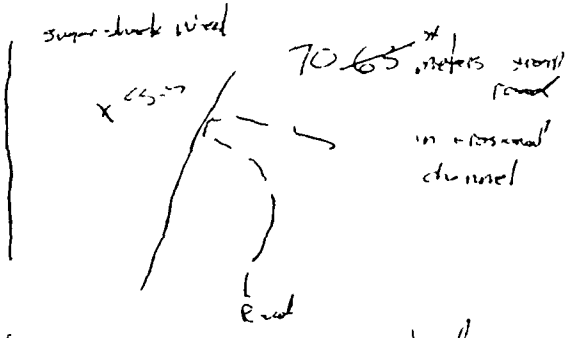
12 40 Pereyra [illegible] Falcon seed on [illegible]
Dump on way to Lab ([illegible]

[illegible] [illegible] to [illegible] [illegible]
samples at [illegible] [illegible] [illegible] +
[illegible] at Molycorp Lab [illegible] Molycorp

8 30 Calibrated the pH meter (Fisher)
went to RR abv Hansen Crk to
check pH paper (phydrion) - 5.5
meter (fisher) - 3.1

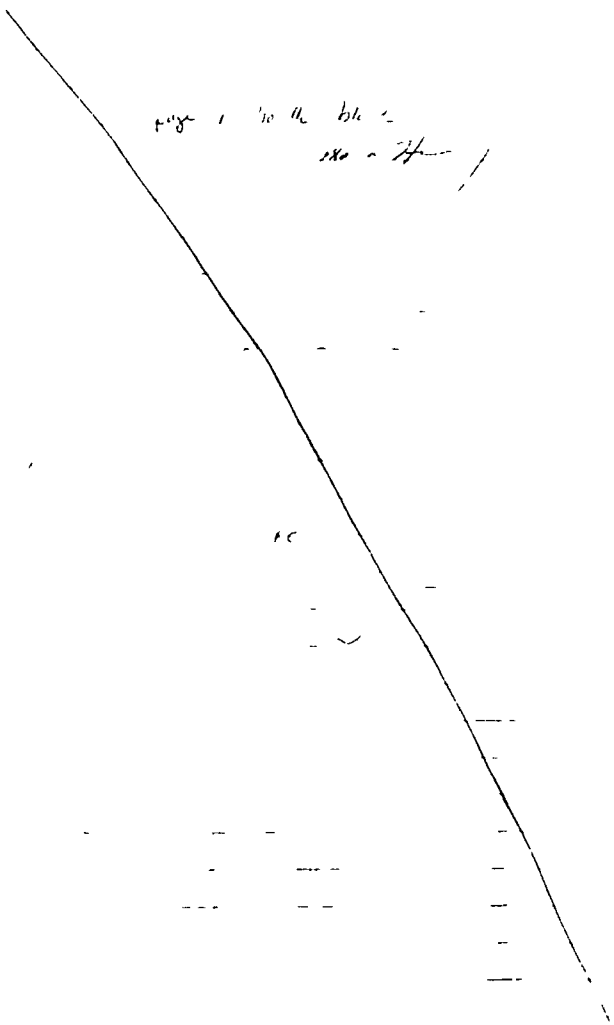
9-00 Arr at Molyc office Sunny, Hot
Kim Hill - EPA
Stephen West
Bob King } NMED
S Kent
Dave Shoemaker
Dave
Jeff Moran } Woodward Clyde

Going to dump at Sugar shack wed
Sample (soil) will be collected
along SS-7



Rock Orange soil sampled

without XRF, Sample locations selected based on greater discoloration



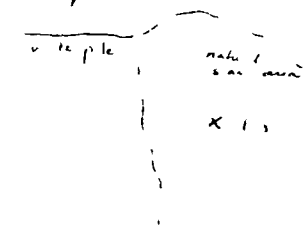
13.30 Arr at Nat Sea app [illegible]

13.30 [illegible] seep sample from [illegible] → SP-8

13.40 [illegible]

[illegible] sample [illegible] collected [illegible] tubing placed in the flow

[illegible] another [illegible] the [illegible] files



13.45 Also collecting a soil sample from this location. Samples are SS-3 and TCLP 3. Samples are collected into a zip lock baggies and will be split into soil jars with Woodward-Clyde staff when we return to the vehicle. Samples will be composite from various locations around seep.

Sample collected from 2 locations on seep slope - one baggie sample is a buff - yellowish-orange color. Second baggie sample is composed of more undigest - reddish-orange material. Samples in baggies collected in roughly equal proportions.

SS-3 is Double Volume for Soil TAL

ph 15–18 Caputin Dump Area
[illegible] view SE → [illegible]

∃ collection lines [illegible] Caputin since '42
minor upper one (ph 19)

Middle French Drain (middle)
– ∃ a lower catchment basin
~100' below French Drain. There must
be seepage getting past French drain
+ minor upper collection area

1215 major collection line
ph 20 22
ph 23 – Bear dropping

123 Lowest collection system
chemistry ~ 1/4 of that from
dump drainage
∴ while most wtr is from
natural area some comes
from dump
– ∃ seeps below this collection
(according to D Shoemaker)
what comes from dumps?

16-15 pH Check

Buffer	Stephens (pHydrion)	Maurus (Baxter)
4	3.5	4
7	7	7
10	10	10.5

16:45 Arr @ Questa Ranger Station to Sample Red ~~Rio~~ SK River stat on RR-3

ph. 5,6 SWust & J. Moen at RR-3 sample at bend abv gaging station

16:50 sample collected, ~~[illegible]~~ southern bank

Cond = 180 [illegible] 22°C

pH 5.5 by paper SWust

6.7 by meter J Moen

SP-0 → SP 7 + RR-1 EQSK TAL

– Gen Chem

RR-2-3, SP-11, 12, FB1, TAL

+ Gen Chem

6 27-91

1:30 Met w/ Molyc + Woodwood Clyde

8:50 Arr. at scar area below Eagle Rock

Seep not flowing enough to collect sample will look for other area Soil Sample SS-1 + SS-2

SS-2 is a duplicate + will be taken from the same composite back

3 different lithologies sampled

4 scoops placed in ea at 4 bags

9:50 SS-1 + TCLP 1 collected

9:45 SS-2 (Dup) collected

10:40 Stop at work station at Goathill Gulch

- 1300' shaft
- No dewatering at present level is ~ 1000' below Red River

ph 8 - NW to scar area near caved in area by SK

ph 9 - View N. up Goathill Gulch (caved in area in foreground)

10 - Sugar Shack West w/ horiz ~~collection lines~~ SK + shelves

To E by SK

ph 11 - collection swamps

No collection

ph 13 & 14 ph. 12 Shelves breached

10 45 Equipment Blank collected
small cup was decon-ed
w/ Liquinox + DI cup filled
w/ DI repeatedly + transferred
to 1-L Btl

Seep 6 located ~16' upstream from
original location Opposite Big Ponderosa in Goath'll Gulch
Sample SP 6 collected
Photo 17, Bob King sampling SP-6
view downstr. by SK
Ph 18 Bob K + Randy Merker @ SP 6
View Downstr ~~from~~ by SK
Cond. 1500 T = 13°C

12:00 Seep 7 (SP-7) located ~150' below
originally identified seep (opposite adit line)
Marshy area found. conductivity taken at
2 locations.
Area of emergence - 1100 µmhos at 12°
~30' from RR - 700 at 8°

ph 19 Randy M sampling SP 7 view SW by SK

ph 20 View N of flowing seep area
(of which SP-7 was taken (upstream))
by SKent

ph 21: seep entering RR by SKent.
12,20
Flow from this seep was followed from
SP-7 (ph #19) to RR (ph 21)

ONRT

Adit

14 45 Arr at Scar Area at end of Hansen Crk Road
Stephen Wust / R Merker will collect 3 gal
2 plock baggies of soil from different area
within scar. Each baggie is assumed to be
homogeneous + will try to be equal among
them.

ph 1,23 Randy M Stephen W + consultants collecting
soil at Scar area composite sample
15 40 collected (called ~~AS~~ SK SS-12)
for Scar Soil. ~~Sample~~ will
also undergo TCLP, then TAL analysis.
(TCLP-12)
5 Adjacent lithologies incl in composite
SK containing 3 scoops @
Leachate / seep sample will be collected
in Hanson Crk below side drainage
where soil samples were collected. (SP-12)

Soil from 3 bags were homogenized
in large trash bag before dispensing
into 4, 8 oz jars

15 25 SP-12 collected. Cond = 2100 @ 22°C
ph 4 R Merker @ SP 12 by SK - pH 3 @ SP-12

side channel/drainage where soil SS-12 taken
pool of leachate pH-2 by paper
Cond. = 7,000 @ 26°C

6-26-94

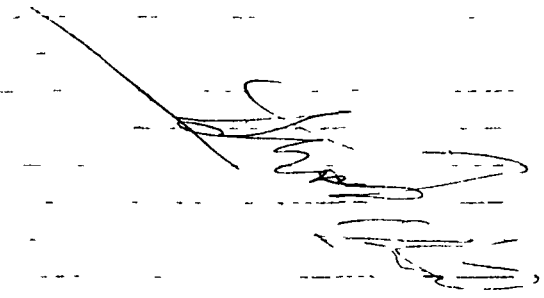
13.50 Arv at Hanson Crk
to sample both H. Crk + RR

RR-1 is Red River above
Hanson Crk

13 58 Randy Merker taking cond at RR abv Hanson Crk
ph 22 view - upstream (east) taken by SKent
Cond = 100 µmhos @ 13°C

14 00 Sample Taken a this location
called RR-1 from river bank
pH = 5.5 by paper
8.5 by Fred Martinez

14 10 Hanson Crk abv Hwy sampled
SP-11, seep along RR not found
ph 23 Randy Merker, S Wust, Dave Shoemaker
at SP-11
pH = 3 by paper



7 SK OK

6 26 Sunny, Cool

7 00 Met w/ Dave Shoemaker Fred Martinez MC
Jeff Mann, Dave ____ w - [illegible]
Ralph Vail consultant
NMED Marie Hanning, Stephen Wust Bob King, Stuart Hunt
ONRT - Randy Merker

7-30 Regrouped at Capulin Can mouth
ph 13 up canyon by SK
Channel Seep — SP-2 Double Volume

8.05 SP-3 + 4 (Dup) Taken
ph 14 up stream by SK
Located near channel seep along RR, upstream ~ 20 meters

8 10 Sample SP-5 collected
- located abv Capulin Canyon
ph 16 view - downstream by SWust
just below new culvert; 88 meters abv Capulin Culvert
Cond = 1610 pH = 4 T = 12°C

9 30 Arv at culvert of Eagle Rock drainage
Tried to auger down to GW w/ auger but unsuccessful
Decided to sample seep opposite the end of
rock cliff area (~ ½ m below Capulin
Sample Location - SP-0
10 30 Cond = 940 T = 21.5° pH 4 by paper
10-30 Sampling Time Other paper (4-bars) checked - pH = 4

7a = W-10
7b = W-11
11 47 7c = W-12 double volume

7b Dup - W-11.5

4/25/94

10 00 Mary Ann Minetrey and David Trujillo of NMED - Superfund [illegible] arrival in Questa, NM

10 15 [illegible] with Stuart [illegible] NMED Stuart is going to call Molycorp to determine if days sampling activities have been changed due to snowfall and wind the previous night and today

10 20 Stuart met with Dave Shomaker, who determined that we would be unable to sample at the mine this week due to snow NMED will sample remaining 5 wells today and return to Santa Fe The first wells to be sampled will be wells 7a, 7b, and 7c (nested wells) David Trujillo returned to Santa Fe due to work cancellation this week

CLP Case # 22010
SAS # 7943 Q02

11 47 Well 7c was sampled (sample W-12) This is a double volume sample
W-12 CLP metals # MFQ061 (UF) Tag # 6-031633,34
MFQ070 (F) Tag - 031635
Wet chemistry CLP # SF1383
Tag #s 6-031636,37 (unpreserved)
6-031638,39 (H_2SO_4)

12 54 Broke for lunch - will return to well post at 14 00
14 00 returned to outside Molycorp gate. Proceeded to sample the Duran residence This will be sample W-5 A duplicate will also be collected (W-5 5) Samples were collected from a hose connected to an outside tap
Duran conductivity was measured at 279 umhos

14 34 Collected sample W-5 (Duran well)
W-5 CLP metals # MFQ071 (UF) Tag # 6-031640
MFQ072 (F) Tag # 6 031641
Wet chemistry CLP # SF1389
Tag #s 6-031642 (unpreserved)
6-031643 (H_2SO_4)
W 5 5 CLP metals # ~~MFQ~~ MFQ073 (UF) Tag # 6-031644
Wet Chemistry CLP # SF1390
Tag #s 6-031646 (unpreserved)
6-031647 (H_2SO_4)
W-5 5 sample time is 14 44

14 45 Returned to well 7 will try to get sample from well 7b (W-11)

1454 Sampled Well 7b (W-11) Water is very muddy
W-11 CLP sample # MFQ074 (UF) Tag# 6-031648
MFQ075 (F) Tag# 6-031649

Wet Chemistry CLP# SF1391
Tag# 6-031650 (unpreserved)
Tag# 6-031651 (H_2SO_4)

1510 Provided to well 9b (alternate for 7a)
- Water level from top ? casing is approx 146'
Construction diagrams indicate the depth of the well is 145' - The well is almost dry - probe is in mud
Well 9a 2840 from top of PVC casing to water.
- Will sample well 9A (sample W-4). TD = 43'
W-4 CLP Sample # MFQ076 (UF) Tag# 6-031652
MFQ077 (F) Tag# 6-031653

Wet chemistry CLP# SF1392
Tag# 6-031654 (unpreserved)
Tag# 6-031655 (H_2SO_4)

Well 1A conductivity is 210 umhos
1:42 Collected W-4 sample. Total purge volume was 1 gallons

6-23 Sunny Warm Lu SFe 9.5c
Air at USFS area at 1100
Scoped out scar area (Eagle Rock)

Location	Cond	Temp	Time
RR @ seep abv Cap	140	13°	13 30
Seep abv Cap	1600	12°	"
Hanson Crk	2600	26°	14-00
Seep below Hanson Cr	170	18°	"

14 50 Dine-liked, biked up to toe of Hanson Crk scar
- Noticed several seeps on west side which were 1st reddish-brown (Fe ppt), then white/gray (Al ppt). occurred only where plants were present. Otherwise all of Hanson Crk were reddish brown (on the ingles in crk)
Sample collected for conduct

3500 27° 16:00

9 35 SS-7 Sampled
dark-orange ~~[illegible]~~ color is a crust
below surface - med yellow gin
sample homogenized in baggie prior
to distribution into jars
ph 5 view Stephen W sampling SS 7 to SE
by Bob King
- sample has high clay content

~~CLP~~ SS

10 00 Arr at Sampling pt. SS-9
few inches down med - brownish yellow
weathers, to light brownish yellow
10 05 SS 9 collected
ph 6 S West & K m Hill sampling SS-9
view to E, taken by Skent
- Along Truck Shop Access Road
Sample Truck Shop Dump, near crossed channel
ph 7 cottonwood seedling on dump
w/ game trail

SS 9 is N57°W from small hump/point
across RR
Also SS-9 is 6/10 mi up Truck Shop Road
from closest intersection / hairpin

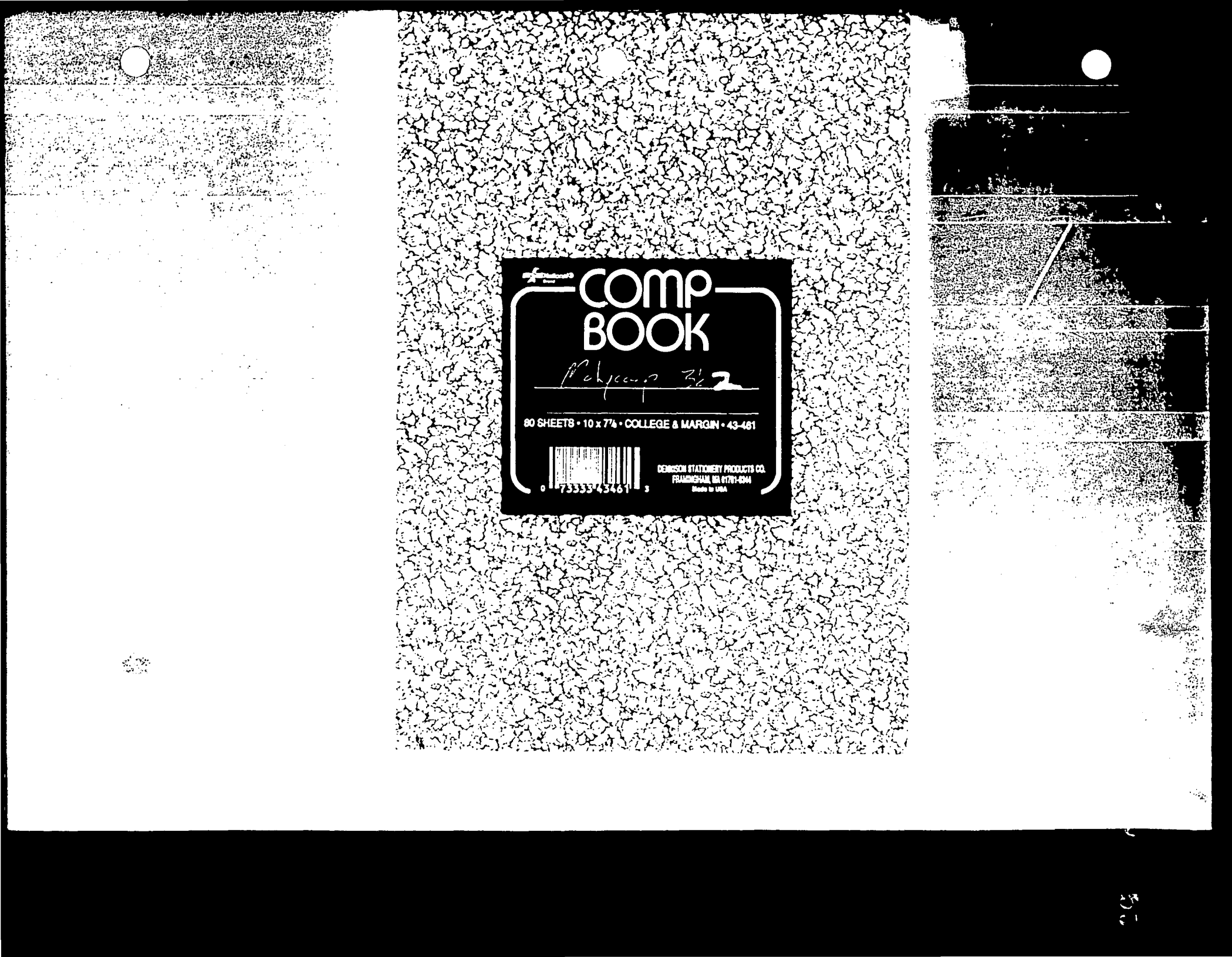
→ Location

10 40 Arr at SS-10
Along bench road of lower mine dump
0.8 m south of open pt road
This is in Sulphur Gulch [illegible]
ph 8 9 S West K Hill [illegible] sampling SS 10 TCLP [illegible]
10 45 SS 10 collected along w/ TCLP-10
Sample scooped into baggie prior
& homogenized before dispensing
into jars Location - N27W from hump
This is near revegetation test plot
11 10 Arr @ Sugar Shack South along lower dump
road Sample location is below
road Soil is med - orange brown
& is mixture of lower & upper dump
material.
11 15 SS 8 collected N90W (re West)
ph 13 at SS-5 (view to south) of hump
by Skent
1 35 [illegible] Molly [illegible]

1-26-95

Upon review of the data (waste samples) of the mine dumps, it became clear that the label for waste sample at Sugar Shack South was labelled SS-8 in the notebook but was labelled SS 41 on the COC (chain of custody)

SK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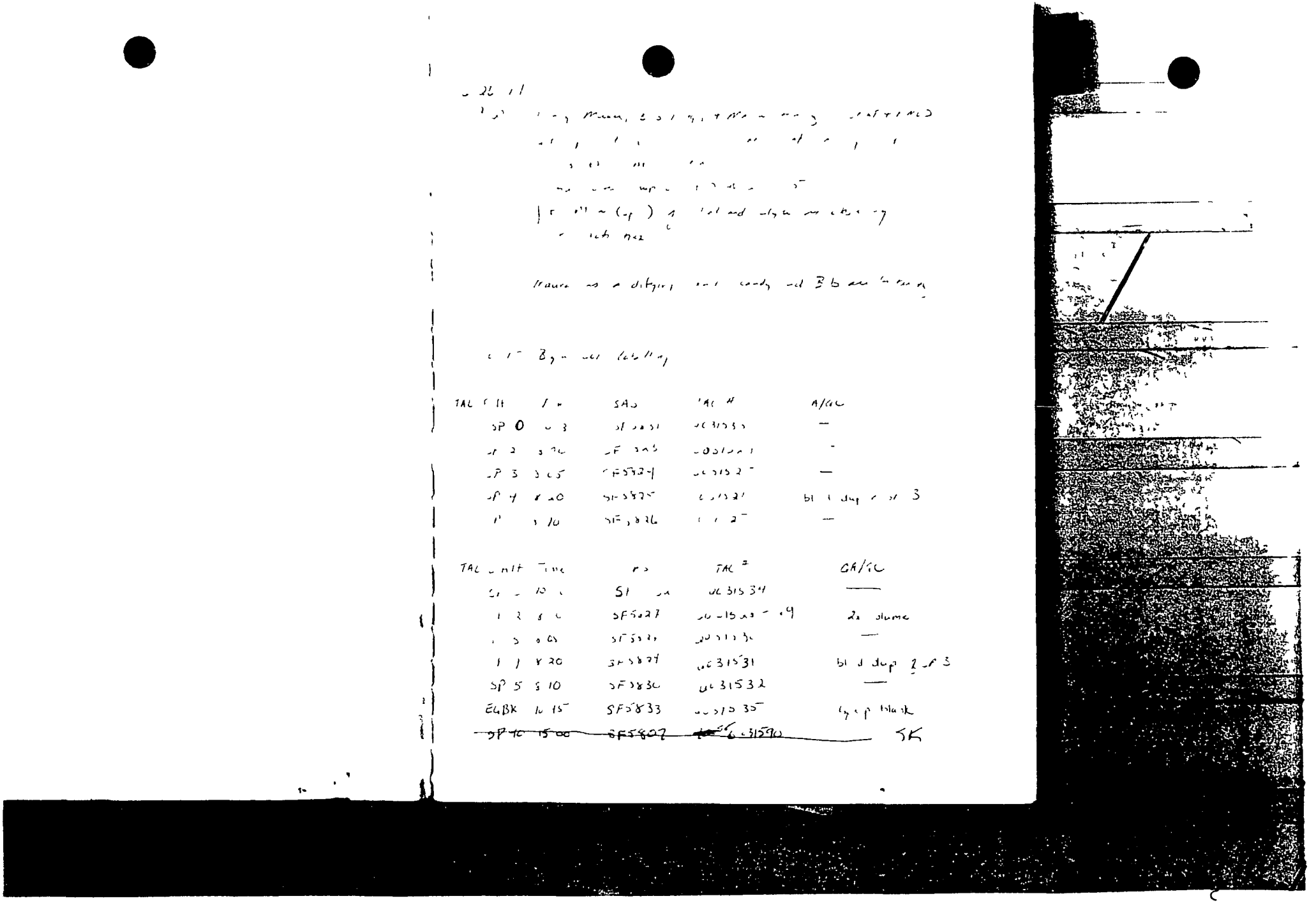


Wet Chem	Time	SAS	TAG#	QA/QC
FBC	10 30	~~SF5345~~	60315710-11	-
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SP 2	8 -	F [illegible]	60 [illegible]	-
SP 1	8 20	SF 5337	60315341 43	blank dup, [illegible]
SP 5	8 10	[illegible]	~~60315345-46~~ [illegible]	—
SP 6	11 20	SF5346	[illegible]	-
SP 7	12 00	SF5347	60315357 58	-
RR 2	13 00	SF5348	[illegible]	
RR-1	14	SF 5349	[illegible]	-
Lab SP 11	11 10	SF 5335	[illegible]	-
FBC	12 00	SF5349	60315361 62	Trip Blank
Lab SP-12	[illegible]	SF 5338	[illegible]	—
RR 3	16 50	[illegible]	[illegible]	—

TAL Fish (Cont)	Time	SAS	TAG#	QA/QC
SP 6	11 20	SF5346	60315348	—
SP 7	12 00	SF5347	60315349	—
RR-2	13 50	SF5341	60315350	—
RR-1	14 00	SF5339	60315353	—
SP 11	11 10	SF5335	60315364	—
SP-12	13 25	SF5338	60315371	—
RR-3	16 50	SF5361	60315377	—

5

[illegible]	[illegible]	SAS	TAG#	A/Q-
[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	F 5343		
[illegible]	[illegible]	[illegible]	[illegible]	
FBC	[illegible]	SF5345	[illegible]	[illegible]
[illegible]	[illegible]	SF5340	[illegible]	-
SF 11	[illegible]	SF5333	[illegible]	-
[illegible]	[illegible]	SF5338	60315372	-
[illegible]	[illegible]	[illegible]	[illegible]	-

[illegible] Main Field [illegible] DS [illegible] bright to dull [illegible] Dol acidity

[illegible] Area of [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible]

[illegible] flow [illegible] stream of bridge

13 50 [illegible] PR 2

[illegible] [illegible] [illegible] [illegible]

Sample [illegible] well mixed [illegible] of the stream -

these were picked [illegible] from the [illegible] side of

[illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible]

14 10 [illegible] [illegible] to set up for [illegible]

Soils	Time	SAS	TAG#
TCLP 12	13 10	SF5331	60315375
SS 12	13 10	SF5326	60315376

27 14

8 [illegible]

[illegible]

12 [illegible] system [illegible] Cap [illegible] collection [illegible] deposit the [illegible] in [illegible] creek [illegible] This [illegible] fence [illegible] dry [illegible] collection system [illegible] collecting [illegible] especially as the distance between the [illegible] many large dead trees noted [illegible] collection [illegible] [illegible] dumps [illegible] [illegible] to plant [illegible] probably [illegible]

[illegible]

X [illegible]	[illegible]	[illegible]	[illegible]
X [illegible]	SF5[illegible]	83	945
[illegible] 3	SF5[illegible]	85	[illegible]
X [illegible]	[illegible]	[illegible]	[illegible]
[illegible] 4	SF5[illegible]	86	1640
X [illegible]	" 04	87	1640
[illegible] 5	" 05	88	1650
[illegible]	" 06	89	1715

Sample	Time	SAS #	Tag #	QA/QC
SP 10 (UF)	15 00	SF5807	6 031570	—
SP 10 (F)	[illegible]	8[illegible]5	11	—
SP 9 (UF)	15 15	809	92	—
SP 9 (F)	15 15	810	93	—
SP-8 (UF)	13 45	811	94	—
SP-8 (F)	13 45	812	95	—

[illegible]

SP-9 (Pre)	15 45	SF5813	6 031576	Preserved
SP 9 (unpres)	15 45	SF5813	" 97	Unpres.
SP 10 (Pre)	15 00	" 14	" 98	
SP-10 (Unpres)	15 00	" 14	" 99	
SP-8 (Pre)	13 15	" 15	0317882	
SP 8 (unpres)	13 45	" 15	031783	

6/28/94

Soil

Sample ID	Cup #	Tag #	Time	G4/6
~~SS-8~~ SS-7 RK	SF5816	~~6-031768~~ 6-031768 RK	~~10 05~~ 9 35 RK	
~~SS-8~~ SS 7 RK	SF5816	6-031780	~~10 05~~ 9 35 RK	
~~SS-8~~ SS 8 RK	SF5817	6-031774	10 05	
~~SS-8~~ SS-8 RK	SF5817	6-031773	10 05	
SS-10	SF5818	6-031766	10 45	
SS-10	SF5818	6-031775	10 45	
TCLP-10	SF5822	6-031720	10 45	
TCLP-10	SF5822	6-031721	10 45	
SS-8	SF5819	6-031722	11 15	
SS 8	SF5819	6-031723	11 15	

11-?-94

[illegible] Lu Santa Fe Sunny Warm

10:00 Meet at Molyc office

Fred Martinez
Bill Renison } Molyc
Dave Shoemaker

Dale Kubesko
Ralph Val } Woodward Clyde

Susan Morris
James McDonald
Stu Kent
Karen McKinnon
Denise Sifer
Bart Ferris } NMED

Safety Mtg
Hazards slippery surfaces → watch terrain
- cold → dress warmly
- traffic use vests

Acknowledg. SK,
[illegible]
[illegible]
J M.

Plan is to sample wells (in order)
7, 11, 10B (molyc designation)

11 08 purge start

Time	Conductivity	Temp	Gal
11 20	7100	14°	35
11 28	6900	13°	50

[5 gal / 20 min = 0.25 gal/min

11 37	7000	13°	80

Note Mini-purge technique used 3 volumes (well) Not purged, look at conductivity

Bladder Pump at 120'
Wtr level - 6/11

Started GW-2 @ 11:55

11 45 pH - 4 (paper)

11 53	7000	135	1

11 55 started sampling GW 2 (acum ?) → bubbles in water possibly due to drilling foam and/or drilling polymer

12 04 Finish sampling GW 2
Decon Procedure
- clean Bladder Pump w/ DI (tube)
- " outside of the hose w/ DI
- inside & hose purged w/ next well wtr

14 50 Arr at RR 4 & S-4 This sample will incl influences from seep
Additional ~~sample~~ RR4a & S 4a
14 58 will be taken abv. seep influence
Samples collected by Randy Merkner & Bill King - Tacs NMED

15 00 Arrive @ RR5 & S5 - located ~1/4 mile above gout hill gulch at big ponderosa (N side of Hwy 38) River and sampling location on S side of Hwy 38 Double volume for 24oc taken from this location.

15 15 ~~Sediment~~ water sampling of ~~S5~~ ; RR5

15 20 Sediment sampling of S5. Sample taken on north bank
Sandy material noted containing some organics - white precipitate and faint odor of sulphuric acid noted while scooping
Conductivity at sediment sample location
365 umhos at 6°
- Cond @ RR-5 - 6° & 230 umhos
- " @ head of seep - 8° & 1400 umhos

RR-5 is located where seep (at Big Ponderosa) enters Red River. Samples are influenced by seep Samples collected according to CLP protocol

16 15 Arr at Columbine Crk (sample pt RR-7)
16 15 RR-7 sampled
Sampling location is ~150 abv confluence where sediment sampling looks possible; further downstr the crk bottom is cobbly.

Transcribed Notes

14 50 Sampling @ RR-4 & S-4
Location is at eastern end of Capulin Canyon
seep stretch Location influenced by seep
Cond = 235 µmhos @ 6°C near seep influence
= 220 µmhos @ 6°C in middle of RR

15 20 Sampled RR-4a + S-4a
Location is ~300' upstream of RR-4
& is abv influence of seep (visual only)
Sample collected according to CLP protocol
Cond = 222 µmhos @ 6°C middle of RR

16 20 Sample S-7 collected in baggie to
homogenize + split w/ PRP.
Placed into 8-oz glass jar
16 25 Cond. = 80 µmhos @ 45°C

16 40 sample RR 6 collected according to
CLP protocol. Location is
below confluence w/ Columbine Crk +
below Hwy 38 Bridge
Cond = 172 @ 55°C
16 45 Sample S-6 collected in baggie,
homogenized + split Placed in 8 oz
glass jar Sample - orangish tan

SK

16 55 sample RR 7 collected according to CLP protocol
Location is 30' abv confluence with Columbine Crk
Cond = 195 µmhos @ 6°C
17 [illegible] sample S 8 collected [illegible]
sample meat brn, collected in baggie to
homogenize, split w/ PRP
sample collected according to CLP protocol
sample in 8 oz glass jar

Sample	pH
GW-1	7 0
GW-2	4 5
GW-4	6 5
GW-5	5.0
GW-6	5 0
RR-1	6 5
RR-2	6 5
RR-3	7 0
RR-4	6 5
RR-5	7 0
RR-6	7 0
RR-7	~~[illegible]~~ 7 0
RR-8	6 5

21 57

CLP Sample LABELS

	CLP#	TAG#	TIME
SS-4	MFQ186	6-037331	14:50
SS-5	MFQ187	6-037332	15 00
SS-4a	MFQ188	6-037333	14:50
S-6	MFQ189	6-037334	16:45
S-7	MFQ190	6-037335	16:20
S-8	MFQ191	6-037336	17:00

use as Double Volume →

CLP W[illegible]2
Samples

LOCATION	TIME	CLP #	TAG #	F.I/UnFil
RR1	12:50	MFQ192	6-037337	Unf
R-2	13.32	MFQ193	6-037338	Unf
R-3	13'34	MFQ194	6-037339	Unf
R-4	~~15:28~~ 14:50	MFQ195	6-037340	Unf
R-4a	15'20	MFQ196	6-037341	Unf
R-5	15 15	MFQ197	6-037342	Unf
R-5	15:15	MFQ197	6-037343	Unf
R-6	16 40	MFQ198	6-037344	Unf
R-7	16:15	MFQ199	6-037345	Unf
K-8	16:55	MFQ243	6037346	unf
GW-1	17'35	MFQ244	6037347	uf
GW 2	11'55	MFQ183	6037328	uf
GW 4	15:55	MFQ245	6037328	uf
GW-5	14:15	MFQ246	6037349	uf
GW-6	14.20	MFQ247	6-037350	unf
GW-6f	14:20	MFQ248	6037351	uf
GW-5f	14:15	MFQ249	6037352	f
GW-4f	15:55	MFQ250	6037353	f
GW-2f	11:35	MFQ251	6037354	f
GW-1f	17:35	MFQ252	6037355	f
RR-8f	16:55	MFQ253	6-037356	f
RR-7f	16:15	MFQ254	6-037357	f
RR-6f	16:40	MFQ255	6-037358	f
RR-5f	15:15	MFQ256	6-037359	f
RR-4af	15'20	MFQ257	6-037360	f
RR-4f	1450	MFQ258	6-037361	f
RR-3f	1334	MFQ259	6-037362	f
RR-2f	1332	MFQ260	6-037363	f
RR-1f	1250	MFQ261	6-037364	f

8 45 11 8'-9" Meet Ralph Val Dave K Mark C?
cell ? R marker, I pt Dumbl, Skiff
Samples → CLP shipping
windy, cloudy, cold, light rain
-one Sonag 93 ft depth
Empl Rt 39 ft depth

[illegible] 15 Arrived @ RR9 - adjacent to old seep
Sediment - bucket sample, commencing
1120 water bank 100 pumps 5°C
deep channel 100 " "
bottom channel = N bank 100 " " } conductivity survey of RR1
N Bank 100 " 6°C
- immediately organics encountered with sediment sampling

[illegible] itive @ RR 10 - above all cypress property at end of [illegible]
0940 Sampling stream sediments
- tannish brown, sandy sediment
conductivity (2) - 100 pumps @ 5°C consistently across width of stream
All with all sediment samples, sediment is first scooped into tray stream, bottom a "zip-lock" baggie, homogenized, then placed into bottles sample containers All sediment and stream sampling being performed per CLP protocol

10 10 Arrive @ sampling locations RR11 & RR12, at confluence of Hansen Creek and Red River. RR11 will be downstream of confluence, RR12 will be upstream of confluence

10 14 Sampling RR11 for stream ac attenuation samples, ~50' downstream from confluence. Transect taken across stream. Conductivity flow meter read 4.5°C

- conductivity for Hansen Creek ~ 10' upstream from confluence = 1450 μmhos @ 4°C
- Hansen creek flow ≈ 5 gpm. Bright orange precipitate noted at site of actual confluence

10 30 Sampling @ RR 12, ≈ 50' upstream of confluence. Stream bottom similar to previous, some bryophytes, silt to sand sized material

11 00 Arrive @ Town of Red River Advanced Water Treatment facility. 4" PVC line from GW 10 into pressure tank inside facility downstairs. "considerable solids" expected from sample at this site. Pump set @ 160', as told by Dan Kerr

11 12 - Sampling from green rubber hose @ 11°C at 1200 μmhos, pH of 3.85, measured by labs personnel on site at the treatment facility

From discharge plan 268

Date	Parameter	Result (all data "in-house")
7-26-94	Nitrate	0.05 mg/l
7-9-94	TDS	1428.5 mg/l
7-19-94	total Kjeldahl Nitrogen	0.112 mg/l
7-9-94	Chloride	4.20 mg/l
7-27-94	Sulfate	8312.5 mg/l

Compare these summer readings with the following winter readings

7-6-94 Nitrate 0.02 mg/l
7-10-94 TDS 1285 mg/l
7-17-94 Total Kjeldahl Nitrogen 0.112 mg/l
7-22-94 Chloride 5.62 mg/l
7-27-94 Sulfate 2046.67 mg/l

11 10 Arrive @ GW-4, which is the well at the Lakeside Park campground

11 41 Began pumping well @ ~ 6 gpm, discharge through 1" of green rubber hose

Conductivity(s) 9 minutes 150 μmhos @ 6°C
11:58 45 minutes 150 μmhos @ 5.5°C
11:58 Samples collected from GW-4

12.04 Arrived @ GW8, which is well at Jumbo Gulch campground
12 05 Began purging @ ≈ 3 gpm

5 minutes 150 μmhos @ 6°C
12 minutes 155 μmhos @ 6°C
15 minutes 161 μmhos @ 6°C
12:20 15 minutes 163 μmhos @ 6°C
12 22 Samples for GW8 taken

12 30 Arrive @ GW7, at the pumphouse next to the well, between the lake and the well
12 43 Began purging GW7 @ 1500 gpm
12:44 Sampling GW7
Conductivity 202 μmhos @ 6°C

13 02 Arrived @ Fagergren Motel, to have sampled as GW-5, but nobody here for permission to sample. Next to Cabin Springs ~ 150-200 yds downstream

45 yds ± >
35 ft/s ± gpm
24 mm

13 24 arrived @ Cabin Springs (SP 1), sampled spring itself and stream for unfiltered TAC metals and general chemistry

13 28 Conductivity - stream (Red River) 170 µmho @ ~~5.5~~ 5.0 °C

upstream ~ 100' 167 µmho @ ~~5.5~~ 5.0 °C

13 31 Conductivity of Cabin Springs proper 1250 µmho @ 6.5 °C

Red River turns muddy, more "milky" in appearance as springs enter red river

1607 pH

GW7 uf	6
GW8 uf	6
GW9 uf	5.5
GW10 uf	5.0
RR9 uf	6.5
RR10 uf	6.0
RR11 uf	6.0
RR12 uf	6.0
Cabin Springs	5.0

CLP Water SAMPLES

Location	TIME	CLP #	TAG #	unfiltered/filtered
GW10	1112	MFQ262	6-037365	uf
GW 9	1158	MFQ263	6-037366	uf
GW 8	1222	MFQ 264	6-037367	uf
GW 7	1244	MFQ 265	[illegible]	uf
GW-3				~~uf~~
SP 1	1324	MFQ266	6-037369	uf
RR9	9.20	MFQ271	6-037370	uf
RR10	9.48	MFQ272	6-037371	uf
RR11	10 14	MFQ 392	6-037372	uf
RR12	10.30	MFQ 393	6-037373	uf
GW10f	1112	MFQ267	6-037374	f
GW9f	1158	MFQ268	6-037375	f
GW8f	1222	MFQ269	6-037376	f
GW7f	1244	MFQ270	6-037377	f
GW3f				—
RR9f	9 20	MFQ 394	6 037378	f
RR10f	9.48	MFQ 395	6-037379	f
RR11f	10 14	MFQ 396	6-037380	f
RR12f	10 30	MFQ 397	6-037381	f
SS-9	9 20	MFQ 398	6-037382	—
soil sample SS-10	9 48	MFQ 399	6-037383	—
SS-11	10 14	MFT695	6-037384	—
SS-12	1030	MFT 696	6-037385	—

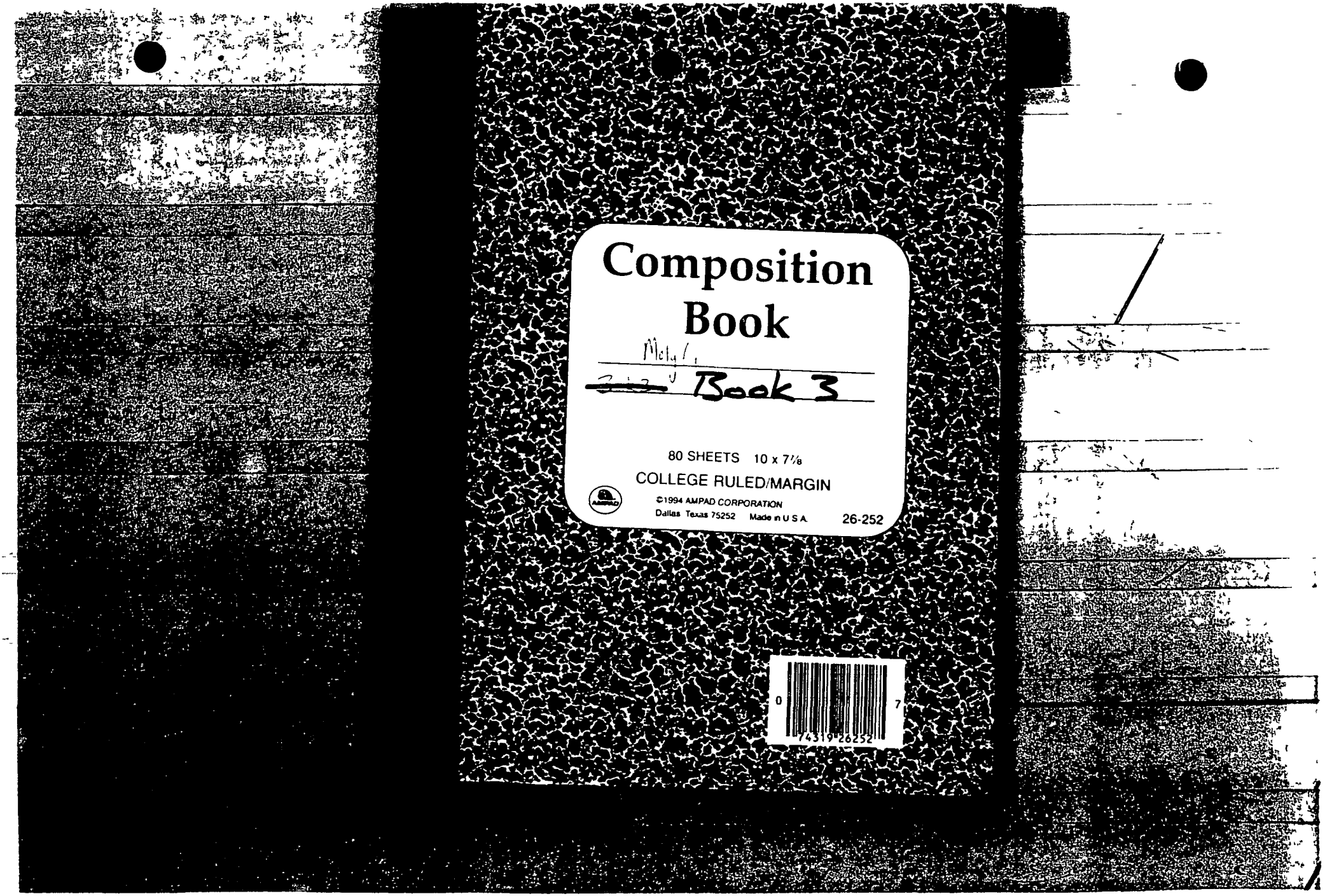
11-9-94 L. Red River 8:30 Arr SLD 13:00

SLD Labels

Station			
RR-1	Request ID No 012900-C		
RR 2		Request ID No 012901-C	
RR 3			Request ID No 012902-C
RR-4	Request ID No 012903-C		
RR 4a		Request ID No 012904-C	
RR-5			Request ID No 012905-C
RR-6	Request ID No 012906-C		
RR-7		Request ID No 012907-C	
RR-8			Request ID No 012908-C
RR-9	Request ID No 012909-C		
RR-10		Request ID No 012910-C	
RR-11			Request ID No 012911-C
RR-12	Request ID No 012912-C		
GW-1		Request ID No 012913-C	
GW 2			Request ID No 012914-C
Not collected GW 3			
GW-4	Request ID No 012915-C		
GW-5		Request ID No 012916-C	
GW 6			Request ID No 012917-C
GW-7	Request ID No 012918-C		
GW-8		Request ID No 012919-C	
GW-9			Request ID No 010490-C
GW-10	Request ID No 010491-C		
SP-1		010492	

Spoke to Jay Finney of SLD gen chem section regarding lack of pre-field sampling. He said that for most analysis, the instrument filters sample prior to injection into instrument [TDS, alkalinity excluded]. He said the presence of particulate (eg GW-5) may alter alkalinity but an ion balance would be a good check for equilibr changes over time. I gave him the OK to record ion balance. Mr Finney said changes in alkalinity over time would be more likely in GW samples; river sample.

Chain of custody


Composition
Book
Moly 1
Book 3
80 SHEETS 10 x 7⅞
COLLEGE RULED/MARGIN
©1994 AMPAD CORPORATION
Dallas Texas 75252 Made in U.S.A.
26-252
0 7 74319 26252

(1)

CATION	TIME	/ CLP #	/ TAG #	/ TAL METALS PRESERVED HNO3
[illegible]	6	MFQ183	[illegible]-037325	[illegible]
	11 [illegible]	/	/	[illegible]
	11 52	filtered/unfiltered sediment sample collected for SLD		

	Time	/ CLP #	/ TAG #	TAL metals
RR-1	1250	MFQ192 unfiltered	/ 6-037337	preserved
1245	12150	filtered	/	preserved
	1250	SLD sample unfiltered, un, preserved		

Sediment Sample SS-1	Time 800	/ CLP # MFQ182	/ TAG # 6-037327
Sediment sample SS-2	13:11 1352	MFQ184	6-037329
SS-3	13,43 1353	MFQ185	6-037330
RR-2	1332	MFQ193 uf f	6037338
RR-3	1334	MFQ 194 uf f	6037339

(2)

1258 conductivity reading

location sample collection location — Temp 7°C — Conduct 261 umhos

stream edge — Temp 6°C — Conduct 228 umhos

Sediment Sampling - RR1 100 -

— focusing on fine grain sediment, sampling at a depth of 1", as much organic material removed as was possible - sample placed in ZIPLOCK BAGGIES and then split into sample containers

Sampling point RR-1, pipeline cross over

South irrigation water / diversion ditch

Near mile marker 2 - HWY 38

RR-2 and RR3 sample collection — Time 13 32 (RR-2) 13 54 (RR-3)

Sample collection point is about sandbar [illegible] in the river

Temp 6°C — conductivity 250 umhos

— 1300 umhos — Temp 7°C conductivity of seep located above sample point for RR-2 & RR3 seep on North side of the river approximately 20 ft upstream of sample point

6 - [illegible]

21

22 23 -

[illegible] RR-2 / RR-3

24 - Randy Marker - Office of Nat Damage [illegible]

[illegible] of seep [illegible]

[illegible]

[illegible]

[illegible] 32 cfs

[illegible] Midgleap

GWS 14 15

[illegible]

GWG 14 20

[illegible] SLIFER / [illegible] SWGB NOTES:

[illegible] 13 28 flow rate 0.58 gpm (58)

[illegible] Level 89 48 feet pump at 150 feet

Reading 13 57 1500 umhos, 9°C, pH 5 4.

14 04 1510 9° pH 5 6

(4)

[illegible]

14 07 [illegible] 14 [illegible]

-Stable sampling [illegible]

15 04	[illegible]	[illegible]	[illegible]	[illegible]
15 30	1°C	[illegible]	7.1	[illegible]
15:34	8.5°C	1300	7.9	
15:41	8.3°C	1300	7.4	
15:43	8.3°C	1290	7.4	

GW-4

Sample time 15 [illegible]

[illegible]

CLP TAL [illegible] HNO3

SLD Sample - [illegible]

CLP TAL metals [illegible] HNO3

Dennis Slifer of SWQB/[illegible] [illegible]

TIME: 17:00

photo 1, 2 At sampling location GW-1, photo 1 is of The Monitoring well #3 or GW-1, photo 2 is of Canyon were endangered species are living.

5

[illegible] 17:25

[illegible]

5

[illegible]

7 45 [illegible]

10 15 Arr Moly [illegible] Mart [illegible] of Molycorp

11 30 Sample SchBk-1 collected
- sample homogenized in plastic bag prior to dispensing into 2 - 4oz jars.
- Split w/ MolyC

location T24N, R13W, S 18, 333
180 west of Road to Cerro
- w/in Triangle [illegible] Road to Cerro

11 50 Sample SchBk-2 collected

11 55 Duplicate sample SchBkgr-3 collected

Both samples homogenized in separate plastic bags prior to transferring to sample jars (2 4oz jars for each location)

All samples SchBk 1-3 collected from top 1"

Location for sample location SchBk 2 + 3
T24N, R13W, S18 133 [within triangle of roads to Cerro]

2 30 Return of Molycorp office

5-1-95

12 50 Drop Fred Martinez off at Molyc p Lab

13 05 Arr @ Goathill Campground to complete CLP

Note regarding sampling locations
SchBk 1 + 2 (3)
- Of same soil type as Jr High School
- Locations selected & had easy access
- Locations in undisturbed areas (eg farm/ranch land) but because of proximity to paved road (to Cerro), may be influenced by car exhaust (?)

Sample #	CLP #	Time	Tag #
Sch Bk 1	MFQ082	11 30	6-037306-07
Sch Bk 2	MFQ083	11.50	6-037308 09
Sch Bk 3	MFQ084	11 55	6 037310 11

MFQ083 will be designated for Lab QA/QC

14 20 Lv Questa + Molycorp for Santa Fe

8-21-95

11

Farm of Sunny

[illegible] Santa Fe

1 30 Arr @ Ranger Station met w/ NMED - Surface Wtr Bur.
Proceeded to look at Capulin Canyon Seeps
- Discuss placement of anoxic drains.

10 30 Arr @ Molyc office met D. Shoemaker, A Robertson + ONRT personnel

11 15 Stop at Cabin Spr
- D Shoe says pH ~5
seeping seen directly from bedrock
- wtr will be collected & sent to tailings ponds or mill processing

11 30 Stop at Portal Spr
Hnoly Rob
infiltr ~ 20-30%
surface runoff - ~10%
Rest - evaporation

11.45 Stop @ Sulphur Gulch
D Shoe
majority of drainages goes into open pit

1300 H Roberts
- Sulfides are removed during extraction process
- tailings in pit
  + ↑ alkalinity
  + # O_2 at pit wall ↓
- Surface runoff + bottom of pit H_2O collected
  ∴ No acid generations

1410 Capulin Dumps

1515 Caved in Area
pH of acidic drainage in cavity ~3
pH " mine wtr ~6
- If dilution was raising pH of wtr it would req 10^3 x the volume since # wtr in mine ~ 2-3 X.
∃ Neutralizing of acid drainage in mine workings

1530 Lv Molycorp Office

1550 Stop to look at sewage lagoon of Questa's 6 Ponds total Noticed in the distance that a new mobile home just east of Molycorp MW-9

18.00 — Return to SFe

SK

Page intentionally left blank
SK

North of Embargo
West of Rae/Hse

9-12-95

Planimeter Readings

Sq. M

452532
433238
441713

$\bar{x} = 442300$

Level I Area

335014
363955
356062

$\bar{x} = 351677$

Level I :

206972
203464
204341

$\bar{x} = 204926$

.....

Area = 34,635 ft² ≈ 35,000

Level I = 20,182 ft² ≈ 20,000

Level I not used

Well	Diameter	Depth of Well (ft)	Depth to Water (ft)	Case Height (ft)	Volume (gal)	Volume Purged (gal)
4-21-94						
MW-4	6"	110'	42.61	67.4'	9.7	364
			44.19 after sampling at 9:53			
MW-2	6"	80'	19.94	61.2'	88	<150
			well pumped almost dry after 12 minutes. Pump rate at end was .75 L/min.			
MW-C	6"	6.52'	3.10	3.4	5.0	130
MW-1	6"	110'	53.18	56.8	82	300
MW-3	6"	52'	19.76 (casing = 0.32')	32.6	47	195
P-1 (Herrera)	6"	72.30 (carried in? was 110')	33.48	38.8	56	325 clear
H-Well		250'	Continuous w/ Clay Bentonite			1000 (estim
			Purge Time ~50 min; Purge Rate ~20 gal/m			
P-46 (Reed)	-	110'	--	—	—	—
4-25-94						
MW-7c	2"	142	88	54	8.7	>30 (est.)
MW-7b	2"	114	108.82	5.2	0.8	10
25 (Dunn)	-	—	—	—	—	87
P-9a	2"	43	28.40	14.6	2.3	

Well	Time	Conductivity (umhos)	Temp (c)	Sample Collected
P-1	14:54	1100	12.5	
	14:59	1130	11.5	
	15:04	1120	11.5	
	15:13			W-6.5
				pH-6.5
CH-Well	Estimated time Molycorp began purging was 15:00			
	15:48	335	13.0	
	15:57	328	12.0	
	15:49			W-1 pH-6.5
P-4b (Rural)				W-5
	4-25-94			
MW-7c	11:47	1080	10.5	W-12
MW-7b		1100 (1st 5 gal.)	9.0	gray &
	13:00	1180 (2nd 5 gal.)		cloudy
	14:54			W-11
P-5 (Duran)	14:27	275	10.0	
	14:33	279	10.0	
	14:34	(sample collected thru garden hose)		W-5
	14:44			W-5.5 (Dupl.
MW-9a	15:42	710	—	W-4

At 19:00, the following pH's were measured at Molycorp lab.

	W-12	W-4	W-5	W-11
pH:	6.76	7.71	7.68	8.02

Well	Time	Conductivity (umhos)	Temp (C)	Sample Collected
MW-4	9:25	312	13.6	
	9:30	1170	—	
	9:37	1230	—	
	9:43	1190	12.7	
	9:47	1270	12.3	
	9:52	1280	12.3	
	9:53			W-2
				pH paper - 6.5 @ 16.4
MW-2	10:25	1200	-	
	10:37	1340	-	
	10 42			W-8 Dark color
				pH paper - 6.5 " "
MW-C	11:23	1200	13.0	
	11:27	1400	13 0	
	11:31	1390	11.5	
	11:32			W-9
				pH - 6.5 at 16:45
MW-1	12:28	1260	13.0	
	12:35	1180	12.5	
	12:40	1190	13.0	
	12:41			W-7
	12:47			W-7.5 Duplicate
				pH - 6.5
MW-3	14:18	1135	13.5	
	14:22	1120	12.0	
	14:27	1120	12.0	
	14:28			W-6

Molycorp Inc

Questa Division
P O Box 469
Questa, New Mexico 87556
Telephone (505) 586-0212

union
MOLYCORP

March 12, 1987

Amy Childers
Water Resource Specialist,
Ground Water Section
New Mexico Health and Environment Department
P. O. Box 968
Santa Fe, New Mexico 87504-0968

Dear Ms. Childers:

Enclosed is the ground water base data which you requested in your memo to me dated January 28, 1987. Call me at 586-0212 if you require additional data or if I can be of further assistance to you regarding this matter.

Very truly yours,

LeRoy E. Apodaca
Manager, Administrative
Services

RECEIVED
APR 13 1987
GROUND WATER HAZARDOUS WASTE
BUREAU

FT
987

APPENDIX E

WATER QUALITY SAMPLING LOCATIONS

Within the Guadalupe Mountains/Questa area, there are several localities where water flow or water quality evaluations can be made. These include wells, springs, drain systems, and surface waters. The following is a description of locations where water measurements were made. Sampling points are identified by both their full name and abbreviated names, and the sampling location or occurrence and its use in the investigation are discussed.

BIG ARSENIC SPRING (RG BARSP)

This spring is the largest natural spring in the area. It is located on the Rio Grande, about 1.5 miles upstream from the confluence of the Red River and Rio Grande. The actual spring is a single source located approximately 40 feet above river level. A few much smaller seeps occur a few hundred feet upstream. This spring was used for spring flow staff gauging and was sampled for ambient ground-water quality evaluation.

LITTLE ARSENIC SPRING (RG LARSP)

This spring is a single source that has a relatively high discharge. It is located approximately 0.75 mile upstream from the confluence and originates about 30 feet above river level. This spring was used for visual spring flow gauging and was sampled for ambient ground-water quality evaluation.

CERRO SPRING (RG CERSP)

This spring is an area of about a dozen seeps along the Rio Grande, just below Cerro Canyon. The seeps occur at river level and vary in discharge from a very small trickle to a couple gallons per minute. Proceeding north to south, the seeps are labeled A through L. Cerro C, one of the larger seeps, was used for visual spring flow gauging and was sampled for ambient ground-water quality evaluation.

FISH HATCHERY 1 AND 2 (RR-FH1-SP, RR-FH2-SP)

These springs are an area of broad, relatively high discharge seeps. They are located about 0.75 mile upstream of the Red River Fish Hatchery and occur about 5 to 10 feet above river level. These springs were used for visual spring flow gauging and were sampled for ambient ground-water quality evaluation.

RED RIVER 1 AND 2 (RR No. 1 SP, RR No. 2 SP)

These springs are very small seeps located at river level a few hundred feet downstream from El Aujae Campground. During late summer, these springs sometimes go dry. They were used for visual spring gauging and were sampled for ambient ground-water quality evaluation.

RED RIVER 3, 4, 5, 6, 7, 8, 9, AND 10 (RR-3-SP - RR-10-SP)

This spring complex is located approximately 0.5 mile downstream from the Red River Fish Hatchery. The springs are located at river level and vary in discharge from small seeps to single sources that have moderate discharges. They were used for visual spring gauging and sampled for ambient ground-water quality evaluation.

BLM CHIFLO CAMPGROUND WELL (BLMCHI W and SHEEPY W)

This well is located approximately 0.5 mile southeast of the Chiflo Campground. The well is 415 feet deep and taps the regional basalt aquifer. Samples from this well were used for ambient ground-water quality evaluation, water-level surveys, and aquifer testing. Water samples from this well are collected at the wellhead and at Sheeps Crossing Campground after being piped for approximately 0.5 mile.

BLM HEADQUARTERS WELL (BLMHDQ W and BARSEN W)

This well is located at the BLM Wild and Scenic River Headquarters facility. The well is 546 feet deep and taps the regional basalt aquifer. Samples from this well were used for ambient ground-water quality evaluation, water-level surveys, and aquifer testing. Water samples from this well were collected at the wellhead and at the Big Arsenic Campground after being piped for approximately 0.5 mile.

OUTFALL 001, 002, 003 (FALL001, FALL002, FALL003)

The Outfalls 001, 002 and 003 are the discharge points for the french tile drain system that underlies the current tailings disposal facility. Outfall 001 rarely flows. Discharges from Outfalls 002 and 003 are combined before the sampling point. Samples from these locations were used for leachate chemistry analyses.

MW-1, 2, 3, 4

These monitor wells are less than 50 feet deep and are positioned along the face of the current tailings dam. Water samples were sporadically taken with a bailer and were used for leachate chemistry analyses.

HERRERA WELL (P-1)

This shallow private well is located 0.25 mile south of the current tailings disposal site. Water samples were collected from the household tap and were used for leachate chemistry evaluation.

RAEL WELL (P-4)

This shallow private well is located 0.5 mile south of the current tailings disposal site. Water samples were collected from the household tap and were used for leachate chemistry evaluation.

TABLES OF INORGANIC DATA-CONCENTRATION IN PPM, pH IN UNITS
AMBIENT GROUND WATER QUALITY, SURFACE WATER, LEACHATE CHEMISTRY
AMB_GW=RG SPRINGS, RR FISH HATCHERY, RR(1-10)SPRINGS, BLM WELLS
L_CHEM=OUTFALLS, TAILDRY, W_DITCH, MW-(1-4), P-1 AND P-4
SUR_WAT=RR AND CABRESTO AND COLUMBINE CREEKS SURFACE LOCATIONS

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C V
TYP=AMB_GW = Ambient Groundwater									
PH	86	8 03720939	0.27909372	7 30000019	8.69999981	0.03009545	691.200008	0.0778933	3 473
COD	1	0.00000000	.	0.00000000	0.00000000	.	0.000000		
TSS	49	31.00000000	53.26036675	0.00000000	274.00000000	7.60862382	1519.000000	2836 6666667	171.808
TDS	95	198.22105263	70 73732936	91.00000000	428.00000000	7.25749686	18831.000000	5003.7697648	35.686
CN	11	0 00000000	0 00000000	0.00000000	0 00000000	0 00000000	0.000000	0 0000000	.
F	95	0 99157895	0 27892772	0.40000000	1 40000000	0.02861738	94 200000	0 0778007	28 130
CD	74	0 00237838	0.00453317	0.00000000	0 02000000	0.00052697	0.176000	0 0000205	190 599
FE	105	0 59948571	0 98396943	0.00000000	5 30000000	0.09602558	62.946000	0 9681958	164 136
MN	105	0 17517143	0 22981130	0.00000000	1 05000000	0.02242729	18.393000	0 0528132	131.192
MO	105	0 06333333	0 16510874	0.00000000	1 44000000	0.01611296	6.650000	0 0272609	260 698
ZN	105	0 18604762	0.44761197	0.00000000	3 58000000	0.04368246	19.535000	0 2003565	240 59C
PB	82	0.01573171	0 02090723	0.00000000	0 07000000	0.00230882	1.290000	0 0004371	132.89
CU	82	0 01808537	0.02001475	0 00000000	0 09000000	0.00221026	1.483000	0 0004006	110 66F
AS	13	0 00000000	0.00000000	0.00000000	0 00000000	0.00000000	0.000000	0 0000000	
HG	11	0 00016364	0.00013508	0.00000000	0 00032000	0.00004073	0.001800	0 0000000	82 54(
SO4	90	38.92111111	45.16512151	0.90000000	172 00000000	4.76082183	3502.900000	2039 8882010	116 04
BA	10	0.00000000	0.00000000	0.00000000	0 00000000	0 00000000	0.000000	0 0000000	.
CR	11	0 01281818	0.00996813	0 00000000	0.03000000	0.00300550	0.141000	0 0000994	77.76(
NI	10	0.03100000	0.02233582	0.01000000	0.08000000	0.00706321	0.310000	0.0004989	72.05
CA	10	22 21000000	7.37660717	17.20000000	38 60000000	2.33268801	222 100000	54 4143333	33 21
AG	10	0 00003200	0.00010119	0.00000000	0 00032000	0.00003200	0.000320	0 0000000	316 22
CL	10	8.90000000	3.66515120	6.00000000	18 00000000	1.15902258	89.000000	13.4333333	41.18
AL	10	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.000000	0 0000000	.
MG	10	6.72000000	2.31651079	5 30000000	11.90000000	0.73254503	67.200000	5.3662222	34.47

4

TABLES OF INORGANIC DATA-CONCENTRATION IN PPM, pH IN UNITS
AMBIENT GROUND WATER QUALITY, SURFACE WATER, LEACHATE CHEMISTRY
AMB_GW=RG SPRINGS, RR FISH HATCHERY, RR(1-10)SPRINGS, BLM WELLS
L_CHEM=OUTFALLS, TAILDRY, W_DITCH, MW-(1-4), P-1 AND P-4
SUR_WAT=RR AND CABRESTO AND COLUMBINE CREEKS SURFACE LOCATIONS

TYP=L_CHEM

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C V
PH	162	7 64135802	0.42959537	5.90000010	9.1000004	0 03375220	1237.90000	0.18455	5.622
COD	116	7 43965517	3 95251993	1 00000000	21 0000000	0 36698226	863.00000	15.62241	53.128
TSS	141	7.88588652	29.16590647	0 00000000	340 0000000	2.45621242	1111.91000	850.65010	369.849
TDS	160	1332.26875000	469.45446356	32.00000000	2165 0000000	37.11363406	213163.00000	220387.49336	35.237
CN	112	0 00249464	0 00208456	0.00000000	0 0114000	0.00019697	0.27940	0 00000	83 561
F	157	1 31337580	0 77543169	0 30000000	2 4000000	0 06188619	206.20000	0 60129	59.041
CD	154	0 00898052	0-00725310	0 00000000	0 0300000	0 00058447	1 38300	0 00005	80 765
FE	174	0 31214943	0 51855575	0 00000000	5 0000000	0 03931161	54 31400	0.26890	166 124
MN	174	0 54620690	0-65024360	0 00000000	2 1700000	0 04929484	95 04000	0 42282	119.047
MO	174	1 06675862	1.06394312	0 00000000	3 5300000	0 08065732	185.61600	1 13197	99 736
ZN	174	0 16637931	0 41697797	0 00000000	3.0000000	0.03161102	28.95000	0.17387	250 619
PB	152	0 05927632	0 03553008	0 00000000	0 2400000	0.00288187	9 01000	0 00126	59 940
CU	152	0 02322368	0 03692846	0 00000000	0 3400000	0 00299529	3 53000	0 00136	159 012
AS	97	0 00917526	0.00276515	0 00000000	0.0100000	0.00028076	0 89000	0 00001	30 137
HG	95	0 00000000	0 00000000	0.00000000	0 0000000	0.00000000	0 00000	0 00000	
SO4	166	850 24698795	343 32720389	28 00000000	1662 0000000	26.64735898	141141 00000	117873 56893	40 380
BA	0								
CR	0								
NI	0								
CA	0								
AG	0								
CL	0								
AL	0								
MG	0								

TABLES OF INORGANIC DATA-CONCENTRATION IN PPM, pH IN UNITS
AMBIENT GROUND WATER QUALITY, SURFACE WATER, LEACHATE CHEMISTRY
AMB_GW=RG SPRINGS, RR FISH HATCHERY, RR(1-10)SPRINGS, BLM WELLS
L_CHEM=OUTFALLS, TAILDRY, W DITCH, MW-(1-4), P-1 AND P-4
SUR_WAT=RR AND CABRESTO AND COLUMBINE CREEKS SURFACE LOCATIONS

LOC=P-1 W

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C V
PH	14	7.56428572	0.50475756	7.0000000	8.5000000	0.13490213	105.900000	0 254780	6 673
COD	0	.	.	.	.	.	.	.	
TSS	3	2.46666667	1 85831465	0.4000000	4.0000000	1.07289846	7.400000	3.453333	75.337
TDS	14	1219 92857143	93.02891551	1102 0000000	1408.0000000	24.86302349	17079.000000	8654.379121	7 626
CN	0	.	.	.	.	.	.	.	
F	14	0 4214285?	0.09749613	0.3000000	0.6000000	0 02605694	5.900000	0 009505	23 135
CD	8	0 00500000	0 00534522	0.0000000	0 0100000	0 00188982	0.040000	0 000029	106 904
FE	14	0 46142857	0.57541767	0 0200000	2 0600000	0.15378684	6.460000	0 331105	124 704
MN	14	0 01642857	0 01277446	0 0000000	0 0400000	0.00341412	0.230000	0 000163	77 758
MO	14	0.08042857	0.03624004	0.0060000	0 1400000	0.00968556	1.126000	0 001313	45 059
ZN	14	0.46571429	0.26267014	0.0900000	0.9500000	0 07020155	6.520000	0 068996	56 402
PB	8	0 05625000	0 03622844	0.0100000	0 1200000	0 01280869	0.450000	0 001313	64 406
CU	8	0 01250000	0.01488048	0 0000000	0 0400000	0 00526104	0 100000	0 000221	119 044
AS	0				.	.	.		
HG	0	.	.		.				
SO4	13	681.30769231	110.25000727	509.0000000	875.0000000	30.57785033	8857.000000	12155 064103	16 182
BA	0	.	.	.	.	.	.	.	
CR	0	.	.	.	.	.	.	.	.
NI	0	.	.	.	.	.	.	.	
CA	0	.	.	.	.	.	.	.	.
AG	0	.	.	.	.	.	.	.	.
CL	0		.	.	.	.	.	.	.
AL	0	.	.	.	.	.	.	.	.
MG	0	.	.	.	.	.	.	.	.

TABLES OF INORGANIC DATA-CONCENTRATION IN PPM, pH IN UNITS
AMBIENT GROUND WATER QUALITY, SURFACE WATER, LEACHATE CHEMISTRY
AMB_GW=RG SPRINGS, RR FISH HATCHERY, RR(1-10)SPRINGS, BLM WELLS
L_CHEM=OUTFALLS, TAILDRY, W DITCH, MW-(1-4), P-1 AND P-4
SUR_WAT=RR AND CABRESTO AND COLUMBINE CREEKS SURFACE LOCATIONS

LOC=FALL001

RIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C V
H	13	7 69230758	0 68855106	6 69999981	8 8000002	0 19096970	99.999999	0 474103	8 951
OD	13	9 61538462	4 55592035	4.00000000	21.0000000	1.26358496	125 000000	20 756410	47 382
SS	13	3.92307692	2 01913919	2.00000000	8.0000000	0.56000845	51.000000	4 076923	51.468
DS	13	1175 23076923	175 67970564	900.00000000	1576 0000000	48 72478360	15278 000000	30863 358974	14 949
N	13	0.00112308	0 00119802	0 00000000	0.0032000	0.00033227	0.014600	0 000001	106 673
F	13	2.01538462	0 19081472	1.70000000	2 4000000	0.05292248	26.200000	0 036410	9 468
D	13	0 01076923	0 00862316	0.00000000	0 0200000	0 00239164	0 140000	0 000074	80 072
E	13	0.24692308	0 12963954	0 00000000	0 4800000	0.03595554	3 210000	0.016806	52.502
N	13	0 28153846	0 21129940	0.02000000	0 5600000	0 05860391	3.660000	0.044647	75 052
O	13	0 69615385	0 38293904	0.38000000	1 8600000	0 10620818	9.050000	0 146642	55 008
N	13	0 02153846	0 01863963	0 00000000	0 0600000	0.00516970	0.280000	0 000347	86 541
B	13	0 05307692	0.02250356	0 00000000	0 0800000	0 00624136	0.690000	0 000506	42 398
U	13	0 04153846	0.09044760	0 00000000	0 3400000	0.02508565	0 540000	0 008181	217 744
S	13	0 01000000	0 00000000	0 01000000	0.0100000	0 00000000	0 130000	0 000000	0 000
G	13	0.00000000	0.00000000	0.00000000	0 0000000	0 00000000	0 000000	0 000000	.
O4	12	842.83333333	68 05456812	672 00000000	932.0000000	19.64566161	10114.000000	4631 424242	8 074
A	0	.	.		.	.	.	.	
R	0	.	.		.	.	.	.	
I	0				.	.	.	.	.
A	0					.	.		.
G	0								
L	0			.		.	.	.	.
L	0				.	.	.	.	.
G	0			.		.	.	.	.

TABLES OF INORGANIC DATA-CONCENTRATION IN PPM, pH IN UNITS
AMBIENT GROUND WATER QUALITY, SURFACE WATER, LEACHATE CHEMISTRY
AMB_GW=RG SPRINGS, RR FISH HATCHERY, RR(1-10)SPRINGS, BLM WELLS
L_CHEM=OUTFALLS, TAILDRY, W DITCH, MW-(1-4), P-1 AND P-4
SUR_WAT=RR AND CABRESTO AND COLUMBINE CREEKS SURFACE LOCATIONS

LOC=FALL002

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C V.
PH	47	7.51489361	0.22261164	7.0999999	8.1999998	0.03247125	353.200000	0.049556	2.962
COD	43	5 20930233	2.36601070	1.0000000	11.0000000	0.36081325	224.000000	5.598007	45.419
TSS	46	4 45652174	5.31123138	0.0000000	23 0000000	0.78309834	205.000000	28.209179	119.179
TDS	46	1458 69565217	121.57665521	1160.0000000	1811.0000000	17.92549987	67100.000000	14780.883092	8.335
CN	44	0.00174318	0.00094510	0.0000000	0 0040000	0.00014248	0.076700	0.000001	54.217
F	46	2.11086957	0.13371323	1.8000000	2.4000000	0.01971494	97.100000	0.017879	6.335
CD	51	0 00862745	0.00663916	0.0000000	0 0200000	0.00092967	0.440000	0.000044	76.954
FE	53	0 16169811	0 10547942	0 0000000	0 4700000	0 01448871	8 570000	0 011126	65 232
MN	53	1 48377358	0 20631591	1.0800000	2 1700000	0 02833967	78.640000	0 042566	13.905
MO	53	2 4749056	0.38490070	1.5100000	3 5300000	0 05287018	131.170000	0 148149	15.552
ZN	53	0.01830189	0.01717958	0.0000000	0 0700000	0.00235980	0.970000	0 000295	93 868
PB	51	0 06313725	0.03049526	0.0000000	0.1600000	0.00427019	3.220000	0 000930	48 300
CU	51	0 01843137	0.02737682	0.0000000	0.1900000	0.00383352	0.940000	0 000749	148.534
AS	44	0 00909091	0.00290803	0.0000000	0 0100000	0.00043840	0.400000	0 000008	31.988
HG	44	0 00000000	0.00000000	0.0000000	0.0000000	0.00000000	0.000000	0 000000	.
SO4	50	930 28000000	123 08285578	714.0000000	1234 0000000	17.40654439	46514.000000	15149 389388	13 231
BA	0	.	.	.		.	.		.
CR	0	.	.	.	.	.	.	.	.
NI	0	.	.	.	.	.	.	.	.
CA	0	.		.	.	.		.	
AG	0	.	.	.	.	.	.	.	.
CL	0	.	.	.	.	.	.	.	.
AL	0	.	.	.	.	.	.	.	.
MG	0	.	.	.	.	.	.	.	.

TABLES OF INORGANIC DATA-CONCENTRATION IN PPM, pH IN UNITS
AMBIENT GROUND WATER QUALITY, SURFACE WATER, LEACHATE CHEMISTRY
AMB_GW=RG SPRINGS, RR FISH HATCHERY, RR(1-10)SPRINGS, BLM WELLS
L_CHEM=OUTFALLS, TAILDRY, W_DITCH, MW-(1-4), P-1 AND P-4
SUR_WAT=RR AND CABRESTO AND COLUMBINE CREEKS SURFACE LOCATIONS

LOC=P-4 W

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN	SUM	VARIANCE	C V
PH	4	7 95000017	0 38729840	7 40000010	8 30000019	0 19364920	31 80000067	0 15000005	4 872
COD	0	.	.	.	.	.	.	.	.
TSS	1	0 50000000	.	0 50000000	0 50000000	.	0.50000000	.	.
TDS	4	227.75000000	22 06618831	200 00000000	250 00000000	11 03309416	911 00000000	486 91666667	9 689
CN	0	.	.	.	.	.	.	.	.
F	4	0 52500000	0.05000000	0 50000000	0 60000000	0 02500000	2 10000000	0 00250000	9 524
CD	1	0 00000000	.	0.00000000	0 00000000	.	0 00000000	.	.
FE	4	0 10000000	0 03559026	0 05000000	0 13000000	0 01779513	0 40000000	0.00126667	35 590
MN	4	0 01250000	0 01500000	0 00000000	0 03000000	0 00750000	0 05000000	0.00022500	120 000
MO	4	0 00500000	0.01000000	0.00000000	0 02000000	0.00500000	0 02000000	0 00010000	200 000
ZN	4	0 36750000	0 11354148	0 25000000	0.50000000	0 05677074	1 47000000	0 01289167	30 896
PB	1	0.02000000	.	0 02000000	0.02000000	.	0.02000000	.	.
CU	1	0.00000000	.	0.00000000	0 00000000	.	0 00000000	.	.
AS	0	.	.	.	.	.	.	.	.
HG	0	.	.	.	.	.	.	.	.
SO4	3	62 00000000	2.64575131	60.00000000	65.00000000	1.52752523	186.00000000	7 00000000	4.267
BA	0	.	.	.	.	.	.	.	.
CR	0	.	.	.	.	.	.	.	.
NI	0	.	.	.	.	.	.	.	.
CA	0	.	.	.	.	.	.	.	.
AG	0	.	.	.	.	.	.	.	.
CL	0	.	.	.	.	.	.	.	.
AL	0	.	.	.	.	.	.	.	.
MG	0	.	.	.	.	.	.	.	.

Appendix C 5

The following table is a comparison of water quality to maximum concentrations allowed by the New Mexico State Standards The comparison was developed by subtracting the water quality standard from the water quality parameter value for that sampling Thus a positive result indicates that maximum allowable concentrations were exceeded

The format is sampling location, date and then the comparison of values and state standards The comparisons are arranged in the following order

	pH.	COD.	TSS.	TDS.	CN	F	Cd	Fe.	Mn.	Mo.	Zn	Pb.	Cu.	As.	Hg	SO4.	Be.	Cr.	Ni	Ca.	Ag.	Cl	Al	Mg
EXCD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

COMPARISON TO NEW MEXICO WATER QUALITY STANDARDS
CONCENTRATIONS IN PPM

OBS	LOC	DAT	EXCD1	EXCD2	EXCD3	EXCD4	EXCD5	EXCD6	EXCD7	EXCD8	EXCD9	EXCD10	EXCD11
189	JUNEBUG	850131	-1 5			-720		-1 1	-0 0100	-0 390	0 1900	-1 000	-9 830
190	JUNEBUG	850228	-1 5			-802		-1 2	-0 0100	-0 680	0 0800	-1 000	-9 960
191	JUNEBUG	850401	-1 9			-800		-1 1	0 0000	-0 400	0 1100	-1 000	-9 950
192	JUNEBUG	850501	-1 1			-855		-1 3	-0 0100	0 640	-0 0800	-1 000	-9 950
193	JUNEBUG	850531	-1 1			-860		-1 2	0 0000	0 830	-0 0700	-1 000	-9 940
197	MW-1	830909	-1 8			172				0 680	0 1400	0 850	7 770
198	MW-2	830909	-1 4			355				-0 210	0 4800	-0 460	-9 950
199	MW-3	830909	-1 7			473		-1 0		2 810	0 7600	-0 510	9 830
201	P-1____W	830128	-0 6			102		-1 0		-0 690	0 2000	-0 940	9 640
202	P-1____W	830224	-1 7			150		-1 0		1 060	0 2000	0 940	7 440
203	P-1____W	830316	-1 1			128		-1 2		-0 940	-0 2000	-0 880	-9 860
204	P-1____W	830425	-1 8			113		-1 2		-0 510	0 1900	-0 950	-9 460
205	P-1____W	830527	-1 7			200		-1 1		-0 520	0 1700	-0 930	9 300
206	P-1____W	830915	-1 8			156		-1 1		-0 780	-0 1600	-0 890	9 520
207	P-1____W	850131	-2 0			320		-1 2	-0 0100	-0 850	0 1800	-0 890	-9 520
208	P-1____W	850228	-1 9			211		-1 2	0 0000	0 130	-0 1800	-0 950	-9 500
209	P-1____W	850401	-1 7			200		-1 2	0 0000	0 010	0 1700	-0 930	9 550
210	P-1____W	850501	-1 5			408		-1 3	0 0000	-0 810	-0 1900	-0 860	-9 050
211	P-1____W	850531	-1 4			336		-1 3	-0 0100	-0 750	-0 1700	-0 880	-9 110
212	P-1____W	850627	-1 7			272		-1 2	0 0000	-0 940	-0 1800	-0 930	-9 910

OBS	EXCD12	EXCD13	EXCD14	EXCD15	EXCD16	EXCD17	EXCD18	EXCD19	EXCD20	EXCD21	EXCD22	EXCD23	EXCD24
189	-0 03	-0 8800			-527								
190	-0 05	-0 9500			-521								
191	-0 03	-0 9300			-528								
192	-0 04	-0 9800			-571								
193	-0 04	-0 9700			-577								
197					-180								
198					-213								
199					-143								
201					-98								
202					-91								
203					-4								
204					108								
205													
206					-50								
207	-0 03	-1 0000			100								
208	0 03	-0 9700			275								
209	0 03	-0 9600			139								
210	0 01	-1 0000			207								
211	-0 04	-1 0000			137								
212	0 07	-0 9900			14								

Positive # means std has been exceeded

Pb

EID/SWQ 86/22

INTENSIVE SURVEY OF THE RED RIVER, TAOS COUNTY, NEW MEXICO

AUGUST 18-21, 1986

Larry R. Smolka and David F. Tague

Surveillance and Standards Section
Surface Water Quality Bureau
New Mexico Environmental Improvement Division
P O Box 968, Harold Runnels Building
1190 St. Francis Drive
Santa Fe, New Mexico 87504-0968

October 1987

EID-SWQ-86/22

INTENSIVE SURVEY OF THE RED RIVER, TAOS COUNTY, NEW MEXICO AUGUST 18-21, 1986

LARRY R. SMOLKA AND DAVID F. TAGUE

Surveillance and Standards Section
Surface Water Quality Bureau
New Mexico Environmental Improvement Division
P.O. Box 968, Harold Runnels Building
1190 St. Francis Drive
Santa Fe, New Mexico 87504-0968

October 1987

SUMMARY AND CONCLUSIONS

During the period of August 18-21, 1986, the Surveillance and Standards Section conducted a 4-day survey of a twenty-three mile reach of the Red River in water quality standards segments 2-119 and 2-120 (Fig. 1). The objectives of the survey were: (1) to assess the water quality of the Red River, (2) to ascertain what effects, if any, the discharges from the Red River wastewater treatment facility, the Questa wastewater ponds, and Molycorp have on the water quality of the Red River, (3) to determine whether water quality standards are being attained, and (4) to evaluate the biological integrity of this reach by inventorying the macroinvertebrate community. Chemical, physical, and biological data collected during this

survey are presented and discussed in this report. Conclusions reached were as follows:

1. The water quality of the Red River is generally good; exceptions are noted below.

2. The Red River WWTF discharges an effluent of excellent quality with no apparent effect on the river.

3. Concentrations of aluminum, iron, and manganese ranged 500-2,500 µg/l below the town of Red River. Low concentrations of zinc and copper were also found in this reach of the river. Molybdenum was elevated below the Molycorp outfall. Except for aluminum the ambient concentrations of these constituents were below the U.S. Environmental Protection Agency's criteria for the protection of human health and freshwater aquatic life.

4. During a thunderstorm runoff event which occurred during the survey, large increases in total non-filterable residue, turbidity, phosphorus, calcium, sulfate, total filterable residue, arsenic, barium, chromium, lead, silver, copper, manganese, molybdenum, nickel, iron, and aluminum were observed for a one-hour period in the Red River. The event also lowered pH from 8.1 to 3.8.

5. The thunderstorm runoff event observed during the survey resulted in violations of water quality standards for turbidity, pH, arsenic, barium, chromium, and lead in segment 2-120. During this event the domestic water-supply use of this segment was not attained.

5. The benthic macroinvertebrate communities of the Red River were indicative of a high quality mountain stream. Though diverse, sharply reduced numbers of macroinvertebrates in the reach between Red River and Questa may be attributable to periodically recurring aluminum-pH toxicity and, possibly, habitat restriction due to adsorption and co-precipitation of aluminum compounds.

7. The Red River below the fish hatchery supports a stable, reproducing trout fishery. The river between Red River and Questa, however, supports only a "put and take" fishery; this reach has very poor potential as habitat for reproducing trout. Impairment of fishery in this reach may be due in part to the paucity of both macroinvertebrates and spawning substrate.

11. Low pH values and high inputs of numerous elements into the river during thunderstorm runoff may be due to the characteristics of soils of the catchment. We postulate the following scenario. During runoff sulfides in eroding soils ~~hydrolyze~~ oxidize to sulfuric acid. The H^+ acidity thereby produced mobilizes trace elements and sharply reduces pH in the river. Downstream these materials precipitate or adsorb as pH returns to circumneutral values.

ACKNOWLEDGEMENTS

Dr. Gerald Jacobi of New Mexico Highlands University analyzed the macroinvertebrate samples for taxonomic composition, calculated the densities and diversities of taxa, prepared the tables, and wrote the section interpreting the results of this work. Robin Gelston-Walls (USEPA,

EID/SWQ-88/8

INTENSIVE WATER QUALITY SURVEY OF THE MIDDLE RED RIVER, TAOS COUNTY, NEW MEXICO

September 12 - October 25, 1988

Larry R. Smolka and David F. Tague

Surveillance and Standards Section
Surface Water Quality Bureau
Environmental Improvement Division
Harold Runnels Building
1190 St. Francis Drive
Santa Fe, New Mexico 87503

May 1989

SUMMARY AND CONCLUSIONS

During a 6-week period, September 12 through October 25, 1988, the Surveillance and Standards Section conducted an 8-day survey of a twenty-five mile reach of the Red River in water quality standards segments 2-119 and 2-120 (Fig. 1). The objectives of the survey were: (1) to assess the water quality of the Red River by sampling both water and sediments, (2) to evaluate the biological integrity of this reach by inventorying the diatom, macroinvertebrate, and fish communities, (3) to determine whether water or sediments from the Red River are toxic to invertebrates or fishes, and (4) to quantify ground-water influx between Zwergle Dam and the Questa Ranger Station. Chemical, physical, and biological data collected during this survey are presented and discussed in this report. Conclusions reached were as follows:

1. The water quality of the Red River is generally good, but exceptions are noted below.

2. During a rainstorm runoff event which occurred in the Bitter Creek drainage basin during the survey, the survey team measured increases in non-filterable residue, turbidity, total phosphorus, copper, lead, iron, zinc, manganese, and aluminum in the Red River below Bitter Creek. These increases resulted in 21 violations of the numeric standards of segment 2-120, including a pH of 5.7, and 26 exceedances of the U.S. Environmental Protection Agency's chronic or acute freshwater criteria for iron, lead, copper, and zinc. The exceedances of criteria occurred in the unfiltered samples, but not in the filtered samples, suggesting that metals were adsorbed to soil particles mobilized during the runoff event.

3. Episodic surface runoff continually erodes and oxidizes the sulfide-rich volcanic soils of barren, south-facing slopes. The strong acid formed in this process aids in mobilizing and transporting trace elements to the Red River and also temporarily reduces the pH of the river. Downstream these materials precipitate or adsorb as the pH of the river returns to near-neutral values.

4. Biomonitoring performed on water and sediments from seven stations using Daphnia pulex, trout fry, and fathead minnows, with one exception, showed no acute or chronic toxicity. An acute toxicity test of sediment eluate from Bitter Creek produced 60% mortality of Daphnia pulex.

5. Biological assessment of the Red River showed sharply reduced numbers of diatoms and benthic macroinvertebrates between the southeast Molycorp boundary and the Questa Ranger Station. At the Questa Ranger Station the survey team found no fish and an 80% reduction in numbers of benthic macroinvertebrates.

6. Historic and recent disturbances in the drainage basin of the Red River continue to contribute to the mobilization and transport of sediment-associated materials to the river.

ACKNOWLEDGMENTS

Dr. Gerald Jacobi of New Mexico Highlands University collected and analyzed the macroinvertebrate samples for taxonomic composition, calculated the densities and diversities of taxa, and prepared the tables summarizing the results. Bob Akroyd, Mike Hatch, and Jim Grasmick of the New Mexico Department of Game and Fish performed the electroshocking survey of the Red River included in this report. Herb Garn and Linda Garrabrant of the U.S. Geological Survey measured streamflows for the seepage study. Henry Holman, Mike Bastian, and William Lane from the USEPA Region VI office collected the water and sediment samples for biological toxicity studies performed in Houston, Texas, and at the Red River fish hatchery. Andrea Gallegos performed the word processing needed to prepare this manuscript. Danny Davis assisted in the collection of the water quality data and performed the diatom identifications. The Scientific Laboratory Division performed the analyses for water chemistry and the Red River fish hatchery provided equipment, facilities, and personnel for the trout toxicity tests and fish studies. Each one of these people and agencies contributed importantly to the informational value of this report and their efforts are gratefully appreciated and acknowledged.

Table A2 Continued

STORET RETRIEVAL DATE 89/02/27
URG120 028045 URG120028045
36 41 55 0 105 28 46 0 5
RED RIVER ABOVE MOLYCORPS BOUNDARY
[redacted]
WESTERN GULF 120900
UPPER RIO GRANDE ABOVE THE PECOS RIVER /TYPA/AMBNT/STREAM/BIO
21NMEX 881217 13020101
0000 FEET DEPTH 2490 METERS ELEVATION

21M SOUT

DATE FROM TO		71900 MERCURY HG,TOTAL UG/L	71890 MERCURY HG,DISS UG/L	01147 SELENIUM SE,TOT UG/L	01145 SELENIUM SE,DISS UG/L	01077 SILVER AG,TOT UG/L	01075 SILVER AG,DISS UG/L	01042 COPPER CU,TOT UG/L	01040 COPPER CU,DISS UG/L	01045 IRON FE,TOT UG/L	01046 IRON FE,DISS UG/L
88/09/13	1040	0 5	0 5	5	5	1	1	100	50	33000	50
88/09/20	1015	0 5	0 5	5	5	1	1	50	50	540	50
88/09/26	0915	0 5	0 5	5	5	1	1	50	50	350	50
88/10/25	1300	0 5		5		1		50		230	
00/00/00											
STATION	NUMBER	4	3	4	3	4	3	4	3	4	3
	MAXIMUM	0 5	0 5	5	5	1	1	100	50	33000	50
	MINIMUM	0 5	0 5	5	5	1	1	50	50	230	50
	MEAN	0 5	0 5	5	5	1	1	63	50	8530	50
	STAND DEV	0 0	0 0	0	0	0	0	25	0	16314	0
	STAND ERR	0 0	0 0	0	0	0	0	13	0	8157	0

DATE FROM TO		01055 MANGNESE MN UG/L	01056 MANGNESE MN,DISS UG/L	01062 MOLY MO,TOT UG/L	01060 MOLY MO,DISS UG/L	01067 NICKEL NI,TOTAL UG/L	01065 NICKEL NI,DISS UG/L	01092 ZINC ZN,TOT UG/L	01090 ZINC ZN,DISS UG/L	01105 ALUMINUM AL,TOT UG/L	01106 ALUMINUM AL,DISS UG/L
			$\bar{x}$		$\bar{x}$				$\bar{x}$	$\bar{x}$	$\bar{x}$
88/09/13	1040	620	360	10	10	50	50	150	50	8900	50
88/09/20	1015	100	90	10	10	50	50	50	50	600	140
88/09/26	0915	100	110	10	10	50	50	50	50	700	100
88/10/25	1300	150		10				50		1075	
			117		100				50	792	120
00/00/00											
STATION	NUMBER	4	3	4	3	3	3	4	3	4	3
	MAXIMUM	620	360	10	10	50	50	150	50	8900	140
	MINIMUM	100	90	10	10	50	50	50	50	600	50
	MEAN	243	187	10	10	50	50	75	50	2819	97
	STAND DEV	253	150	0	0	0	0	50	0	4059	45
	STAND ERR	126	87	0	0	0	0	25	0	2030	26
99/99/99											

farm event — NOT used

Table A2 Continued

STORET RETRIEVAL DATE 89/02/27
URG120 028040
36 40 52 0 105 30 53 0 5
RED RIVER ABOVE COLUMBINE CREEK
35055 NEW MEXICO TAOS
WESTERN GULF 120900
UPPER RIO GRANDE ABOVE THE PECOS RIVER /TYPA/AMBNT/STREAM/BIO
21NMEX 881217 13020101
0000 FEET DEPTH 2397 METERS ELEVATION

DATE FROM TO		71900 MERCURY HG,TOTAL UG/L	71890 MERCURY HG,DISS UG/L	01147 21M SOUT SELENIUM SE,TOT UG/L	01145 SELENIUM SE,DISS UG/L	01077 SILVER AG,TOT UG/L	01075 SILVER AG,DISS UG/L	01042 COPPER CU,TOT UG/L	01040 COPPER CU,DISS UG/L	01045 IRON FE,TOT UG/L	01046 IRON FE,DISS UG/L
88/09/13	1055	0 5	0 5	5	5	1	1	110	50	45000	50
88/09/20	1035	0 5	0 5	5	5	1	1	50	50	1000	50
88/09/26	0925	0 5	0 5	5	5	1	1	50	50	400	50
88/10/25	1425	0 5		5		1		50		530	
00/00/00											
STATION	NUMBER	4	3	4	3	4	3	4	3	4	3
	MAXIMUM	0 5	0 5	5	5	1	1	110	50	45000	50
	MINIMUM	0 5	0 5	5	5	1	1	50	50	400	50
	MEAN	0 5	0 5	5	5	1	1	65	50	11733	50
	STAND DEV	0 0	0 0	0	0	0	0	30	0	22180	0
	STAND ERR	0 0	0 0	0	0	0	0	15	0	11090	0

DATE FROM TO		01055 MANGNESE MN UG/L	01056 MANGNESE MN,DISS UG/L	01062 21M SOUT MOLY MO,TOT UG/L	01060 MOLY MO,DISS UG/L	01067 NICKEL NI,TOTAL UG/L	01065 NICKEL NI,DISS UG/L	01092 ZINC ZN,TOT UG/L	01090 ZINC ZN,DISS UG/L	01105 ALUMINUM AL,TOT UG/L	01106 ALUMINUM AL,DISS UG/L
88/09/13	1055	740	390	20	10	50	50	180	50	12000	70
88/09/20	1035	110	80	10	10	50	50	50	50	800	120
88/09/26	0925	110	100	10	10	50	50	50	50	700	100
88/10/25	1425	150		10				50		770	
00/00/00											
STATION	NUMBER	4	3	4	3	3	3	4	3	4	3
	MAXIMUM	740	390	20	10	50	50	180	50	12000	120
	MINIMUM	110	80	10	10	50	50	50	50	700	70
	MEAN	278	190	13	10	50	50	83	50	3568	97
	STAND DEV	309	173	5	0	0	0	65	0	5622	25
	STAND ERR	154	100	3	0	0	0	33	0	2811	15
99/99/99											

1 event — Not used

Table A2 Continued

STORET RETRIEVAL DATE 89/02/27
URG120 028035
36 40 50 0 105 30 53 0 5 Rel
COLUMBINE CREEK ABOVE THE [redacted] RIVER
35055 NEW MEXICO TAOS
WESTERN GULF 120900
UPPER RIO GRANDE ABOVE THE PECOS RIVER /TYPA/AMBNT/STREAM/BIO
21NMEX 881217 13020101
0000 FEET DEPTH 2397 METERS ELEVATION

DATE FROM TO	00010 WATER TEMP CENT	00095 CNDUCTVY AT 25C MICROMHO	21M SOUT 00300 DO MG/L	00400 PH SU	82079 TURBIDTY LAB NTU	00665 PHOS-TOT MG/L P	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3+NH4- N TOTAL MG/L	00612 UN-IONZD NH3-N MG/L	00625 TOT KJEL N MG/L
88/10/25 1410	6 5	130	9 5	8 1	1	0 01	0 14	0 10	0 00	0 37
88/00/00	--	- -								

DATE FROM TO	00640 T INORG NITROGEN MG/L N	00605 ORG N N MG/L	21M SOUT 00600 TOTAL N N MG/L	00530 RESIDUE TOT NFLT MG/L	70300 RESIDUE DISS-180 C MG/L	00410 T ALK CACO3 MG/L	00440 HCO3 ION HCO3 MG/L	00915 CALCIUM CA,DISS MG/L	00940 CHLORIDE TOTAL MG/L	00925 MGNSIUM MG,DISS MG/L
88/10/25 1410	0 24	0 27	0 51	3	90	66	81	32	5	0 0

DATE FROM TO	00935 PTSSIUM K,DISS MG/L	00930 SODIUM NA,DISS MG/L	21M SOUT 00945 SULFATE SO4-TOT MG/L	00900 TOT HARD CACO3 MG/L	00680 T ORG C C MG/L
88/10/25 1410	1 0	2	7	80	
88/00/00					

DATE FROM TO	01002 ARSENIC AS,TOT UG/L	01000 ARSENIC AS,DISS UG/L	01007 BARIUM BA,TOT UG/L	01005 BARIUM BA,DISS UG/L	01027 CADMIUM CD,TOT UG/L	01025 CADMIUM CD,DISS UG/L	01034 CHROMIUM CR,TOT UG/L	01030 CHROMIUM CR,DISS UG/L	01051 LEAD PB,TOT UG/L	01049 LEAD PB,DISS UG/L
88/10/25 1410	5		50		1		5		5	

DATE FROM TO	71900 MERCURY HG,TOTAL UG/L	71890 MERCURY HG,DISS UG/L	21M SOUT 01147 SELENIUM SE,TOT UG/L	01145 SELENIUM SE,DISS UG/L	01077 SILVER AG,TOT UG/L	01075 SILVER AG,DISS UG/L	01042 COPPER CU,TOT UG/L	01040 COPPER CU,DISS UG/L	01045 IRON FE,TOT UG/L	01046 IRON FE,DISS UG/L
88/10/25 1410	0 5		5		1		50		50	

DATE FROM TO	01055 MANGNESE MN UG/L	01056 MANGNESE MN,DISS UG/L	21M SOUT 01062 MOLY MO,TOT UG/L	01060 MOLY MO,DISS UG/L	01067 NICKEL NI,TOTAL UG/L	01065 NICKEL NI,DISS UG/L	01092 ZINC ZN,TOT UG/L	01090 ZINC ZN,DISS UG/L	01105 ALUMINUM AL,TOT UG/L	01106 ALUMINUM AL,DISS UG/L
88/10/25 1410	50		10				50		90	
88/00/00										

Table A2 Continued

STORET RETRIEVAL DATE 89/05/08
URG120 026035 URG120020010
36 41 19 0 105 32 25 0 5
RED RIVER AT THE GOAT HILL CAMPGROUND
35055 NEW MEXICO TAOS
WESTERN GULF 120900
UPPER RIO GRANDE ABOVE THE PECOS RIVER /TYPA/AMBNT/STREAM/BIO
21NMEX 881217 13020101
0000 FEET DEPTH 2324 METERS ELEVATION

DATE FROM TO	00010 WATER TEMP CENT	00095 CNDUCTVY AT 25C MICROMHO	21M 00300 DO MG/L	SOUT 00400 PH SU	82079 TURBIDITY LAB NTU	00665 PHOS-TOT MG/L P	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3+NH4- N TOTAL MG/L	00640 T INORG NITROGEN MG/L N	00625 TOT KJEL N MG/L
88/10/25 1520	6 1	287	8 9	7 5						

DATE FROM TO	00945 SULFATE SO4-TOT MG/L	00680 T ORG C C MG/L	00900 TOT HARD CACO3 MG/L	00940 CHLORIDE TOTAL MG/L	01105 ALUMINUM AL,TOT UG/L	70300 RESIDUE DISS-180 C MG/L	00945 SULFATE SO4-TOT MG/L	00925 MGNSIUM MG,DISS MG/L	00915 CALCIUM CA,DISS MG/L	00935 PISSIUM K,DISS MG/L
88/10/25 1520			159 0	5 0	1050	214	72.8	4 6	56 0	2 0

DATE FROM TO	00930 SODIUM NA,DISS MG/L	00440 HCO3 ION HCO3 MG/L	21M 00410 T ALK CACO3 MG/L	SOUT 31616 FEC COLI MEM-FLDR /100ML	01002 ARSENIC AS,TOT UG/L	01092 ZINC ZN TOT UG/L	01007 BARIUM BA TOT UG/L	01027 CADMIUM CD,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01051 LEAD PB,TOT UG/L
88/10/25 1520	5 0	65 0	53 0		5	50	50	1	5	5

DATE FROM TO	71900 MERCURY HG,T TAL UG/	01147 SELENIUM SE,TOT UG/L	21M 01077 SILVER AG,TOT UG/L	SOUT 01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01062 MOLY MO,TOT UG/L
88/10/25 1520	0 5	5	1	50	420	270	10

Table A2 Continued

STORET RETRIEVAL DATE 89/02/27
HRG24 URG120028025 08265000
36 42 12 0 105 34 04 0 4
LOWER RED RIVER AT USGS GAGE - USFS Ranger Station
[redacted]
120991

/TYPA/AMBNT/STREAM

21NMEX 15020101028 0001 250 ON
0005 FEET DEPTH

DATE FROM TO		71900 MERCURY HG,TOTAL UG/L	71890 MERCURY HG,DISS UG/L	01147 SELENIUM SE,TOT UG/L	01145 SELENIUM SE,DISS UG/L	01077 SILVER AG,TOT UG/L	01075 SILVER AG,DISS UG/L	01042 COPPER CU,TOT UG/L	01040 COPPER CU,DISS UG/L	01045 IRON FE,TOT UG/L	01046 IRON FE,DISS UG/L
88/03/25	1500	0 5		5		1		60		340	
88/09/13	1115	0 5	0 5	5	5	2	1	130	50	45000	50
88/09 20	1100	0 5	0 5	5	5	1	1	50	50	590	50
88/09/26	0940	0 5	0 5	5	5	1	1	50	50	440	50
88/10/25	1615	0 5		5		1		50		440	
00/00/00											
STATION	NUMBER	5	3	5	3	5	3	5	3	5	3
	MAXIMUM	0 5	0 5	5	5	2	1	130	50	45000	50
	MINIMUM	0 5	0 5	5	5	1	1	50	50	340	50
	MEAN	0 5	0 5	5	5	1	1	68	50	9362	50
	STAND DEV	0 0	0 0	0	0	0	0	35	0	19922	0
	STAND ERR	0 0	0 0	0	0	0	0	16	0	8910	0

DATE FROM TO		01055 MANGNESE MN UG/L	01056 MANGNESE MN,DISS UG/L	01062 MOLY MO,TOT UG/L	01060 MOLY MO DISS UG/L	01067 NICKEL NI,TOTAL UG/L	01065 NICKEL NI,DISS UG/L	01092 ZINC ZN,TOT UG/L	01090 ZINC ZN,DISS UG/L	01105 ALUMINUM AL,TOT UG/L	01106 ALUMINUM AL,DISS UG/L
Storm event — Not used	88/03/25 * 1500	1200	$\bar{X}$	$\bar{X}$ 10				260	$\bar{X}$	4600	$\bar{X}$
	88/09/13 1115	1300	800	33	10	50	50	300	70	17000	70
	88/09/20 1100	600	610	10	10	50	50	100	120	2000	50
	88/09/26 0940	640	660	10	10	50	50	120	100	2100	100
	88/10/25 1615	780		10				130		1310	
	00/00/00										
STATION	NUMBER	5	3	5	3	3	3	5	3	5	3
	MAXIMUM	1300	800	33	10	50	50	300	120	17000	100
	MINIMUM	600	610	10	10	50	50	100	70	1310	50
	MEAN	904	690	15	10	50	50	182	97	5402	73
	STAND DEV	325	98	10	0	0	0	91	25	6603	25
	STAND ERR	145	57	5	0	0	0	41	15	2953	15
99/99/99											

673 635 117 110 160 75

* Data not used since other stations were not sampled on this date

INTERIM STUDY OF THE ACIDIC DRAINAGE TO THE MIDDLE RED RIVER, TAOS COUNTY, NEW MEXICO

FOR

UNOCAL 76 MOLYCORP, INC.
QUESTA DIVISION

VAIL ENGINEERING, INC.
SANTA FE, NEW MEXICO

JULY 9, 1993

INTERIM STUDY OF THE ACIDIC DRAINAGE TO THE MIDDLE RED RIVER, TAOS COUNTY, NEW MEXICO

TABLE OF CONTENTS

Introduction and Summary	
Purpose	1
Background	1
Method of Investigation	2
Geological Setting	3
Mine Dumps	6
Ground Water Flow	7
Historical Data	8
Geochemical Overview	14
Red River Survey - pH	19
Red River Survey - Geochemical	21
Discussion	34
Temporal Variability of Mass Loading	38
Interception of Acidic Drainage	42
Storm Drainage	46
Summary	49
References	52
Appendices	

affected value, and by comparison to similar sample runs on other dates

Aluminum Aluminum increased fairly steadily downstream There were fairly sharp rises at Hanson Creek, Goathill Gulch and Capulin Canyon, however, by far the greatest part of the gain was from below Capulin Canyon to the ranger station

The indicated gains in aluminum correlate well with the location of acid springs in which aluminum precipitate was observed Moreover, there is a particularly strong association of aluminum in river water with the pH of the springs Only springs with pH 5 0 or lower input significant quantities of aluminum to the river The largest gains are from downstream springs with pH as low as 3 5 The solubility relationships shown in Figure C indicate that dissolved aluminum is mainly transportable at pH values less than 5 0

There was a significant indicated loss of aluminum between some stations for some surveys This generally was attributed to settling out of precipitated gibbsite along the stream bed Similarly substantial gains in aluminum may have resulted in part from remobilization of the precipitate

Sulfate The distribution of sulfate gains to the river does not correlate proportionally with aluminum gains Sulfate gain is informative, as it is a measure of the distribution of acid ground water sources The distribution of sulfate gains indicates that sources of acidic water are fairly extensive along the river Observed pH and transportation of aluminum, however, are not always proportional to the sulfate content of the water

In particular, the Goathill Gulch area was responsible for a significantly large percentage of the sulfate gain and a fairly low percentage of the aluminum gain

Total Dissolved Solids Gains in total dissolved solids (TDS) agree somewhat with the pattern of gains in sulfate This is to be expected, as roughly 60 percent of the gain in TDS is sulfate Thus, TDS is also apparently controlled principally by stream accretion

Total Suspended Solids Changes in total suspended solids (TSS) vary widely over the study area The largest gains agree with the gains in aluminum at Hanson Creek and at the ranger station The amount of suspended solids can decrease along some reaches settling out along the stream bed and plating of rocks by the gibbsite At other times, particularly with rising stream flow, the suspended solids may increase above natural accretions as a result of re-mobilization of the precipitated material Gibbsite also precipitates out as suspended material and re-dissolves with increases and decreases in river pH

Alkalinity Total alkalinity (as $CO_3^=$) also varies considerably, although there is a general, decreasing trend of incremental changes This is to be expected, as acid waters react with and neutralize alkaline components downstream

Bicarbonate is the principal alkaline ion It is principally atmospherically derived, and thus tends to replenish downstream, buffering the pH at around 8 0 The decline in alkalinity reflects the input of sulfuric acid overwhelming the natural buffer The declines occur at roughly downstream locations from Hanson Creek, Goathill

Gulch and Capulin Canyon with a one-half to one-mile lag indicating that neutralization is not instantaneous The cause of the sharp gain at Red River has not been determined Perhaps a man-made source of alkalinity is present in the town area

Turbidity (Jackson Turbidity Units) Turbidity was not converted to flow-compensated values, as it is measured in light absorption units rather than concentration, however, it is useful in that the turbidity plot in Drawing 3 closely follows suspended aluminum and TSS, confirming that the most important sites of clouding occur below Capulin Canyon, at Goathill Gulch, and at Hanson Creek

Other Metals and Fluoride Samples collected during the river surveys were also analyzed for several other trace metals and fluoride

Cadmium, barium and molybdenum concentrations were below the detection limit in all samples for the analytical methods used

The lead concentration was below the detection limit in most samples

Copper concentrations remained nearly constant at 01 mg/l, suspended and 02 mg/l, dissolved from the Town of Red River to above Capulin Creek Below Capulin Creek the copper concentration increased slightly

Concentrations of zinc, manganese and iron are shown on Drawings 2, 4 and 6 There was a general increase in a downstream direction in the concentration of all of these elements The pattern of increase was similar to that of aluminum, with the larger incremental increases occurring downstream of Capulin Canyon Such adds evidence of the high leaching activity in the mountain slopes above the lower stream reach even though there is evidently only a small ground water flow

Most of the iron concentration is suspended matter The significant fluctuation in iron concentration along the stream is attributed to oxidation and precipitation Red staining by iron oxide is present along several reaches of Red River

The zinc concentration at the Ranger Station ranged from 27 mg/l to 37 mg/l The zinc concentration increased slightly in a downstream direction to Capulin Canyon with larger increases indicated along the lower reach

Manganese concentrations were largely dissolved matter

Discussion

For the purposes of discussion, we have divided the length of the Red River studied into four segments Figure A shows the location of the prominent hydrothermal scars and the percentage of the total scar area along each segment

1 Red River town to Molycorp mill area (stations 1 - 7) This reach is characterized by low accretion to the river and widespread scar and mud flow areas on the north and the smaller June Bug Creek scar on the south Pioneer Creek, Mallette Creek, Bitter Creek, and Hansen Creek are intermittent flowing tributary streams in this reach Below Hanson Creek, springs are the only significant source of acidic water and aluminum Mildly acidic water enters the river in the town area, but no precipitate was observed there

This reach contains approximately 45% of the middle Red River stream length and about 50% of the hydrothermal scar area

Approximately 40% of the flow in Red River at the Ranger Station, during periods when the flow is less than 40 cfs, originates above the Town of Red River. The stream

HYDROTHERMAL SCAR AREAS
PERCENTAGE BY REACH

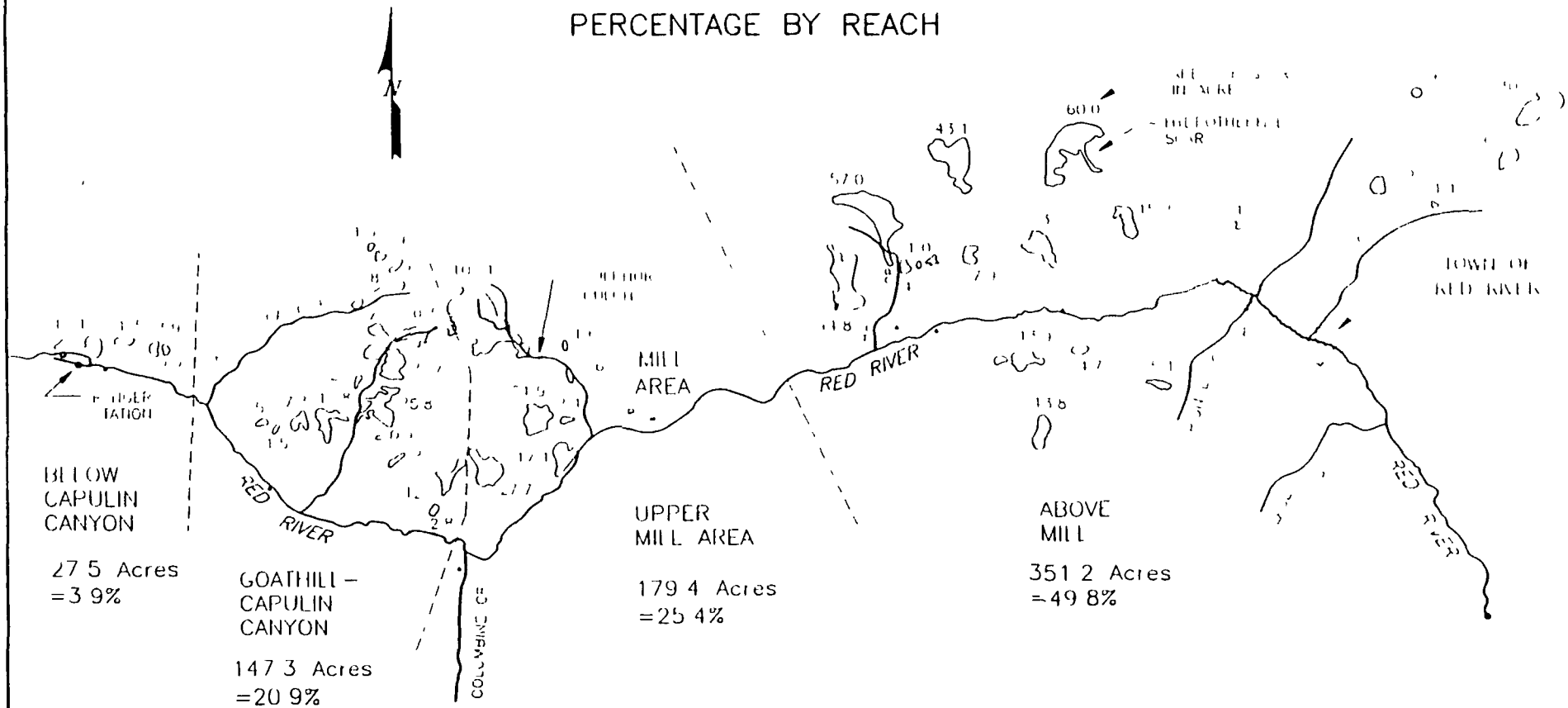


FIGURE A

HYDROTHERMAL SCAR AREAS

U S G S STREAM GUAGE
RED RIVER NEAR QUESTA
AVERAGE DAILY STREAM FLOW 1961 – 1992

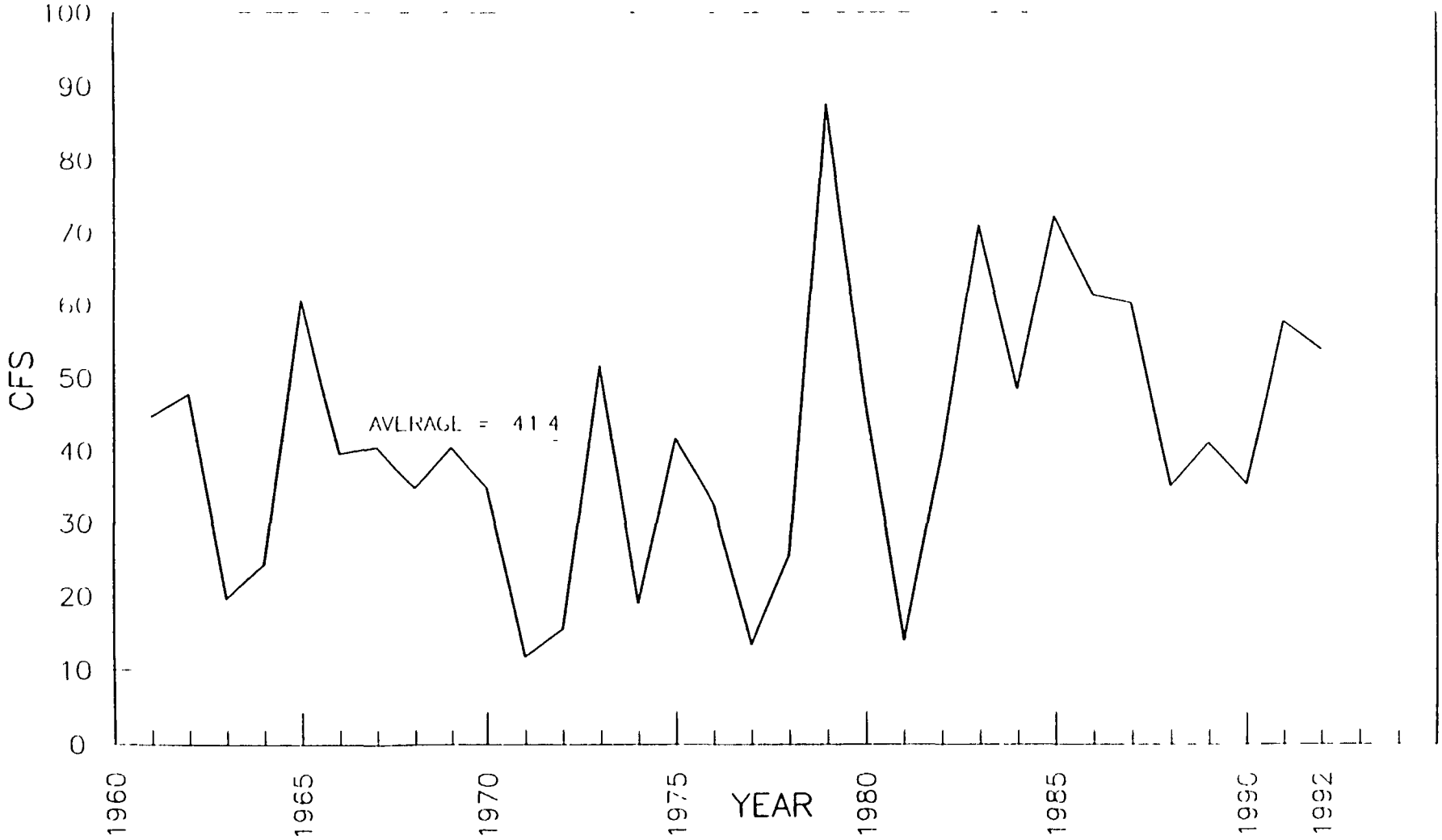


FIGURE B

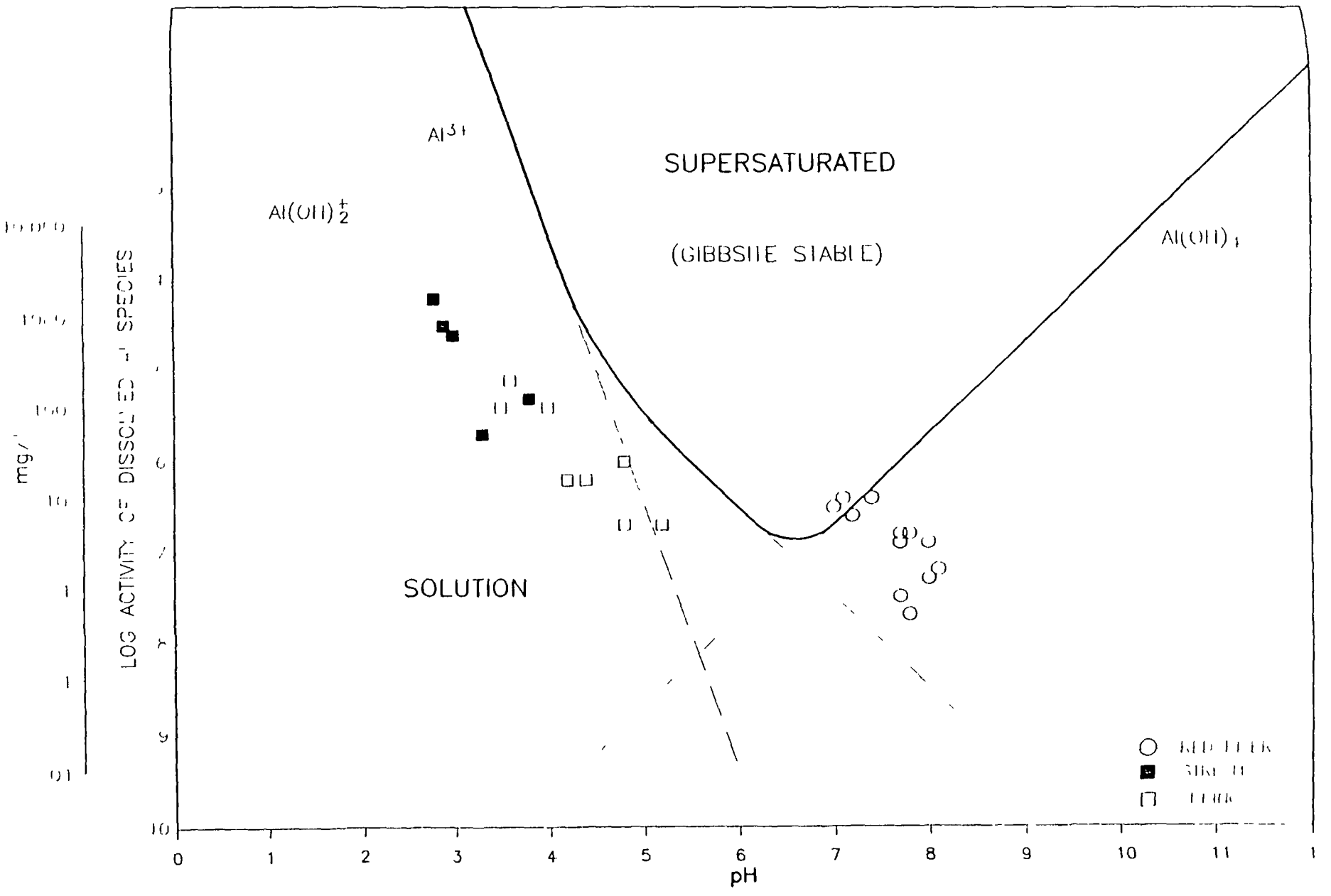


FIGURE C – ACTIVITIES OF DISSOLVED ALUMINUM SPECIES IN EQUILIBRIUM WITH GIBBSITE [$Al(OH)_3$] AT 25°C

APPENDIX 1

Analytical data for water samples from the Red River, November 29, 1988

Major Consituents

Station	pH	Al mg/l (Suspended)	Al mg/l (Dissolved)	$SO_4^=$ mg/l	TDS mg/l	TSS mg/l	Tot Alk	JTU
1	7.8	< 5	< 5	8	106	<1	38	1
2	8 1	< 5	< 5	33	115	5 2	67	1
3	7 7	< 5	8	34	138	1 9	71	3
4	8.0	5	7	43	133	1 6	68	4
5	8 1	5	1.0	40	140	6 0	65	4
6	7.7	1 2	1 8	46	149	17.8	62	8
7	7 7	2 3	1 8	65	163	33 7	55	10
8	7.7	1 6	1 9	85	173	8 7	56	7
9	8.4	< 5	< 5	5	73	<1	60	2
10	8.0	1.6	2 0	98	216	14.4	54	9
11	7.7	1.6	1.8	68	171	16 1	54	6
12	7 8	1.7	2.6	106	229	14.6	54	5
13	7.7	1 6	3 0	131	246	9.2	45	5
14	6.2	2.9	3 6	121	235	6 2	36	7
15	7.0	5.2	4 0	136	276	14.9	26	14
16	7 1	7.1	4.4	137	263	49 6	26	22
17	7.4	6 6	4.0	140	296	35 3	30	20

Apx 1

Appendix 1 continued

Spring and Creek Data
Major Constituents

	Date	pH	Al suspended mg/l	Al dissolved mg/l	SO_4= mg/l	TDS mg/l	TSS mg/l	Tot Alk mg/l	JTU
Streams:									
Haut N Taut Cr.	3-16-88	3 3	32	19	450	925			
Hanson Creek	3-15-88	3 8	50	65	1130	1785			
Goathill Gulch	3-16-88	3 0	41	560	9560	5820			
Goathill Gulch	4-14-88	2 6	7	611	9730	11832	127	.2 0	50
Capulin Creek	3-15-88	3 0	5	650	8980	11440			
Springs									
Junebug Seep	9-06-88	4 8		6 0	796	1466	14.1		
Hanson Spring	10-15-88	4 4	<.5	18 2	573	813	3 6		2
Assay Lab	10-21-88	5 2	1 8	3 1	359	600	115 1		34
Above Goathill	10-21-88	4.2	1 4	16.1	836	1492	15 9		4
Goathill Seep	3-16-88	3 6	9 2	216	3100	5155			
Above Capulin	10-14-88	4 8	10 9	321	520	366			100
Capulin Seep	10-14-88	4 0	1 1	110.4	1244	2296	43 8		20
Old Channel (near Capulin)	10-14-88	3.5	<.5	116 5	1404	2463			

"Boxed" data is > 5x Background

App. 1 (cont.)

Appendix 1 continued

Spring and Creek Data (continued)
Trace Constituents (mg/l)

	F^-	Cd	Pb	FE	Mn	Mo	Zn	Cu
Streams.								
Hot & Tot Creek	3 0	020	24	82	4 84	<.02	2 03	.47
Hanson Creek	3 8	018	.11	5.3	8.42	<.02	3 83	.16
Goathill Gulch	32	.300	.23	274	222	<.02	52	7.4
Capulin Creek	38	320	20	238	296	< 02	60	7.2
Springs:								
Junebug Seep	4 8	018	< 05	32	3 59	< 02	1 10	26
Hanson Spring (Background)	1 6	< 018	< 05	13	3 16	<.02	70	13
Assay Lab	3 5	< 01	< 05	85	68	<.02	52	05
Above Goathill	4 6	017	< 05	.68	4 82	<.02	1 46	26
Goathill Seep	8 0	070	18	106 20	38 72	05	9 63	1 22
Above Capulin	2.4	010	< 05	16.76	3.23	< 02	83	47
Capulin Seep (Downstream)	4.2	.018	10	25 42	16 33	03	4 35	1 26
Old Channel (near Capulin)	4 1	.032	06	2 65	18 42	< 02	4 90	1 46

"Boxed" data > 3x Bkgr

App 1 (cont)

MOLYCORP INC.
RED RIVER ALUMINUM SURVEYS

SUMMARY OF RED RIVER DATA 11-29-88 (SGV)
Laboratory Analytical Results

STATION LOCATION	STA	SO4 mg/l	Sus Al mg/l	Dis Al mg/l	Total Al mg/l	ALK mg/l	TDS mg/l	TSS mg/l	Turb JTU	F mg/l	Fe mg/l	Mn mg/l	Zn mg/l	Cond uMHO	pH
1 ABOVE RED RIVER	60600	8	0 01	0 00	0 01	38	106	1 0	1	0 2	0 15	0 03	0 01		7 8
3 BLLOW RED RIVER	55300	24	0 02	0 80	0 82	71	138	1 9	3	0 4	0 15	0 11	0 04	NOT RUN	7 7
4 JUNEBUG CAMPGROUND	50400	43	0 53	0 70	1 23	68	133	1 6	4	0 3	0 41	0 13	0 04		8 0
5 ELEPHANT ROCK CG	43800	40	0 53	1 00	1 53	65	140	6 0	4	0 4	0 51	0 11	0 02		8 1
6 BELOW HANSON CR	39100	46	1 20	1 80	3 00	62	149	17 8	8	0 5	0 64	0 18	0 04		7 7
Bkgr 7 ABOVE MILL	31800	65	2 30	1 80	4 10	55	163	33 7	10	0 5	1 48	0 23	0 08		7 7
8 BELOW SULFUR GULCH	29800	88	1 60	1 90	3 50	56	173	8 7	7	0 7	0 39	0 16	0 07		7 7
10 ABOVE COLUMBINE CR	22400	98	1 60	2 00	3 60	54	216	14 4	9	0 4	0 58	0 2	0 03		8 0
9 COLUMBINE CR (Not Red River)	5	<0 5	<0 5	<0 5	60	73	<0 1	2	0 2	0 13	0 02	0 01			8 4
11 ABOVE THUNDER BR	18300	63	1 60	1 80	3 40	54	171	16 1	6	0 5	0 62	0 32	0 08		7 7
12 GOAT HILL TURNOUT	14400	106	1 70	2 60	4 30	54	229	14 6	5	0 7	0 44	0 33	0 08		7 8
13 ABOVE CAPULIN	10300	131	1 60	3 00	4 60	45	246	9 2	5	0 8	0 23	0 39	0 1		7 7
14 BELOW CAPULIN	7800	121	2 90	3 60	6 50	36	235	6 2	7	0 9	0 4	0 53	0 14		6 2
15 EAGLE ROCK CG	5500	136	5 20	4 00	9 20	26	276	14 9	14	1 3	1 27	1 27	0 31		7 0
16 RANGER STATION	3300	137	7 10	4 40	11 50	26	263	49 6	22	1 2	2 17	1 39	0 37		7 1
17 EAGLE ROCK LAKE	1400	140	6 60	4 00	10 60	30	296	35 3	20	1	1 27	1 3	0 35		7 4

>3x Bkgr

MOLYCORP INC.

RED RIVER ALUMINUM SURVEYS

SUMMARY OF RED RIVER DATA 10-22-92 (REV)
Laboratory Analytical Results

STATION LOCATION	STA	SO4 mg/l	Sus Al mg/l	Dis Al mg/l	Total Al mg/l	ALK mg/l	TDS mg/l	TSS mg/l	Turb JTU	F mg/l	Fe mg/l	Mn mg/l	Zn mg/l	Cond uMHO	pH
1 ABOVE RED RIVER	60600	9	<0 5	<0 5	0 00	91	152	1 5	1	0 1	0 214	0 01	0 013		7 80
3 BELOW RED RIVER	55300	50	0 78	0 70	1 48	78	186	8 0	5	0 26	0 673	0 224	0 085	240	7 53
4 JUNEBUG CAMPGROUND	50400	53	0 39	0 50	0 89	88	154	2 0	3	0 263	0 396	0 154	0 054	265	8 15
6 BELOW HANSON CR	39100	66	0 39	0 50	0 89	72	176	4 7	4	0 268	0 359	0 126	0 053	286	8 23
Bkgr 7 ABOVE MILL	31800	85	0 90	0 70	1 60	62	184	6 0	4	0 358	0 31	0 21	0 071	317	8 19
8 BELOW SULFUR GULCH	29800	98	0 84	0 50	1 34	56	214	7 0	5	0 452	0 305	0 21	0 092	334	7 69
8A ABOVE PORTAL	25000	97	0 86	0 50	1 36	62	214	5 0	5	0 452	0 203	0 234	0 072	336	8 06
10 ABOVE COLUMBINE CR	22400	114	0 78	0 50	1 28	63	202	7 0	5	0 222	0 252	0 21	0 084	343	8 19
9 COLUMBINE CR (Not Red River)	9	<0 5	<0 5	<0 5	72	98	1 0	2	0 211	0 04	0 03	0 01	161	8 28
10A COMPANY CABINS	21000	113	1 1	0 50	1 60	61	210	16 7	4	0 776	0 147	0 462	0 108	356	7 61
11 ABOVE THUNDER BR	18300	125	1 10	0 77	1 87	56	216	8 0	4	0 762	0 249	0 476	0 133	352	7 86
11A THUNDER BRIDGE	16400	131	1 4	0 62	2 02	68	200	5	4	0 744	0 159	0 434	0 127	391	7 62
12 GOAT HILL TURNOUT	14400	132	1 50	0 55	2 05	54	266	3 3	3	0 762	0 191	0 378	0 12	401	7 88
13 ABOVE CAPULIN	10300	125	1 50	0 50	2 00	62	244	6 7	5	0 772	0 209	0 448	0 135	400	7 76
14 BELOW CAPULIN	7800	140	2 50	0 50	3 00	48	284	10 0	6	0 841	0 272	0 658	0 206	416	7 45
14A BEAR CANYON	6650	143	2 74	0 65	3 39	51	328	20	8	0 877	0 231	0 742	0 197	419	7 46
15 EAGLE ROCK CG	5500	156	3 56	1 20	4 76	38	336	24 0	9	0 921	0 361	1 13	0 263	431	7 24
16 RANGER STATION	3300	152	3 36	0 79	4 15	44	331	32 0	9	0 948	0 2	1 13	0 273	427	7 39
17 EAGLE ROCK LAKE	1400	153	3 00	0 79	3 79	34	326	27 0	9	1 09	0 181	1 18	0 323	436	7 51

MOLYCORP INC.
RED RIVER ALUMINUM SURVEYS

SUMMARY OF RED RIVER DATA 02-16-93 (DRS)
Laboratory Analytical Results

STATION LOCATION	STA	SO4 mg/l	Sus Al mg/l	Dis Al mg/l	Total Al mg/l	ALK mg/l	TDS mg/l	TSS mg/l	Turb JTU	F mg/l	Fe mg/l	Mn mg/l	Zn mg/l	Cond uMHO	pH
1 ABOVE RED RIVER	60600	6	<0 5	<0 5	0 00	84	122	1 0	NO	0 1	0 101	0 03	0 02	194	7 6
6 BELOW HANSON CR	39100	86	0 83	0 50	1 33	46	200	6 0	T	0 32	0 467	0 179	0 041	305	7 6
7 ABOVE MILL	31800	113	2 00	0 50	2 50	49	230	8 0	R	0 37	0 442	0 274	0 083	336	7 7
8A ABOVE PORTAL	25000	105	1 80	0 50	2 30	43	238	7 0	UN	0 498	0 281	0 234	0 072	371	7 8
10 ABOVE COLUMBINE CR	22400	130	2 00	0 50	2 50	49	256	4 0		0 606	0 636	0 309	0 504	393	7 8
10A COMPANY CABINS	21000	131	1 80	0 50	2 30	49	266	7 0		0 812	0 278	0 221	0 063	369	7 6
11A THUNDER BRIDGE	16400	166	1 6	0 50	2 10	47	292	6		0 812	0 214	0 504	0 111	416	7 3
12 GOAT HILL TURNOUT	14400	182	1 40	0 50	1 90	47	302	11 0		0 831	0 236	0 474	0 112	414	7 6
13 ABOVE CAPULIN	10300	177	1 40	0 50	1 90	43	302	12 0		0 862	0 245	0 518	0 127	436	7 5
14 BELOW CAPULIN	7800	188	3 10	0 50	3 60	26	310	18 0		0 968	0 421	0 755	0 179	444	7 3
16 RANGER STATION	3300	202	5 10	0 50	5 60	29	338	21 0		1 1	0 524	1 5	0 348	458	7 2

MOLYCORP INC.
RED RIVER ALUMINUM SURVEYS

SUMMARY OF RED RIVER DATA 11-29-88 (SGV)
Calculated Mass Flow Data (Grams/Sec)

STATION LOCATION	STA	FLOW CFS	SO4	Sus Al	Dis Al	Total Al	ALK	TDS	TSS	Turb JTU	F	Fe	Mn	Zn	Cond uMHO	pH
1 ABOVE RED RIVER	60600	6 6	1 49	0 00	0 00	0 00	7 06	19 68	0 19	1	0 04	0 03	0 01	<0 01		7 8
3 BELOW RED RIVER	55300	10 1	6 89	0 01	0 23	0 24	20 38	39 60	0 55	3	0 11	0 04	0 03	0 01	N	7 7
4 JUNEBUG CAMPGROUND	50400	10 3	12 48	0 15	0 20	0 36	19 74	38 62	0 46	4	0 09	0 12	0 04	0 01	O T	8 0
5 ELEPHANT ROCK CG	43800	10 6	11 95	0 16	0 30	0 46	19 42	41 83	1 79	4	0 12	0 15	0 03	0 01	R U	8 1
6 BELOW HANSON CR	39100	10 7	13 98	0 36	0 55	0 91	18 84	45 27	5 41	8	0 15	0 19	0 05	0 01	N	7 7
7 ABOVE MILL	31800	10 9	20 08	0 71	0 56	1 27	16 99	50 35	10 41	10	0 15	0 46	0 07	0 02		7 7
8 BELOW SULFUR GULCH	29800	11 6	28 96	0 53	0 63	1 15	18 43	56 93	2 86	7	0 23	0 13	0 05	0 02		7 7
10 ABOVE COLUMBINE CR	22400	12 0	33 24	0 54	0 68	1 22	18 32	73 26	4 88	9	0 14	0 20	0 07	0 01		8 0
9 COLUMBINE CR (Not Red River)		3 2	0 45	<0 05	<0 05	<0 05	5 46	6 64	< 0 1	2	0 02	0 01	<0 01	<0 01		8 4
11 ABOVE THUNDER BR	18300	15 2	40 00	0 69	0 78	1 46	23 25	73 63	6 93	6	0 22	0 27	0 14	0 03		7 7
12 GOAT HILL TURNOUT	14400	15 8	47 43	0 76	1 16	1 92	24 16	102 46	6 53	5	0 31	0 20	0 15	0 04		7 8
13 ABOVE CAPULIN	10300	16 0	50 00	0 73	1 36	2 09	20 44	111 72	4 18	5	0 36	0 10	0 18	0 05		7 7
14 BELOW CAPULIN	7800	16 3	55 77	1 34	1 66	3 00	16 59	108 31	2 86	7	0 41	0 18	0 24	0 06		6 2
15 EAGLE ROCK CG	5500	16 7	64 28	2 46	1 89	4 35	12 29	130 46	7 04	14	0 61	0 60	0 60	0 15		7 0
16 RANGER STATION	3300	17 0	65 91	3 42	2 12	5 53	12 51	126 53	23 86	22	0 58	1 04	0 67	0 18		7 1
17 EAGLE ROCK LAKE	1400	17 0	67 35	3 18	1 92	5 10	14 43	142 41	16 98	20	0 48	0 61	0 63	0 17		7 4

MOLYCORP INC
RED RIVER ALUMINUM SURVEYS

SUMMARY OF RED RIVER DATA 10-22-92 (REV)
Calculated Mass Flow Data (Grams/Sec)

STATION LOCATION	STA	FLOW CFS	SO4	Sus Al	Dis Al	Total Al	ALK	TDS	TSS	Turb JTU	F	Fe	Mn	Zn	Cond uMHO	pH
1 ABOVE RED RIVER	60600	9 7	2 46	0 00	0 00	0 00	24 85	41 51	0 41	1	0 03	0 06	0 00	0 00	--	7 80
3 BELOW RED RIVER	55300	14 9	21 10	0 33	0 30	0 62	32 92	78 50	3 38	5	0 11	0 28	0 09	0 04	240	7 53
4 JUNEBUG CAMPGROUND	50400	15 1	22 63	0 17	0 21	0 38	37 57	65 75	0 85	3	0 11	0 17	0 07	0 02	265	8 15
6 BELOW HANSON CR	39100	15 8	29 49	0 17	0 22	0 40	32 17	78 63	2 10	4	0 12	0 16	0 06	0 02	286	8 23
7 ABOVE MILL	31800	16 1	38 61	0 41	0 32	0 73	28 17	83 59	2 73	4	0 16	0 14	0 10	0 03	317	8 19
8 BELOW SULFUR GULCH	29800	17 1	47 43	0 41	0 24	0 65	27 10	103 56	3 39	5	0 22	0 15	0 10	0 04	334	7 69
8A ABOVE PORTAL	25000	17 4	47 70	0 42	0 25	0 67	30 49	105 23	2 46	5	0 22	0 10	0 12	0 04	336	8 06
10 ABOVE COLUMBINE CR	22400	17 6	56 86	0 39	0 25	0 64	31 42	100 76	3 49	5	0 11	0 13	0 10	0 04	343	8 19
9 COLUMBINE CR (Not Red River)		4 7	1 20	<0 05	<0 05	<0 05	9 63	13 10	0 13	2	0 03	0 01	<0 01	<0 01	161	8 28
10A COMPANY CABINS	21000	22 4	71 47	0 70	0 32	1 01	38 58	132 83	10 56	4	0 49	0 09	0 29	0 07	356	7 61
11 ABOVE THUNDER BR	18300	22 4	79 15	0 70	0 49	1 18	35 46	136 77	5 07	4	0 48	0 16	0 30	0 08	352	7 86
11A THUNDER BRIDGE	16400	23 0	85 36	0 91	0 40	1 32	44 31	130 32	3 26	4	0 48	0 10	0 28	0 08	391	7 62
12 GOAT HILL TURNOUT	14400	23 3	86 85	0 99	0 36	1 35	35 53	175 02	2 17	3	0 50	0 13	0 25	0 08	401	7 88
13 ABOVE CAPULIN	10300	23 6	83 48	1 00	0 33	1 34	41 41	162 96	4 47	5	0 52	0 14	0 30	0 09	400	7 76
14 BELOW CAPULIN	7800	24 0	94 89	1 69	0 34	2 03	32 53	192 49	6 78	6	0 57	0 18	0 45	0 14	416	7 45
14A BEAR CANYON	6650	24 3	98 14	1 88	0 45	2 33	35 00	225 10	13 73	8	0 60	0 16	0 51	0 14	419	7 46
15 EAGLE ROCK CG	5500	24 6	108 44	2 47	0 83	3 31	26 41	233 56	16 68	9	0 64	0 25	0 79	0 18	431	7 24
16 RANGER STATION	3300	25 0	107 54	2 38	0 56	2 94	31 13	234 18	22 64	9	0 67	0 14	0 80	0 19	427	7 39
17 EAGLE ROCK LAKE	1400	25 0	108 25	2 12	0 56	2 68	24 06	230 64	19 10	9	0 77	0 13	0 83	0 23	436	7 51

MOLYCORP INC

RED RIVER ALUMINUM SURVEYS

SUMMARY OF RED RIVER DATA 02-16-93 (DRS)
Calculated Mass Flow Data (Grams/Sec)

STATION LOCATION	STA	FLOW CFS	SO4	Sus Al	Dis Al	Total Al	ALK	TDS	TSS	Turb JTU	F	Fe	Mn	Zn	Cond uMHO	pH
1 ABOVE RED RIVER	60600	8 5	1 44	0 00	0 00	0 00	20 19	29 32	0 24	N O T	0 02	0 02	0 01	0 00	191	7 6
6 BELOW HANSON CR	39100	13 9	33 81	0 33	0 20	0 52	18 09	78 63	2 36		0 13	0 18	0 07	0 02	305	7 6
7 ABOVE MILL	31800	14 1	45 17	0 80	0 20	1 00	19 59	91 95	3 20	R U N	0 15	0 18	0 11	0 03	336	7 7
8A ABOVE PORTAL	25000	15 3	45 43	0 78	0 22	1 00	18 61	102 98	3 03		0 22	0 12	0 10	0 03	371	7 8
10 ABOVE COLUMBINE CR	22400	15 5	57 06	0 88	0 22	1 10	21 51	112 37	1 76		0 27	0 28	0 14	0 22	393	7 8
10A COMPANY CABINS	21000	19 7	72 92	1 00	0 28	1 28	27 27	148 06	3 90		0 45	0 15	0 12	0 04	369	7 6
11A THUNDER BRIDGE	16400	20 1	94 26	0 91	0 28	1 19	26 69	165 80	3 41		0 46	0 12	0 29	0 06	416	7 3
12 GOAT HILL TURNOUT	14400	20 5	105 38	0 81	0 29	1 10	27 21	174 86	6 37		0 48	0 14	0 27	0 06	414	7 6
13 ABOVE CAPULIN	10300	20 8	104 03	0 82	0 29	1 12	25 27	177 50	7 05		0 51	0 14	0 30	0 07	436	7 5
14 BELOW CAPULIN	7800	21 1	112 13	1 85	0 30	2 15	15 51	184 90	10 74		0 58	0 25	0 15	0 11	444	7 3
16 RANGER STATION	3300	22 0	125 77	3 18	0 31	3 49	18 06	210 44	13 07		0 68	0 33	0 93	0 22	458	7 2

APPENDIX 4

COMPUTATIN OF THE PERCENT OF THE TOTAL GAIN
WHICH WAS INDICATED FOR MAJOR STREAM SEGMENTS

HEW-11 04/1965

	FLOW CFS	CONC mg/l	FLOW X CONC	MASS GAIN	% OF TOTAL
ABOVE RR TOWN	9 9	5 3	52 5		
				278 4	17 2
BELOW RR TOWN	16 3	20 3	330 9		
				464 7	23 7
BELOW HANSEN	17 0	46 8	795 6		
				396 2	24 5
BLW COL CREEK	23 6	50 5	1191 8		
				478 2	29 6
RANGER STATION	26 3	63 5	1670 1		
TOTALS				1617 6	100 0

EPA-11/04/1970

	FLOW CFS	CONC mg/l	FLOW X CONC	MASS GAIN	% OF TOTAL
ABOVE RR TOWN	4 2	10 1	42 5		
				369 9	32 9
BELOW RR TOWN	10 0	41 2	412 4		
				380 7	33 9
BELOW HANSEN	12 7	62 5	793 1		
				56 9	5 1
BLW COL CREEK	9 6	44 4	427 6		
- EST MC DIVER	6 5	65 0	422 5		
				316 6	28 2
RANGER STATION	11 2	66 5	744 1		
- EST MC DIVER	6 5	65 0	422 5		
TOTALS				1124 1	100 0

SMOLKA-TAGUE 10/25 1988

	FLOW CFS	CONC mg/l	FLOW X CONC	MASS GAIN	% OF TOTAL
ABOVE RR TOWN	11 6	12 0	139 2		
				666 3	19 6
BELOW RR TOWN	17 9	45 0	805 5		
				484 3	14 2
BELOW HANSEN	19 3	67 0	1289 8		
				770 5	22 7
@ GOAT HILL	28 3	72 8	2060 2		
				1479 8	43 5
RANGER STATION	30 0	118 0	3540 0		
TOTALS				3400 8	100 0

APPENDIX 4 - (continued)

COMPUTATIN OF THE PERCENT OF THE TOTAL GAIN
WHICH WAS INDICATED FOR MAJOR STREAM SEGMENTS

SCOTT VAIL 11/29/1988 W/BLW COL CREEK

	FLOW CFS	CONC mg/l	FLOW X CONC	MASS GAIN	% OF TOTAL
ABOVE RR TOWN	6 6	8 0	52 8		
				189 6	8 3
BELOW RR TOWN	10 1	24 0	242 4		
				466 1	20 5
BELOW HANSEN	10 9	65 0	708 5		
				249 1	10 9
BLW COL CREEK	15 2	63 0	957 6		
				1371 4	60 2
RANGER STATION	17 0	137 0	2329 0		
TOTALS				2276 2	100 0

SCOTT VAIL 11/29/1988 W/GOAT HILL

	FLOW CFS	CONC mg/l	FLOW X CONC	MASS GAIN	% OF TOTAL
ABOVE RR TOWN	6 6	8 0	52 8		
				189 6	8 3
BELOW RR TOWN	10 1	24 0	242 4		
				466 1	20 5
BELOW HANSEN	10 9	65 0	708 5		
				902 7	39 7
@GOAT HILL	15 2	106 0	1611 2		
				717 8	31 5
RANGER STATION	17 0	137 0	2329 0		
TOTALS				2276 2	100 0

RALPH VAIL 10/22/1992

	FLOW CFS	CONC mg/l	FLOW X CONC	MASS GAIN	% OF TOTAL
ABOVE RR TOWN	9 7	9 0	87 3		
				657 7	17 7
BELOW RR TOWN	14 9	50 0	745 0		
				623 5	16 8
BELOW HANSEN	16	85 0	1368 5		
				1431 5	38 6
BLW COL CREEK	22 4	125 0	2800 0		
				1000 0	26 9
RANGER STATION	25 0	152 0	3800 0		
TOTALS				3712 7	100 0

APPENDIX 4 - (continued)

COMPUTATIN OF THE PERCENT OF THE TOTAL GAIN
WHICH WAS INDICATED FOR MAJOR STREAM SEGMENTS

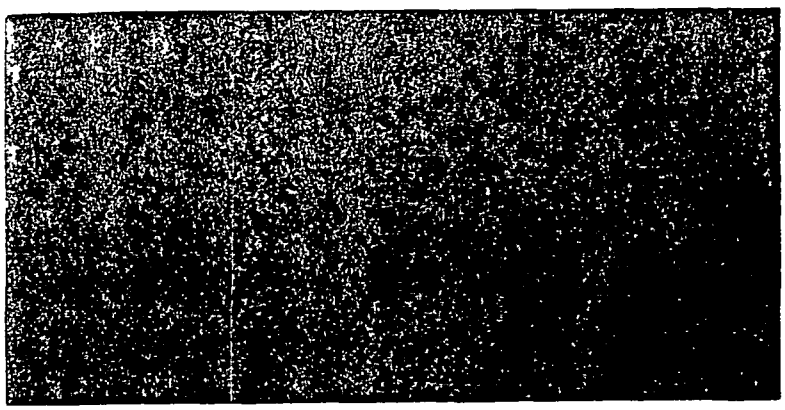
DAVID SHOEMAKER 02/16/1993

	FLOW CFS	CONC mg/l	FLOW X CONC	MASS GAIN	% OF TOTAL
ABOVE RR TOWN	8 5	6 0	51 0		
				800 5	[illegible]
BELOW RR TOWN	13 1	65 0	851 5		
				981 5	[illegible]
BELOW HANSEN	14 1	130 0	1833 0		
				1112 2	[illegible]
BLW COL CREEK	19 9	148 0	2945 2		
				1498 8	[illegible]
RANGER STATION	22 0	202 0	4444 0		
TOTALS				4393 0	100 %

DISCHARGE PLANS
ALPHABETICAL LIST

NMED, Groundwater Section

DP #	FACILITY NAME	TREATMENT	REVIEWER	DISTRICT	COUNTY		
809	MELROSE SLUDGE	OTHER	DEFUNCT	4	CURRY	11-JUN-91	D
808	MELROSE WWTP-EFFLUENT	WWTP	OHRBOM	4	CURRY	15-MAR-95 29-APR-92 29-APR-97	A
174	MERRILL DAIRY-ALEXANDER	LAGOON	JONES	1	SOCORRO		
197	MERRILL DAIRY-ALEXANDER 2	LAGOON	CEASED	1	SOCORRO	29-SEP-81 05-NOV-87 05-NOV-92	C
161	MERRILL DAIRY-LESTER	LAGOON					
18	MERRITT RANCH	CONSTRUCTED WETLANDS	GARCIA	4	QUAY		
957	MESA DEVELOPMENT CENTER	PACKAGE PLANT	BUSTAMANTE	3	DONA ANA	16-MAR-93	P
916	MESA VILLAGE	LAGOON	FARIS	3	DONA ANA	11-JAN-93 24-FEB-95 24-FEB-00	A
403	MESILLA VALLEY CHRISTIAN SCH	SEPTIC TANK	KNISKERN	3	DONA ANA	06-APR-94 07-OCT-94 07-OCT-95	A
812	MESQUITE INTERIM LIQUID WASTE DIPOSAL FA	LAGOON	MCCORMACK	3	DONA ANA	27-SEP-90 25-MAR-93 25-MAR-98	P
539	MESQUITE LIQUID WASTE DISPOS	LAGOON	MCCORMACK	3	DONA ANA	13-JAN-88 01-JUL-93 01-JUL-98	A
1036	MESQUITE WASTEWATER COLLECTI	CONSTRUCTED WETLANDS	FARIS	3	DONA ANA	25-NOV-94	P
722	MEYER'S FARM		DEFUNCT	4	LEA	12-JUN 90	D
681	MI RANCHITO PACKING	SEPTIC TANK	BUSTAMANTE	4	EDDY	09-FEB-90 17-MAY-90 17 MAY-95	A
941	MID-AM NEW MEXICO INC	LAGOON	MCCORMACK	3	ROOSEVELT	0 APR-93 07-SEP-93 07-SEP-98	A
836	MID-AMERICA PIPELINE COMPANY	OIL-WATER SEPARATOR	BUSTAMANTE	4	CHAVES	30-DEC-91 24 APR-92 24-APR 99	I
932	MIDWAY DAIRY	LAGOON	EVERETT	4	ROOSEVELT	16-MAR-93 20-MAY-93 20-MAY-98	I
1030	MIGHTY VAC	E/T BED	FARIS	4	CURRY	20-OCT-94 21-JUL-95 21-JUL-00	A
754	MILLER MOBILE MANOR	SEPTIC TANK	KNISKERN	3	DONA ANA	18-OCT-90 13-DEC-90 13-DEC-95	A
5	MIMBRES CHRISTIAN CAMP	SEPTIC TANK	MCCORMACK	3	GRANT	06-JAN 88 30 JUL-93 30-JUL-98	A
332	MIMBRES RESOURCE DEV CO			3			D
272	MINERAL INDUS COMM OF AMERIC	LAGOON	MANNING	2	RIO ARRIBA	26 JAN 93 19 APR-93 19 APR 98	A
961	MINI-MOBILE VILLAGE	SEPTIC TANK	MANNING	3	DONA ANA	10-SEP-93	P
987	MITCHELL DAIRY	LAGOON	KNISKERN	4	ROOSEVELT	08-APR-94 15-SEP-95 15-SEP 00	P
137	MOBIL MONUMENT URAN IN SITU	NONE	OHRBOMC/D	1	MCKINLEY		C
26	MOBILE CROWNPOINT SECTION 9	OTHER	OHRBOMC/D	1	MCKINLEY		C
151	MOBILE SOUTH TREND-IN SITU MG	NONE	OHRBOMC/D	1	MCKINLEY		C
467	MOLINA COURT CONDOMINIUMS	PACKAGE PLANT	DYE	1	VALENCIA	01-MAR-87 31-MAR-88 31-MAR-95	C
402	MOLLER OIL COMPANY	LAGOON	MCCORMACK	3	HIDALGO	08-APR-91 20-SEP-91 20-SEP-96	A
132	MOLYCORP / QUESTA	LAGOON	MANNING	2	TAOS	23-MAY-90 05-SEP-90 05-SEP-95	A
350	MOLYCORP GUADALUPE TALINGS			2		06-JUL-84	D
1055	MOLYCORP QUESTA WASTE ROCK PILES	NONE	MCCORMACK	2	TAOS	11-MAY-95	
933	MOLYCORP TAILINGS IMPOUNDMEN	METALLURGICAL EXTRACTION	MCCORMACK	2	TAOS	22-MAR-93	P
414	MONTEREY CONST CO-BRANTLEY DM	SEPTIC TANK	CEASED	4	EDDY	17-JAN-86 07-MAR-86 07-MAR-91	C



STEFFEN ROBERTSON & KIRSTEN

Consulting Engineers and Scientists

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QUESTA MOLYBDENUM MINE
GEOCHEMICAL ASSESSMENT

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SRK Project No 09206
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TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Background and Scope of Work 1
1.1.2 Requirement for Mine Waste Characterization Study 1
1.1.3 Geologic Setting 1
1.1.4 Environmental Setting 2
1.1.4.1 Physical Conditions 2
1.1.4.2 Geochemical Conditions 3
1.1.5 Mine Operations 3
1.1.6 Mining Impacts 4
1.1.6.1 Physical Impacts 4
1.1.6.2 Geochemical Impacts 4
1.1.7 Other Impacts 5
1.1.8 Study Approach and Scope 5
1.1.9 Report Content 6
1.2 Mine Layout and Development History 6
1.2.1 Early Underground Mining Operations 6
1.2.2 Open Pit Mine 7
1.2.3 New Underground Mining Operations 8
1.3 Characteristics of Hydrothermal Scar and Mine Waste Drainage 8
1.3.1 Characteristics of Hydrothermal Scar Drainage 8
1.3.2 Characteristics of Drainage From Mine Disturbed and Mine Waste Areas 9
1.4 Fate of Natural and Mine Impacted Drainage 10
1.4.1 Drainage from Hydrothermal Scars 10
1.4.1.1 Physical Conditions 10
1.4.1.2 Chemical Conditions 10
1.4.2 Mine Disturbed Areas 11
1.4.2.1 Physical Conditions 11
1.4.2.2 Chemical Conditions 12
1.5 Water Quality Conditions 12
1.5.1 Springs Discharging to Red River 12
1.5.2 Underground Mine Water Quality 13
1.5.3 Water Supply Wells 14
1.5.4 Monitor Wells 14
1.5.5 Red River Water Quality 15
1.5.6 Columbine Creek 15
1.6 Premine Water Quality 15

2.0 HYDROLOGICAL INVESTIGATION 17
2.1 Previous Investigations 17
2.2 Data Developed for This Study 18
2.3 Regional Watershed 18
2.4 Subwatersheds 19
2.5 Hydrothermal Scar Areas and Flows 19
2.6 Site Impacted Subwatersheds 20

TABLE OF CONTENTS
(continued)

2 6 1 Pre-mine Conditions 20
2 6 2 Present Conditions 20

3.0 GEOCHEMICAL CHARACTERIZATION 22
3 1 Previous Studies 22
3 2 Data Collected for This Study 22
3 3 Surficial Geochemistry 23
3 3 1 Geochemical Properties and Drainage Chemistry of Hydrothermal Scars 23
3 3 1 1 General Description of Hydrothermal Scars 23
3 3 1 2 Whole Rock Analysis 23
3 3 1 3 Static Testing 24
3 3 1 4 Shake Flask Tests 24
3 3 1 5 Scar Area Drainage Composition 25
3 3 2 Geochemical Properties and Drainage Chemistry of Mine Waste and Mine Disturbed Materials 25
3 3 2 1 Whole Rock Analysis 25
3 3 2 2 Field and Static Tests 25
3 3 2 3 Shake Flask Tests 27
3 3 2 4 Mine Waste Drainage Chemistry 28
3 3 3 Rock, Soil, Alluvium and Colluvium from Other Areas 29
3 3 3 1 Field Tests 29
3 3 3 2 Shake Flask Tests 30
3 3 3 3 Drainage Quality from Unaffected Areas 30
3 3 3 4 Acidity Attenuation Capacity of Soils and Alluvium 31
3 4 Discussion of Test Findings 31
3 4 1 Current State of Acid Generation 31
3 4 1 1 Waste Rock Disposal Areas 31
3 4 1 2 Open Pit 32
3 4 1 3 Underground Mine Workings 32
3 4 2 Potential For Future Acid Generation 32
3 4 2 1 Waste Rock Disposal Areas 32
3 4 2 2 Open Pit 33
3 4 2 3 Underground Mine 33
3 4 3 Future Mine Waste Drainage Water Quality 34
3 4 4 Quality of Springs and Seeps Discharging to the Red River 35

4 0 SUMMARY AND CONCLUSIONS 36
4 1 Geochemical Properties 36
4 1 1 Hydrothermal Scars 36
4 1 2 Mine Waste Materials 36
4 1 2 1 Waste Rock 36
4 1 2 1 1 Mixed Volcanic Waste Rock 36
4 1 2 1 2 Black Andesite and Aplite/Granite Waste Rock 37
4 1 2 1 3 Other Mine Waste 37

TABLE OF CONTENTS
(continued)

4.2 Sources of Sulfate and Metals Loads to the Red River 37
4.2.1 Hydrothermal Scars 37
4.2.2 Mine Waste Materials 38
4.3 Long Term Climatic Effects on Water Quality 39

5.0 RECOMMENDATIONS FOR NEXT PHASE OF INVESTIGATION AND CHARACTERIZATION 40
5.1 Requirements for Additional Investigation and Characterization 40
5.2 Waste Rock Quantifications and Characterization 41
5.3 Quantification and Characterization of ARD Conditions 42
5.4 Characterization and Modelling of ARD Kinetics 42

6.0 REFERENCES 44

LIST OF TABLES

TABLE 1.1 Summary of Waste Rock Quantities by Location
TABLE 1.2 Summary of Water Quality Data
TABLE 1.3 Representative Water Quality Data
TABLE 1.4 Selected Water Quality Monitoring Data
TABLE 1.5 Upper Red River Acidic Drainage Survey
TABLE 1.6 Estimated Contaminant Loading
TABLE 1.7 Comparison of 1965 and 1993 Water Quality Data
TABLE 2.1 Summary of Discharge Records at the Questa Gaging Station in CFS
TABLE 2.2 Summary of Mean Monthly Discharge at the Questa Gaging Station in CFS
TABLE 3.1 Hydrothermal Scars - Whole Rock Analysis
TABLE 3.2 Hydrothermal Scars - ABA Data
TABLE 3.3 Hydrothermal Scars - Shake Flask Test Results
TABLE 3.4 Mine Waste Materials - Whole Rock Analysis
TABLE 3.5 Waste Rock/Tailings - ABA Data
TABLE 3.6 Waste Rock/Tailings - Summary of Shake Flask Data
TABLE 3.7 Outside Mine Disturbed Areas - Field Test Results
TABLE 3.8 Outside Mine Disturbed Areas - Summary of Shake Flask Data
TABLE 3.9 Results of Titration Testing

LIST OF FIGURES

FIGURE 1.1 Location Map
FIGURE 1.2 Mine Facilities Plan
FIGURE 1.3 Schematic of Major Surface and Underground Mine Features
FIGURE 1.4 Hydrothermal Scar Areas
FIGURE 1.5 Water Sampling Locations
FIGURE 1.6 Monitor Well and Spring Location Plan
FIGURE 1.7 Red River Water Quality Survey

FIGURE 3 1 Hydrothermal Scar Sample Locations
FIGURE 3 2 Mine Waste and Mine Disturbed Area Sample Locations
FIGURE 3 3 Geochemical Sample Locations
FIGURE 3 4 Results of Titration Testing

LIST OF APPENDICES

APPENDIX A Red River Basin Hydrologic Data
APPENDIX B Geochemical Test Methods and Interpretation of Test Results
APPENDIX C Geotechnical Data
C-1 Questa Mine Water Quality - ICP Data
C-2 Field Paste pH and Total Dissolved Solids (TDS) Measurements
C-3 Questa Mine Solid Samples - ICP Data
C-4 Questa Mine Solid Samples - Acid Base Accounting Data
C-5 Questa Mine Solid Samples - Shake Flask Data

1.0 INTRODUCTION

1.1 Background and Scope of Work

1.1.1 Location

The Questa molybdenum mine is located approximately 5 miles east of the town of Questa in Taos County in north central New Mexico. The mine property lies within the Taos range of the Sangre De Cristo mountains. The mine area is bounded on the south by the Red River and on the north by the Cabresto Creek drainage. The location of the mine is shown on Figure 1.1. Mine facilities are shown on Figure 1.2.

1.1.2 Requirement for Mine Waste Characterization Study

This report describes the execution and results of an initial study to characterize the mine waste rock that has been produced by the mines activities. This waste rock has been placed in dumps on the southward sloping hillsides and valleys north of Red River. Sulfides contained in some of the waste rock is oxidizing to produce acidic drainage which drains to the south towards the Red River. Most, if not all, of this acidic drainage is intercepted. In order for the nature, quantity and flowpaths of this acidic drainage to be evaluated it is necessary to determine the geochemical characteristics of the waste in the various dumps, their current state of oxidation and contaminant generation, and to evaluate how this state may change with time as the oxidation processes mature. Natural exposures of sulfide bearing rocks occur as "scars" on and adjacent to the mining impacted area. These exposures are subject to the same oxidation processes as are the dump waste rock. It is therefore necessary also to characterize the geochemical nature of these natural scars in order to be able to better understand the relative contributions of acidic drainage to the Red River from both natural and mine derived sources.

1.1.3 Geologic Setting

The Questa molybdenum mine is located in the Taos Range of the Sangre De Cristo mountains within in the Latir volcanic field. The area has been subject to a complex geologic and structural history associated with plate boundary tectonics, mid-Tertiary volcanism and development of the Rio Grande rift. The volcanic and tectonic history of the Questa area is described by Lipman (1981). Schilling (1956) described the surficial geology and early mining history at Questa.

Basement rocks in the Questa area consist of Precambrian metamorphic rocks, including schists, amphibolites and metasedimentary rocks that have been intruded by Precambrian granite. In the vicinity of the mine Precambrian rocks are exposed primarily south of the Red River. Precambrian schist and amphibolite are overlain by a Tertiary aged (40-35 m.y.) sequence of intermediate volcanic rocks. These volcanic rocks were intruded and overlain by Miocene aged (23 m.y.) granitic rocks and associated cogenetic silicic volcanic rocks. Rocks associated with these episodes of volcanic activity correspond to the upper and lower volcanic sequences defined by Molycorp geologists and others who have investigated local geology and mineral resources.

The granitic and aplitic intrusives at Questa and the surrounding region have been interpreted to be part of a regional batholithic complex Following the pulse of intense Miocene volcanic activity at Questa, the Questa caldera collapsed into the underlying batholith Evidence of the existence of the Questa caldera includes the presence of a thick sheet of welded tuff and megabreccias that have been interpreted by others, as intra-caldera fill and collapse breccias, respectively

Later north-south oriented normal faulting associated with crustal extension and the development of the Rio Grande rift zone has exposed the caldera core and ring fracture The trace of the caldera is truncated to the west by later rift-associated faulting and buried by younger sedimentary rocks

Intrusions, mineralization and alteration in the Questa molybdenum mine area were focused along the southern portion of the ring fracture that defines the wall of the Questa caldera Structural deformation associated with caldera collapse and concurrent rift development prepared the area for emplacement of rhyolitic and aplitic intrusives and the migration of mineralizing hydrothermal fluids

In the mine area, hydrothermal alteration is intense and wide spread as indicated by the existence of areas locally referred to as hydrothermal scars The hydrothermal scars appear to be spatially related to Tertiary rhyolitic intrusive plugs The cores of the scar areas are highly brecciated erodible and, where well developed, support little vegetation Mineralization in hydrothermal scar areas consists primarily of pyrite although chalcopyrite quartz and carbonates are also present Secondary minerals in the hydrothermal scars include kaolinite and sericite, and weathering has produced limonite, jarosite, copper and manganese oxides and selenite gypsum

Mineralization at Questa is associated with the mine aplite and consists primarily of a zone of closely spaced high grade molybdenum veins in the outer shell of the aplite intrusive (the mine aplite) that locally extends into the surrounding volcanic rocks

1 1.4 Environmental Setting

1.1.4.1 Physical Conditions

The mine is located within an area of high topographic relief Elevations at the site range from approximately 7550 feet adjacent to the Red River below the mine to over 10,750 feet at the divide between the Red River and Cabresto Creek drainage basins north of the mine area. The mine site and surrounding area are dissected by deeply incised valleys North of the Red River, many of the valleys contain areas of hydrothermal scar

Areas exhibiting the most intense hydrothermal alteration are identified by highly erodible material that supports little or no vegetation These areas are contained within larger zones that have been subjected to varying degrees of hydrothermal alteration and mineralization The hydrothermal scars have produced periodic mud and debris flows and, locally, thick alluvial mud flow debris has accumulated adjacent to the Red River

Outside the mine area, the hydrothermal scars continue to generate mud flows and contribute to the sediment loads in the Red River due to the high degree of erodibility In the mine area surface water and sediment generated from naturally occurring hydrothermal scars are contained within Molycorp s surface water and sediment collection facilities

1.1.4 2 Geochemical Conditions

Under low flow conditions, the Red River exhibits a milky white appearance that has been attributed to the formation of aluminum hydroxide that occurs when low pH water containing dissolved aluminum mixes with the neutral pH water in the Red River The aluminum hydroxide precipitates and forms fine particles that tend to remain in suspension for an extended period of time The milky appearance of the Red River has been observed upstream and downstream of the mine site Aluminum in the Red River, as well as other metals and sulfate, are potentially derived from both mine waste sources and naturally occurring hydrothermal scars

Prior to the initiation of mining at Questa, the quality of the Red River was impacted by drainage from hydrothermal scars Place names such as Sulphur Gulch, Bitter Creek and Red River allude to the conditions that existed when the region was settled and the mineral resources at Questa were identified Drainage from hydrothermal scars contains elevated concentrations of sulfate, fluoride and dissolved metals Scars located outside the mine site, such as those in Hansen Creek and Haut N Taut Creek, will continue to contribute to the concentration of sulfate and metals in the Red River as they did prior to the initiation of mining operations at Questa

Within the mine site, hydrothermal scars occur in Capulin Canyon, Goathill Gulch, Sulphur Gulch and beneath the waste rock placed adjacent to the Red River Prior to the mining operation, these areas contributed runoff and subsurface drainage containing elevated sulfate, fluoride and metals to the Red River Currently, the majority of seepage and surface runoff from mine area hydrothermal scars is collected in Molycorp s seepage and runoff collection systems

1 1.5 Mine Operations

The site has been the focus of several periods of exploration and mining dating from 1920 Both underground and open pit mining methods have been employed at the site Facilities include the existing open pit, old and new underground mining areas, waste rock disposal areas, a mill site and a tailings impoundment located approximately 6 miles west of the mine adjacent to the town of Questa

The last period of mining activity at the new underground workings was terminated 1992 due to general economic conditions, however, developed reserves remain in place in the new underground mine Following the cessation of underground mining, the mine was placed on care and maintenance and the underground workings were flooded Underground mine water is periodically pumped to the nearby tailings impoundment to maintain the underground mine water level below the elevation of surface openings Mine dewatering has recently been commenced

1.1.6 Mining Impacts

1.1.6.1 Physical Impacts

Physical impacts at the site are primarily associated with open pit mining operations. In addition to the open pit, these operations resulted in the placement of approximately 328 million tons of waste rock in the mine waste rock disposal facilities.

Local drainage patterns have been altered as a result of mining and the implementation of Molycorp's surface water management and sediment collection program. Currently, surface water and seepage from areas in upper Sulphur Gulch drain through the open pit and are collected in the underground mine workings.

A caved area was developed over the new underground mine area in Goathill Gulch. This area intercepts subsurface flow and seepage from upper Goathill Gulch, as well as mine waste impacted seepage that is intercepted in Capulin Canyon and transferred to Goathill Gulch through a horizontal drainage borehole.

All watersheds within the mine disturbed area contain exposures of hydrothermal scar. These drainages are equipped with surface water and sediment collection facilities that prevent discharge of surface water and sediment from the mine disturbed area to the Red River.

1.1.6.2 Geochemical Impacts

At present, the extent of impacts to local water resources from mine disturbed materials is unknown. Acid rock drainage (ARD) has been observed at the site. ARD is associated with the waste rock generated during open pit mining operations and specifically, from material that appears to have been derived from the hydrothermal scar located in upper Sulphur Gulch. This material has been placed in several of the waste rock disposal areas. Drainage affected by ARD from the waste rock is similar in composition to drainage from hydrothermal scar areas and contains elevated sulfate, fluoride, aluminum, iron, manganese, copper and zinc.

Most of the surface water and seepage impacted by acid generating waste rock, as well as the runoff and subsurface drainage affected by the hydrothermal scars within the mine area, is collected in the underground workings and has no impact on Red River water quality. Affected seepage is collected in the new underground mine area through drainage into the floor of the open pit, and from the caved area in Goathill Gulch.

The potential exists for a portion of the seepage from waste rock placed in Capulin Canyon to bypass the seepage collection and pump back system located in Capulin Creek. Seepage from the waste rock disposal areas located adjacent to the Red River and from upper Capulin Canyon potentially contributes sulfate and metals to the Red River, however, hydrothermal scars located in upper Capulin Canyon and beneath the waste rock disposal areas are also potential sources of sulfate, aluminum and other metals. The relative contribution of mine waste and naturally

occurring hydrothermal scars to the sulfate and metal concentrations in the Red River is currently unknown

1.1.7 Other Impacts

The Red River area has experienced considerable growth and development during the period of active mining operations at Questa Most notable is the development associated with the commercial skiing facilities in Red River Many new homes have been and are being constructed in the Town of Red River Existing roads have been improved and new roads have been constructed in residential areas Development also includes new surface water management facilities such as storm drains and highway culverts The area's National Forest attracts visitors who participate in outdoor recreational activities that include hunting, fishing and off-road vehicle use

While the impacts associated with residential, recreational and commercial development have not been investigated as part of this study or quantified by other sources these activities have contributed to current water quality conditions in the Red River Physical impacts that can alter regional water quality include alteration of local surface water drainage patterns, increases in runoff resulting from development and increases in erosion Areas of hydrothermal scar occur in the vicinity of the town of Red River where most development has occurred, and in areas frequented by outdoor recreationists The disturbance of these areas has potentially altered both the sediment loads in the Red River, and the quality of surface runoff

1.1.8 Study Approach and Scope

Steffen Robertson and Kirsten (U S) (SRK) has been commissioned by Molycorp to conduct a geochemical assessment of the mine area and a geochemical characterization of the waste rock The purpose of this work is to determine the geochemical properties of mine waste materials at the site assess the current state of acid generation in the mine and the potential for future acid generation, and identify potential areas of concern with respect to impacts to local and regional water quality resources The data obtained from the geochemical assessment will form part of the basis for the development of a closure and reclamation plan for the site

The work has been performed with assistance from Vail Engineering Inc for the characterization of regional and local hydrological conditions and in developing water quality data for springs and seeps identified in the mine area and in the Red River

To conduct the study, SRK personnel visited the site in October 1994 and conducted the following work

- Collection of water samples from mine waste and hydrothermal scar impacted areas to determine the chemical composition of drainage from each source,
- Field testing of paste pH and total dissolved solids content (paste TDS) to determine the present state of acid generation in the mine waste rock,

- Collection of waste rock samples to determine acid generating potential and leachable metals content
- Collection of samples from hydrothermal scars to determine acid generating potential and leachable metals content
- Collection of samples of soils, colluvium and alluvium unimpacted by the mining operation to determine background geochemical conditions
- Review of mine records to assist in determining the mine operational and waste placement history and
- Review of water quality monitoring data collected by Molycorp

As discussed above, the Red River was impacted by conditions that existed prior to the initiation of mining activities at Questa Therefore, the geochemical assessment of the mine area included an investigation of the geochemical properties of naturally occurring hydrothermal scar areas located in and adjacent to the mine site to assess the potential impacts of these areas on local surface water and groundwater quality

1.1.9 Report Content

The remainder of this section of the report (1 2 to 1 5) describes the existing mine site conditions, including its development history (section 1 2), the water quality that is derived from both natural scar areas and the mine disturbed area (section 1 3), the drainage routes from the various water sources (section 1 4), and the water quality at the various springs and monitoring wells along the Red River (section 1 5)

Section 2 0 describes and summarizes the hydrological investigations that have been performed in order to develop an understanding of the hydrological conditions influencing the movement of contaminants from the point where they are generated (sources) and the receiving waters

Section 3 0 describes the geochemical characterization work performed to better understand the geochemical conditions and processes that have, and are occurring at the source locations

Section 4 0 provides an overall summary and conclusions and this is followed in section 5 0 by recommendations for the next phase of more detailed investigation of mine waste geochemical characteristic and behaviour

1.2 Mine Layout and Development History

1.2.1 Early Underground Mining Operations

Small scale mining operations were initiated at Questa in 1918 In 1920, the Molybdenum Corporation of America acquired several claim groups and commenced underground development

and mining Early underground mining was concentrated in the Sulphur Gulch area in and beneath the area presently occupied by the open pit

Over 35 miles of underground workings were developed Early mining operations were conducted by tunnelling and stoping, and targeted the high grade vein deposits that occur in the mine aplite Over 18 million pounds of concentrates were produced prior to 1956 The old underground workings were accessed from openings in Sulphur Gulch, and from the 7960 adit that daylights adjacent to the Red River approximately 1/2 mile east of its confluence with Columbine Creek The development rock and facilities near the 7960 adit and the old tailings deposits at the current mill site are the only surface remnants of the early underground mining operation

1 2.2 Open Pit Mine

Open pit mining operations were conducted between 1965 and 1983 During this time, facilities near Questa were constructed for tailings disposal This facility now contains approximately 95,000 000 tons of flotation tailings

Approximately 328,000,000 tons of waste rock were produced during open pit mining and placed in waste rock disposal areas located in Capulin Canyon, Goathill Gulch, Spring Gulch, in the mine pit area (in-pit waste disposal area), and adjacent to the Red River in the Sugar Shack South, Middle and Spring and Sulphur Gulch waste rock disposal areas. Waste rock quantities in each waste disposal area are summarized in Table 1 1 The general composition and geochemical characteristics of the waste rock located in each of the waste disposal areas is discussed in Section 3 0

Historical records concerning the development of the waste rock disposal areas are limited In general mixed volcanic waste rock excavated from the Sulphur Gulch hydrothermal scar area of the western pit zone was deposited in the Blind Gulch, Goathill, Sugar Shack South, Sugar Shack West Middle and Spring and Sulphur Gulch waste rock disposal areas The mixed volcanic rocks were derived from the upper rhyolitic and lower andesitic series rocks of Tertiary age Much of the mixed volcanic waste rock was derived from the Sulphur Gulch hydrothermal scar area

Molycorp aerial photographs indicate that the disposal of the mixed volcanic waste rock was typically accomplished by end dumping at the upper dump limits of the waste rock disposal areas Based on materials exposed on the surface mixed volcanic waste rock composes the majority of the waste rock located west and south of the open pit

The remainder of waste rock was derived from propylitic black andesite generally located in the southern pit area, and aplite and granite from the eastern pit area The majority of this waste rock was placed in Spring Gulch, Spring and Sulphur Gulch and locally within the in-pit disposal areas Later in the open pit mine operation, these materials were used to armor the lower faces of the Middle, Sugar Shack South and Spring and Sulphur Gulch waste disposal areas

1.2.3 New Underground Mining Operations

Underground mining at the new site was conducted between 1983 and 1992 by block caving methods. The surface facilities at the new mine site were developed in Goathill Gulch by side hill cut and fill methods. The mine development was conducted from two shafts sunk to the mine haulage level (7130 elevation). A decline was driven from the existing mill area to the mine haulage level to facilitate the transport of ore to the mill facilities. The old underground mine workings were connected to the new workings by a vertical borehole from the decline. The relationship of the major surface and underground mine features is shown schematically on Figure 1.3. Mine development waste rock from the new underground workings was placed in a small disposal area in lower Goathill Gulch.

A caved area has developed in Goathill Gulch above the block caving area. Surface water in Goathill Gulch drains to the underground workings through the broken rock in the caved zone.

Following cessation of mining operations in 1992, the new underground workings were flooded. Mine dewatering recommenced in December 1994, and mine water is being discharged to the tailings impoundment near the town of Questa. Prior to mine dewatering, the water level in the underground workings had recovered to an elevation of 7600 feet.

1.3 Characteristics of Hydrothermal Scar and Mine Waste Drainage

During the October 1994 site visit, surface runoff and seepage samples were collected from mine waste and hydrothermal scar areas. The characteristics of the runoff and seepage from mine waste and hydrothermal scar areas have been determined to allow a comparison with site water quality monitoring data contained in Section 1.5. The current fate and/or management of the runoff and seepage from these areas is discussed in Section 1.4.

1.3.1 Characteristics of Hydrothermal Scar Drainage

As discussed above, areas of hydrothermally altered rock contribute surface water and groundwater seepage to the Red River. The distribution of hydrothermal scars in the vicinity of the mine is shown on Figure 1.4. These areas are representative of the most intense alteration and are commonly treeless, highly erodible, and often sources of periodic mud and debris flows. These scars are often part of larger altered zones that may be characterized by thin vegetative cover, a high degree of fracturing, moderate erodibility, mineralization and low pH runoff and seepage. Figure 1.4 indicates the approximate limit of the altered zone that extends from Sulphur Gulch, through Goathill Gulch into Capulin Canyon.

As part of the site work conducted by SRK in October 1994, water samples from seeps and springs originating in a number of the hydrothermal scar areas were collected and analyzed to determine their contribution to local water quality. Water sampling locations are shown on Figure 1.5.

Scar areas that are unaffected by recent mining operations were identified in Capulin Canyon, Goathill Creek Canyon, upper Sulphur Gulch above the open pit and in the Hansen Creek

drainage located approximately 2 miles east of the mine site Water quality in seepage and runoff from undisturbed scar material is summarized in Table 1 2

Scar seepage and runoff contain on average approximately 4000 mg/l sulfate Metals present in significant concentrations include calcium, iron, zinc, nickel, manganese and aluminum Traces of cadmium and chromium were also measured

Samples of runoff discharging to the Red River from local sources are shown in Table 1 3 Both Haut N Taut and Hansen Creek, located east of the mine site, contain areas of well developed hydrothermal scar Seepage from a scar area located below the mine site at the USFS Ranger station are also shown The characteristics of the surface waters from Haut N Taut and Hansen creek are similar to those of the direct scar area seepage samples collected by SRK in October 1993 and summarized in Table 1 2 Seepage water from the Ranger Station scar area exhibits very high aluminum and sulfate content and is similar in nature to the scar seepage and runoff samples summarized in Table 1 2

Table 1 2 also contains water quality data for seep sample CAP-2 (background) collected in an area that is presumed to be unaffected by mining or significant hydrothermal alteration in western Capulin Canyon The sample contained slightly elevated sulfate concentrations at 140 mg/l suggesting that areas exhibiting minor alteration may contribute significant sulfate to local surface waters The sample contained traces of dissolved iron and zinc

Selected samples from hydrothermal scar areas were analyzed for fluoride content Seepage from the hydrothermal scar in the Hansen Creek (sample HC-1) area contained fluoride at a concentration of 28 9 mg/l Seepage from undisturbed hydrothermal scars located in the Goathill Canyon and Sulphur Gulch (samples GC-6 and Pit-2) contained fluoride at concentrations of 28 5 and 34 0 mg/l, respectively

1.3.2 Characteristics of Drainage From Mine Disturbed and Mine Waste Areas

Mine disturbed and mine waste seepage and runoff sampling locations are shown on Figure 1 5 Water quality data from mine disturbed areas are summarized in Table 1 2

Mine affected drainage samples represent ARD from the Capulin (CAP1) and Goathill (GC1 and GC2) waste disposal areas, seepage from disturbed materials in the open pit (PIT 1) and temporarily ponded surface water in the Sugar Shack South and Spring and Sulphur Gulch waste rock disposal areas (WS1, SS1 and SS2) Sample WS2 was collected from a seep in lower Capulin Canyon at the Red River The water quality at this sample location is potentially impacted by both natural scars and seepage from the Capulin waste rock disposal area

From a comparison of water quality, both mine impacted and scar impacted drainage exhibit similar pH conditions With the exception of iron, the sulfate and metals concentrations in mine waste impacted water appears to moderately exceed that of scar impacted water The most substantial increases in ion concentrations in mine waste impacted drainage over that of drainage from the hydrothermal scars appear to be sulfate, aluminum, manganese and zinc

Selected samples of mine waste drainage were subjected to analysis for fluoride Seepage from the failed pit wall area (sample Pit-1) contained fluoride at a concentration of 3 55 mg/l Drainage from the waste rock in Capulin Canyon (sample Cap-1) contained fluoride at a concentration of 39 5 mg/l

1.4 Fate of Natural and Mine Impacted Drainage

1.4.1 Drainage from Hydrothermal Scars

1.4 1.1 Physical Conditions

Previous to mining operations drainage from hydrothermal scar areas in the mine area discharged to the Red River through groundwater flow and surface water runoff

Presently, runoff and seepage from the Sulphur Gulch scar is intercepted by the pit and drains to the underground mine workings

Goathill Gulch is almost entirely located within an area of well developed hydrothermal scar Currently, seepage and runoff from the majority of scar areas in Goathill Canyon flow into the new underground mine through the caved zone Surface runoff from the area located below the caved zone is intercepted by Molycorp s surface water management facilities Groundwater flow through scar derived alluvium to the Red River may still occur from below the caved area

Hydrothermal scars are located in the upper and lower reaches of the Capulin Canyon In upper Capulin Canyon, the hydrothermal scar has been buried with waste rock Seepage from the scars and waste rock are currently collected in a series of surface impoundments and pumped to Goathill Gulch where they enter the new underground mine workings Surface water flow in Capulin Canyon to the Red River is prevented by Molycorp s surface water management facilities

Scar areas occur beneath the Sugar Shack South and Middle waste rock disposal areas Prior to development of the waste rock disposal sites these areas discharged surface runoff, sediment and groundwater seepage to the Red River Presently, surface runoff is collected by Molycorp s surface water management facilities and sediment is no longer generated from buried scars Mining activities have not altered the potential for subsurface flow from hydrothermal scars beneath the Sugar Shack South and Middle waste rock disposal areas to the Red River

1.4.1.2 Chemical Conditions

Drainage and surface runoff from the hydrothermal scars has occurred over geologic time. As such, the neutralization potential and sulfate, acidity and metal attenuating capacity of seepage and surface water flow paths have been consumed Therefore, the hydrothermal scars represent a mature source of metals, sulfate and low pH drainage, and the contribution of hydrothermal scars to local surface water and groundwater quality is influenced only by long term variations in climatic conditions

During periods of high precipitation the rates of affected runoff and subsurface seepage from hydrothermal scar areas will increase Following extended periods of above normal precipitation spring and seepage flow from hydrothermal scars to the Red River would be anticipated to increase Conversely during drought conditions, affected spring and seepage flow would be reduced

The quality of seepage and runoff from hydrothermal scars, prior to the construction of the mine surface and seepage collection systems and the alteration of pre-mine flow paths, was likely similar to present scar area water quality as discussed in Section 1 3 1

Currently the majority of seepage and runoff from hydrothermal scar areas within the mine area is collected in the underground workings Mine water is pumped to the tailings impoundment located west of Questa in order to maintain the underground mine water level below elevation of surface openings In contrast to pre-mine conditions, hydrothermal scar impacted drainage from the mine area that is collected in the underground mine currently has no impact on Red River water quality Those hydrothermal scars located outside the mine contribute sulfate and metals to the Red River as they have over geologic time

1.4.2 Mine Disturbed Areas

1.4 2.1 Physical Conditions

Runoff and seepage from the pit and in-pit waste rock disposal areas is collected in the open pit and drains to the underground workings through the pit floor The majority of the seepage from the Capulin Creek waste rock disposal area is collected in a series of surface impoundments and discharged to Goathill Creek through the horizontal borehole Seepage from the Capulin and Goathill waste disposal areas then enters the underground workings through the caved area in Goathill Gulch

The water level in the new underground workings is maintained at an elevation well below Red River by the mine dewatering Direct discharge of underground mine water through existing mine openings to Red River does not occur The potential for releases from the mine workings through subsurface flow is under investigation However, previous hydrogeological assessment work indicates low potential for a significant hydraulic connection of the new underground mine to the Red River

Direct surface runoff from disturbed areas to the Red River does not occur under normal conditions All significant areas of mine affected drainages contain surface water and sediment impounding facilities

Potential paths of mine impacted drainage flow to the Red River include seepage and groundwater flow from the Capulin, Sugar Shack South, Middle and Spring and Sulphur Gulch waste rock disposal areas through alluvium and geologic structures possessing high hydraulic conductivity

1.4.2.2 Chemical Conditions

The mine affected seepage and runoff from the in-pit, Capulin and Goathill waste rock disposal areas is collected in the new underground workings The quality of mine waste drainage is improved through neutralization by the alkalinity contained in the mine wall rocks and the rubblized rock in the caved zone Mine water is pumped to the tailings impoundment located west of Questa in order to maintain the underground mine water level below the elevation of surface openings Therefore, mine affected drainage collected in the underground mine has no impact on Red River water quality

The fate of mine waste impacted seepage from the Sugar Shack South, Middle and Spring and Sulphur Gulch waste rock disposal areas (the seepage that is currently not collected in the underground mine) is affected by several conditions

- The mine waste rock represents a relatively new source of sulfate, acidity and metal loads The process of acid generation within these areas may not be mature and the quality of seepage that currently migrates from these areas may be expected to change with time.
- As the mine waste has been in place for a relatively short period of time, the acidity, sulfate and metal attenuation capacity of the underlying rock and alluvium may not be consumed. and,
- The current extent of the migration of contaminated seepage plumes from these area may be limited by attenuation in the alluvium

1.5 Water Quality Conditions

Table 1 4 summarizes recent and current water quality data from local springs and seeps, the under ground mine workings, and water supply and monitoring wells The locations of springs and monitoring wells are shown on Figure 1 6

The data contained in Table 1 4 is selected from Molycorp data files and does not contain all available data The most recent data were selected for inclusion Partial data from monitoring wells is included for the purposes of comparison to the larger historic data base that typically includes fewer analyses Red River and Columbine Creek water quality data from November 1993 is shown in Table 1 5

1.5.1 Springs Discharging to Red River

Springs at the mouth of Capulin Canyon contain sulfate in the range of 1000 to 1276 mg/l They also contain concentrations of aluminum, manganese, zinc and copper that are higher than measured in other local springs and seeps adjacent to the river A seepage collection system was recently installed in upper Capulin Canyon to intercept ARD from the Capulin waste rock disposal area. Several scars exist in Capulin Canyon that may contribute to the quality of the springs at the mouth of the Capulin Canyon

Numerous springs and seeps have been identified in the area extending from the mouth of Sulphur Gulch to below Goathill Gulch The Highway 38 spring east of Goathill gulch appears to be impacted by either hydrothermal scar or mine waste drainage The spring lies beneath the new mine site fill area Portions of the mine site fill were derived from hydrothermal scar areas The area also contains extensive scar derived mud and debris flow deposits Sulfate and metal concentrations are relatively low in the Highway 38 spring Seepage from the Goathill Gulch scar areas (water samples CG3, 4 and 6) and the Highway 38 spring is high in manganese

The Portal Springs exhibit variable quality The pH varies from slightly acidic to neutral and sulfate concentrations are low to moderate Metal concentrations are also moderate The water quality in the Portal Springs does not appear to indicate conditions that could be identified as related to either hydrothermal scar or mine waste drainage

The cabin springs indicate moderate water quality that could be attributed to either mine waste or hydrothermal scar impacts Aluminum and manganese are elevated, sulfate concentration is moderate and pH indicates slightly acidic conditions

Questa geologists mapped northeast-southwest and east-west trending Tertiary dike swarms that intersect in the area of the Cabin Springs The northeast-southwest swarm underlies the existing Middle and Sugar Shack South waste rock disposal areas The presence of the dikes may be indicative of structurally controlled zones that hydraulically connect the foundation of Middle and Sugar Shack waste rock disposal areas and the hydrothermal scars that underlie the waste rock disposal areas to the Cabin Springs The current water quality in the Cabin Springs may be impacted by ARD from the mine waste dumps or from local scars or both The quality of the Cabin Springs is relatively good in comparison to both scar and mine waste drainage, and the signature of a specific source is not apparent

The Sulphur Gulch spring has near neutral pH and contains low sulfate and metal concentrations The spring appears to exhibit quality that reflects both the Red River water and limited impacts from mine waste or hydrothermal scar drainage

1.5.2 Underground Mine Water Quality

Selected underground mine water quality is shown on Table 1 4 In general the underground water contains low metal concentrations and moderate sulfate levels Molycorp personnel indicate that during mine operations, mine waters were non-acidic Corrosion of pipes rails and other mine equipment was not noted. The mine area rocks provide a source of alkalinity that has resulted in maintenance of neutral pH conditions in the underground mine water despite inflows of acidic water from the caved zone in Goathill Gulch and the open pit

A seep located at the 1000 foot station in the decline exhibits elevated sulfate, fluoride and metal concentrations The source of the station 1000 seep appears to be dump drainage

1.5.3 Water Supply Wells

The Columbine Cabin and Molycorp Cabin wells are located in the vicinity of the confluence of Columbine Creek and the Red River. The Molycorp well exhibits water quality similar to the Red River. The Cabin and Columbine wells exhibit elevated sulfate levels that indicate potential impacted from hydrothermal scar and/or mine drainage sources. The quality of water in the Mill well is comparable to that of the Red River.

1.5.4 Monitor Wells

Monitor wells indicated on Figure 1.6 were installed in 1994. Both alluvial fill wells and bedrock wells were installed adjacent the Red River in locations beneath the mine and waste disposal sites.

Wells in Capulin Canyon (MMW-2 and MMW-3) exhibit low pH in the alluvium and neutral pH in the groundwater at depth. The shallow alluvial water exhibits a higher dissolved metals content while sulfate concentrations are similar at depth. The neutral pH conditions at depth would lead to precipitation of dissolved metals and a reduction of metal concentrations.

Zinc is elevated in the shallow alluvial water (9.48 mg/l) and at low levels at depth. Seepage from hydrothermal scar in Capulin Canyon (CAP4 in Table 1.2) exhibited low zinc concentrations (2.08 mg/l) while water samples collected from ARD below the Capulin waste dump exhibited high zinc content. The data suggest that the shallow alluvium in Capulin Creek may be impacted by mine waste drainage. The sulfate and metal concentrations in the deeper bedrock are potentially a result of mine waste or hydrothermal scar drainage.

Well MMW-7 was placed in bedrock in the mine area between the No. 1 and 2 shafts. The quality of water in the well is poor and it contains dissolved aluminum and sulfate concentrations that exceed those measured in scar drainage and mine waste seepage samples. The source of poor quality water in well MMW-7 is unknown. It is not consistent with the underground mine water quality.

Wells MMW-8A and MMW-8B were placed in bedrock and alluvium, respectively, in the sewage pond area below the new mine site. Both wells exhibit neutral to near neutral pH. Sulfate concentrations are moderate. Well MMW-8A indicates elevated iron and zinc content at depth that is potentially an impact of mine waste or hydrothermal scar drainage.

Wells MMW-10A, 10B, 10C and 11 were placed beneath the Sugar Shack South waste rock disposal area at depths indicated in Table 1.4. Sulfate concentration is lower in the shallow alluvium that in deep alluvium or bedrock, possibly indicating mixing with water in the Red River alluvial aquifer. All wells indicate elevated aluminum and manganese. The quality of water in this area is consistent with drainage from either hydrothermal scar or mine waste.

1.5.5 Red River Water Quality

Vail (July 1993) conducted a study of the quality of water in the Red River in an attempt to identify sources of acidity and metal loading A portion of the results of the November 1993 sampling are presented in Table 1 5 Sampling locations in the vicinity of the mine site are shown on Figure 1 7

Water quality data was collected during a period in which the river historically approaches its low flow condition As such the data better indicate local water quality impacts because the effects of dilution by stormwater runoff are minimized

The November 1993 data indicate that at a point above the mill site (station 7), sulfate concentration was 80 mg/l Below the Capulin Canyon, sulfate concentration increases to 133 mg/l Increases in the loading rates of TDS, TSS, aluminum, iron, manganese and zinc are also indicated by the data

Estimated loading rates for sulfate and selected metals are listed in Table 1 6 At near low flow conditions, the sulfate loading rate is approximately 2768 kg/day at station 7 Downstream of Capulin Canyon (below the mine site and mine area hydrothermal scars) sulfate loading increases to 8741 kg/day

1.5.6 Columbine Creek

The concentration of selected constituents in Columbine Creek in November, 1993 is shown in Table 1 5 Hydrothermal scar development, and the more widespread mineralization and alteration associated with the ore deposits at Questa does not occur to the same degree south of the Red River In November 1993 Columbine Creek contained 2 mg/l sulfate and trace concentrations of aluminum, iron, copper, zinc manganese and fluoride

1.6 Premine Water Quality

Water quality data that predate the mining operations at Questa are not available Periodic sampling surveys have been conducted by the now defunct U S Department of Health Education and Welfare (HEW), by the EPA and others The earliest water quality data are from the HEW which were obtained in 1965 The sampling post dates the early underground mining operations (1920 to 1956) and occurred near the time of the initiation of open pit mining activities

Data developed by HEW in 1965 are summarized in Table 1 7 For comparison, water quality data collect by Vail in November 1993 for approximately equivalent sampling locations are shown In comparison to the 1965 data, increases in sulfate TDS, iron and zinc are indicated These increases occur both above and below the mine site

Total suspended solids (TSS), which would be influenced by rates of erosion and sedimentation, were elevated in 1965 in the samples collected upstream from the mine site Samples collected at the Questa ranger station indicate an increase in TSS in 1993

In reviewing the data shown in Table 1 7, consideration should be given to several factors The present database and, in particular, the past database are limited and, therefore do not represent statistically valid sample sets

The potential effects of regional development in the Red River basin on Red River water quality since collection of water samples in 1965 must be considered as having a finite affect on current (and recent) water quality

In addition, the HEW samples were collected during a period of lower than average regional precipitation and discharge in the Red River Discharge records (Section 2 3) indicate an increase in the annual average discharge in the Red River at Questa since 1978 Increased precipitation has resulted in increased runoff with an associated increase in erosion and, potentially, a resurgence of springs and seeps discharging hydrothermal scar impacted drainage to the Red River These conditions could result in the increased concentrations of sulfate, TDS, iron and zinc that are indicated by the data in Table 1 7

2.0 HYDROLOGICAL INVESTIGATION

2.1 Previous Investigations

Recently completed studies of hydrological conditions and water quality of the Red River were conducted by Vail Engineering (Vail) in July 1993 and South Pass Resources Inc (SPRI) in June 1994 Water quality data collected by Molycorp from Red River, tributary drainages, springs and seeps and the underground mine workings has been introduced in Section 1 of this report

Vail researched historic discharge records for the Red River Basin and historic water quality data Red River water quality data that predate the mining activities at Questa are not available Chemical surveys of sulfate gain in the river conducted by various parties in 1965, 1970, 1988, 1992 and 1993 were evaluated with respect to historic discharge records Variations in sulfate gain below Columbine Creek (below the waste rock disposal areas) were investigated.

Vail has noted that sulfate gains could not be directly correlated with the zones effected by operations at the mine and postulated that sulfate gains may also be influenced by long term variations in precipitation Stream flow records indicated near drought conditions in the period from 1970 to 1978 An increase in precipitation and discharge since 1978 may have resulted in an increase in scar erosion as well as a resurgence in flows from springs and seeps, and thus the quality and quantity of the discharge waters impacted by the hydrothermally altered areas above at and below the mine site

A detailed water sampling study was conducted to identify sources and locations of elevated metals and sulfate input to the Red River The study involved collection of water samples from below the Questa Ranger Station to the area above the town of Red River, New Mexico Subwatershed contributions to the Red River were estimated in order to develop an accretion profile for the development of a chemical mass balance model of the river

It was noted that the mass loading of aluminum several metals, fluoride and sulfate increases in a downstream direction in the Red River The most significant increases appear to be related to areas where hydrothermal scars are developed The contribution of hydrothermal scars located in the western reaches of the river to aluminum and sulfate loading appears to be greater than those located above the mine site and the town of Red River The greatest increases were noted in the area near the Questa Ranger Station where the scars occur in close proximity to the river Minor increases in sulfate and aluminum loading were noted in the reach adjacent to the mine waste rock disposal areas located at and below Sulphur Gulch where several springs and seeps discharging low pH (3 5 to 5 0) water were identified

Sulfate and aluminum loading were found to be more significant during periods of low flow in the Red River Additional water quality data collected by Vail in the November 1993 were introduced in Section 1

SPRI conducted a hydrological and hydrogeological assessment of the Questa site in June, 1994 Primary hydrogeologic units identified by SPRI include the Tertiary volcanic rocks that exhibit

secondary permeability as a result of fracturing and faulting, alluvial mudflow deposits and Red River alluvium.

SPRI noted that during dewatering of the new underground mine workings, no affect on the rates of groundwater recharge to the Red River in the vicinity of the mine was observed It was postulated that a weak hydraulic connection exists between the new underground mine and the river It was noted that dewatering rates in the new underground mine were approximately 225 gpm Approximately 50 gpm of the mine water inflow was from the "rain forest" area located in the north of the underground mine at the haulage level Dewatering rates in the old underground workings were reported to be between 15 to 30 gpm Thus the inflow into the underground workings is very small compared with the surface and shallow alluvial and upper fractured bedrock groundwater flow quantities.

Based on observations of water levels in local monitoring wells and the rate of underground mine rewatering, SPRI estimated the configuration of the post mine rewatering piezometric surface It was predicted that points of discharge from the underground mine workings, if dewatering or pumping was ceased, would be the 7960 adit and through the alluvium south of the caved zone in Goathill Gulch

SPRI reviewed Red River accretion studies conducted by Vail and previous investigators and estimated groundwater recharge rates to the Red River to be between 0 66 and 1 6 cfs for the area between Sulphur Gulch and Capulin Canyon

2.2 Data Developed for This Study

Additional hydrological evaluation of the mine area and the Red River basin is being conducted by Vail Engineering Ongoing work includes estimation of average monthly yields for all subwatersheds within the Red River catchment above the Questa Ranger Station gaging station

Subwatersned contributions to the Red River were estimated on the basis of a precipitation versus elevation relationship that accounts for observed variations in precipitation with elevation The combined subsurface and surface water contributions of the subwatersheds were calibrated against discharge records for the stream gage at the Questa Ranger Station

2.3 Regional Watershed

The mine facilities at Questa are contained entirely within the Red River basin The basin upstream from the Questa Ranger Station covers an area of 112.7 square miles Elevation ranges from approximately 7,450 feet at the Questa gaging station to over 12,000 Average annual precipitation rates vary over the basin as a function of elevation Below 9,000 feet annual precipitation is approximately 18 inches per year, and between 9,000 and 11,000 feet. annual average precipitation is approximately 35 inches Annual snowfall can exceed 100 inches

USGS discharge records from the Questa Gaging Station for the period from 1913 to 1925 and 1927 to 1965, when no diversions were in effect at the mine, indicate an average annual discharge

of 55 9 cfs Records for the period from 1961 to 1993 indicate an average discharge of 41 6 cfs Annual average discharge for the period from 1961 to 1993 are summarized in Table 2 1

The region, has been subject to long term variations in precipitation and runoff Figure 2 1 illustrates graphically the data contained in Table 2 1 For the period between 1961 and 1978, the average annual discharge at the Questa Ranger Station was 33 1 cfs For the period between 1978 and 1993, mean annual discharge was 52 2 cfs The average annual flow for 1991 to 1993 was 59 2 cfs These large variations of flow also indicate that substantially different rates of erosion and seepage from natural scar areas would have accompanied the natural variations in weather conditions The assessment of mine impacts on Red River drainage water quality must take into account the likely natural variations in contaminant loadings due to these variations of weather Note that the open pit mine operation was from 1965 to 1983 and the new underground mine operation extended from 1983 to 1992

The average monthly discharge in cfs for water years 1966 to 1993 at the Questa gaging station is summarized in Table 2 2

Peak discharge occurs in May and June as a result of snowmelt in the higher elevations of the Red River basin Low flow conditions occur from November through March with the lowest flows recorded in January

2.4 Subwatersheds

An analysis of subwatershed yields to the Red River was conducted for this study The overall Red River catchment was subdivided into individual subwatersheds and incremental areas were determined for each subwatershed by elevation The areas of known hydrothermal scars within each subwatershed were also determined

Subwatershed yields that include the combined surface runoff and groundwater flow contributions were calculated Calculated yields for the overall basin were combined, compared to gaging station records and calibrated based on average monthly discharge conditions A subwatershed map and tabulated yield data are contained in Appendix A The estimation of the relative subsurface and surface contributions is in progress

In the vicinity of the mine, Columbine Creek contributes the most significant quantity of flow to the Red River The estimated combined surface and subsurface contribution of Columbine Creek to the Red River ranges from 2 4 to 28 4 cfs Other basins in the mine area contribute average surface and subsurface flows of up to a few tenths of a cfs

2.5 Hydrothermal Scar Areas and Flows

Hansen Creek (Figure 1 2) is representative of a small subwatershed in which a relatively high percentage of the surface area is in hydrothermal scar The surface area of the Hansen Creek subwatershed is approximately 0 11 square miles and hydrothermal scar covers approximately 0 077

square miles At low flow conditions, the average surface and subsurface contribution of Hansen Creek is approximately 0 1 cfs

Other areas of hydrothermal scar are located in the drainages above and below the mine site The area north of the Red River between Hansen Creek and the town of Red River contains several well developed scars that have produced mud and debris flows in the past and will continue to do so following periods of high runoff in the future These subwatersheds contribute average yields of a few tenths of a cfs to the Red River under low flow conditions They are also continuing sources of low pH water containing elevated dissolved metal concentrations and the runoff from these areas also contributes to the sediment loads in the Red River

2.6 Site Impacted Subwatersheds

2.6.1 Pre-mine Conditions

Subwatersheds that contain significant areas of hydrothermal scar include Capulin Creek, Sulphur Gulch and Goathill Gulch and the areas occupied by the Sugar Shack South and Middle and rock disposal areas (Figure 1 4)

Prior to development of Molycorp s surface water management facilities, mining in the open pit and development of the caved area, these drainages contributed surface runoff and groundwater flow to the Red River The quality of these flows, like those derived from areas outside the mine site, were impacted by drainage from the hydrothermal scars Runoff from these areas also contributed to the sediment loads, sulfate and metals concentrations in the Red River Vail (1993) estimated that historic surface flow from Sulphur Gulch was approximately 30 gpm (0 07 cfs)

In periods of high runoff, the hydrothermal scar areas also produced mud and debris flows Significant accumulations of mud flow deposits that pre-date the mine can be seen at the mouths of Capulin and Goathill canyons These scar derived mud flows represent distributed sources of contaminated drainage and are particularly significant as they occur directly in the surface water drainage path They yield both suspended solids to surface flows, as a consequence of erosion, and dissolved contaminants, as a consequence of subsurface leaching

Based on subwatershed yields estimated by Vail (Appendix A) for pre-mine conditions, the combined surface and subsurface contribution from mine impacted drainages is estimated to have been on the order of 0 4 cfs under low flow conditions

2.6.2 Present Conditions

Drainage from mine impacted subwatersheds are now controlled by the mine's surface water management facilities and surface discharges to the Red River do not occur All surface water in upper Sulphur Gulch is collected in the pit area and drains to the underground workings The caved zone intercepts the drainage and shallow groundwater flow in Goathill Gulch from all areas located upstream of the caved zone The water level maintained in the underground mine is

below the elevation of the Red River as it passes the mine site Therefore, the potential for flows from the underground mine to Red River is limited

In Goathill Gulch below the caved zone, surface runoff is collected in surface impoundments Surface flow in Capulin Canyon is also impounded and retained Surface water discharges from the waste rock disposal areas adjacent to the Red River are contained in sediment collection ponds located at the toes of the waste rock disposal areas

The mud and debris flows that previously originated from these areas are controlled either through burial with waste rock or by collection in surface water impounding structures The sediment load and natural sulfate and metal loading to Red River associated with surface discharges from mine area drainages have been substantially eliminated by Molycorp's surface water management facilities

Groundwater flow from these areas still occurs but the rate of subsurface flow is currently undefined. The groundwater drawdown cone that has developed around the mine captures much of the groundwater flow in the low permeability bedrock The main potential source of groundwater flow to the Red River is the flows of groundwater in the shallow alluvial and upper fractured bedrock perched water systems Seepage through the waste rock disposal areas and the shallow underlying colluvium and alluvium potentially contributes to the quality of springs and seeps that have been identified adjacent to the Red River near the mine site Potential pathways for seepage migration include through the alluvium and in structurally controlled zones of high permeability in bedrock

3.0 GEOCHEMICAL CHARACTERIZATION

3.1 Previous Studies

Previous geochemical characterization studies have been conducted by Vail (1993) and Molycorp personnel. The majority of this work involved sampling of local surface water and groundwater. Vail investigated the hydrothermal scar areas to determine their contribution to local and Red River water quality. Vail and Molycorp have investigated springs and seeps in the area and conducted an accretion and metal loading study of the Red River. These data were introduced in Section 1.0.

Molycorp continues to monitor surface water and underground mine water quality. Direct geochemical testing of mine waste and disturbed material has not been undertaken prior to this study.

The geology, mineralization and alteration at the site have been described by Shilling (1956) and later by Molycorp geologists.

3.2 Data Collected for This Study

The following geochemical testing was undertaken for this study,

- Field testing of the paste pH and paste TDS of mine waste, hydrothermal scar and mine disturbed areas to assess the present acid generating condition of materials in and adjacent to the mine site,
- Whole rock analysis of field samples by digestion and ICP scan,
- Collection of water samples for chemical characterization of drainage from mine waste and undisturbed hydrothermal scar areas,
- Static testing of waste rock, hydrothermal scar materials and old tailings to determine acid generating potential, and
- Shake flask testing of mine waste, hydrothermal scar and undisturbed materials to determine the soluble and leachable metals content, and potential effects of disturbed and undisturbed areas on surface water and groundwater quality.

Selected samples of alluvial material from the areas of springs and seeps discharging to the Red River were also subjected to titration testing to determine their potential to attenuate acidity.

Descriptions of the test procedures used in geochemical characterization of the site and the interpretation of test results are described in Appendix B. Complete test results are listed in Appendix C.

The purpose of this work was to enable the geochemical characterization of the mine waste at the site and assess the current behaviour of the waste, identify potential sources of sulfate and metals and to assess potential long term waste behaviour and drainage water quality Soils, rock colluvium and alluvium from undisturbed areas were tested to determine the potential contribution of materials unaffected by the mining operation to local and regional surface water and groundwater quality As the areas of hydrothermal scars have a significant influence on regional and local water quality, hydrothermal scar samples obtained inside and outside the mine area were subjected to the testing described above

3 3 Surficial Geochemistry

3.3.1 Geochemical Properties and Drainage Chemistry of Hydrothermal Scars

Characterization of the geochemistry and current contaminant yield from the hydrothermal scar material is important, not only to estimate the total contaminant contribution from scars to the Red River, but also to obtain a better understanding of the long term evolutionary processes of the exposed sulfitic rocks of the region The mine waste is the same rock material and is expected to pass through the same evolutionary stages of acid generation and contaminant production to reach the same final condition

Metals data, ABA and shake flask data for hydrothermal scars are summarized in Tables 3 1, 3 2 and 3 3, respectively

3.3.1.1 General Description of Hydrothermal Scars

Locations of hydrothermal scar samples collected for geochemical testing are shown on Figure 3 1 Hydrothermal scars are well developed in Goathill Gulch Sulphur Gulch, Capulin Canyon and in Hansen Creek east of the mine site Scars exist beneath the cover of waste rock in Goathill Canyon, Capulin Canyon and adjacent the Red River between the mouth of Sulphur Gulch and the old underground mine site

Based on field observations, hydrothermal scars may be characterized as consisting of a central brecciated core that grades laterally to a less fractured, altered and mineralized material Where observed, the brecciated rock is non-rotational in nature and lacks secondary cementing Fracture spacings in the brecciated cores of the hydrothermal scars of 0 25 to 0 5 inches are common The high degree of fracturing and lack of cementing result in highly erodible material that lacks vegetative cover and is the source of the alluvial mudflow deposits in and beneath the canyons where hydrothermal scars are developed.

3.3.1.2 Whole Rock Analysis

Selected scar samples were analyzed for metals by ICP Test results are summarized in Table 3 1 The scar materials contain iron, potassium, calcium, sodium, magnesium and aluminum in concentrations that are consistent with the composition of typical rock forming minerals Metals present in potentially leachable concentrations, in addition to the above, include barium copper,

manganese, nickel, zinc, lead, chromium and vanadium The scar materials also contain appreciable phosphorous

3.3.1.3 Static Testing

Acid base accounting (ABA) is done to establish the balance between acid generating minerals (sulfides), and potentially acid consuming minerals (alkaline minerals) present in a sample (Sobek, 1978) The former is expressed as the acid generating potential (AP) and the latter as the acid neutralization potential (NP)

Paste pH and conductivity are simple tests that can be done in the laboratory or in the field to indicate the extent of oxidation of sulfides that has occurred in the rock prior to the testing The procedures used for pH and conductivity, and for acid base accounting and shake flask tests are listed in Appendix B Complete static test results are listed in Appendix C

Samples of hydrothermal scar material typically exhibited low paste pH (1 8 to 3 5) and high paste TDS in field tests These conditions indicate advanced, bacterially accelerated oxidation and acid generation is occurring in the surficial portions of the scars High paste TDS content indicates the samples contain stored oxidation products (sulfate and dissolved metals) Static acid generation potential test results for typical hydrothermal scar materials are shown on Table 3 2

Sample No 35 was collected from an undisturbed scar located above the open pit in upper Sulphur Gulch Sample HC-2 was collected from an area of high grade scar adjacent Hansen Creek Samples exhibit oxidizable sulfide sulphur contents of 0 44 and 0 16 percent, respectively In both samples, the neutralization potential has been consumed and much of the sulfide mineralization has been converted to sulfate While the net acid producing potential of these materials is relatively low, they exhibit the potential to continue acid generation

3.3.1.4 Shake Flask Tests

Distilled water extraction or shake flask tests, indicate the amount of readily soluble (oxidized) metal salts present in the material The testing procedure for shake flask tests is listed in Appendix B Complete results are listed in Appendix C

Table 3 3 contains the results of shake flask distilled water extraction tests conducted on hydrothermal scar samples Samples were obtained from Goathill Gulch, Capulin Canyon and Sulphur Gulch Samples HC1 through HC3 were obtained from the Hansen Creek area. The primary constituents in the shake flask extracts include calcium and aluminum Metals found in trace concentrations include cadmium cobalt, copper, iron, nickel and zinc Lead was detected in the extract from a scar area located in Capulin Canyon (sample No 71) Sulfate content in shake flask extracts ranged from 18 6 to 4450 mg/l Extracts from scar samples collected in upper Sulphur Gulch and in lower Goathill Gulch contained 7 02 and 1 36 mg/l fluoride, respectively These results indicate a significant availability and leachablity of aluminum and sulfate, and limited availability of copper, iron, nickel and zinc

Sample HC3 obtained from the peripheral area of the large scar in Hansen Creek, is representative of a lesser degree of alteration and mineralization and exhibits a reduction in available aluminum Sample No 71, from Capulin Canyon, appears to be anomalous with respect to available aluminum content Samples collected in the mine area (No s 15, 35, and 80) exhibit relatively consistent test results

3.3.1.5 Scar Area Drainage Composition

Analysis of seepage and surface water runoff from scar areas undisturbed by the mining operations (Table 1 2) indicates high average concentrations of sulfate (3018 mg/l), aluminum (230 mg/l), and iron (317 mg/l) Copper, manganese and zinc were also detected in significant concentrations Hydrothermal scar seepage from the Hansen Creek and Goathill Gulch areas also contained fluoride at concentrations of 28 5 and 28 9 mg/l, respectively The trace metal content of the scar area water samples is similar to that of the shake flask test extracts

3.3.2 Geochemical Properties and Drainage Chemistry of Mine Waste and Mine Disturbed Materials

Mine waste and mine disturbed sampling locations are shown on Figure 3 2 All samples were subjected to field paste pH and TDS tests to assess their current acid generating condition Selected samples of mine disturbed materials were subjected to whole rock analysis, static tests and shake flask extraction tests Data from these analyses on waste rock and tailings are shown on Tables 3 4 3 5 and 3 6

3.3.2.1 Whole Rock Analysis

Analysis by ICP (Table 3 4) indicates the mine waste materials contain iron, potassium calcium sodium, magnesium and aluminum in concentrations that are consistent with the composition of typical rock forming minerals Metals present in potentially leachable concentrations, in addition to the above include barium copper, manganese nickel zinc, lead, chromium and vanadium

The mine waste materials exhibit increases in the quantities of potentially leachable manganese molybdenum zinc and chromium Boron, which was not detected in mine waste or hydrothermal scar samples, is contained in two samples of old tailings collected at the mill site in concentrations of 225 and 112 mg/kg

3.3.2.2 Field and Static Tests

Waste rock and disturbed materials at all sampling locations were subjected to field paste pH and TDS tests to assess their current behaviour Field paste pH and TDS test results for all samples are listed in Table C-2 in Appendix C, and shown on Figure 3 2

The waste rock observed on the surface was classified into three general types Each type is described below along with the results of field tests

- Mixed volcanic rocks are composed of the upper rhyolitic and lower andesitic rocks of Tertiary age that were defined by Molycorp geologists These materials were derived from the western side of the pit in an area that contained the Sulphur Gulch hydrothermal scar The majority of these materials have been placed in the waste rock disposal areas located to the north, south and west of the pit Mixed volcanics were placed with other waste rock types in the in-pit disposal areas

  The mixed volcanics are highly fractured and weathered, and contain abundant pyrite Where these rocks were observed, they typically exhibited a paste pH in the range of 2 3 to greater than 6 0, with the majority less than 3 5 Paste extractions typically indicated a high TDS content Based on these field test results, these materials are undergoing advanced, biologically catalyzed oxidation and they contain residual oxidation products (stored acidity, sulfate and dissolved metals) Their current acid generating behaviour is believed to have been influenced by the high degree of alteration and mineralization associated with the development of the Sulphur Gulch hydrothermal scar

- Black andesite is presumed to be derived from the lower andesitic series volcanics of Tertiary age The black andesite appears to be in fault contact with the highly fractured and intensely altered Sulphur Gulch scar in the south side of the open pit The black andesite contains secondary mineralization that includes calcite, fluorite, quartz, chlorite, pyrite and chalcopyrite

  Where exposed on the surface this material typically exhibits near neutral paste pH and low paste TDS content Field observations and testing indicate that this material is not currently generating acid

- Ore grade mineralization at Questa is associated with Tertiary aged aplitic and granitic intrusives (the mine aplite) Aplite is exposed in the eastern pit wall and the bulk of the aplite waste rock has been placed in Spring Gulch, Sulphur Gulch, in the in-pit disposal areas, and over the lower toe of the Middle, Sugar Shack South, and Spring and Sulphur Gulch waste disposal areas as an erosion controlling cover

  Where exposed on the surface this material typically exhibits neutral paste pH and low paste TDS content Field tests and observations indicate that the aplite exposed on the surface is not currently generating acid

Static test results conducted on selected waste rock samples are shown in Table 3 5

Aplite (and granite) samples contain between 0 06 and 0 61 percent sulfide sulphur (total sulphur minus unoxidizable sulfate sulphur) The neutralization potential (NP) of aplite is relatively consistent and varies between 19 35 to 38 83 tons per kiloton (T/KT) The aplite exhibits net neutralization potentials of between 11 85 and 34 43 T/KT indicating that the aplite is net acid consuming The average ratio of acid neutralizing to acid generating potential (NP/AP) in aplite and granite is 3 5 1 Of the samples tested, 3 of 7 had NP/AP ratios greater than 3 1 indicating low potential for acid generation The remaining 4 samples exhibited NP/AP ratios between 1 1

and 3 1 indicating uncertain acid producing potential (Acid Rock Drainage Technical Guidelines, 1989)

Black andesite samples contain between 0 12 and 0 68 percent sulfide sulphur and exhibit a net acid neutralizing potential (NNP i e NP-AP) that varies between 16 28 and 43 93 T/KT Of the samples tested 5 of 7 had NP/AP ratios greater than 3 1 indicating low acid producing potential The remaining 2 samples have NP/AP ratio between 1 1 and 3 1 indicative of uncertain acid producing potential

Mixed volcanic materials typically contain low neutralizing potential and have a net acid producing potential as indicated by static tests NNP values range from -27 78 to +24 27 T/KT Of the 15 samples tested, 10 had NP/AP ratios less than 1 1, indicating high acid generating potential In the majority of the samples, the neutralizing potential appears to have been consumed However, they contain residual sulfide sulphur at levels sufficient to sustain oxidation and acid generation for an indefinite and potentially extended period of time

Other mine disturbed samples subjected to static testing included development rock from the new underground mine site, tailings from the old tailings ponds at the mill site and fill materials placed in the new mine site foundation

The development rock from the new underground mine has a high field paste pH and low paste TDS The material tested had an NP/AP ratio of 4 4 1, indicating that it is net acid consuming

Tailings from the old tailings ponds in the mill site, and the old tailings used to construct the mill site foundation exhibit low paste pH and high paste TDS One of the samples tested had significant residual oxidizable sulfide sulphur content and its neutralizing potential appears to have been consumed Based on and NP/AP ratio of 0 1, the material exhibits acid generating potential The regraded mill site fill composed of old tailings contains low sulfide sulphur content and neutralizing potential and exhibits limited acid generating potential

The new mine site foundation area was constructed by cut and fill methods Much of the material exposed in the mine site area cut slopes appears to have been altered by local hydrothermal activity The mine site foundation fill samples exhibited low paste pH and high paste TDS content Static tests indicate the mine site fill is potentially acid generating

3.3.2.3 Shake Flask Tests

Shake flask test results for selected waste rock and mine disturbed samples are shown in Table 3 6 Primary metals leachable in shake flask tests include aluminum, calcium, iron, manganese copper and zinc Metals leached in lesser concentrations included cobalt, chromium, molybdenum, cadmium and lead. Leachable sulfate in mine waste materials ranged from 68 1 to 3940 mg/l The presence of leachable metals and sulfate in mine waste rock occurs primarily in the mixed volcanic waste rock that exhibits low paste pH and high paste TDS content in field tests

Typically, the field tests indicate low TDS content in black andesite and aplite/granite waste rock Therefore, the potential for leaching of metals and sulfate from these materials is limited

In comparison to the leachable metals from hydrothermal scar samples (Table 3 3), shake flask extracts from mine waste and hydrothermal scars contain a similar group of metals with similar ranges in concentration

3.3 2.4 Mine Waste Drainage Chemistry

The quality of seepage and drainage from mine waste and mine disturbed materials is summarized in Table 1 2 Complete water quality results are presented in Table C1, Appendix C

Samples WS1, WS-SS1 and WS-SS2 were collected from temporarily impounded surface water runoff in areas containing primarily mixed volcanic waste rock in the Spring and Sulphur Gulch and Sugar Shack South waste rock disposal areas The samples contained moderate sulfate contents and somewhat elevated concentrations of aluminum, iron, manganese and zinc

Sample WS-Cap1 was collected from the base of the western lobe of the Capulin waste rock disposal area and is representative of the drainage from the waste rock. Samples WS-GC1 and WS-GC2 were collected from drainage immediately below the Goathill Gulch waste rock disposal area These samples contain moderate to highly elevated sulfate and dissolved aluminum and manganese In comparison to concentrations of aluminum and manganese in the drainage from the hydrothermal scar area the drainage from the Capulin and Goathill waste rock contains up to an order of magnitude increase in the concentrations of aluminum and manganese Fluoride analyses conducted on selected samples indicates similar concentrations of fluoride can be anticipated in mine waste and hydrothermal scar seepage

Sample WS-Pit1 was collected from hydrothermal scar rubble that occurs in the failed western wall of the open pit Sample WS-Pit1 represents the quality of water that is currently draining from disturbed acid generating materials in the pit to the underground workings The sample contains moderate to high concentrations of sulfate, aluminum and iron, and relatively high concentrations of manganese and zinc

Sample WS-Cap3 represents the quality of waste rock drainage that escapes the surface water impoundments in upper Capulin Canyon As there are hydrothermal scars in the area, the quality of WS-Cap3 may also be impacted by hydrothermal alteration WS-Cap3 exhibits a reduction in sulfate and metals concentrations that potentially results from dilution with less affected groundwater or interaction with soils rock and alluvium in the bed of the creek

Sample WS-2 was collected from a seep at the mouth of Capulin Creek at its confluence with the Red River The quality of WS-2 potentially reflects either further dilution and interaction of waste rock disposal drainage that bypasses the seepage collection system in upper Capulin Canyon, or hydrothermal scar impacted drainage Sulfate, aluminum manganese and zinc concentrations are slightly elevated in WS-2

The metals present in waste rock disposal area seepage are also found in seepage from the hydrothermal scar areas Based on available data seepage from acid generating waste rock can be anticipated to have higher concentration of sulfate, aluminum, zinc and nickel with respect to seepage from undisturbed scar materials Fluoride analyses conducted on selected samples indicates similar concentrations of fluoride occur in mine waste and hydrothermal scar seepage The metals contained in trace concentration in waste rock seepage (Cd, Cr, Co Cu and Pb) are present at similar levels in hydrothermal scar seepage Only iron exhibits a concentration that on average, is greater in the seepage from hydrothermal scars, however, additional testing would be required to confirm this observation

Much of the waste rock from which acidic fluids are currently draining is derived from the Sulphur Gulch hydrothermal scar and therefore, it would be anticipated to have similar drainage composition In the mine area, the increase in the concentration of aluminum, manganese and zinc can be attributed to the physical condition of the waste rock Oxidation of sulfides contained in the in-place hydrothermal scar is limited to near surface zones and areas where erosion and weathering processes have resulted in exposure of the near surface rock to oxidizing conditions In contrast, the large dumps of waste rock have been rubblized by blasting, excavation and disposal practices The conditions required for advanced rates of oxidization and acid generation, and the hydraulic properties required for ARD migration (infiltration and permeability) have been enhanced The minerals within the waste rock and hydrothermal scar that liberate dissolved metals, either through oxidation or through dissolution in acidic drainage, are more readily available within the waste rock due to mining disturbance and the increased exposure of fresh sulfides

3.3.3 Rock, Soil, Alluvium and Colluvium from Other Areas

3.3.3.1 Field Tests

Samples of rock soils, colluvium and alluvium from areas outside the mine disturbance and hydrothermal scars were subjected to field paste pH and TDS testing, and shake flask extraction tests Sampling locations are shown on Figure 3.3 Results of field tests are shown on Table 3.7 Shake flask test results are contained in Table 3.8

The alluvium samples 10 and 73 were collected from alluvial mud flow debris in Capulin Canyon They have potentially been impacted by both drainage from hydrothermal scar areas and seepage from the Capulin waste rock disposal area They exhibit low paste pH, however, as the paste TDS content is also low, these materials do appear to be, of themselves, acid generating

Rock soil and colluvium samples collected in Capulin Canyon outside the alluvial stream bed zone typically exhibit near neutral paste pH and low paste TDS content Test results for samples 13, 14, 22 and 68 do not indicate acid generating conditions and as paste TDS is relatively low, the dissolved metals contribution of these materials to surface water and groundwater is anticipated to be low in comparison to hydrothermal scar and mine waste materials that exhibit acid generating behaviour

Samples 43 and 44 were collected from rock outcrops above the mine disturbed area in Blind Gulch and Spring Gulch These materials are also unaffected by significant hydrothermal alteration They exhibit neutral paste pH and low paste TDS content These conditions do not indicate acid generating behaviour or significant dissolved metals contributions to surface water or groundwater

Samples HC-4, 5, 6 and 7 were collected in the Hansen Creek area Sample HC-4 was collected from a soil/rock subcropping adjacent to the Hansen Creek drainage The material exhibits neutral paste pH and low paste TDS

Samples HC-5, 6 and 7 were collected from alluvial mudflow debris derived from the hydrothermal scar in upper Hansen Creek The paste pH of the alluvium is low and paste TDS is high in comparison to other materials collected outside the mine or hydrothermal scar areas As the metal contents measured in shake flask tests is low (Section 3 3 3 2) , the TDS content of the soils is anticipated to reflect high sulfate concentration Based on visual examination, these materials are not believed to possess significant residual acid generating potential as they have undergone extensive weathering

Several samples of river alluvium at active seeps, and mudflow deposits in the vicinity of the seeps, were collected near the Red River adjacent to the mine site The paste pH and TDS content of the river alluvium samples collected in seepage path reflects the quality of the seepage water The mudflow deposits exhibit variable paste pH while TDS content is low The conditions suggest that the mudflow debris does not possess significant acid generating potential

3 3.3.2 Shake Flask Tests

Shake flask test results for soils, rock and colluvium samples obtained outside mine disturbance areas are contained in Table 3 8 Most of the samples of mine-unaffected materials contain minor amounts of leachable calcium, iron copper, zinc, manganese and aluminum Calcium and aluminum appear to occur in somewhat anomalous concentrations in Hansen Creek samples HC-5 6 and 7, however, the concentrations are low Test results indicate that the contribution of dissolved metals from these materials to surface water or groundwater would be minimal

Leachable sulfate concentration in mine area soils, rock, alluvium and colluvium varies between 6 2 and 381 mg/l, indicating that the undisturbed surficial materials in the mine area potentially contribute sulfate to surface water runoff and groundwater The average sulfate concentration in mine area undisturbed material shake flask extracts was 86 8 mg/l

3 3.3 3 Drainage Quality from Unaffected Areas

Water sample WS-Cap 2, was collected from a small tributary to Capulin Creek in an area undisturbed by mining activity or development of hydrothermal scar This sample had neutral pH, contained trace concentrations of iron and zinc, and 42 mg/l calcium. The sulfate content of the sample was 140 mg/l (Table C-1, Appendix C)

3.3.3.4 Acidity Attenuation Capacity of Soils and Alluvium

Selected samples of alluvial material from the area of springs and seeps located beneath the waste rock disposal areas were subjected to titration testing to determine their potential to attenuate or neutralize acidity. Titration test data is shown in Table 3.9 and illustrated in Figure 3.4.

Titration test results indicate that the alluvial materials in and adjacent to the spring and seepage flow paths below the Middle and Sugar Shack waste rock disposal areas have limited potential to attenuate the acidity in seepage water.

Carbonates (calcite, siderite or magnesite etc.) that can modify or buffer seepage to near neutral pH have been consumed. Minor capacity to buffer seepage to a pH in the range of 3.7 to 4.3 is indicated. This capacity is assumed to be provided by aluminum and iron hydroxides. Additional but limited capacity to buffer seepage in the range of 2.0 is provided by aluminosilicates.
In general, the neutralization potential of the alluvial materials adjacent to the Red River has been consumed and their ability to provide sustained acidity attenuation capacity is limited.

3.4 Discussion of Test Findings

3.4.1 Current State of Acid Generation

3.4.1.1 Waste Rock Disposal Areas

Although acid generation is occurring at the site it appears to be limited mainly to materials derived from waste rock obtained in or near the Sulphur Gulch hydrothermal scar and, to a lesser extent, from the cut and fill materials at the new mill site. This material is typically of mixed andesitic and rhyolitic composition. Field paste pH in the mixed volcanic waste rock is typically in the range of 3.5 or less indicating advanced bacterially accelerated oxidation. As a group, static tests indicate low or consumed neutralizing potential. The mixed volcanics were derived from highly altered, highly fractured rock and their potential to generate acid has been influenced by geologic conditions created prior to mining. These materials have probably been exposed to oxidizing conditions over geologic time as a result of the history of structural disturbances (faulting and brecciation) and alteration to which they have been exposed.

Currently, acid generating conditions appear to be well advanced in the Blind Gulch, Capulin, Goathill, Sugar Shack South, Sugar Shack West, and Middle waste rock disposal areas. Lesser amounts of mixed volcanic waste rock have been placed in the in-pit and Spring and Sulphur Gulch waste rock disposal areas. Acid generation also appears to be occurring at these locations.

Black andesite from the southern pit area and aplite from the eastern side of the pit were not significantly affected by hydrothermal scar development in Sulphur Gulch. Black andesite has been placed with aplite and granite in Spring Gulch, in the in-pit disposal areas, and as an erosion controlling armor on the lower faces of the Sugar Shack South, Middle and Spring and Sulphur Gulch waste rock disposal areas. Field tests indicate neutral conditions and low paste TDS

content These materials exhibit an average net acid neutralizing potential The average NP/AP ratio for black andesite and aplite/granite exceeds 3 1, indicating low acid producing potential

3.4 1.2 Open Pit

The western wall of the open pit mine is composed of up to 200 feet of rubblized failed wall rock that has been affected by hydrothermal scar development in Sulphur Gulch This material is currently acid generating

Other exposed pit wall materials are composed of black andesite and aplite The black andesite exposed in the pit wall exhibits zones of oxidation that appear to be fracture controlled The oxidation of black andesite in the exposed pit wall areas is probably a result of natural oxidation that has occurred over geologic time at a slow rate within the fractures transporting oxidizing solutions (containing ferric iron a strong oxidant) from oxidizing surficial materials

The aplitic and granitic materials exposed in the northeast and eastern pit walls do not exhibit oxidizing or acid generating conditions

3.4.1.3 Underground Mine Workings

Seepage entering at the 1000-foot station of the decline and draining to the underground workings contains elevated metal concentrations that suggest the overlying scar zones and waste dumps are the seepage source Inflows through the caved area in Goathill Canyon contain low pH and high metal content and are water derived from ARD from the Capulin and Goathill waste rock disposal areas Despite inflows of low pH water to the underground mine workings, the mine water quality data collected by Molycorp indicates that the underground mine water exists at near neutral conditions and is of relatively good quality Dissolved metal concentrations are low and sulfate concentration is moderate This indicates that extensive neutralization of acidic drainage, and possibly sulfate reduction, is occurring in the underground workings

3 4 2 Potential For Future Acid Generation

3.4.2.1 Waste Rock Disposal Areas

Testing completed to date shows an excess of alkalinity over acid generating potential and no observed acidic paste pH values Thus, black andesite and aplite/granite are anticipated not to generate acidity in the future unless they are subjected to an external source of acidity, such as drainage from acid generating waste rock, that would remove the reserve alkalinity Slow but continued oxidization of the sulfides in this waste rock will contribute moderate levels of sulfate to drainage

Where these materials have been intermingled with mixed volcanic waste rock in the in-pit disposal areas, the mixture may be acid generating They are the only materials exposed on the surface of waste dumps in Spring Gulch and in the eastern portion of the Spring and Sulphur Gulch waste rock disposal area If the rock exposed on the surface of the Spring Gulch and Spring

and Sulphur Gulch waste rock disposal areas is representative of subsurface composition, future acid generation is not anticipated in these areas

The black andesite and aplite placed to armor the waste rock disposal areas is also not anticipated to generate acid in the future

While the neutralizing potential of the mixed volcanic rocks has been, for the most part, consumed, this material contains sufficient residual oxidizable sulfide content to continue generating acid for an indefinite and potentially extended period of time

3.4.2.2 Open Pit

The rate of oxidation of black andesite and aplite exposed in the pit walls is slow and is not anticipated to reach a level that would significantly increase the sulfate and metal loading to the pit water that drains to the underground mine workings

The rubblized hydrothermal scar material that comprises the failure zone in the western pit area can be anticipated to continue generating acid for an extended and indefinite period of time The quality of drainage from the failed scar area is currently of better quality than drainage from the Capulin and Goathill waste rock disposal areas The concentration of sulfate and metals in drainage from this area can be expected to increase with time as the oxidizing conditions in the failed mass matures

Several of the waste rock piles placed in the in-pit waste disposal area are exhibiting acid generating conditions The maximum rate of acid generation may not yet have been reached in these relatively young deposits Therefore, the concentration of sulfate and metals in runoff and seepage reporting to the pit and the underground workings could potentially increase with time

The undisturbed portions of the hydrothermal scar located in upper Sulphur Gulch will continue to provide poor quality seepage and runoff to the open pit and underground mine workings at concentrations characteristic of mature acid generation conditions The rate of sulfate and metal loading from the Sulphur Gulch hydrothermal scar is not anticipated to increase unless additional disturbance occurs in the scar

3.4.2.3 Underground Mine

The flow of water discharged from the seepage collection system in Capulin Canyon to Goathill Gulch, as measured by Molycorp, varies between 25 and 75 gpm (during snowmelt) and averages approximately 35 gpm Vail (1993) estimates that the seepage and runoff rates from Goathill Canyon are slightly greater than the borehole discharge Therefore, caved area inflows to the new underground mine average approximately 70 gpm Based on historic dewatering rates of 225 and 30 gpm, respectively, in the new and old underground mine workings, the total inflow to the underground mine is estimated to be in excess of 300 gpm A significant portion of the inflow to the new mine is poor quality mine waste and hydrothermal scar impacted drainage with low pH and high concentrations of aluminum, iron, manganese, zinc, sulfate and fluoride

Despite the high inflow rate of poor quality drainage, the mine water pumped from the decline exhibits near neutral pH conditions and contains relatively low concentrations of dissolved metals Therefore, the mine wall rock, and the rubble in the caved area, provide a source of alkalinity that maintains mine water quality through buffering and subsequent precipitation of metals The extent of the source of alkalinity in mine and caved area wall rocks, and the potential for future and continued maintenance of mine water quality are unknown at present The potential exists for concentrations of sulfate and metals in the mine water to increase in the future, when the available alkalinity is exhausted

3.4.3 Future Mine Waste Drainage Water Quality

The quality of the drainage from the "old" acid generating rock in Capulin Canyon is currently the most representative indication of the quality of drainage from similar acid generating sources in the future The reasons to support this assumption include

- The Capulin waste rock disposal area was developed early in the life of open pit mine Molycorp aerial photographs indicate that the waste rock disposal areas in Capulin and Goathill Gulches were already well developed in 1969 The materials placed therein have been exposed to oxidizing conditions for in excess of 25 years

- The majority of static tests conducted on the mixed volcanic rocks derived from the Sulphur Gulch scar area, such as those placed in the Capulin waste rock disposal area, indicate that much of the neutralization potential of this material has been consumed Therefore, the pH of the drainage is not anticipated to decrease significantly and the material is oxidizing and generating acid at a rate that is uncontrolled by factors other than the availability of air and water that is required to sustain oxidation and acid generation

- The means of flushing of oxidation reaction products and dissolved metals from the waste rock to the receiving environment has been established over a period of 25 years The waste rock disposal area is considered to be in equilibrium with respect to the flux of oxygen and water that sustains oxidation and transports oxidation reaction products from the waste rock Given the length of time that ARD has occurred in Capulin Canyon it is anticipated that the neutralizing potential and attenuation capacity of the migration pathways are fully consumed

- Static tests and field observations indicate that the mixed volcanic waste rock contains sufficient acid producing potential to continue oxidation and acid generation for an indefinite period of time, therefore the acid generating process is unhindered by lack of oxidizable materials

Drainage from the Capulin waste rock disposal area, as measured in October 1994, contains 12,700 mg/l sulfate, 39 5 mg/l fluoride, 1,300 mg/l total aluminum, 848 mg/l total iron, 787 mg/l total manganese, 132 mg/l total zinc 13 9 mg/l total copper and 445 mg/l total calcium Constituents in concentrations of up to a few milligrams per litre include cadmium, cobalt and chromium. The drainage pH in October 1994 was 2 58

The sulfate and metal concentrations measured by SRK in October 1994 are representative of near base flow conditions The sulfate and metal concentrations can be expected to increase if any remaining neutralizing potential is consumed, or the waste material is disturbed to alter the flow paths within the waste The flux of metals and sulfate from the waste rock disposal area would increase following the spring thaw when the waste rock disposal area experiences flushing

3.4.4 Quality of Springs and Seeps Discharging to the Red River

The quality of springs and seeps currently discharging to the Red River adjacent to the mine area indicates impact from sources that potentially include drainage from mine waste and hydrothermal scar sources The seeps at Capulin Canyon appear to be impacted by historic hydrothermal drainage as well as mine waste drainage that occurred prior to the construction of the seepage collection system in upper Capulin Canyon in 1992

At present, the relative contributions of natural hydrothermal scar and mine waste drainage sources in other seeps and springs located between the mouths of Capulin Canyon and Sulphur Gulch are unknown Spring and seep water quality does not exhibit a signature that could be positively assigned to either source

Field and static tests conducted on the mixed volcanic waste rock placed in the Middle, Sugar Shack South and Spring and Sulphur Gulch waste rock disposal areas indicate that acid generation is occurring and shake flask testing indicates that these materials contain leachable aluminum, copper, iron, manganese and zinc Over time, ongoing acid generation in the waste rock disposal areas adjacent to the Red River, and the consumption of the neutralizing potential of the waste rock and consumption of the remaining attenuation capacity in the alluvium in seepage flow paths has the potential to increase sulfate and metal loads in local springs and seeps Seepage of water impacted by the hydrothermal scars that underlie the waste rock disposal areas will likely continue.

4.0 SUMMARY AND CONCLUSIONS

4.1 Geochemical Properties

4.1.1 Hydrothermal Scars

Samples of hydrothermal scar material collected in and adjacent to the mine site are indicated by static testing to possess significant acid generating potential and by field testing to have acidic paste pH and high conductivity, indicative of a high soluble salt load The hydrothermal scars produce surface runoff and drainage that is of low pH and contains elevated concentrations of sulfate, fluoride aluminum, copper, iron manganese and zinc Metals that occur in the drainage and runoff from hydrothermal scars include cadmium, cobalt chromium and nickel Shake flask extraction tests indicate a similar suite of leachable metals exists in hydrothermal scar solid samples

4.1 2 Mine Waste Materials

4.1.2.1 Waste Rock

4.1.2.1.1 Mixed Volcanic Waste Rock

The waste rock in the various waste rock dumps exhibit variable geochemical properties that are related to waste rock type and source

Field and static testing indicates acid generating potential, and current acid generation in mixed volcanic waste rock excavated from the area of the Sulphur Gulch hydrothermal scar zone during open pit mining operations This material was located in the western portion of the pit and remains exposed in the west pit wall The mixed volcanic waste rock forms the majority of the waste rock placed in the waste rock disposal areas located north, west and south of the open pit Capulin Cyn & Goathill Gulch

The mixed volcanic waste rock exhibits drainage chemistry and leachable metals content that are similar in composition to that of the hydrothermal scars As the mixed volcanic waste rock and hydrothermal scars were subjected to similar geologic processes, the similarity in geochemical properties are anticipated

The concentration of sulfate and copper, manganese and zinc in drainage derived from the mixed volcanic waste rock is, on average, somewhat elevated with respect to the drainage from hydrothermal scars This is a result of the high degree of disturbance associated with blasting, excavation and disposal of waste rock that results in favorable conditions for oxidation and ARD generation

4.1.2.1.2 Black Andesite and Aplite/Granite Waste Rock

Black andesite and aplite/granite form the remainder of the waste rock produced during open pit mining operations These materials were derived from the south and east sides of the open pit where hydrothermal scar has not been developed These materials were placed as an armoring cover on the Sugar Shack South, Middle and Spring and Sulphur Gulch waste rock disposal areas Portions of this material were placed with mixed volcanic waste rock in the in-pit waste rock disposal areas and these materials appear to be the only waste rock type placed in Spring Gulch and the eastern portion of the Spring and Sulphur Gulch waste rock disposal areas

Field paste tests indicate that these materials do not nowgenerate acid and static tests indicate they have a low potential to develop acidic conditions In addition, field tests showed low paste TDS content in black andesite and aplite/granite waste rock Therefore, these materials have limited potential for leaching of sulfate and metals

4.1.2.1.3 Other Mine Waste

Other mine waste materials include development rock from the old and new underground mine workings, mine site fill materials, and relic tailings from the old underground mining operation

Field and static testing of development rock from the old and new underground workings indicates low potential for acid generation Field tests indicate low paste TDS content and limited potential for leaching of metals and sulfate

The new mine site area was developed by cut and fill methods The exposed cut slopes in the mine site indicate that a portion of the fill was derived from areas affected by hydrothermal scar development Based on field tests, portions of the fill currently exhibit acid generating behaviour and the potential for leaching of metals and sulfate

The relic tailings from the old underground mining operation were placed at the site of the existing mill A portion of the relic tailings were used to regrade the mill site prior to facility construction Field and laboratory testing of relic tailings indicates current acid generating behaviour and the potential for leaching of metals and sulfate

4.2 Sources of Sulfate and Metals Loads to the Red River

4.2.1 Hydrothermal Scars

The hydrothermal scars in the region represent a mature source of sulfate and metals loads to surface water and groundwater The oxidation of the scars has been occurring over geologic time and the acidity and metal attenuating capacity of the seepage and flow paths from areas of hydrothermal scar to the river are depleted The scars are highly erodible Therefore the potential for oxidation in hydrothermal scar areas remains relatively constant as surficial materials are removed by erosion, and underlying, unoxidized materials are exposed to oxidizing conditions The rate of sulfate and metal loading from hydrothermal scars is influenced only by short and

long term changes in climatic conditions that control the rates of erosion and the quantity of runoff and seepage from hydrothermal scar areas

Outside the mine area hydrothermal scars continue to contribute sulfate and metal loads to the Red River as they have over geologic time Within the mine area, the majority of seepage and runoff from areas affected by hydrothermal alteration is collected in the underground mine The scar impacted drainage and runoff collected in the underground mine is now being pumped to the tailings impoundment west of the town of Questa to dewater the underground mine Therefore, the seepage and runoff from scar areas collected in the mine has no impact on the quality of water in the Red River

In the mine area, drainage from several areas of hydrothermal scar are not collected in the underground mine and may still contribute to the sulfate and metals concentrations in the Red River Hydrothermal scars occur under a cover of waste rock in the Sugar Shack South, Middle and Spring and Sulphur Gulch waste rock disposal areas While surface runoff and sediment generation from these areas are controlled by Molycorp's surface water management facilities the subsurface flow paths from these areas have not been substantially altered by the mining operation Hydrothermal scars also occur adjacent to the Red River in the area between the mine site and the mouth of Capulin Canyon The potential for the contribution of sulfate and metal loads from these sources has not been reduced or increased by the mining operation

4.2.2 Mine Waste Materials

The drainage and runoff from waste rock placed in the in-pit waste rock disposal areas is currently collected in the open pit and drains to the new underground mine, and has no impact on the quality of water in the Red River

At several locations, the potential for contributions of sulfate and metals from mine waste to the Red River exists

Seepage from the Capulin waste rock disposal together with seepage and runoff affected by hydrothermal scars located in Capulin Canyon potentially migrates down Capulin Canyon as subsurface flow

Subsurface seepage from the new mine site, the mill site and the Sugar Shack South, Middle and Spring and Sulphur Gulch waste rock disposal areas are currently not controlled by Molycorp s seepage collection systems Acid generating materials in these areas have the potential to contribute sulfate and metals loads to the Red River

In contrast to the hydrothermal scars, the mine waste at Questa represents a new source of sulfate and metal loads Testing of the alluvial and colluvial materials located below the waste rock disposal areas adjacent to the Red River indicates a limited but measurable ability for attenuation of acidity Therefore contaminated mine waste drainage may still be buffered along the seepage path to the Red River and the current water quality as indicated by springs and seeps may not represent mine waste drainage quality The location of the contaminant fronts of seepage plumes

from these areas is currently unknown Moreover, since the chemistry of the hydrothermal scar and mine waste impacted drainage is similar in composition, the relative contributions of these sources cannot be identified

4.3 Long Term Climatic Effects on Water Quality

As previously mentioned, the hydrothermal scars in the region represent a mature and relatively constant source of sulfate and metal loads to regional and local surface water and groundwater resources However, these sources are influenced by climatic conditions and during extended periods of above average precipitation, loading from these sources can be anticipated to increase as a result of increased erosion, runoff and infiltration Conversely a reduced loading is expected during periods of prolonged drought

From 1961 to 1991, the average annual discharge at the Questa gaging station was 40 4 cfs This period spans the life of the open pit and new underground mining operations at Questa when water was diverted for mill use In the period between 1961 and 1978, average annual discharge at the Questa gaging station was 33 1 cfs while from 1978 to 1993, the average annual discharge was 52 2 cfs These large changes in average flow rates are expected to have associated substantial erosion and seepage from scar material, resulting in large natural fluctuations in the mean annual contaminant loading to the Red River

Because of the change in climatic conditions the "background" water quality data from 1965 may not be representative of that for 1993 Indeed it may be anticipated that the average natural contaminant loads to the Red River in the first half of the 1990's would be substantially greater than the average loading experienced in the first half of the 1960's

5.0 RECOMMENDATIONS FOR NEXT PHASE OF INVESTIGATION AND CHARACTERIZATION

5.1 Requirements for Additional Investigation and Characterization

This initial mine waste rock investigation and characterization has served to identify the current and potential sources of the contaminant drainage to the Red River. It has been established that contaminant sources exist both as exposed sulfitic rocks in the waste rock dumps and open pit. This investigation focused mainly on the identification and qualitative characterization of these sources and the contaminant migratory routes to the Red River. A relatively good understanding of the qualitative characteristics has been developed for:

- The locations from which contaminated drainage is originating for both natural and mine induced drainage,
- the current quality of the pore water in these sources,
- the lithological and geochemical characteristics of the rock from which the contaminants originate,
- the surface flow and seepage pathways along which the contaminated drainage migrates,
- the physical and geochemical controls along the migratory routes, and
- the quality of surface and ground water discharges to the Red River and the contaminant loads in the Red River.

In the next phase, investigation of mine waste rock should attempt to extend this qualitative understanding to be more quantitative in regard to the characterization of the rock contaminant flow paths, and to both current and long term contaminant load generation and migration. Aspects to be investigated and characterized may be divided into four groups:

i) The definition of the quantities and distribution of ARD characteristics of waste rock in the various dumps and portions of dumps, construction embankments and rock cuts on the mine disturbed site. This investigation should extend the current surficial survey to define conditions at depth within the deposits. This quantification and extension will be based on a detailed review of the mine plans and dump development records, additional surficial surveying and limited drilling to determine the rock characteristics at depth.

ii) The definition of the conditions other than rock characteristics controlling acid generation in the waste piles. This includes determining water and oxygen entry and distribution, and temperature conditions in the waste rock piles.

An understanding of the oxygen distribution in the piles indicates the zones where acid generation is occurring or is inhibited. It provides an understanding of the likely long term conditions which will control acid generation both without and with the addition of oxygen entry control measures such as covers.

Moisture content distributions are needed to understand the field capacity of the waste rock and the time required for dumps to become wetted to the extent that they yield seepage, as well as the factors controlling seepage in the piles

Temperature profiles indicate where exothermic acid generation reactions are occurring, the temperature controls on bacterial oxidation in the dumps and the thermal convective forces that draw oxygen into the dumps (an important mechanism in the high rock dumps at Questa)

The data required for this characterization is obtained from a combination of drilling, sampling and testing, and drill hole instrumentation and monitoring

iii) The kinetic behaviour of the various waste rock types Quantification of the rates of oxidation and the definition of precise evolutionary stages of ARD development allows a better interpretation of the field observations and the modelling of long term behaviour of dumps under both controlled (remediated) and uncontrolled (no remediation) conditions This requires laboratory kinetic testing of selected representative samples as well as a correlation between laboratory observed behaviour and field observed conditions

iv) The detailed contaminant yield behaviour and load balance from a natural scar affected area such as the Hansen Creek drainage Detailed characterization of the scars as well as the rest of the drainage basin, together with detailed monitoring of the contaminant load yielded to the Red River by both surface and ground water pathways will allow the natural loading from hydrothermally altered areas to be quantified and modelled These results could then be extended to the modelling and estimation of natural (or pre-mining) contaminant load yield from the mine disturbed areas

The recommended investigation and characterization studies appropriate for the next stage of waste rock characterization at the Questa mine are described in the following sub-sections

5.2 Waste Rock Quantifications and Characterization

Spring Gulch Waste Rock

Based on surface exposures, the majority of waste rock placed in the Spring Gulch waste rock disposal area appears to be black andesite and aplite with low ARD potential Thus, no ARD mitigation measures should be required in this area This potential should be verified based on detailed rock characterization from surface surveys, mine waste rock records and, if necessary drilling to verify the nature of underlying deposits waste rock

Other Waste Rock Dumps

Detailed zones of different rock characteristics should be established from a detailed review of mine and waste rock development, together with more detailed surface surveys, and limited drilling and sampling in areas where uncertainty as to underlying rock types exist

Drilling is best performed by a Becker Hammer type drill which uses air as the drilling fluid (avoiding the flushing out of oxidation products) and which minimizes the rock breakage (hence the exposure of fresh alkali which changes the geochemical characteristics of the sample) The one limitation of this type of drilling is that the depths of penetration may be limited to 100 to 150 ft

Drilling should be extended into the underlying scar zones where possible to allow characterization of the underlying scar materials and conditions

Samples should be selected from representative rock types and subject to the same range of static evaluation tests as were performed for this initial characterization study Additional sampling and testing should be performed to define the geotechnical properties of the rock waste such as, grain size distribution slaking characteristics, shear strength, field moisture content, infiltration and permeability characteristics These properties will be required for the evaluation of long term behaviour, with and without ARD remediation

5 3 Quantification and Characterization of ARD Conditions

The conditions which control oxidation and ARD migration in the waste dumps can only be investigated by drilling, instrumentation and monitoring The drill holes used for such determinations can be combined with those used in 5 2 above The instrumented holes would be located such as to determine the distribution of the ARD control conditions in a few select dump zones (two or three locations with 2 to 3 holes each)

During drilling of the holes samples of waste rock will be taken to investigate current oxidation, acid product storage and moisture migration variation with depth The holes would be instrumented with a water sampling standpipe at its base and strings of thermistors and pore gas sampling tubes The pore gas sampling tubes will allow the determination of oxygen and carbon dioxide concentrations in the pore gas, and thus the oxidation conditions along the profile of the drill hole

5.4 Characterization and Modelling of ARD Kinetics

ARD kinetics for the various rock types will be determined by NAG (net acid generation) and humidity column tests The number of such columns will be limited since much kinetic behaviour and data can be deducted from the field observations.

The data from both this task and previous task will be used to develop a conceptual model of dump behaviour which can be used for long term prediction of ARD evolution from dumps under

both controlled and uncontrolled (remediated and unremediated) conditions. This will allow the cost effectiveness of any feasible remediation options to be evaluated and compared

5.5 Quantification and Characterization of Natural ARD Contaminant Generation

Characterization of Hansen Creek drainage

A detailed geochemical survey should be made of the entire Hansen Creek drainage using the same techniques as for this study In addition, regular sampling should be made of the surface drainage flows within the drainage and of discharges to Red River to characterize both its contaminant concentrations and flow quantity throughout the year An estimate should be made of groundwater flow contribution seasonally Based on these results, a model of the contaminant loads and drainage from the Hansen Creek drainage area can be developed

The effect of seasonal and long term weather effects, mainly precipitation, erosion and weathering/oxidation rates must be considered in the extension of this model to described seasonal and long term contaminant yields

Mine Site Area Characterization

The same characterization should be made of the undisturbed areas of the mine site The pre-mining conditions should be estimated in order to develop a pre-mine characterization of all the individual drainages which are impacted by the mine site Based on these results, models of contaminant loads and drainage from the individual drainages can be developed. These individual models can be calibrated against the results of the Hansen Creek model These can then be combined to represent the interaction that has resulted from the mine development This will allow the modelling and contaminant load estimation of the "natural components" of contamination flow in the current site water contaminant balance This model would then be used to estimate the reduction in "natural contaminant load" resulting from the mine water control measures Comparison of the current contaminant loads and the estimated pre-mining of remediation to be evaluated

6.0 REFERENCES

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TABLE 1.1
Summary of Waste Rock Quantities by Location

Waste Disposal Area	Waste Rock Quantity (tons x 1,000,000)
Blind Gulch (in-pit)	26
Spring Gulch	31
Spring and Sulphur Gulch	80
Middle	46
Sugar Shack South	53
Sugar Shack West	31
Copulin	26
Goathill	6
Goathill South	0
Total	228

TABLE 12

Summary of 1994 Water Quality Data Collected from Seeps and Streams around the Questa Mine

	Background* (N = 1)	Undisturbed Scar Material ** (N = 8)				Disturbed Scar Material*** (N 9)			
		Mean	Median	Minimum	Maximum	Mean	Median	Minimum	Maximum
pH	6 9	2 771	2 725	2 33	3 2	3 09	3 12	2 58	3 63
Conductivity (µmho)	409	3996	3865	1 350	6830	5038	3390	1600	12 300
Acidity (mg CaCO$_3$ eq/l)	14 2	2517	1933	326	5350	3132	856	135	12 200
Alkalinity (mg CaCO$_3$ eq/l)	41	1 0	1 0	1 0	1 0	1 0	1 0	1 0	1 0
SO$_4$ (mg/l)	140	5018	2360	735	5900	1395	1500	976	12 700
Al (mg/l)	18	2996	1738	503	5882	171	138	6 37	1850
Cd (mg/l)	< 0 01	0 026	0 01	0 01	0 092	0 11	0 021	0 01	0 585
Co (mg/l)	0 018	0 181	0 231	0 01	1 63	1 238	0 511	0 187	4 15
Cr (mg/l)	<0 015	0 077	0 0585	0 015	0 218	0 162	0 067	< 0 015	0 495
Cu (mg/l)	0 091	2 191	1 23	0 022	7 25	3 89	2 31	0 19	13 9
Fe (mg/l)	1 7 2	416 7	1835	6 83	890	240	59	3 66	918
Mo (mg/l)	<0 03	0 036	0 03	0 03	0 079	0 099	0 03	0 03	< 0 15
Mn (mg/l)	3 62	31 21	18 85	2 33	87 4	210	59 6	4 7	787
Ni (mg/l)	0 042	1 196	0 5495	0 107	4 08	2 51	0 97	0 369	9 43
Pb (mg/l)	0 146	0 104	0 05	< 0 05	0 137	0 184	0 05	<0 05	1 01
Zn (mg/l)	0 527	7 177	4 59	0 198	20 6	36	8 01	1 86	132

Notes All metal concentrations are total, dissolved concentrations are listed in Table C2 Appendix C N Number of Samples

*Sample WS Cap2

**Samples WS GC3 WS GC4 WS GC5 WS GC6 WS HC 1 WS HC2 WS Pit2 WS Cap4

***Samples WS 1 WS 2 WS Cap1 WS Cap3 WS GC1 WS GC2 WS SS1 WS SS2 WS Pit1

TABLE 1 3

Questa Molybdenum Mine and Regional Area

Representative Water Quality Data

Sample Location	Date	pH	TDS (mg/L)	SO_4 (mg/L)	Al (mg/L)	Cd (mg/L)	Cu (mg/L)	F (mg/L)	Fe (Mg/L)	Mn (Mg/L)	Pb (mg/L)	Zn (mg/L)
Hansen Creek	5/10/91	3 5	7620	1511	52	0 015	0 15	0 91	11 1	7 5	ND	2 3
Hunt N Taut Creek	5/17/91	3 6	861	286	11 5	ND	0 5	1 1	9 3	3 7	ND	0 8
Seep Bear Ranger Station	5/4/93	1 0	1316	1800	226	0 017	1 6	2 3	ND	121	ND	19 5

ND = Not Detected

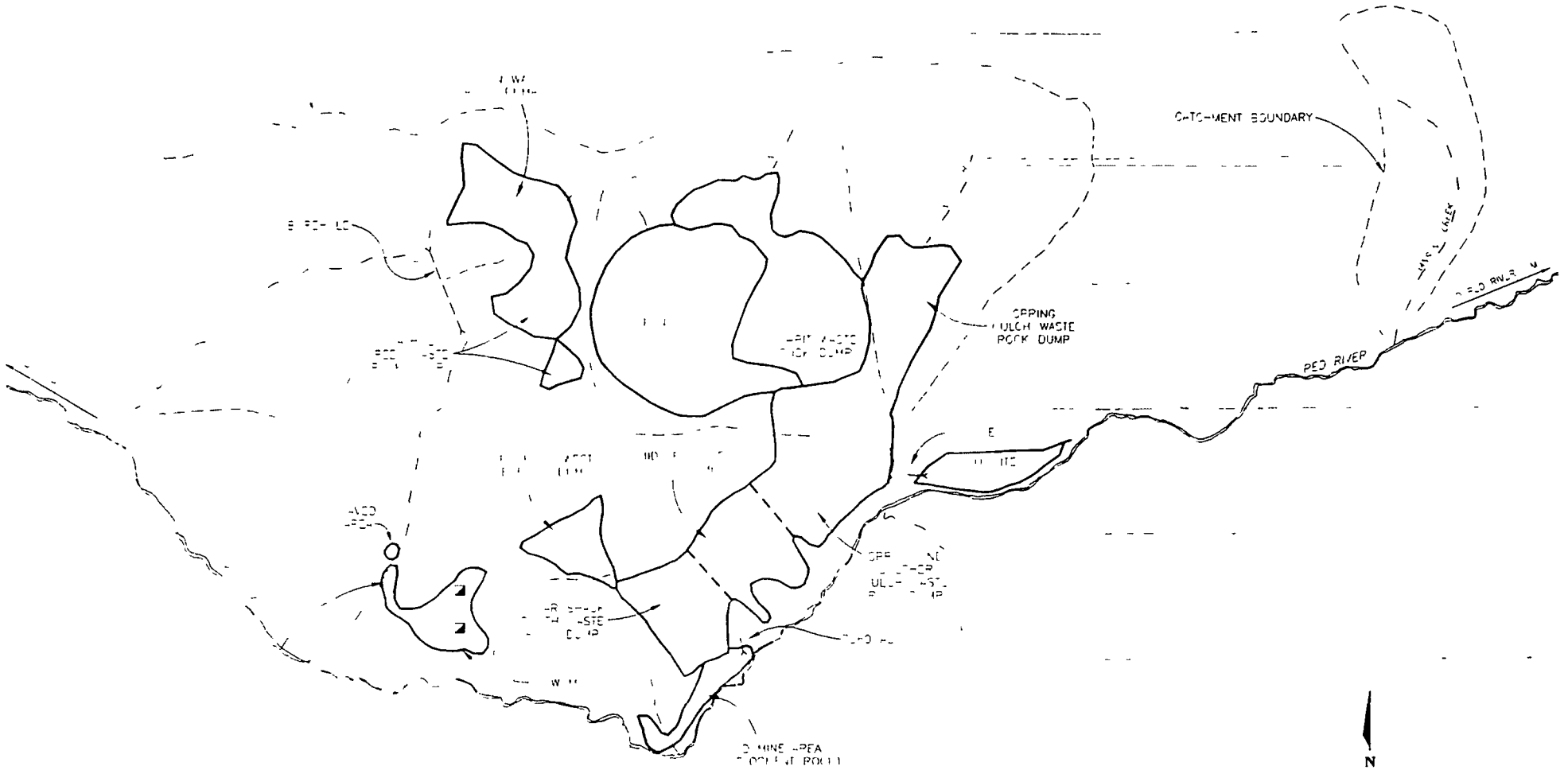
TABLE 1 4
Selected Water Quality Monitoring Data

	Date	pH	TDS (mg/L)	SO_4 (mg/L)	Al (mg/L)	Cd (mg/L)	Cu (mg/L)	F (mg/L)	Fe (mg/L)	Mn (mg/L)	Zn (mg/L)
Mine Area Springs and Seeps at Red River											
Spring below Capulin Canyon	10/93	ND	2700	1021	157	0 082	1 8	4 26	10 3	55	13 1
Spring below Capulin Canyon	2/11/91	3 1	2206	1276	43	0 016	1 17	5	35 9	15 2	1 1
Culvert ca 1 of Goathill Gulch (Hwy 38)	8/28/93	3 3	1850	710		0 033	3 9	ND	1 5	36 1	8 8
Portal Spring No 1 (near 7960 Adit)	2/11 91	7 5	367	181	1 80*	0 019	0 015	1	0 13	0 15	0 119
Portal Spring No 2 (near 7960 Adit)	2/11/91	1 8	1131	788	19 1	0 016	0 27	11 1	0 315	10 6	2
Portal Spring No 2a (near 7960 Adit)	2/11/91	1 9	956	631	10 9	0 019	0 35	10	2 1	1 7	1 3
Cabin Spring No 3	9/17/92	5 1	1826	913	2 1 1	0 01	0 13	15 5	0 21	16 7	2 5
Cabin Spring No 3	2/11/91	5 2	1950	978	30 1	0 019	0 105	11	0 063	18 1	3 5
Portal Spring Culvert	2/11/91	1 9	1150	551	22 1	0 016	0 15	11	2 8	1 7	2 3
Sulphur Gulch	2/11/94	6 0	510	260	8 8	ND	0 075	2 1	2	0 51	0 518
Mine Workings Water Quality											
7100 Level (old mine)	2/20/91	7 1	3100	1800	ND	ND	0 03	5 8	0 9	5	1 1
Decline Station 1000	2/20/91	6 0	3928	2123	ND	0 08	0 03	23 7	0 81	13 6	25 6
Underground Mine (old?)	2/20/91	7 9	2600	1650	ND	ND	0 03	3 7	0 1	1 97	0 15
7960 Portal	2/20/91	7 4	891	592	ND	ND	0 03	2 1	0 1	0 36	0 58
7960 Adit	9/17/92	6 8	2100	ND	1	ND	ND	ND	1	2 9	0 5
Decline	5/2/93	7 5	2168	1004	1	ND	ND	7 1	ND	1 2	2 8
Decline Station 1150	7/29/91	7 6	2578	1382	ND	0 019	ND	ND	ND	13 2	2 9
Decline Station 2500	7/29/94	7 4	2752	1500	ND	ND	0 01	ND	0 156	0 12	2 3
No 1 Shaft (New Mine Deep)	1/21/94	7 7	3386	1180	ND	0 01	0 02	13 1	ND	15 5	0 3
No 1 Shaft (Shallow?)	4/23/93	6 9	3072	1155	ND	ND	ND	8 8	0 3	8 6	1 3

TABLE 14
Selected Water Quality Monitoring Data (continued)

	Date	pH	TDS (mg/L)	SO_4 (mg/L)	Al (mg/L)	Cd (mg/L)	Cu (mg/L)	F (mg/L)	Fe (mg/L)	Mn (mg/L)	Zn (mg/L)
Water Supply Wells											
Cabin Well (private)	9/91	6.1	712	276	ND	0.008	ND	ND	6.5	1.2	3
Molycorp Cabin Well	9.91	7.6	160	21	ND	ND	ND	ND	0.18	ND	0.1
No. 1 Columbine Well	7/25/91	5.1	1150	756	5.5	0.013	0.083	ND	0.551	1.8	2.8
No. 1 Mill Well	7/25/91	6.6	201	101	ND	ND	ND	ND	0.138	0.05	0.035
Monitor Wells (Partial Data Set)											
MMW 2 Capulin Canyon Valley Fill	8/11/91	4.9	3100	2100	63.5	0.021	0.088	2.1	50.8	52.1	9.18
MMW 3 Capulin Canyon Bedrock	7/11/91	7.5	2800	1700	0.63	0.0021	ND	2.59	0.076	31.5	1.86
MMW 7 Shaft No. 1 Area Bedrock	7/11/91	3.1	16000	10100	911	0.096	1.81	1.12	881	72.1	11.7
MMW 8a East of Sewage Pond Bedrock	8/11/91	7.0	2200	1300	ND	ND	ND	2.72	2.51	7.15	ND
MMW 8b East of Sewage Pond Valley Fill	8/11/91	6.1	1100	730	0.11	ND	ND	1.83	ND	0.202	0.211
MMW 10a Sugar Shack South Valley Fill	8/11/91	5.8	1700	1100	33.1	0.028	0.558	11.2	ND	13.1	2.29
MMW 10b Sugar Shack South Bedrock	7/11/91	7.9	1800	1100	8.71	0.025	0.179	12.2	0.101	8.55	1.5
MMW 10c Sugar Shack South Valley Fill	8/11/91	4.7	1100	880	31.1	0.026	0.38	15.1	ND	16.3	3.2
MMW 11 Sugar Shack South Bedrock	7/11/91	5.6	2000	1300	56.3	0.036	0.919	17.6	0.129	31.7	5
MMW 13 Middle Dump	8/11/91	7.9	1400	700	ND	ND	ND	1.67	0.198	1.02	0.223

ND = no data
* = Suspended Al



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Consulting Engineers & Scientists

PROJECT NO	DATE	REVISION
09206	12/94	A

FIGURE 1 2

MINE FACILITIES PLAN

TABLE C1
Questa Mine Water Quality - ICP Data

			WS-1	WS-2	WS-Cap 1	WS-GC1	WS-GC2	WS-GC3
Physical Tests								
Conductivity		umhos/cm	3390	2240	11700	12300	4600	4630
pH			3.63	3.28	2.53	2.69	2.93	2.33
Dissolved Anions								
Acidity		CaCO3	973	856	11700	12200	3150	4110
Alkalinity - Total			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Sulphate		SO4	2800	1410	12700	11100	4220	2910
Total Metals								
Aluminum	T-Al		164	138	1300	1850	522	248
Antimony	T-Sb		<0.20	<0.20	<1.0	<1.0	<0.20	<0.20
Arsenic	T-As		<0.20	<0.20	<1.0	<1.0	0.21	<0.20
Barium	T-Ba		0.034	<0.010	<0.050	<0.050	0.623	0.224
Beryllium	T-Be		0.034	0.019	0.68	0.45	0.119	0.065
Bismuth	T-Bi		0.24	0.12	1.33	1.19	0.33	<0.10
Boron	T-B		<0.10	<0.10	<0.50	<0.50	<0.10	<0.10
Cadmium	T-Cd		0.013	0.021	0.42	0.585	0.148	0.034
Calcium	T-Ca		382	219	445	418	178	104
Chromium	T-Cr		0.067	<0.015	0.445	0.495	0.242	0.066
Cobalt	T-Co		1.04	0.187	2.76	4.45	1.23	0.314
Copper	T-Cu		3.06	0.853	13.9	10.1	2.94	7.25
Iron	T-Fe		8.57	3.66	848	493	290	866
Lead	T-Pb		<0.050	<0.050	<0.25	<0.25	1.04	0.437
Lithium	T-Li		0.319	0.075	1.19	1.33	0.393	0.106
Magnesium	T-Mg		239	57.9	1020	1080	295	44.5
Manganese	T-Mn		17.5	16	787	612	171	43.9
Molybdenum	T-Mo		0.081	<0.030	<0.15	<0.15	<0.030	0.079
Nickel	T-Ni		1.74	0.369	6.26	9.43	2.56	0.645
Phosphorus	T-P		0.06	<0.30	23.8	12.1	14.4	6.35
Potassium	T-K		3.1	2.9	<10	<10	10.4	11.1
Selenium	T-Se		<0.20	<0.20	<1.0	<1.0	<0.20	<0.20
Silicon	T-Si		8.23	27.3	43	52.4	75.8	25.2
Silver	T-Ag		<0.015	<0.015	<0.075	<0.075	<0.015	<0.015
Sodium	T-Na		3.1	23	24	15	4.3	9
Strontium	T-Sr		3.05	0.708	1.6	1.29	0.56	0.799
Thallium	T-Tl		<0.10	<0.10	0.64	<0.50	0.22	<0.10
Tin	T-Sn		<0.30	<0.30	<1.5	<1.5	<0.30	<0.30
Titanium	T-Ti		0.232	<0.010	<0.050	<0.050	0.052	0.044
Tungsten	T-W		<0.10	<0.10	<0.50	<0.50	<0.10	<0.10
Vanadium	T-V		<0.030	<0.030	<0.15	<0.15	0.125	0.03
Zinc	T-Zn		1.86	4.16	132	127	33.4	11.9

TABLE C1
Questa Mine Water Quality - ICP Data

		MS-1	MS-2	MS-Cab	MS-GC1	MS-GC2	MS-GC3
Dissolved Metals							
Aluminum	D-Al	164	135	1290	1850	434	246
Antimony	D-Sb	<0 20	<0 20	<1 0	<1 0	<0 20	<0.20
Arsenic	D-As	<0 20	<0 20	<1 0	<1 0	<0 20	<0 20
Barium	D-Ba	<0 010	<0 010	<0 050	<0 050	<0 010	<0 010
Beryllium	D-Be	0 004	0 019	0 67	0 44	0.109	0 065
Bismuth	D-Bi	0 22	0 11	1 03	1 19	0 29	<0 10
Boron	D-B	<0 10	<0 10	<0 50	<0 50	<0 10	<0.10
Cadmium	D-Cd	0 022	0 015	0 42	0 585	0 148	0.034
Calcium	D-Ca	252	219	409	416	173	104
Chromium	D-Cr	0 055	<0 015	0 44	0 485	0 106	0 062
Cobalt	D-Co	1 00	0 186	2 74	4 42	1 15	0 314
Copper	D-Cu	3 06	0 823	13 7	10	2 55	7 23
Iron	D-Fe	1 87	2 89	836	490	66	785
Lead	D-Pb	<0 050	<0 050	<0 25	<0 25	<0 050	<0 050
Lithium	D-Li	0 028	0 067	1 17	1 33	0.332	0 106
Magnesium	D-Mg	209	56 7	1010	1070	265	44
Manganese	D-Mn	17 5	16	777	612	160	43 9
Molybdenum	D-Mo	<0 030	<0 030	<0 15	<0 15	<0.030	<0 030
Nickel	D-Ni	1 74	0 369	6 26	9 38	2 44	0.645
Phosphorus	D-P	<0 00	<0 00	20 6	11 6	0 8	5 31
Potassium	D-K	<2 0	2 4	<10	<10	<2 0	<2 0
Selenium	D-Se	<0 20	<0 20	<1 0	<1 0	<0.20	0 20
Silicon	D-Si	4 79	26 9	42 5	51 9	13.7	21 8
Silver	D-Ag	<0 015	<0 015	<0 075	<0 075	<0 015	<0 015
Sodium	D-Na	3 1	20 3	23	15	3 7	7 1
Strontium	D-Sr	0 05	0 695	1 59	1 26	0 372	0 532
Thallium	D-Tl	<0 10	<0 10	0 64	<0 50	0 13	<0.10
Tin	D-Sn	<0 00	<0 00	<1 5	<1 5	<0 30	<0 30
Titanium	D-Ti	<0 010	<0 010	<0 050	<0 050	<0 010	<0 010
Tungsten	D-W	<0 10	<0 10	<0 50	<0 50	<0 10	<0 10
Vanadium	D-V	<0 030	<0 030	<0 15	<0 15	<0 030	<0 030
Zinc	D-Zn	1 86	4 16	130	127	32 1	11 9

TABLE C1
Questa Mine Water Quality - ICP Data

			WS-GC4	WS-GC5	WS-GC6	WS-C1	WS-C2	WS-SS1
Physical Tests								
Conductivity		umhos/cm	4860	2640	6500	6830	2290	2410
pH			2 61	3	2 66	2 55	3 2	3 63
Dissolved Anions								
Acidity		CaCO3	2100	705	5350	5150	658	435
Alkalinity - Total			<1 0	<1 0	<1 0	<1 0	<1 0	<1 0
Sulphate		SO4	3710	1680	5850	5900	1850	1640
Total Metals								
Aluminum	T-Al		332	97 1	582	375	99 6	95 8
Antimony	T-Sb		<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Arsenic	T-As		<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Barium	T-Ba		0 147	0 012	<0 010	0 258	0 042	0 291
Beryllium	T-Be		0 103	0 046	0 085	0 096	0 014	0 03
Bismuth	T-Bi		0 25	<0 10	0 29	0 2	<0 10	<0 10
Boron	T-B		<0 10	<0 10	<0 10	<0.10	<0 10	<0.10
Cadmium	T-Cd		0 092	<0 010	<0 010	0 035	<0 010	0 02
Calcium	T-Ca		227	298	275	279	207	267
Chromium	T-Cr		0 091	<0 015	0 218	0 147	<0 015	0 1
Cobalt	T-Co		0 678	0 34	0 834	0 63	0 154	0 511
Copper	T-Cu		4 89	0 022	0 87	1 76	0 206	2 01
Iron	T-Fe		248	6 83	376	890	20 9	54 2
Lead	T-Pb		0 097	<0 050	<0 050	<0 050	<0 050	0 098
Lithium	T-Li		0 24	0 024	0 014	0 468	0 049	0 249
Magnesium	T-Mg		270	138	333	500	50 1	91 3
Manganese	T-Mn		87 4	12 8	24 9	62 6	7 65	12 6
Molybdenum	T-Mo		<0 030	<0 030	<0 030	<0 030	<0 030	0.615
Nickel	T-Ni		1 55	0 107	2 18	1 08	0 264	0 97
Phosphorus	T-P		0 00	<0 00	0 83	18 2	<0 00	2 28
Potassium	T-K		0 4	7 0	<2 0	6 5	5 4	11 3
Selenium	T-Se		<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Silicon	T-Si		49 1	26 0	28 8	42 6	21 2	31 7
Silver	T-Ag		<0 015	<0 015	<0 015	<0 015	<0 015	<0 015
Sodium	T-Na		5 9	14 6	22 5	7 8	9 4	<2.0
Strontium	T-Sr		0 261	0 82	1 5	3 91	1 21	3 52
Thallium	T-Tl		0 14	<0 10	0 13	0 15	<0 10	<0 10
Tin	T-Sn		<0 30	<0 30	<0 30	<0 30	<0 30	<0 30
Titanium	T-Ti		<0 010	<0 010	<0 010	<0 010	<0 010	0 8
Tungsten	T-W		<0 10	<0 10	<0 10	<0 10	<0 10	<0 10
Vanadium	T-V		<0 030	<0 030	<0 030	<0 030	<0 030	0.055
Zinc	T-Zn		20 6	5 46	3 72	10 8	2 38	3 08

TABLE C1
Questa Mine Water Quality - ICP Data

		NS-GC4	NS-GC5	NS-GC6	NS-HC1	NS-HC2	NS-SS1
Dissolved Metals							
Aluminum	D-Al	202	97	577	370	99 6	84.4
Antimony	D-Sb	<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Arsenic	D-As	<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Barium	D-Ba	<0 010	<0 010	<0 010	<0 010	<0 010	<0 010
Beryllium	D-Be	0 103	0 0-6	0 085	0 096	0 014	0 029
Bismuth	D-Bi	0 25	<0 10	0 29	0 19	<0 10	<0 10
Boron	D-B	<0 10	<0 10	<0 10	<0.10	<0.10	<0 10
Cadmium	D-Cd	0 092	<0 010	<0 010	0 035	<0 010	0 018
Calcium	D-Ca	227	298	273	379	207	367
Chromium	D-Cr	0 097	<0 015	0 218	0 132	<0 015	0 032
Cobalt	D-Co	0 678	1 007	0 834	1 63	0 154	0 509
Copper	D-Cu	4 89	3 02	1 06	1 74	0 136	2 23
Iron	D-Fe	205	1 14	275	763	4 64	1 46
Lead	D-Pb	<0 050	<0 050	<0 050	<0 050	<0 050	<0 050
Lithium	D-Li	0 2-	0 024	0 21	0 456	0 048	0 228
Magnesium	D-Mg	170	18 1	232	498	53 1	82.6
Manganese	D-Mn	87 4	12 9	24 9	62 6	7 65	12 2
Molybdenum	D-Mo	<0 030	<0 030	<0 030	<0 030	<0 030	0 043
Nickel	D-Ni	1 55	1 07	2 17	4 08	0 364	0 958
Phosphorus	D-P	0 15	0 20	0 83	10	<0 30	<0 30
Potassium	D-K	<2 0	6 5	<2 0	<2 0	5 1	<2 0
Selenium	D-Se	<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Silicon	D-Si	45 6	24 8	28 6	35 7	21	7 32
Silver	D-Ag	<0 015	<0 015	<0 015	<0 015	<0 015	<0 015
Sodium	D-Na	5 7	14 6	22 4	6	8 4	<2 0
Strontium	D-Sr	0 209	1 82	1 49	3 3	1 21	3 1
Thallium	D-Tl	0 14	<0 10	0.13	0 1	<0 10	<0 10
Tin	D-Sn	<0 30	<0 30	<0 30	<0 30	<0 30	<0 30
Titanium	D-Ti	<0 010	<0 010	<0.010	<0 010	<0 010	<0 010
Tungsten	D-W	<0 10	<0 10	<0 10	<0 10	<0 10	<0 10
Vanadium	D-V	<0 030	<0 030	<0 030	<0 030	<0 030	<0 030
Zinc	D-Zn	20 6	15 46	3 7	10 8	2 28	3 06

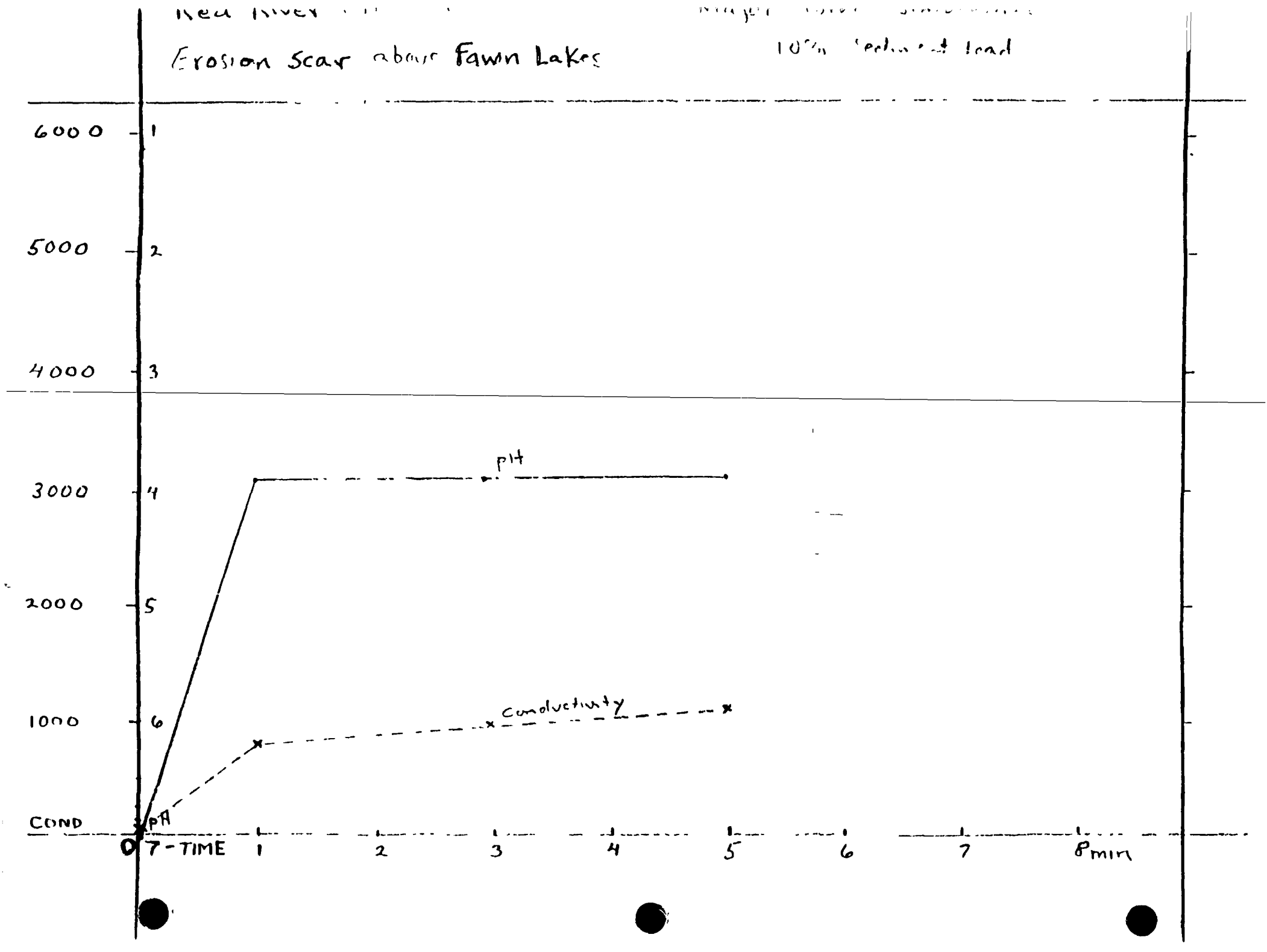
5

TABLE C1
Questa Mine Water Quality - ICP D

			WS-SS2	WS-Pit 1	WS-Pit 2	WS-Cap 2	WS-Cap 3	WS-Cap 4
Physical Tests								
Conductivity		umhos/cm	1600	4600	9170	409	2500	1350
pH			3 12	2 82	2 73	6 9	3 14	3 05
Dissolved Anions								
Acidity		CaCO3	447	866	680	14 2	558	326
Alkalinity - Total			<1 0	<1 0	<1 0	41	<1 0	<1 0
Sulfate		SO4	976	3020	1810	140	1690	735
Total Metals								
Aluminum	T-Al		74 8	6 07	52 8	18	87 6	50.3
Antimony	T-Sb		<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Arsenic	T-As		<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Barium	T-Ba		0 244	0 017	<0 010	0 064	<0 010	<0 010
Beryllium	T-Be		0 014	0 041	0 01	0 019	0 056	0 011
Bismuth	T-Bi		<0 10	0 01	<0 10	<0 10	0 14	<0 10
Boron	T-B		<0 10	<0 10	<0 10	<0 10	<0 10	<0 10
Cadmium	T-Cd		0 012	<0 010	<0 010	<0 010	0 025	<0 010
Calcium	T-Ca		134	442	437	69 3	237	67 1
Chromium	T-Cr		0 065	<0 015	0 051	<0 015	<0 015	<0 015
Cobalt	T-Co		0 066	0 038	0 105	0 018	0 298	0 114
Copper	T-Cu		0 16	0 19	1 01	0 094	0 465	1 09
Iron	T-Fe		89	305	119	17 2	10 9	6 95
Lead	T-Pb		0 064	0 050	<0 050	0 146	<0 050	<0 050
Lithium	T-Li		0 28	0 1	0 077	0 015	0 141	0 103
Magnesium	T-Mg		72 1	209	66 2	15 4	90.9	41 6
Manganese	T-Mn		4 7	206	2 33	0 62	59 6	8 13
Molybdenum	T-Mo		0 125	<0 030	<0 030	<0 030	<0 030	<0 030
Nickel	T-Ni		0 406	0 51	0 434	0 042	0 62	0 21
Phosphorus	T-P		4 88	1 8	2 43	1 42	<0 30	<0 30
Potassium	T-K		7 0	7 8	<2 0	7 2	<2 0	2 9
Selenium	T-Se		<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Silicon	T-Si		16 4	10 0	20 0	26.7	31.6	26 5
Silver	T-Ag		<0 015	<0 015	<0 015	<0 015	<0 015	<0 015
Sodium	T-Na		<2 0	25 6	10 9	15 9	29 2	13 6
Strontium	T-Sr		0 872	3 06	1 42	0 677	1 15	0.082
Thallium	T-Tl		<0 10	0 26	<0 10	<0 10	<0 10	<0 10
Tin	T-Sn		<0 30	<0 30	<0 30	<0 30	<0 30	<0 30
Titanium	T-Ti		0 137	0 056	<0 010	0 049	<0 010	<0.010
Tungsten	T-W		<0 10	<0 10	<0 10	<0 10	<0 10	<0.10
Vanadium	T-V		0 100	<0 060	<0 030	<0 030	<0 030	<0.030
Zinc	T-Zn		1 80	3 01	0 498	0 527	8 85	2 06

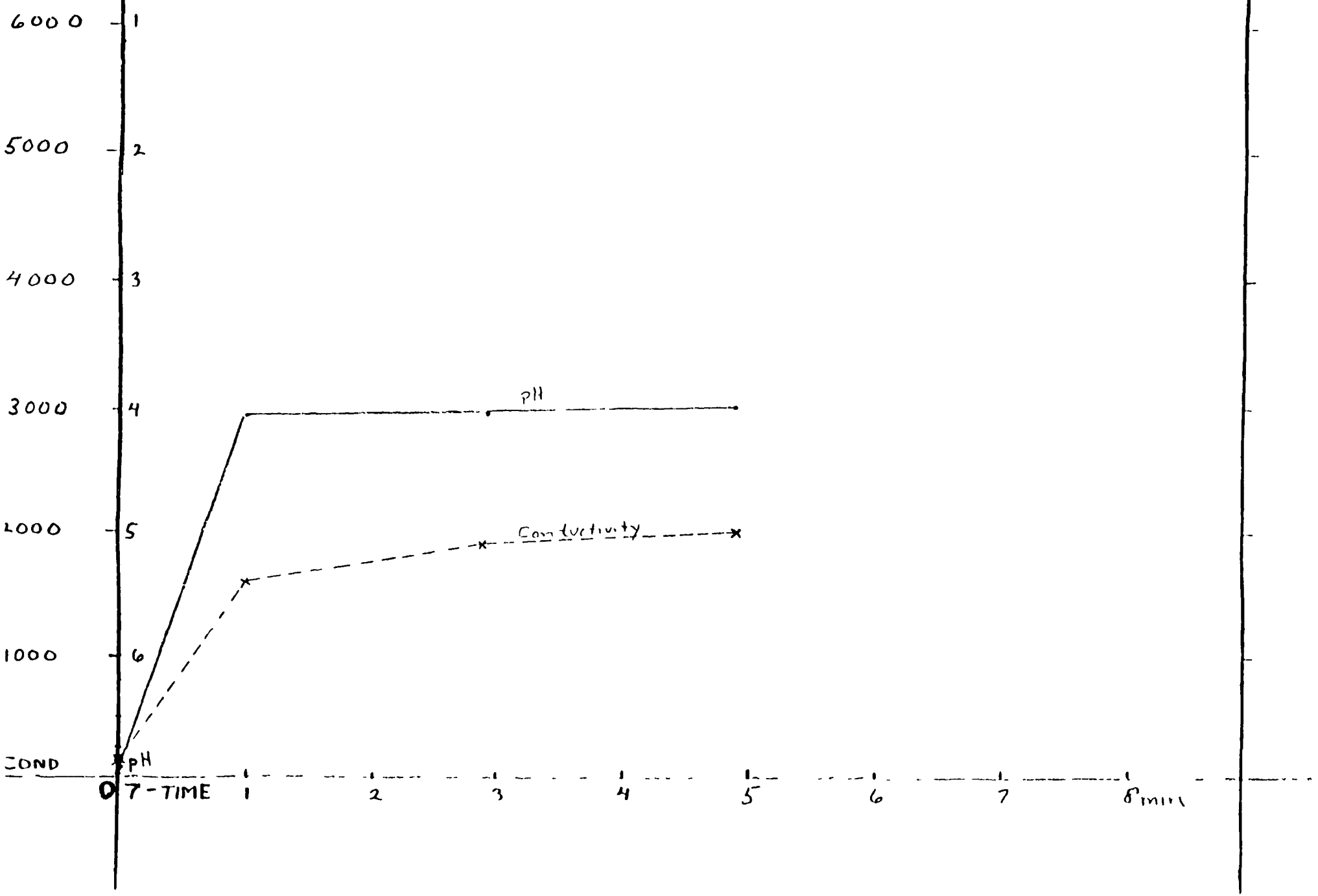
TABLE C1
Questa Mine Water Quality - ICP D

		WS-SS2	WS-Pit 1	WS-Pit 2	WS-Cap 2	WS-Cap 3	WS-Cap 4
Dissolved Metals							
Aluminum	D-Al	60 9	- 22	82 8	<0 20	87 6	50 3
Antimony	D-Sb	<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Arsenic	D-As	<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Barium	D-Ba	<0 010	<0 010	<0 010	0 031	<0 010	<0 010
Beryllium	D-Be	0 013	0 041	0 01	<0 005	0 056	0 011
Bismuth	D-Bi	<0 10	0 06	<0 10	<0 10	0 14	<0 10
Boron	D-B	<0 10	<0 10	<0 10	<0 10	<0 10	<0 10
Cadmium	D-Cd	0 01	<0 010	<0 010	<0 010	0 025	<0 010
Calcium	D-Ca	134	442	437	42 1	237	67 1
Chromium	D-Cr	0 029	<0 015	0 051	<0 015	<0 015	<0 015
Cobalt	D-Co	0 066	0 298	0 125	<0 015	0 298	0 114
Copper	D-Cu	- 13	0 107	- 01	<0 010	0 465	1 09
Iron	D-Fe	4 24	167	119	0 108	10.9	6 76
Lead	D-Pb	<0 050	<0 050	<0 050	<0 050	<0 050	<0 050
Lithium	D-Li	0 27	0 099	0 077	<0 015	0 141	0 103
Magnesium	D-Mg	70 8	009	66 2	8 55	90 9	41 6
Manganese	D-Mn	- 69	206	2 03	<0 005	59 6	8 13
Molybdenum	D-Mo	<0 030	<0 030	<0 030	<0 030	<0 030	<0.030
Nickel	D-Ni	0 436	0 81	0 434	<0 020	0 62	0 21
Phosphorus	D-P	<0 30	<0 30	2 04	<0 30	<0 30	<0 30
Potassium	D-K	<2 0	7	<2 0	3 5	<2 0	2 7
Selenium	D-Se	<0 20	<0 20	<0 20	<0 20	<0 20	<0 20
Silicon	D-Si	8 47	7 09	19 5	15 -	31 6	26 5
Silver	D-Ag	<0 015	<0 015	<0 015	<0 015	<0 015	<0 015
Sodium	D-Na	<2 0	25 6	10 9	14 7	29 2	13 6
Strontium	D-Sr	0 177	1 06	- 42	0 389	1 15	0 082
Thallium	D-Tl	<0 10	- 22	<0 10	<0 10	<0 10	<0 10
Tin	D-Sn	<0 30	<0 30	<0 30	<0 30	<0 30	<0 30
Titanium	D-Ti	<0 010	<0 010	<0 010	<0 010	<0 010	<0.010
Tungsten	D-W	<0 10	<0 10	<0 10	<0 10	<0 10	<0 10
Vanadium	D-V	<0 030	<0 060	<0 030	<0 030	<0 030	<0 030
Zinc	D-Zn	- 90	8 02	0 498	0 007	8 85	2 06

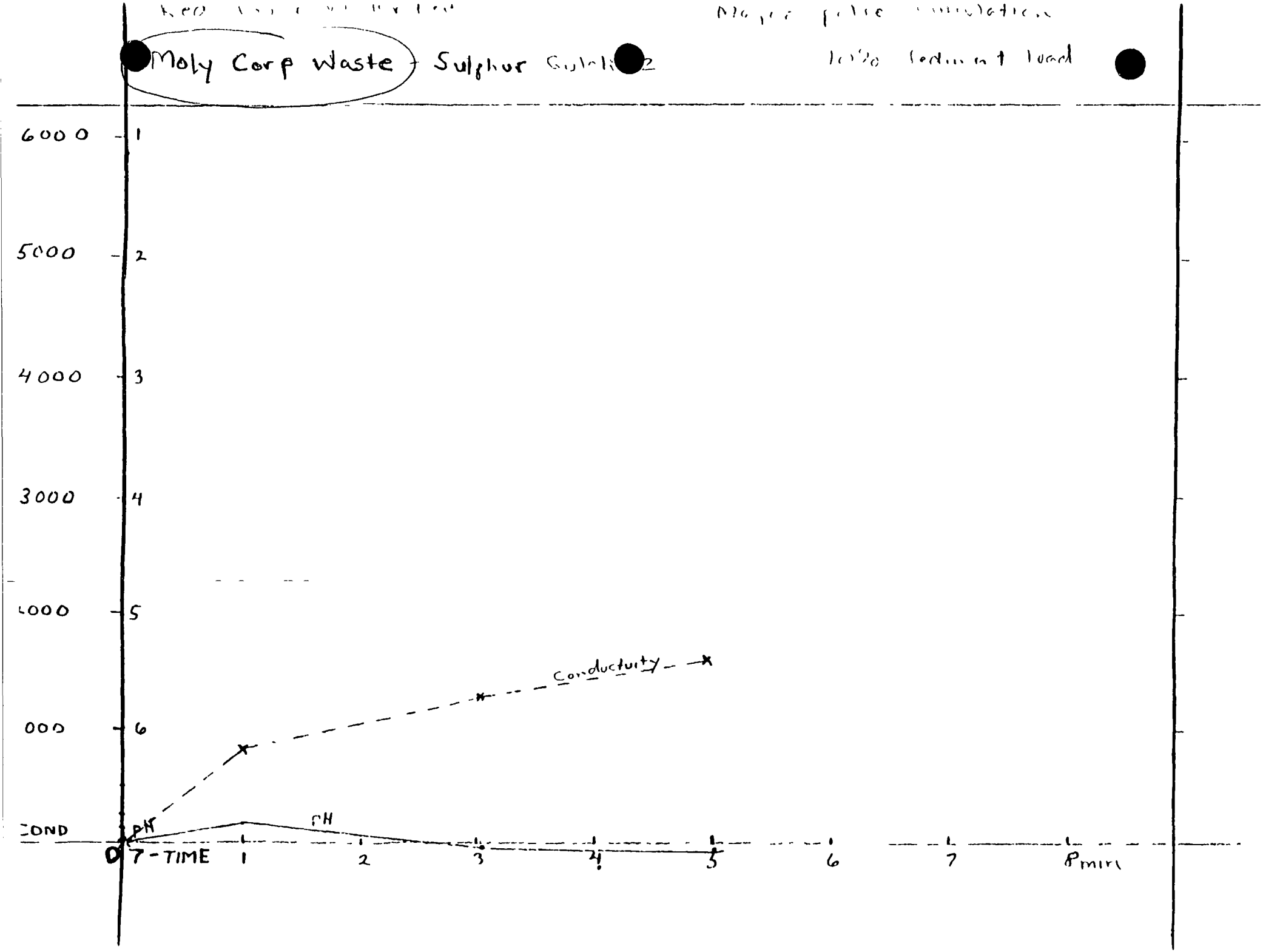

Red River
Erosion Scar above Fawn Lakes
10% sediment load
6000
5000
4000
3000
2000
1000
COND
1
2
3
4
5
6
pH
conductivity
pH
0
T-TIME
1
2
3
4
5
6
7
8 min

Moly Corp Waste - [illegible] #1

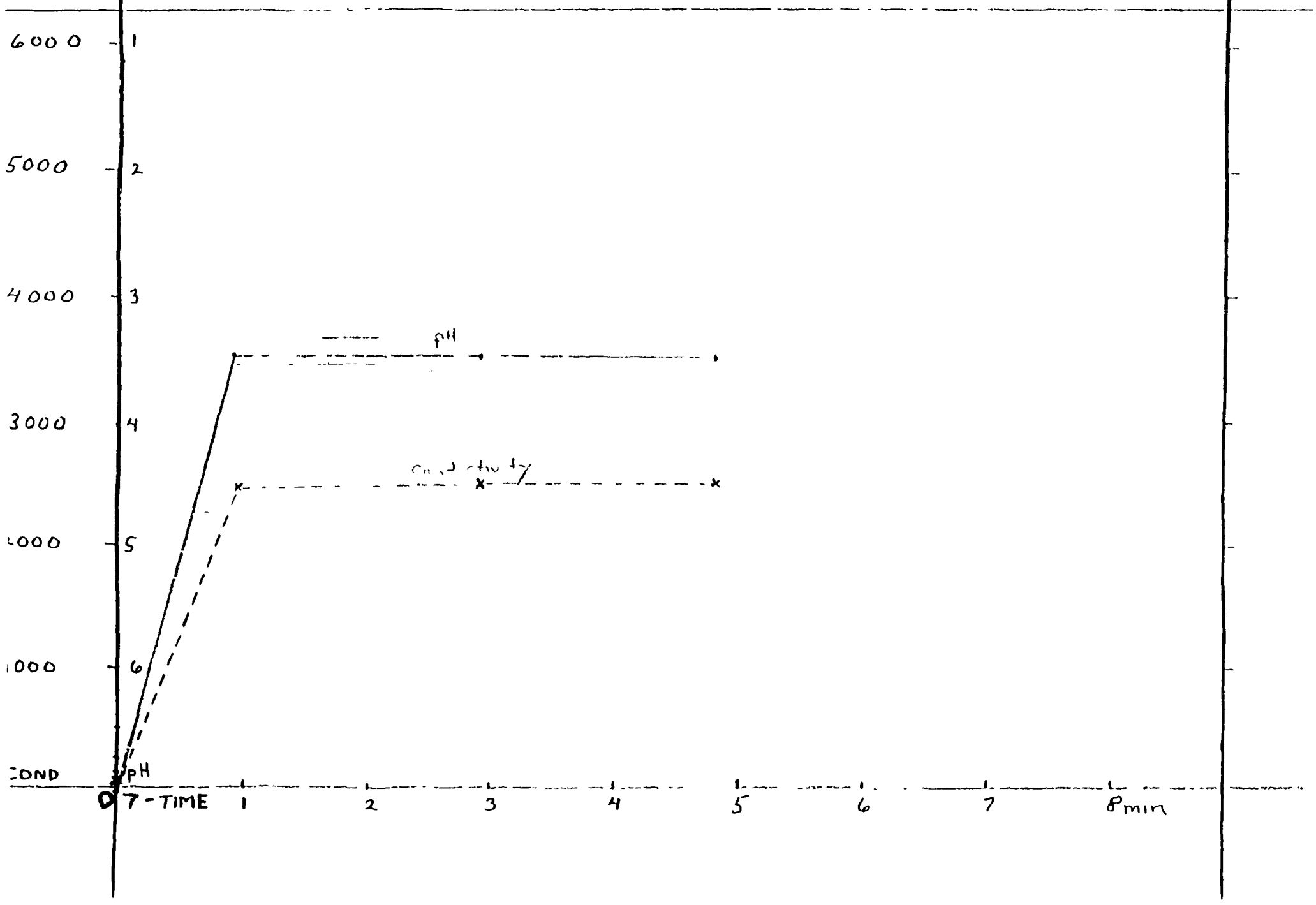
10% Sediment load

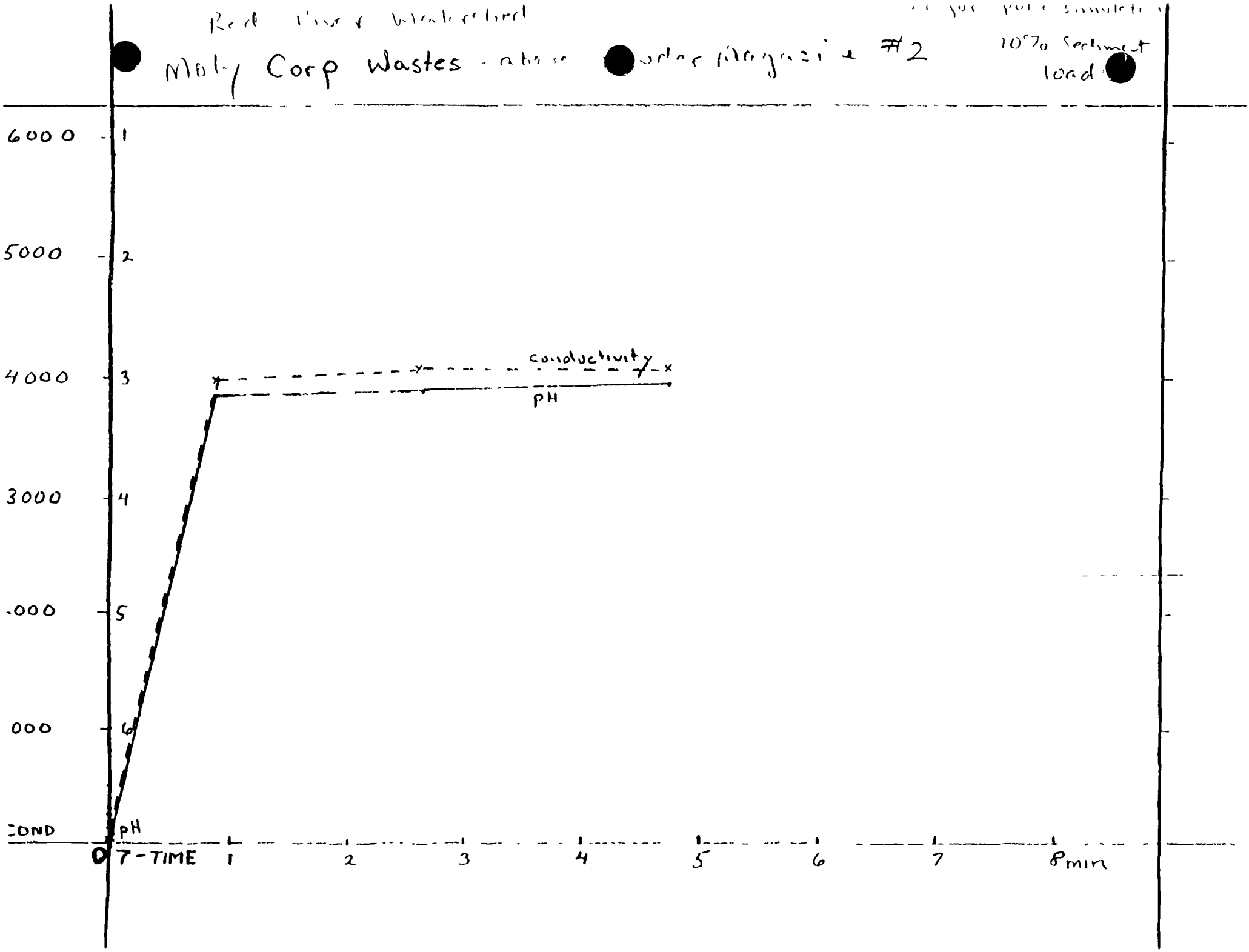


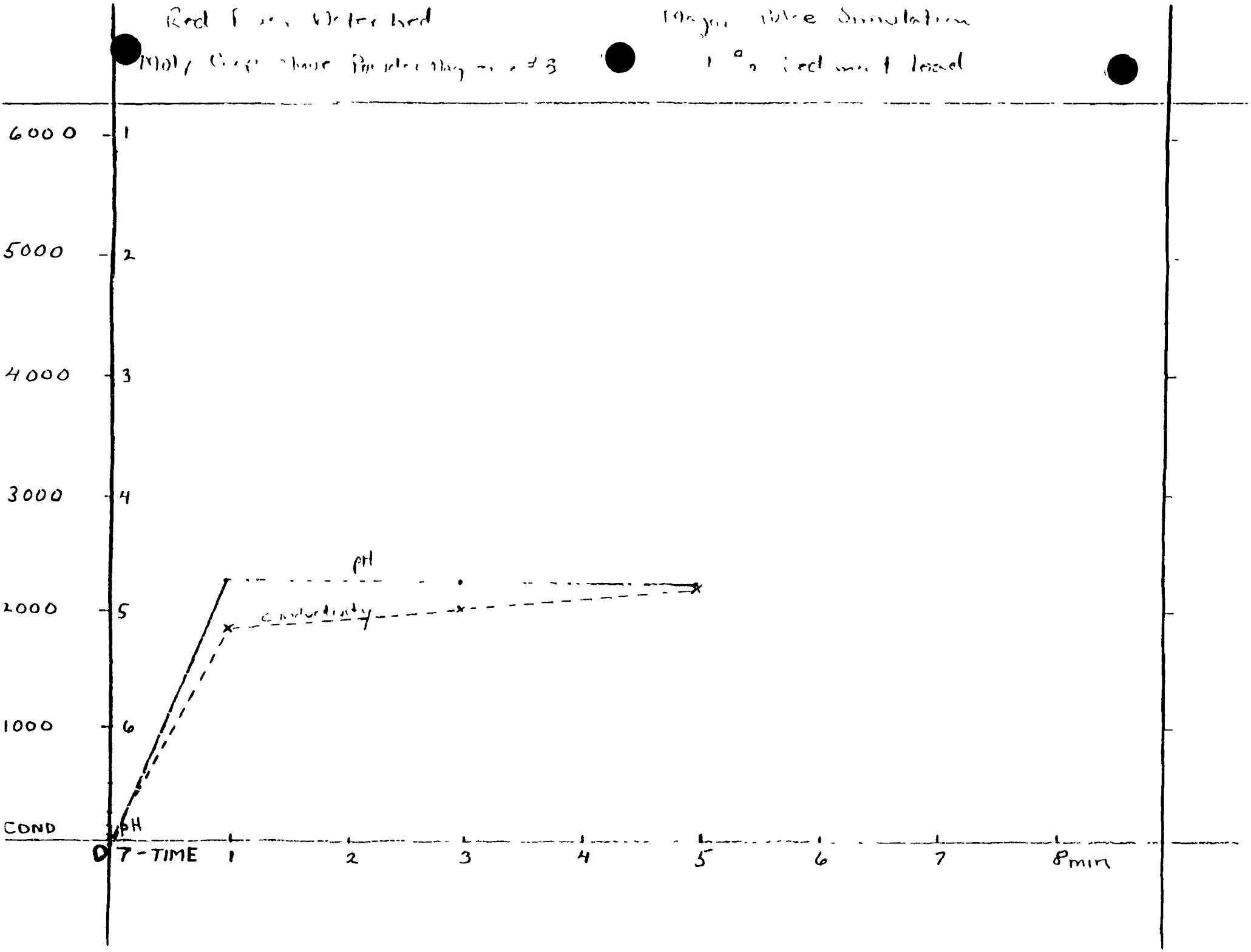
Moly Corp Waste + Sulphur



Moly Corp above Powder Magazine




Red River Watershed
Moly Corp Wastes - above Powder Magazine #2
10% Sediment load
6000
5000
4000
3000
.000
000
COND
1
2
3
4
5
6
pH
conductivity
pH
0
7-TIME
1
2
3
4
5
6
7
8min


6000
5000
4000
3000
2000
1000
COND
1
2
3
4
5
6
pH
conductivity
pH
0
T-TIME
1
2
3
4
5
6
7
8 min

APPENDIX B

RESPONSE TO "SUMMARY STATEMENT" PRESENTED BY QUESTA BOARD OF EDUCATION

March, 1982

RESPONSE TO "SUMMARY STATEMENT" PRESENTED BY QUESTA BOARD OF EDUCATION

INTRODUCTION & CONCLUSIONS

Molycorp has worked with the New Mexico Environmental Improvement Division (EID), the Questa Council and the Questa Board of Education for several years to inform concerned parties on the dust control program, and to determine if potential hazards exist with blowing tailings dusts. All study information collected to date, including one contracted by the Questa Board of Education in mid-1981, indicates that there is no potential for health problems associated with the tailings dusts. While this dust is a nuisance problem during periods of strong wind, no chronic health problems have been associated with it.

Molycorp's dust control program, including wetting of the tailings, chemical stabilization and reclamation is well documented. The continued research on the problem has been addressed in the past, and is discussed further in this report.

There have been substantial improvements to the dust control program in recent years. The current surfactant spraying

program with newly purchased equipment has resulted in a 30 percent reduction in airborne particulates in 1980-81 as reported by the EID.

Previous tailings pond management planning, which called for early completion of Section 36 tailings disposal is being further studied as a result of discussions with the school board. If design approval is obtained from the State Engineer's office, it would be possible to complete and revegetate the northern portion of Section 36 (within 3/4 miles of the school) by late 1984 or early 1985.

A BRIEF HISTORY OF TAILINGS DISPOSAL

During the feasibility studies for the open pit operations the issue of tailings disposal was considered carefully. Because of the steep terrain around the mill operations, tailings disposal was one of the major technical considerations in planning the mine. Several studies were undertaken to determine the best location of the tailings impoundment and to develop a plan of operations. The Questa location was chosen because it offered stability and flexibility for construction and the closest economic site to the mine.

Several consulting engineers were called in to analyze the site and design before construction started. In the summer of 1964, work on the site began so the new mill could start up in

SPLIT SAMPLE RESULTS

	School Board Dry Sample	Moly Dry Sample	School Board Wet Sample	Moly Wet Sample
Aluminum (Al)	63,000	>10,000	65,000	>10,000
Arsenic (As)	8*	2.7	3*	1.1
Barium (Ba)	<50	740	<50	740
Boron (B)	6	1.3	12	1.3
Cadmium (Cd)	<10	.28	<10	.44
Calcium (Ca)	18,900	>10,000	20,300	>10,000
Chromium (Cr)	60	87	80	87
Cobalt (Co)	35	8.9	37	18
Copper (Cu)	140	94	200	150
Iron (Fe)	29,300	>10,000	31,900	>10,000
Lead (Pb)	90	180	80	70
Magnesium (Mg)	8,300	10,000	10,300	>10,000
Manganese (Mn)	620	490	500	770
Mercury (Hg)	<0.5	NR	<0.5	NR
Molybdenum (Mo)	290	130	210	87
Nickel (Ni)	40	5.6	50	12
Potassium (K)	39,900	>10,000	39,700	>10,000
Selenium (Se)	<5*	4.7	<5*	2.7
Silver (Ag)	10	5.5	5	.45
Sodium (Na)	20,400	10,000	19,800	>5,000
Uranium (U)	<10	2.3	<10	1.7
Vanadium (V)	<40	50	60	50
Zinc (Zn)	240	98	210	170
Carbonate (CO_3)	7,200		15,100	
Chloride (Cl^-)	4,100		1,900	
Chlorine (Cl)		24		51
Cyanide (CN)	<1	<0.4	<1	<0.4
Fluoride (F^-)	2,200		1,000	
Fluorine (Fl)		4,500		>5,000
Silica(SiO_2)	665,000		632,000	
Silicon (Si)		>10,000		>10,000
Sulfide (H_2S)	6,470		5,750	
Sulfate (SO_4)	5,440	>1,000	7,790	1,000
Total Organic Carbon (TOC)	2,000	600	1,100	1,000
Tin (Sn)				
Tungsten (W)				
Bismuth (Bi)				
Thallium (TI)				

* Corrected by Colorado School of Mines

BULLETIN 53

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Geology of Questa Quadrangle, Taos County, New Mexico

BY PHILIP F McKINLAY

Geology and ore deposits of the southwestern quarter of the Taos Range of the Sangre de Cristo Mountains and the Taos Plain to the west

Prepared cooperatively by
New Mexico Bureau of Mines & Mineral Resources
and the United States Geological Survey

1957

STATE BUREAU OF MINES AND MINERAL RESOURCES
NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY
CAMPUS STATION SOCORRO, NEW MEXICO

NEW MEXICO INSTITUTE OF MINING & TECHNOLOGY
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Contents

	Page
INTRODUCTION	1
Location and Accessibility	1
Previous Work	1
Acknowledgments	1
GEOGRAPHY	3
Surface Features	3
Climate	3
GEOLOGY	4
Sequence of Rocks	4
Introduction	4
Precambrian Rocks	4
Undifferentiated Metamorphic Rocks (pCm)	4
Amphibolite and hornblende schist	4
Quartz mica schist and gneiss	4
Cabresto Metaquartzite (pCq)	5
Graphite mica gneiss	5
Sillimanite biotite gneiss	5
Granite and Granite Gneiss (pCgr)	6
Pegmatites (pCp)	7
Paleozoic Rocks	7
Sangre de Cristo(?) Formation (PPsc)	7
Tertiary Rocks	8
Andesite Flows and Pyroclastics (Ta)	8
Latir Peak Latite (Tlp and Tlpi)	9
Granite (Tgr)	9
Rhyolite Tuffs and Flows (Tr)	10
Rhyolite Intrusives (Tri)	10
Soda Granite (Tsg)	11
Monzonite Porphyry Dikes (Tmp)	12
Quaternary Tertiary Rocks	12
Basalts (QTb)	12
Quaternary Rocks	13
Andesite (Qan)	13
Coarse Fan Gravels (Qg)	13
Cemented Conglomerate	13
Valley Alluvium (Qal)	14

Page

Structure 14
Folds 14
Faults 14
Thrust Faults 14
Normal Faults 14
Brecciation 15
Fractures 15
Foliation 15

Metamorphism 15

Alteration 16

Geologic History 16

Mineral Deposits 18
Questa Molybdenum Mine 18
Other Deposits 18
Water 19

REFERENCES 20

INDEX 21

Illustrations

TABLE

1 Section of Sangre de Cristo(?) formation on Cabresto Creek 8

PLATE

1 Geologic map and section of Questa quadrangle New Mexico In pocket

Introduction

This report describes the geology and mineral deposits of the southwestern quarter of the Taos Range of the Sangre de Cristo Mountains, a fault block range with complex geology, and the Taos Plain, a bolson, to the west

The study was made by the New Mexico Bureau of Mines and Mineral Resources in cooperation with the U S Geological Survey as part of a study of the entire Taos Range Field work began in the summer of 1947 and continued during the summers through 1950 Work done in the northern half of the area has been reported in Geology of Costilla and Latir Peak quadrangles, Taos County, New Mexico," issued as Bulletin 12 of the State Bureau of Mines and Mineral Resources

LOCATION AND ACCESSIBILITY

Questa quadrangle is in the north central part of Taos County, between latitudes 36°30′ and 36°45′ and longitudes 105°30′ and 105°15′ The region is served by State Highway 3, which runs north from Taos through Questa to Colorado State Highway 38 extends east from Questa to Red River, State Highway 111, a graded road, extends west from near Arroyo Hondo on Highway 38 to Tres Piedras Other roads extend up Rio Hondo and Cabresto Canyons The principal towns are Questa (population 250), Arroyo Seco (population 600), and Arroyo Hondo (population 700)

PREVIOUS WORK

Previous geologic work within the quadrangle has been confined to reconnaissance mapping and detailed study of the Questa molybdenum mine A geologic map, scale 1 253,000, including this quadrangle, was compiled by Stevenson (1881) as part of the Wheeler survey Bryan (1930, p 116 118) described the basalts and gravels west of the mountain front Gruner (1920) described the geology of the southeastern corner of the quadrangle

The Questa molybdenum mine was described initially in a brief paper by Larsen and Ross (1920) More detailed studies have been made by Vanderwilt (1938) and Schilling (1956)

ACKNOWLEDGMENTS

The author wishes to thank all who helped in the field mapping and organization of this report Special mention is due Charles F Park, Jr., Art Lees, Jack Hunt, Ken Rheim, and John H Schilling, who helped

with the mapping, Charles Park and Ken Rheim, who examined most of the rock specimens and sections, C B Read and coworkers, of the U S Geological Survey, who contributed background information and invaluable advice while the mapping of the quadrangle was in progress, E C Anderson, under whose directorship the field work was undertaken, Eugene Callaghan, former director of the New Mexico Bureau of Mines and Mineral Resources, for his active interest and helpful supervision during the preparation of the map and report, J B Carmen, former general manager of the Questa Molybdenum mine, who was a constant inspiration to the field personnel and furnished information on the geology and ore deposits, Jerry Olson, of the U S Geological Survey, who did detailed geologic mapping in several of the alteration areas and contributed to the deciphering of the various rock units exposed along the Red River, Mrs Richard H Frische, who helped draft the map, John H Schilling, who helped compile the map and text and drafted part of the map, and Howard E Sylvester, who edited the report Many local people and prospectors in the Questa Red River area contributed to the mining history of the area and assisted in the location of the numerous prospects

Geography

SURFACE FEATURES

Maximum relief within Questa quadrangle is about 5 600 feet, with the lowest point, 6 500 feet on the Rio Grande at the southern border, and the highest point, 12,106 foot Lobo Peak The area can be divided into two physiographic subdivisions (1) the Taos Range of the Sangre de Cristo Mountains, and (2) the Taos Plain

The Taos Plain covers the western half of the quadrangle Elevations range from 7,000 feet at the rim of the Rio Grande gorge to 8,000 feet along the mountain front to the east The Rio Grande gorge extends southward across the plain and ranges in depth from 300 feet at the northern edge of Questa quadrangle to 500 feet at the southern edge

The Taos Range of the Sangre de Cristo Mountains covers the eastern half of the quadrangle The prominent features are the steep western front, high peaks and glaciated valleys, and the Red River and Rio Hondo drainages

CLIMATE

The region is semiarid, although the range in altitude produces large variations in temperature and precipitation The annual precipitation varies from less than 8 to more than 20 inches Temperatures in winter range from 25° to 50°F, those in summer from 30°F to 90°F The higher precipitation and lower average temperatures occur in the mountainous areas From May to October, the moisture falls as rain or hail, except on the high peaks, where snowstorms may occur throughout the year

Geology

SEQUENCE OF ROCKS

Introduction

The Taos Plateau is a geologic setting very different from that of the Taos Range of the Sangre de Cristo Mountains. In the Taos Range, Precambrian metamorphic rocks (amphibolites, schists, and quartzites) and granite crop out over two-thirds of the area within Questa quadrangle. Tertiary volcanics (andesite, latite, and rhyolite) and granite stocks crop out over much of the remaining area. Dikes of rhyolite, monzonite porphyry, latite, and andesite are common. Scattered outcrops of Permo-Pennsylvanian sediments occur along the northeastern edge of the quadrangle.

In contrast, the Taos Plain is covered by a series of late Quaternary-Tertiary basalts and interbedded gravels. East of the Rio Grande, recent fan gravels cover the basalts.

Precambrian Rocks

Undifferentiated Metamorphic Rocks (p€m)

The oldest rocks in Questa quadrangle are amphibolites and hornblende schists, interlaid quartzites and quartz-mica schists, and layers of massive quartzite. The amphibolites, schists, and small lenses of quartzite make up the undifferentiated metamorphic rocks (p€m) shown on the map (pl. 1). Where possible, the quartzite exposures have been mapped as a separate unit (p€q). These metamorphic rocks crop out over large areas throughout the part of the Taos Range covered by this report and are similar to rocks of the Valdito formation of the Picuris Range to the south (Montgomery, 1953).

Amphibolite and hornblende schist. These rocks are interlayered with other metamorphic rocks throughout the Taos Range in Questa quadrangle.

The amphibolite and hornblende schists are massive to well foliated rocks that range from black to dark green. Both have similar mineral content. Hornblende, andesine(?), and quartz in decreasing amounts are the important minerals. Apatite, sphene, and magnetite occur more sparingly. Epidote is abundant along fractures and quartz veins cutting the amphibolite and schist. Hornblende commonly is altered to chlorite, the feldspars to sericite. The amphibolite lacks foliation and is low in quartz, the hornblende schist is foliated and contains a higher percentage of quartz.

The amphibolite and schist may have been derived from basic volcanic rocks, but conclusive evidence is lacking.

Quartz-mica schist and gneiss. Quartz-mica schist and gneiss which are interlayered with the amphibolite and hornblende schist are well exposed north of Cabresto Creek in the northeast corner of Questa quadrangle.

Biotite up to 2 mm in diameter makes up approximately 45 percent of the rock. Small crystals of feldspar (40%) and quartz (15%) are intergrown with the biotite. Varying amounts of muscovite, almandite garnet, epidote, chlorite, and calcite may be present.

The quartz-mica schist and gneiss may have been derived from shale, sandstone, or rhyolite, again, however, conclusive evidence is lacking.

Cabresto Metaquartzite (p€q)

The Cabresto metaquartzite was named (McKinlay, 1956) for exposures along lower Cabresto Creek, where the formation crops out on both sides of Cabresto Canyon for over 5 miles. The formation is best exposed along the north side of the canyon, 4 miles east of Questa. Quartzite tentatively assigned to the Cabresto metaquartzite forms a narrow band extending east from the mountain front north of San Cristobal Creek to Lobo Peak. Several smaller areas are found along the mountain front to the south. Quartzite exposed in the Taos Range east of Questa quadrangle has been called Pueblo quartzite by Gruner (1920).

Maximum thickness in Questa quadrangle is about 100 feet. Thin layers of quartzite in the amphibolite, hornblende schist, and quartz-mica schist and gneiss where they could not be mapped separately, have been included with the undifferentiated metamorphic rocks.

The quartzite is a cream to gray, or reddish brown, coarsely crystalline rock. Along Cabresto Canyon it is made up of massive, 2- to 10-foot layers separated by thin muscovite or biotite-magnetite-garnet bands. Within the massive quartzite alined magnetite grains occur in layers 2 inches to 1 foot apart, and parallel the mica layers.

When examined microscopically, the massive quartzite is a mosaic of quartz grains which commonly show wavy extinction. Original grain boundaries and cement are destroyed. Scattered flakes of muscovite and sillimanite bunches occur along microscopic shear planes.

Layers of graphite-mica gneiss and sillimanite-biotite gneiss locally are interlayered with the massive quartzite, and have been mapped as part of this unit.

Graphite-mica gneiss. Graphite-mica gneiss is exposed in a few places along Cabresto Creek. Under the microscope it is an intimate intergrowth of equigranular orthoclase and quartz crystals enclosing alined graphite flakes. The graphite content varies from 1 to 10 percent. Muscovite and sphene occur sparingly. This rock may have been formed by the metamorphism of carbonaceous shale.

Sillimanite-biotite gneiss. Sillimanite-biotite gneiss is also found along Cabresto Creek as layers ranging from 1 foot to about 50 feet in thickness. The rock is commonly granitic in appearance and exhibits a

the soda granite is fresher appearing, less granulated, and molybdenite deposits are associated with the soda granite bodies, but not with the earlier granite The soda granite is tentatively dated as late Tertiary in age

The similarities in age and mineralogy of the rhyolite volcanics, rhyolite porphyry dikes, soda granite, and other Tertiary granite suggest a common parent magma, although evidence is not conclusive

Monzonite Porphyry Dikes (Tmp)

Long thin monzonite porphyry and quartz monzonite dikes are scattered throughout the Taos Range

The monzonite porphyry ranges from light greenish gray to gray Textures and mineral compositions vary from place to place The principal minerals are orthoclase, albite, quartz, biotite, and hornblende The orthoclase forms white to pinkish phenocrysts that are in places 2 inches in diameter White albite phenocrysts as large as one half of an inch are common Rounded quartz phenocrysts range to as much as three quarters of an inch in diameter Crystals in the groundmass are generally not over one eighth inch in size and consist of quartz, feldspar, and scattered biotite and hornblende

The monzonite dikes are one of the youngest dike rocks in the area, and cut the Tertiary volcanic flows and pyroclastics Dikes assigned to this unit are exposed in the Questa molybdenum mine workings, where they cut the soda granite stock (Schilling, 1956)

Quaternary-Tertiary Rocks

Basalts (QTb)

Light- to dark gray basaltic to andesitic flows of olivine rich rocks underlie the Taos Plain and are well exposed in the Rio Grande gorge The flows range from 20 to 55 feet in thickness and extend under the alluvial fans along the front of the Taos Range A low domal type mass of this rock forms Cerro Negro north of the community of Arroyo Hondo in the southern part of the quadrangle

The flows are often vesicular, and are interlayered with beds of semi-consolidated sand and gravel This basalt and basaltic andesite has been correlated by Atwood and Mather (1932) with the basalt of the Hinsdale formation of the San Juan region

Accurate dating could not be made This unit is tentatively dated as late Tertiary to Quaternary in age

Quaternary Rocks

Andesite (Qan)

A mass of gray porphyritic andesite forms Cerro Chiflo, an east west trending ridge along the northern edge of the quadrangle on the Taos Plain

The andesite is exposed in the Rio Grande gorge Here the Quaternary Tertiary basalt flows are in contact with the sides of the andesite mass which is exposed over the entire vertical extent of the western gorge wall Whether the andesite intrudes the basalts or represents a hill of older andesite is not clear Definite intrusive relations were not noted This andesite is quite different from the Tertiary andesites in the Taos Range To the west similar andesite is associated with the basalts The uppermost basalt flow appears to butt against the andesite without being deformed by any intrusive action

It is suggested that the andesite may be an extrusive dome, the andesite having been intruded up through the lower basalt flows and interbedded gravel as a dikelike mass, then spreading out on the surface as a dome, and later becoming partially buried by more flows and gravel However, the possibility that the andesite is prebasalt or entirely intrusive cannot be ruled out until better evidence is available

Coarse Fan Gravels (Qg)

Fan gravels lie west of the steep mountain front of the Taos Range They dip westward at 5 20 degrees The gravels are loosely consolidated and contain many thin sand lenses

The coarse fan gravels are in places 3,000 feet thick Basalt flows are interlayered with the gravels near the bottom of the gravel unit In places basalt with only a thin veneer of gravel is encountered The youngest fan gravels have been laid over the topmost basalt flows from Guadalupe Mountain

Cemented Conglomerate

Angular conglomerate, with occasional lenses of sand, is exposed up to 200 feet above present streams and gulch bottoms in the areas of intense alteration along the Red River Exposures were too isolated and small to be shown on Plate 1 Schilling (1956) called this unit "cemented conglomerate "

The angular conglomerate is made up of angular fragments of altered volcanic rocks washed from the large alteration areas and later cemented by limonite and hematite This rock is so well cemented that in places it appears to be part of the older volcanic rocks

This conglomerate now is a terrace deposit The relatively small amount of downcutting since the formation of this unit suggests a late Pleistocene age

Valley Alluvium (Qal)

The gravels and other unconsolidated materials on the present floors of the gulches, valleys, and cirques were mapped as valley alluvium.

Mud flows of debris from the alteration areas along the Red River have formed thick fans in Red River Canyon.

Although glacial deposits are widespread in the Taos Range east of Questa quadrangle, such deposits are less common within the quadrangle. Cirques at heads of tributaries to Columbine Creek contained small glaciers during Wisconsin time. Morainal deposits indicate that the glaciers did not extend much below 9,600 feet.

STRUCTURE

The most prominent structural features of Questa quadrangle are the block faulted Taos Range, bounded on the east by a thrust fault and on the west by normal faulting, and the downfaulted bolson which forms the Taos Plain.

Within the mountains a downfaulted zone bounded on the north by Cabresto Canyon and on the south by Red River Canyon extends eastward across the range (Schilling, 1956). Not only are the Tertiary volcanic and older rocks downfaulted in a complex pattern but the alteration areas and most of the Tertiary soda granite stocks are localized within the zone.

Folds

Folding is not an important feature within the quadrangle. Precambrian rocks were folded along N. 70° E. and N. 20° W. axes. Some folding may have occurred in late Permian time, though the steep dips of the Sangre de Cristo(?) sediment could be due to tilting of Tertiary fault blocks. Tertiary and Quaternary rocks show no apparent folding.

Faults

Thrust Faults

The principal Laramide thrust fault along the east edge of the Taos Range is east of Questa quadrangle. Minor thrust faults in Precambrian rocks are indicated across upper San Cristobal Creek and north of Valdez where a mass of quartzite lies above a crenulated zone of undifferentiated metamorphics.

Normal Faults

The Taos Range has been elevated and tilted eastward along a zone which approximately parallels the present position of the western mountain front. The evidence of a fault along the mountain front is based on apparent displacement of Tertiary volcanics and Precambrian quartzite, on faceted ridges, the steplike nature of the topography along the front, and the thick gravel deposits underlying the Taos Plain. The amount of vertical displacement is estimated to be more than 7,000 feet.

The latest displacement along this frontal fault zone is well developed east of the village of Costilla, in Costilla quadrangle to the north (McKinlay, 1956) where Quaternary basalt flows are broken.

The frontal fault zone trends south from the north border of the quadrangle to Lobo Creek. South of Lobo Creek the zone has a southeast trend. Normal faults and the rhyolite porphyry dike swarm in the mountains to the southeast of Lobo Creek have this same trend.

High angle faults within the downfaulted zone along the Red River commonly have an east-west trend, although the fault pattern is irregular and is difficult to trace because of poor exposures and the intense alteration.

Brecciation

Areas of intense brecciation are common in the downfaulted zone along the Red River. These areas are not only brecciated but are intensely altered. The intensity of brecciation varies greatly. Large masses of unbrecciated rock are surrounded by intensely brecciated rock.

Although the Tertiary volcanic and older rocks have been brecciated, the soda granite apparently has not been affected, a difference which suggests that the brecciation occurred during late Tertiary time.

Fractures

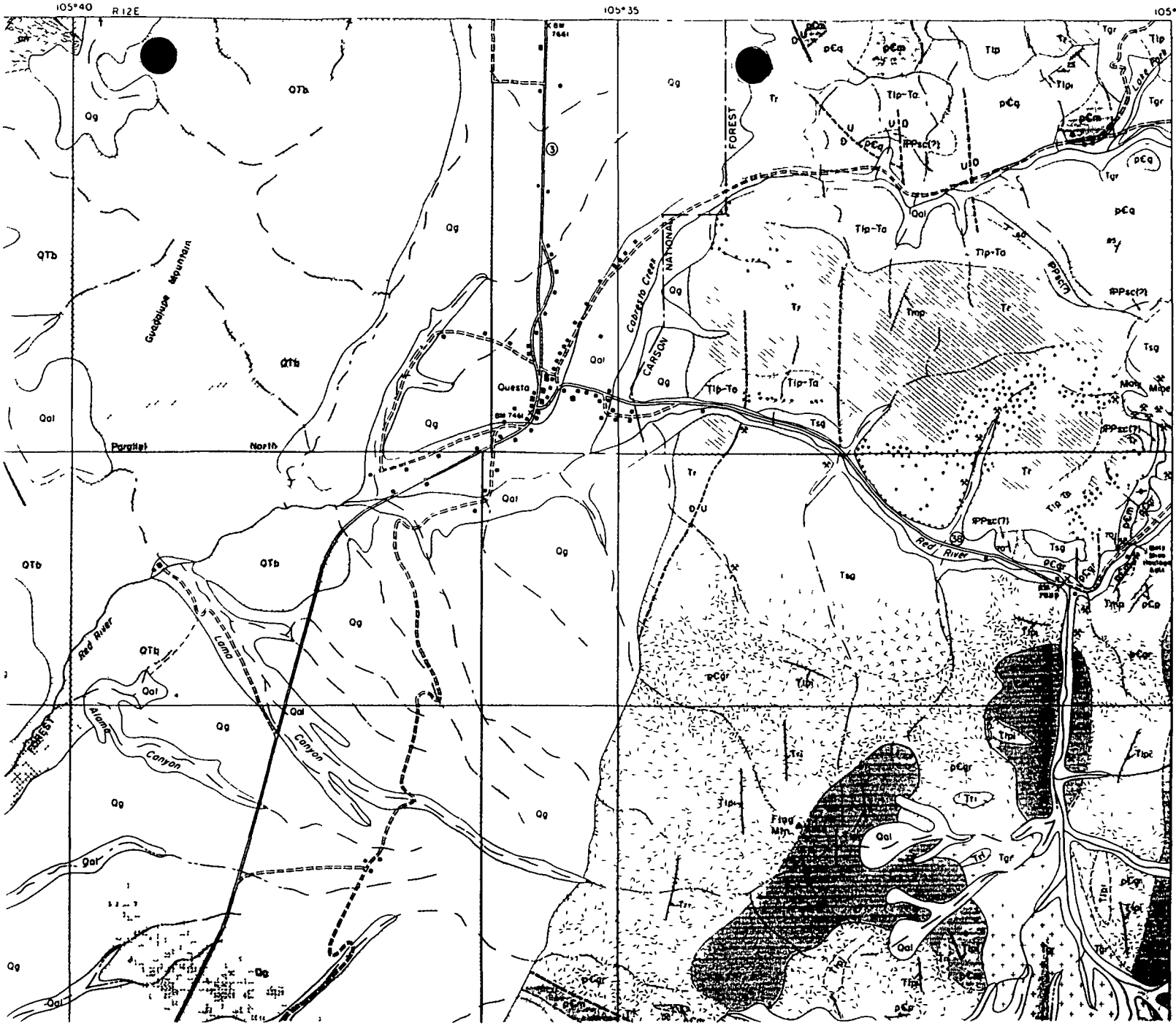
Fracturing is widespread in the mountains. Fracturing parallel to the normal faulting is common. Another group of fractures trend eastward with steep dips to the north. Fracturing within the downfaulted zone is irregular and, where more closely spaced, is gradational with the less intense brecciation.

Foliation

Foliation in the Precambrian metamorphic rocks shows no predominant trend, although east-west trends with steep dips to the north or south are the most common.

METAMORPHISM

In general, the metamorphism of the Precambrian rocks is of low or medium grade. The metamorphic process which produced the mineral assemblages was first regional in nature and, second, was confined to local thermal effects near the Precambrian granite. The regional meta



EXPLANATION

Qal — Valley alluvium
Stream gravel talus and glacial debris

Qg — Coarse fan gravels

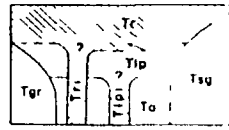
an — Andesite
Gray porphyritic andesite

QTb — Basalt
Dark gray basalt flows

ANGULAR UNCONFORMITY

Altered rock
Areas of hydrothermal alteration where the rock units were undifferentiated

Tmp — Monzonite porphyry
Dikes of gray to dark green monzonite porphyry

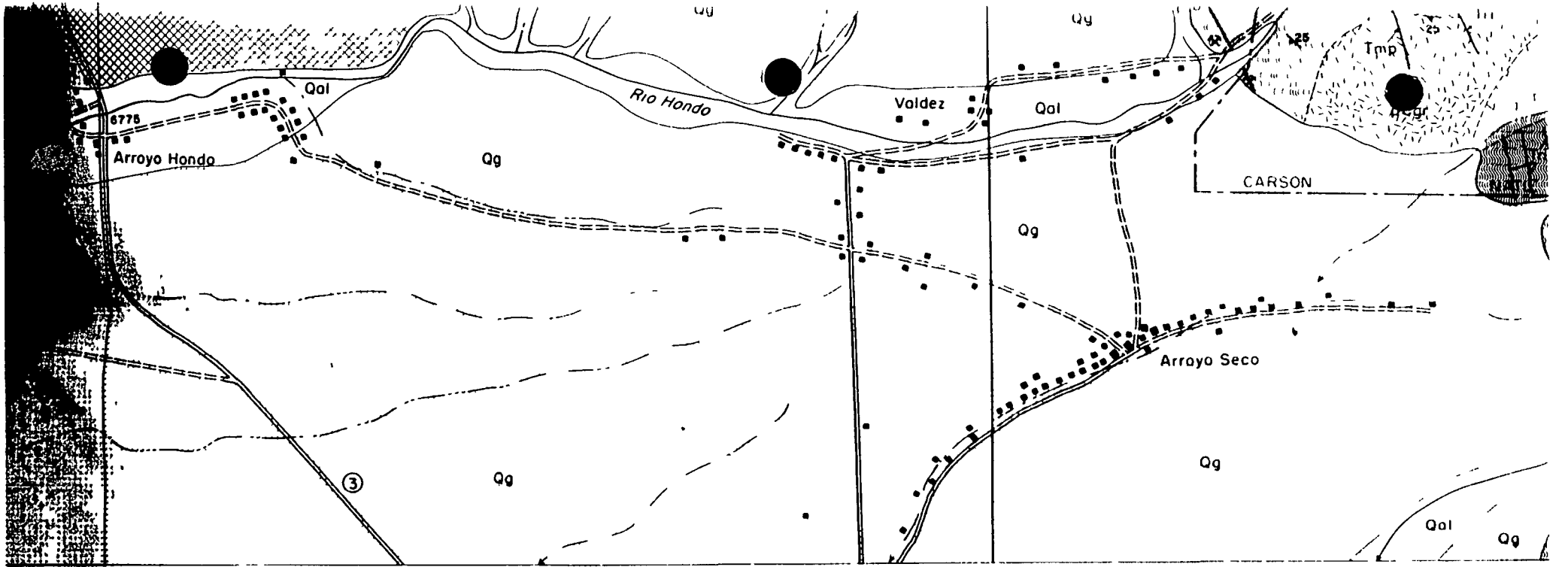


Tertiary igneous complex
Tsg *pink soda (albite rich) granite dikes and stocks*
Tr, *gray to light pink rhyolite tuffs, breccias and flows*
Tri *rhyolite dikes*
Tgr *cream to light-pink porphyritic granite dikes and stocks*
Tlp and **Tlpi** Latir Peak formation
Tlp *light-gray to reddish andesite and latite porphyry flows or sills (?)*
Tlpi, *gray andesite and latite porphyry dikes*
Ta, *red, purple to green andesite flows, sills (?) breccias and tuffs*

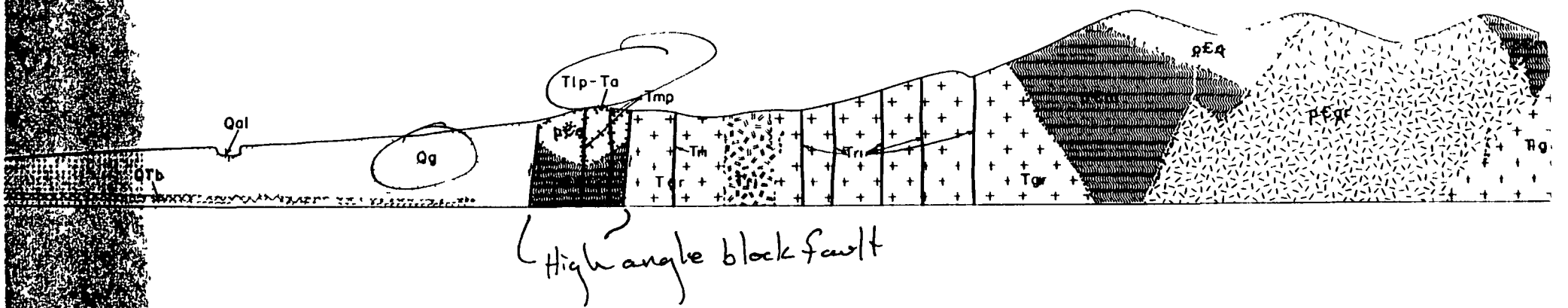
UNCONFORMITY

IPPsc(?) — Sangre de Cristo(?) formation
Red arkosic shale sandstone and conglomerate

ANGULAR UNCONFORMITY



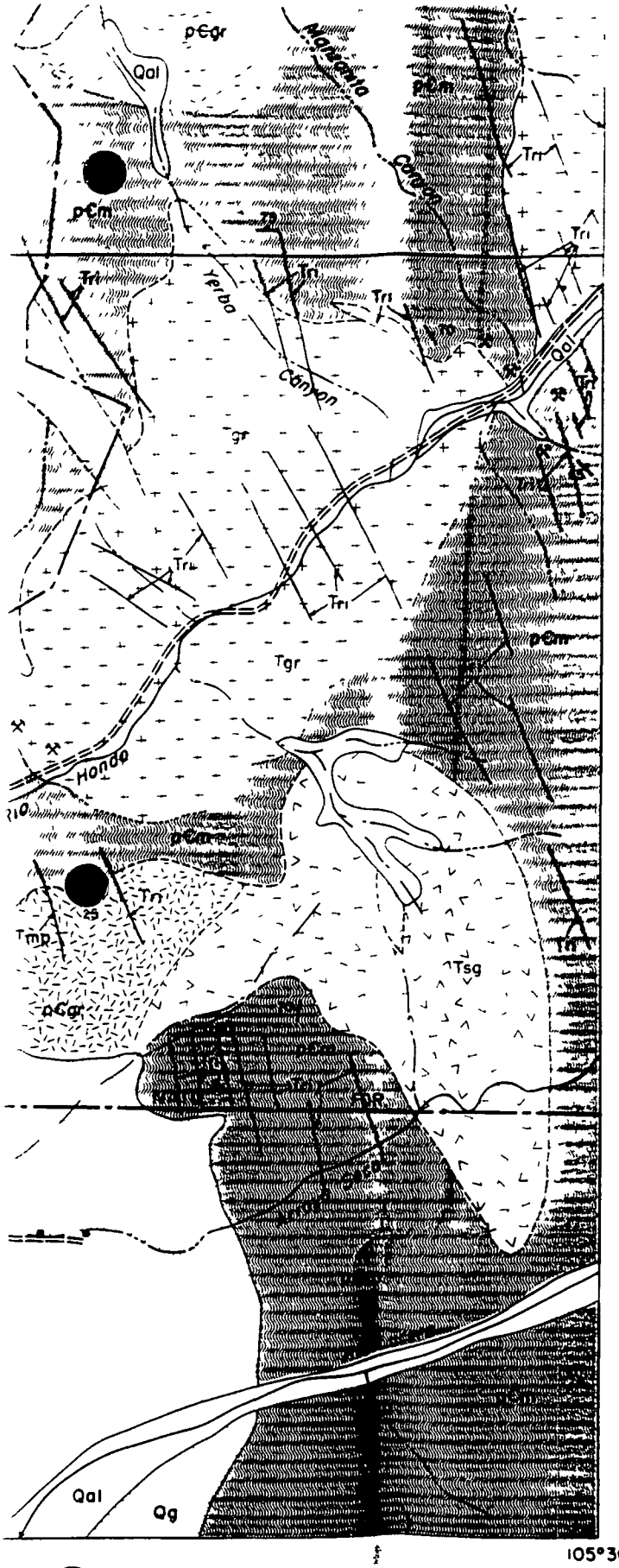
Geolo
Arthur
Schill



High angle block fault

GEOLOGIC MAP AND SECTION OF QUESTA QUADRANGLE, NEW M

Scale $\frac{1}{48000}$



Metamorphic rocks

p€q, Cabresto (?) quartzite, *gray to cream massive quartzite, in places layers of mica gneiss and graphite mica gneiss*

p€m, *Undifferentiated amphibolite schist and gneiss, mica schist and gneiss, quartzite and migmatites*

Dike

Contact

Dashed where approximately located, dotted where concealed

U / D

High angle fault

U, *upthrown side*, D, *downthrown side*

T

Thrust fault

T, *upper plate*

40

Strike and dip of beds

75

Strike and dip of foliation

Strike of vertical foliation

Dry lake

Intermittent stream

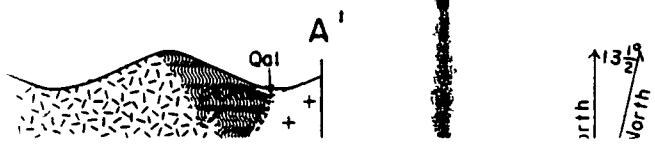
Perennial stream

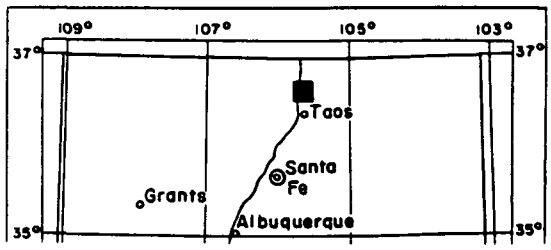
Road

Mines or prospects

Buildings

Geology by P F McKinlay; assisted by C F Park, Jr, Arthur Lees, Jack Hunt, Kenneth Reim and John Schilling Surveyed 1947-1950



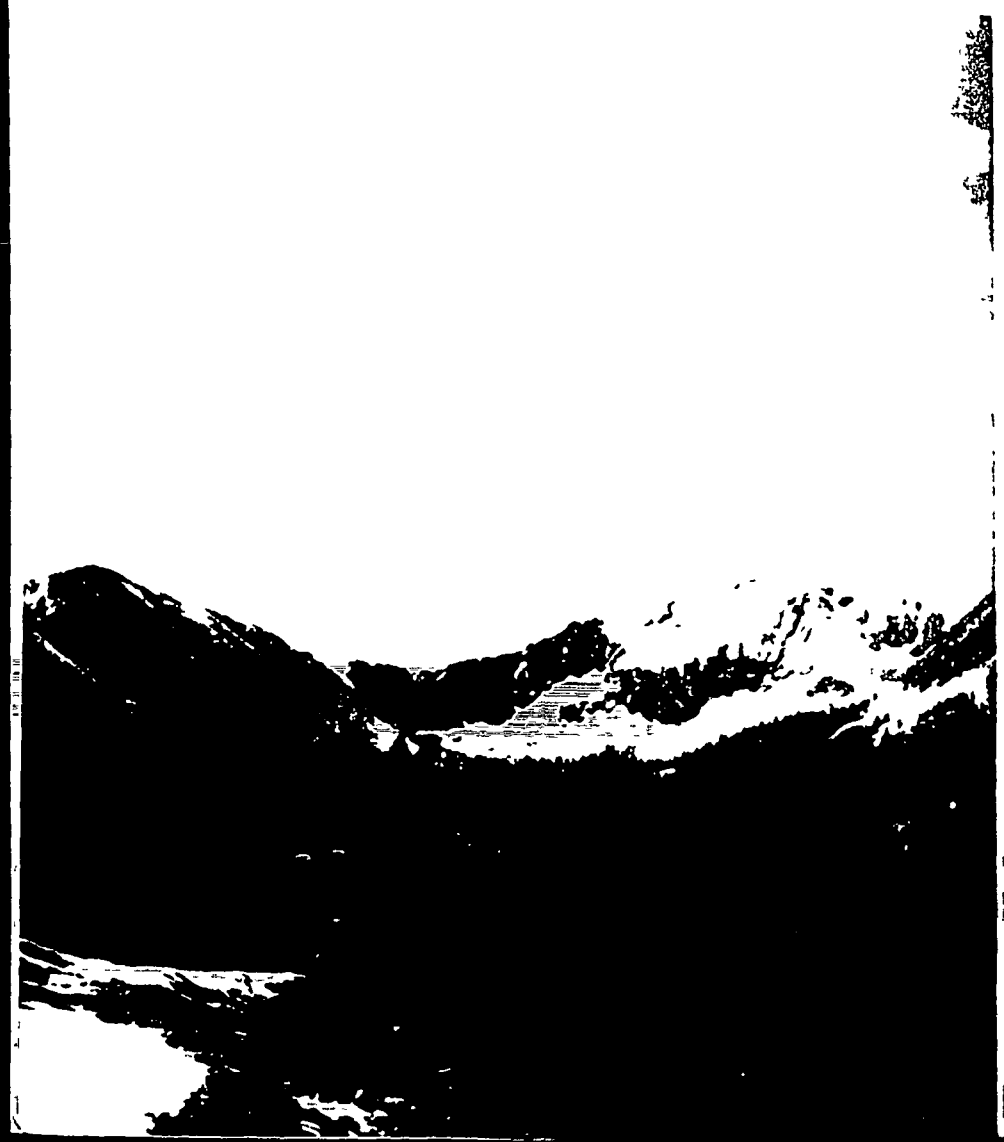


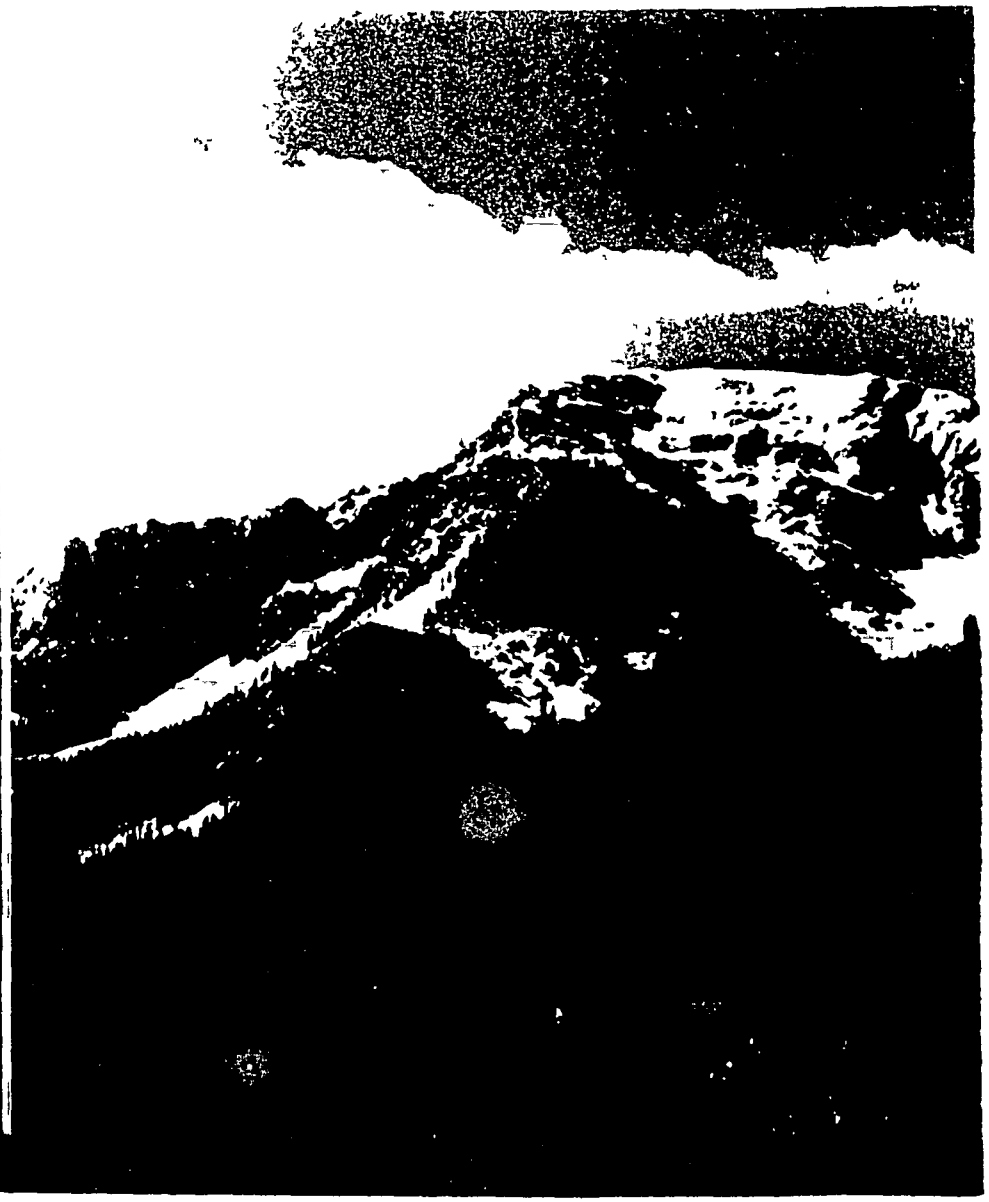
NEW MEXICO STATE BUREAU OF MINES AND MINERAL RESOURCES

BULLETIN 94 1972

GEOLOGY AND ORE DEPOSITS OF EAGLE NEST AREA, NEW MEXICO

by KENNETH CLARK *and* CHARLES B. READ





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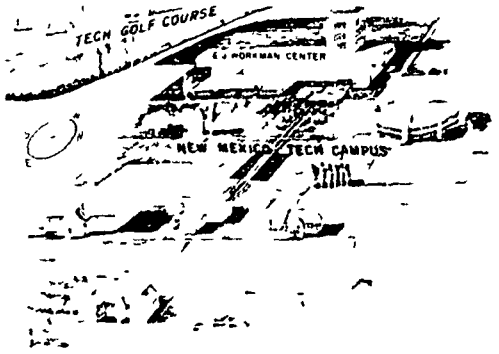

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Contents

1 *Abstract*
1 *Introduction*
1 METHODS
2 PREVIOUS STUDIES
2 GEOGRAPHY
5 ACKNOWLEDGMENTS
9 *Stratigraphy*
9 PRECAMBRIAN
9 Metaquartzite group
15 Mafic gneiss group
18 Granitic group
21 Migmatitic group
25 Diabase dikes
26 Metamorphism
27 MISSISSIPPIAN
28 Espiritu Santo Formation
29 Tererro Formation
31 PENNSYLVANIAN
31 Distribution
31 Lithology
34 Contacts
35 Thickness
36 Paleogeography
37 Fauna
40 Age
40 Correlation
42 PENNSYLVANIAN AND PERMIAN
42 Sangre de Cristo Formation
45 TRIASSIC
45 Dockum Group
47 JURASSIC
47 Entrada Sandstone
48 Wanakah equivalent
48 CRETACEOUS
48 Dakota Sandstone
49 Graneros Shale
49 Greenhorn Limestone
50 Carlile Shale
50 Niobrara Formation
51 PALEOCENE
51 Poison Canyon Formation
52 TERTIARY IGNEOUS COMPLEX
52 Basal sediments
57 VOLCANIC SERIES
57 Andesite group
59 Latite group

61 Rhyolite group
64 INTRUSIVE SERIES
64 Hornblende granite
67 Augite diorite porphyry
67 Quartz diorite porphyry
69 Biotite granite
71 Quartz veins
71 Summary
72 Quartz porphyry
73 Monzonite porphyry
74 LATE TERTIARY AND QUATERNARY
74 High level gravel
74 Tertiary Quaternary gravel
75 Glacial deposits
77 Mudflows and cemented gravel
78 Landslides
78 Alluvium

79 *Structure*
79 PRECAMBRIAN DEFORMATION
79 Foliation
80 Lineation
81 Folds
81 Faults
81 Intrusive rocks
81 LOWER PALEOZOIC DEFORMATION
82 UPPER PALEOZOIC DEFORMATION
82 MESOZOIC DEFORMATION
82 CENOZOIC DEFORMATION
83 Laramide thrusts and folds
92 Miocene faulting
98 Summary

99 *Geomorphology*
100 MOUNTAIN AREAS
102 DRAINAGE SYSTEMS
103 MIDDLE TERTIARY EROSION SURFACES

106 *Geologic History*

109 *Economic Geology*
110 RIO HONDO DISTRICT
110 Geology mineralization production
111 RED RIVER DISTRICT
111 General geology
111 Alteration
113 Mineralization and production
115 Questa mine
119 ELIZABETHTOWN BALDY DISTRICT
120 Hematite Creek district
121 West Moreno district
121 Elizabethtown Baldy districts

127 *References*

135 *Appendix* - descriptions of measured sections
135 MISSISSIPPIAN
135 PENNSYLVANIAN
140 PENNSYLVANIAN AND PERMIAN
140 (PERMIAN) TO CRETACEOUS
141 LOWER CRETACEOUS
142 UPPER CRETACEOUS
142 CRETACEOUS TO PALEOCENE
142 PALEOCENE
142 OLIGOCENE (?)

145 *Index*

Tables

Page
4 *1–Climatological data for Taos, Red River, and Eagle Nest*
10 *2 Stratigraphic units of the Eagle Nest area*
38 *3 Distribution of Pennsylvanian fossils by locality*
41 *4–Pennsylvanian fossils of Eagle Nest area compared with adjacent areas in New Mexico and Colorado*
66 *5 Modal analyses of Tertiary granites*
72 *6 Chemical analyses of Questa mine stock*
76 *7 Correlation of glacial deposits in Lake Fork*
109 *8 Summary of ore deposits in the Eagle Nest area*

Figures listed on next page

the lake where the sediments are vertical to overturned and by the attitude of the Mississippian on Old Mike and Bear Lake However on the south side of Lost Lake differential movement between Pennsylvanian and Mississippian appears to have taken place

Miocene Faulting

The last earth movements in the Eagle Nest area accentuate the topographic features seen today because vertical displacements are characteristic The age of this deformation is Miocene possibly as late as late Pliocene because the Moreno Valley fill has been faulted (Ray and Smith 1941 p 208) In the Moreno Valley the earlier Laramide thrust plates and folds have been faulted In the igneous complex of Red River volcanic rocks are cut by a series of faults of various trends and intrusives are localized along the same lines The structures are dominated by high-angle normal faults that sharply contrast with the Laramide thrusts and folds described above The principal trends are east-northeast and north-northeast and to a lesser extent northwest A subordinate group includes east west north-south and east-southeast The most complicated area is along lower Red River where all the trends are present Several structural elements are recognized the Taos horst Red River ring structure Red River graben Moreno Valley and the Cimarron Range

Taos Horst

The structure of the Sangre de Cristo Mountains in this area is dominated by the Taos horst which exposes Precambrian rocks at its crest (Clark 1966b fig 3) This horst is a dissected uplift expressed today as the Taos Range

The Taos horst is some 17 miles long in a north south direction and about 10 miles wide in an east west direction However the width is variable at the north end because of the divergence between the Taos cone fault and the Blue Lake thrust The Taos horst as defined here is considered a local structural element developed by Miocene faulting impressed on the Sangre de Cristo uplift that was developed by both Laramide and Miocene faults

The western side of the uplift although outside the map area is marked by a sharp topographic break between the Rio Grande depression and the flank of the Sangre de Cristo Mountains (fig 15) The Taos Range has been elevated along a zone approximately paralleling the present position of the mountain front on the west according to McKinlay (1957 p 14)

The eastern margin of the Taos Range is bordered by the Moreno Valley The common slope of these two features is a complex zone of normal reverse and thrust faults. Thrusts are complex in that they consist of low-angle segments which pass into tears and high angle portions Dip slip and forward movement ranges from 2 000 to 9 000 feet The thrusts (Laramide) are broken by high-angle normal faults (Miocene) in both sides of the Moreno Valley

The northern part of the horst is truncated by the Red River graben but the southern limit is less well defined although it extends as far south as the upper part of Rio Pueblo de Taos

The vertical displacement is as much as 7 000 feet on the west side of the horst (McKinlay 1957) and up to 3 000 feet along the Taos Cone fault on the east side To the north in the Red River graben vertical displacement is 2 800 feet but to the south the magnitude of displacement is unknown

FIGURE 15—Northward view of west side of Taos Range The Rio Grande depression referred to locally as the Taos Plateau is covered with late Pliocene gravel and basalt that have been deeply incised by the Rio Grande The bottom of the gorge seen at the left side of the picture is 7 000 feet below Wheeler Peak 16 miles to the east Some low volcanic cones are on the horizon

Red River Ring Structure

On the geologic map (pl 1) a circular pattern is etched by the Red River This ring is completed by the drainage patterns of Rio Hondo the unnamed stream northwest of Amizette and Columbine Creek in Questa quadrangle The ring averaging about eight miles in diameter has a core of Precambrian rocks with a thin cover of volcanics in the northeast At the periphery are the biotite granite stocks at Flag Mountain Sulfur Gulch and Red River the Relica Peak rhyolite and the Rio Hondo hornblende granite (fig 16) Clark (1966a p 246) noted that the emplacement of these Tertiary igneous intrusives in such a geometrical arrangement was more than fortuitous

The east northeast fractures along the north and south sides of the ring are marked by the Red River fault and a series of shears near the Frazer mine in Rio Hondo respectively This direction is nearly parallel to the foliation in the Precambrian rocks and the fractures filled with pegmatites and quartz veins Rejuvenation along this old direction of weakness is apparent Schilling (1960 p 35) noted that the Red River downfaulted area lies along a northeast trend of volcanic activity extending from Springerville Arizona to Spanish Peaks in Colorado Included along this line are Mount Taylor Jemez caldera volcanoes of Taos Plateau and the volcanic rocks of the Taos Range He further suggested that this belt reflects a deep-seated zone of weakness explaining the unusual trend found along the Red River

Completing the structural segments of the Red River ring are the northwest-trending faults bordering the Rio Hondo granite on its east side and the fault bordering the Red River stock along its south side The remaining part of the ring is comprised of a fault along upper Red River Canyon referred to as the Taos Cone fault being colinear along a high angle segment of the Blue Lake thrust

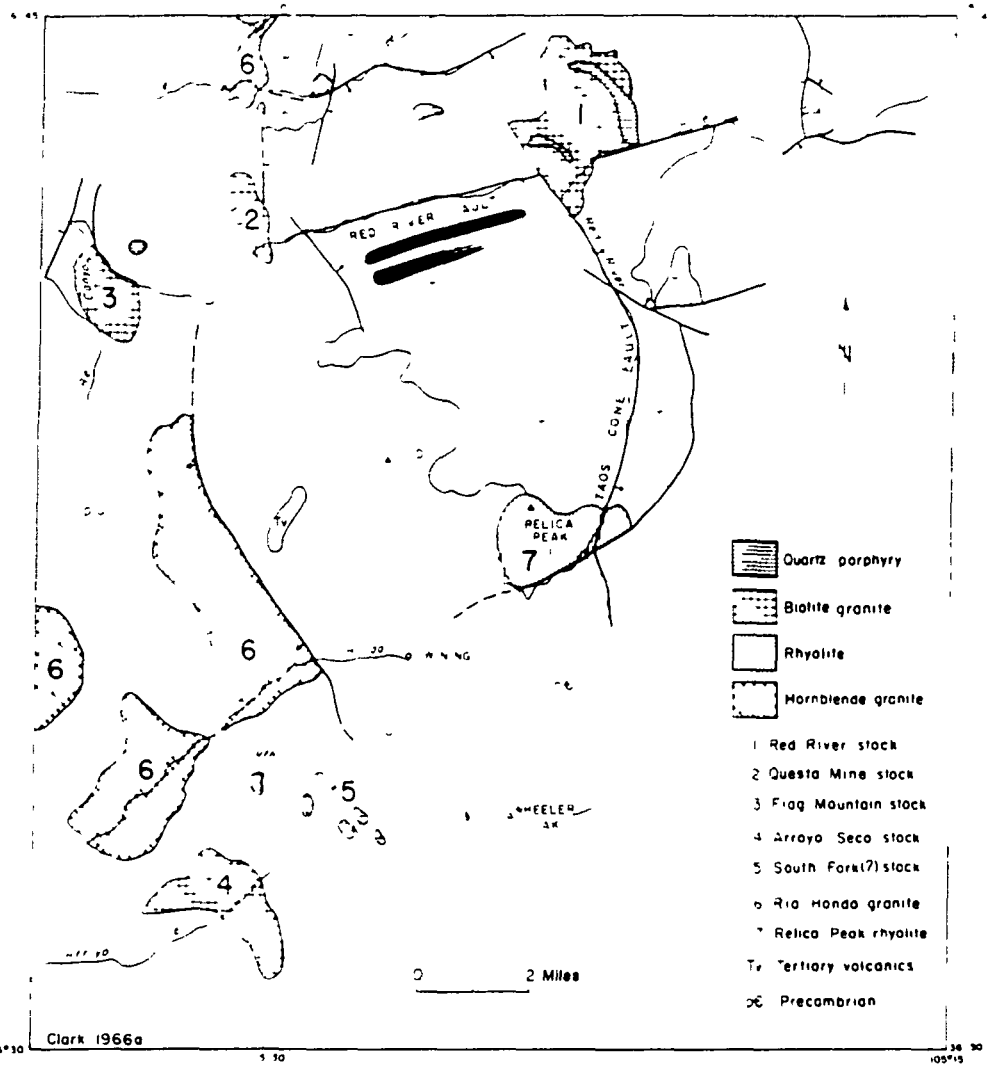


FIGURE 16–Red River ring structure showing relationship to the Precambrian basement and Tertiary volcanic and intrusive series
(geology after McKinlay 1957 and Clark 1966)

In summary the vertical displacements characteristic of Miocene and post Miocene faulting appear to have been active around a competently welded block of Precambrian rocks in such a way that its core has been relatively undisturbed by Cenozoic deformation At the periphery siliceous igneous stocks have been intruded and major thicknesses of volcanic rocks have been preserved in fault angles on the north and east sides Within the ring the volcanic rocks have been largely stripped away by erosion Similar drainage patterns developed in the area include a partial ring defined by Rio Hondo Lake Fork and Rio Lucero in the Eagle Nest area and around the Costilla massif in Costilla quadrangle

Although the individual intrusives occur along lines of weakness evidence does not show that the ring results from a single integrated structural break The interpretation offered here is that the east northeast north-south and northeast Miocene fracture

systems have been etched by the drainage to form the ring structure Doubtless the ring structure is near the center of Cenozoic igneous activity in this region Not only is it associated with intrusives but it is flanked and cut by dike swarms and circumscribed by Tertiary and Quaternary volcanics of north central New Mexico

Red River Graben

This element is a negative structural feature consisting of jumbled and tilted fault blocks aligned in an east northeast direction referred to by Clark (1966a) as the Red River Graben Previously Schilling employed the terms 'down-faulted zone" and graben like area (1956a p 33 35) 'down faulted area (1960, p 20) and "down-faulted trench (1965 p 26)

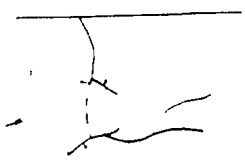
The structure is only partly contained within the map area its full extent occupies parts of the Questa Costilla and Latir Peak quadrangles The relation of molybdenum mineralization in the Red River district to this feature and to other lineaments in the western United States has been pointed out by Clark (1966c 1968 p 560) However it cannot be overemphasized that this structure is complex and that numerous cross faults have greatly modified the picture of a simple linear depression

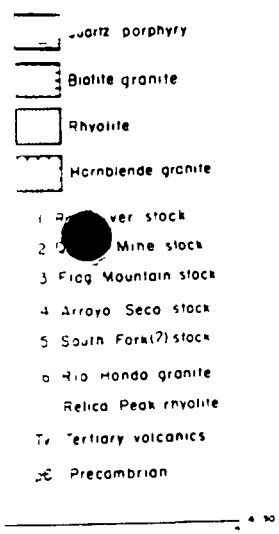
This structure is aligned in an east-northeast direction stretching from near the western margin of the Sangre de Cristo Range in the Questa quadrangle to the Midnight Anchor area in Costilla quadrangle Overall the length is about 14 miles and the width ranges from two to four miles As shown in section D-D′ plate 1 a considerable thickness of the volcanic series is structurally preserved The thickness of this wedge is greater than that immediately to the north and south of the structure To the south the base of the volcanics lies on a high platform of Precambrian rocks it thins and then disappears entirely south of Gold Hill on the west and Wheeler Peak village on the east A small area of Tertiary volcanics appears as far south as Tienditas Creek-La Junta Canyon south of the map area North of Cabresto Creek and Bonito Canyon Precambrian mica quartzite is extensively exposed but the thickness of the volcanics increases thereafter towards Latir Peak before the limit is reached some 10 miles farther north on the Costilla massif The eastern and western limits are more difficult to ascertain To the east the graben is lost in upper Bitter Creek although the volcanic rocks appear as far east as Costilla Pass and as far north as the area of Ortiz Peak in the Costilla quadrangle (McKinlay 1956 pl 1) To the west the limit is again ill defined in that both Precambrian and Tertiary rocks are found at the mouth of Red River Canyon where north trending faults predominate along the mountain front

The major fault along the graben follows the line of Red River and Bitter Creek Although almost completely concealed by alluvium and mudflow its presence can be inferred by the attitudes of the Precambrian-Tertiary unconformity and to a lesser extent the elevation of the base of the rhyolite group This high-angle normal fault has been referred to as the Red River fault To the south it is bordered by a parallel fault that probably forms the southern limit of the graben This fault is possibly continuous with an east-southeast fault that brings latite against andesite in the vicinity of Red River Pass

North of the Red River fault a line of hydrothermal alteration areas marks a parallel fault The northern limit of the graben in the line of the structure section (pl 1 D-D′) is in Bonito Canyon where at one locality the base of the andesite is 100 feet higher than the base of the downfaulted rhyolite The elevation of the base of the andesite is 9 800 feet the same as that in upper Pioneer Creek on the south side of the graben The base of the andesite in the intervening depressed area is almost 7 000 feet which indicates a structural relief of 2 800 feet in the line of section

The segmentation of the Red River graben by northerly striking faults is illustrated in





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an east-west structure section (pl 1 C C') In Spring Gulch the Questa Mine stock appears locally exposed along the line of a north trending fault that brings up Precambrian mica quartzite against andesite Nearby the base of the andesite resting on mica quartzite is at an elevation of 10 300 feet which suggests a throw on this fault of about 2 000 feet Farther east the base of the volcanic series is repeatedly dropped to the east with one exception by high angle cross faults

The andesite thins and is locally absent in the line of section east of the Red River stock Meanwhile the increasing thickness of latite attains its maximum in Bitter Creek Above the Enderman mine rhyolite rests directly on the Precambrian suggesting that this area was a topographic high on an erosion surface bevelled on Precambrian rocks

West of Van Diest Peak rhyolite and andesite are faulted down against mica quartzite this fault may mark the structural eastern limit of the Red River graben

The base of the andesite is not exposed on the east side of this fault but judging from thickness considerations is believed to be near 10 600 feet Comparison with the elevation of 10 300 feet near Spring Gulch and the structural low of 6 800 feet elevation east of Hottentot Canyon indicate a structural relief of 3 500 to 3 800 feet

Finally Tertiary granite intrusives are found along the axis of the graben These include the Flag Mountain Questa Mine and Red River stocks in addition to several smaller bodies of quartz porphyry

Moreno Valley

On the west side of Moreno Valley a fault along Red River and Rio Pueblo de Taos though variable may have a throw of as much as 3 000 feet near Taos Cone The Taos Cone fault displaces the volcanic rocks in the upper Red River Canyon (pl 1) and at the entrance to Foster Park Canyon the andesite tuffs and breccias have slumped into and partly block Red River Canyon Farther south the fault coincides with a segment of the Blue Lake thrust

At Wheeler Peak village the Taos Cone fault offsets another high angle fault that marks the eastern limit of the volcanic rocks and the western limit of a large salient of Precambrian granitic biotite gneiss (pl 1) The latter fault is interesting because it connects an earlier tear fault along the south side of the Precambrian salient with a tear along the north side of the salient The fault extends southeast and may die out in the shears near the Frazer mine at Twining

The tear on the north side of the salient strikes in an east-west direction from Hematite Creek eastward to North Moreno Creek where it passes into the northern part of the Blue Lake thrust Although this tear is poorly exposed it has sheared the muscovite hematite granulite producing a lustrous schist An apparent offset of the granulite on the north side of the tear suggests a forward movement of about 2,500 feet In other words the tear marks the south side of another salient of Precambrian rocks in the area of North Moreno Creek

Another high angle normal fault on the west flank of Moreno Valley cuts and displaces the flat trace of the Six Mile Creek thrust Sections A-A' and B-B' (pl 1), show it parallels the Taos Cone fault and strikes along Sawmill Creek southward to the margin of the map area There Precambrian granitic rocks are in fault contact with the Magdalena Group along a small scarp The throw on this fault is only 200 to 300 feet Topographic expression of this fault is imperceptible compared with that on the east side of the valley the west flank of the valley is largely a dip slope of Pennsylvanian rocks

Finally the synclinorium produced by Laramide thrusting folding, and doming in

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he Moreno Valley has been modified by high-angle Miocene faulting inasmuch as the synclinal structure occupies a topographic depression (fig 17)

FIGURE 17—Eastward view of Blue Lake cirque and Moreno Valley Upper part of a gorge is cut in mica quartzite Lower tree-covered slopes are underlain by the Magdalena Group whereas Mesozoic sediments underlie the grass-covered valley floor The Precambrian core of the Cimarron Range is exposed east of Eagle Nest Lake

Cimarron Range

Along the east side of the valley the Eagle Nest fault can be traced from Eagle Nest Lake northward through Baldy Mountain and beyond the northernmost part marked by a large diorite porphyry dike intruding Poison Canyon sediments The line of this fault traced intermittently for 12 miles becomes flexed and branched in the vicinity of the McEvoy Hill rhyolite Apparently the intersection with the southeasterly trending Fowler Pass fault localized this intrusive body Referring to a segment of this fault system Wanek and Read (p 83) indicated that it cuts and displaces an earlier flat fault The flat fault referred to is the underthrust fault of the postulated plunger core of the Cimarron Mountains described earlier

Much of the differential uplift of the Baldy Cimarron Range due to normal faulting takes place along the Eagle Nest fault The present physiography of the range (fig 18) is the result of mid Tertiary high-angle faulting along its western flank although like the Taos Range the full extent of the structural and topographic relief can best be interpreted by additional consideration of Laramide deformation and doming by igneous intrusion Graton (in Lindgren Graton and Gordon, p 294) drew attention to the eastward dip of the Mesozoic strata in the Baldy area these strata are tilted up to the fault and consequently dip away from it The implications of the uplifted Precambrian core in the range south of Cimarron Canyon have been dealt with under Laramide deformation

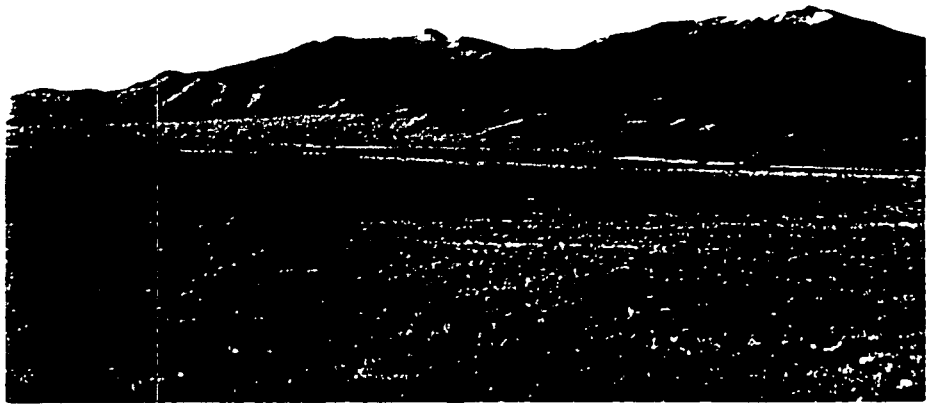

FIGURE 18—Northern part of Cimarron Range seen across Moreno Valley. Foothills are part of the downthrown side of the Eagle Nest fault. Baldy Mountain at center and Touch-Me Not Mountain at the right are underlain by eastward-dipping Mesozoic rocks intruded by sills of quartz diorite porphyry.

Summary

Ideas concerning the structural origin of the southern Rocky Mountains may be summarized as follows: some investigations favor the theory of lateral compression while others consider vertical movements dominant. Burbank and Goddard (1937, p. 933) recognized both thrust faults as well as vertical uplifts in Huerfano Park. Differential vertical movements apparently became dominant during the latter stages of deformation with upthrust of the Precambrian core and the downfaulting of adjacent valleys. We subscribe to these views based on our study of the Eagle Nest area. We further believe that an account of the mountain building must also include effects due to the emplacement of the Tertiary granites and volcanic tectonic depression within the area (Clark, 1961, p. 253).

More recently Petersen (1969, p. 66) and Petersen and Woodward (1969) have used models simulating uplift in the adjacent Trinchitas Creek–La Junta area. They were able to reproduce upthrusting similar to that described by Prucha, Graham and Nickelsen (1965). The stress responsible for these simulated movements was ascribed to doming by magma from below. This event was followed sequentially by upthrusting, collapse and grabening.

In Cenozoic time a sequential and possibly related series of closely spaced tectonic epochs contributed to the complex structures in this region. Lateral compression, folding, thrusting, and movement of the basement have preceded igneous intrusion, doming and collapse along vertical faults. Different structural elements have emerged as a result of one or more of these processes. The overall result is one of complexity to the point of being anomalous when compared to other segments of the Sangre de Cristo Mountains.

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The Eagle Nest area is part of the Sangre de Cristo Range falls within the southern Rocky Mountains Province However some structural evidence indicates that the west side of Moreno Valley could locally be considered as the western limit of the Great Plains Province

Erosional features accentuated by rock type and structural control dominate over depositional features Erosional features possess the striking relief of the area The western and eastern parts of the map area are rugged in contrast to the middle part which is characterized by the more gentle surface bounding the Moreno Valley In particular the western part is made up entirely of crystalline rocks which in the Taos uplift have been sculptured by glaciation In contrast depositional features consisting of glacial moraine talus landslide mudflow and alluvium are confined to valley floors

Within the Eagle Nest area and adjoining country are several elements whose lithology geomorphic history and structure differ widely They include the Taos uplift Red River graben Moreno Valley and the Cimarron Range (fig 19) Briefly the Taos uplift consists mainly of Precambrian rocks bounded by high-angle normal faults and is a glacially sculptured horst It is bounded on the west by the Rio Grande rift and on the east by the Moreno Valley The Moreno Valley is floored by sedimentary rocks largely covered by alluvium bounded on the west by high-angle normal and thrust faults The negative physiographic expression of the Moreno Valley strongly contrasts with the positive Taos uplift on the west and the Cimarron Mountains on the east The Red River graben is composed primarily of volcanic rocks and associated intrusives of mid Tertiary age Structurally this graben is complex Its boundaries are

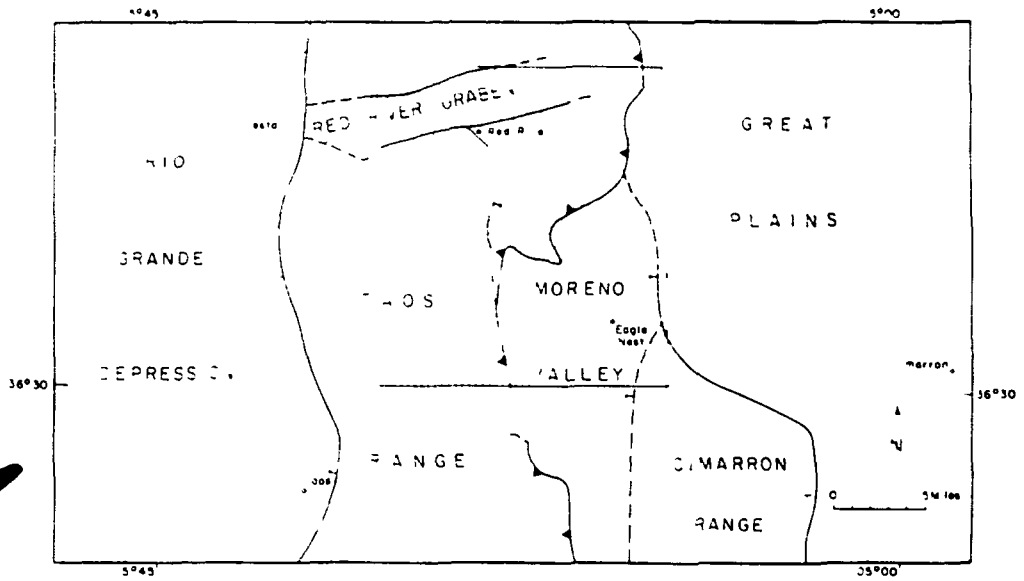


FIGURE 19—Relation of local structural and geomorphic elements of Eagle Nest area to regional provinces

TECHNICAL REPORT NO. 12

State of New Mexico
State Engineer Office
Santa Fe, N Mex.

GROUND-WATER CONDITIONS AND GEOLOGY OF SUNSHINE VALLEY AND WESTERN TAOS COUNTY, NEW MEXICO

By

I. J Winograd

U S Geological Survey

1959

TABLE OF CONTENTS

	Page
Abstract	1
Introduction	2
Location and extent of the area	2
Purpose and scope of the investigation	3
Previous investigations	3
Acknowledgments	3
Well-numbering system	3
Geography	5
Climate	5
Physiography	5
Sangre de Cristo Mountains	7
Lava-capped plateau	7
Piedmont alluvial plains	8
Irrigation	10
General geology	11
Stratigraphy	11
Geologic history	12
Proterozoic era	12
Paleozoic era	12
Mesozoic era	12
Cenozoic era	12
Structure	12
Faulting	12
Unconformities	13
Rock formations and their water-bearing characteristics	13
Precambrian system	13
Pennsylvanian and Permian systems	14
Sangre de Cristo formation	14
Tertiary system	14
Volcanic complex	14
Tertiary and Quaternary systems	15
Santa Fe group	15
Alluvial sediments	15
Andesite-basalt	16
Lake deposits	18

PAGE

Quaternary system 18
Recent series 18
Subsurface geology 18
Surface waters 21
Rio Grande 21
Mountain streams 21
Irrigation canals and ditches 22
Ground-water resources 22
Sunshine Valley 22
Water in alluvial sediments 22
Occurrence 22
Well characteristics 24
Chemical quality of the water 26
Water in andesite-basalt 26
Occurrence 26
Well characteristics 27
Chemical quality of the water 28
Relation of water in alluvial sediments to water in andesite-basalt 28
Recharge 30
Movement and discharge 32
Lava-capped plateau 34
Occurrence of ground water 34
Well characteristics 36
Recharge and discharge 37
Ground water at Tres Piedras 37
Ground-water accretion to the Rio Grande and the Red River 38
Effects of ground-water withdrawals in Sunshine Valley upon spring flow into the Rio Grande and the Red River 40
Summary 42
Literature cited 43

ILLUSTRATIONS

	Index map of Taos County, N. Mex., showing area covered by report and major physiographic features	FRONTISPIECE
		FOLLOWING PAGE
PLATE		
1	Generalized geologic map of Sunshine Valley and vicinity, Taos County, N. Mex.	4
2	Water-table contour map of Sunshine Valley and vicinity, Taos County, N. Mex.	4
3	Generalized geologic section across Sunshine Valley, Taos County, N. Mex.	16
FIGURE		PAGE
1	System of numbering wells in New Mexico	4
2	Rio Grande Canyon at the Dunn Bridge crossing	6
3	Rio Grande Canyon and Cerro Chiflo	6
4	East wall of Rio Grande Canyon 2 miles north of the confluence with the Red River	7
5	Sunshine Valley and Ute Mountain viewed from Guadalupe Mountain	9
6	One of six vertical diesel pump units used in Sunshine Valley	11
7	Map showing water-table contours and location of deep wells in western Taos County, N. Mex.	17
8	Map of southwestern Sunshine Valley illustrating dip of the buried andesite-basalt lava flows and thickness of deposits formed within a lake during Quaternary time	19
9	Modes of occurrence of ground water in Sunshine Valley, Taos County, N. Mex.	25
10	"Arsenic" Springs	35
11	Profile of Rio Grande from Red River, N. Mex., to Colorado-New Mexico line	41

TABLES

TABLE		PAGE
1	Average monthly precipitation and temperature at weather stations in the Sunshine Valley area Taos County N Mex	15
2	Discharge of Costilla Creek Latir Creek and Llano ditch Sunshine Valley Taos County N Mex 1948-55	15
3	Tests conducted on Chiflo dam-site test hole R-1 and Costilla dam-site test hole 1	16
4	Accretion to the Rio Grande between Lobatos Colo and Cerro N Mex in the month of least runoff at Lobatos 1948-55	16
5	Records of irrigation wells in Sunshine Valley Taos County N Mex and Costilla County Colo 1955 and 1956	47
6	Records of stock wells domestic wells and dam-site test holes in the Sunshine Valley area Taos County N Mex and Costilla County Colo 1955 and 1956	50
7	Logs of wells and dam-site test holes in the Sunshine Valley area, Taos County, N Mex., and Costilla County Colo	57
8	Chemical analyses of ground water in the Sunshine Valley area Taos County, N Mex and Costilla County Colo	70

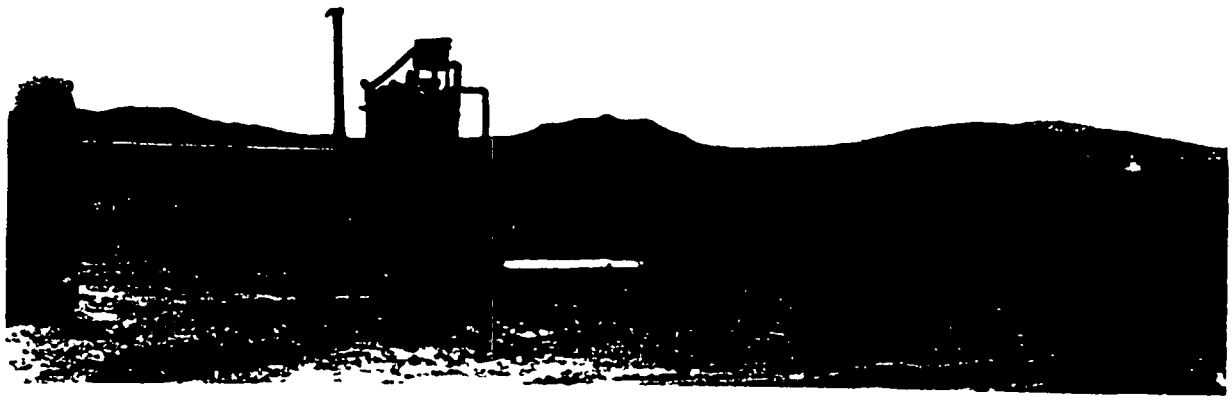


FIGURE 6 One of six vertical diesel pump units used in Sunshine Valley A vertical crankshaft eliminates the need for a gear box to connect the drive shaft to the pump The three mountains in the background are left to right Guadalupe Mountain Cerro Cuello and Cerro de la Olla View is southwestward

GENERAL GEOLOGY

The Sunshine Valley area is geologically a re-entrant between two prongs of the Southern Rocky Mountains These mountains were formed in late Cretaceous and early Tertiary time by compression of the earth's crust which deformed the rocks exposed at and underlying the earth's surface Renewed uplift of these mountains occurred during Miocene time and this uplift is apparently continuing to the present day Uplift of the area during the Miocene took place unevenly and a trough formed between two highland prongs This depression referred to as the Rio Grande trough includes the area covered by this investigation In the trough were deposited materials eroded from the bordering highlands and lava emitted from numerous volcanoes in the region The occurrence movement and quality of ground water are closely related to the structure and distribution of the valley-fill materials for it is within these materials known collectively as the Santa Fe group that most ground water in the region is found In the course of this investigation it was therefore necessary to examine the distribution structure composition texture and subsurface relations of the materials composing the valley fill or associated with it particularly in so far as these materials affect the occurrence of ground water

STRATIGRAPHY

The rocks that crop out in the Sunshine Valley area are of sedimentary igneous and metamorphic origin and range from Precambrian to Recent Most of the area is directly underlain by valley fill and lava of late Tertiary and Quaternary age The areas of outcrop of the sedimentary igneous and metamorphic rocks in the vicinity of Sunshine Valley are shown on plate I The oldest rocks exposed in the area are Precambrian These rocks crop out largely within the Sangre de Cristo Mountains and as isolated hills protruding through the surface of the lava-capped plateau The Paleozoic rocks are represented by the Sangre de Cristo formation which crops out in small areas on the mountain range of the same name and is considered to be of Pennsylvanian and Permian age The middle Tertiary rocks are volcanic rocks of varying composition which compose much of the Sangre de Cristo Mountains and several of the isolated hills found in the lava-capped plateau Valley fill and lava of late Tertiary and Quaternary age compose the Santa Fe group which crops out in most of the region and uncomformably overlies the Precambrian and middle Tertiary rocks except where they protrude above the general surface of the tableland Alluvial sediments of Recent age are found along stream courses

GEOLOGIC HISTORY

Previous studies of outcrops by many geologists and the examination of well logs during the investigation have revealed much of the geologic history of the area The following discussion is taken largely from Bryan (1938 p 204-226) and McKinlay (1956 p 25-26)

Proterozoic Era

The granite schist gneiss and quartzite which form much of the Sangre de Cristo Mountains the granitic hills at Tres Piedras and the quartzite forming Cerro Azul have been assigned in the literature to the Proterozoic era The lack of fossils and the deformation undergone by these rocks make any attempt at deciphering the geologic history of the era most difficult Folding faulting uplift metamorphism weathering and inundation occurred repeatedly during the era

Paleozoic Era

The Paleozoic era was marked in New Mexico by the encroachment of a sea from the south This sea did not inundate northern New Mexico until Devonian(?) time for rocks of early Paleozoic age are missing in the northern half of the State During Devonian(?) Mississippian Pennsylvanian and Permian time the sea submerged at least parts of Taos County and the Magdalena group now exposed atop the Sangre de Cristo Mountains in the southeast quarter of the county was deposited Some uplift of the Sunshine Valley area earlier than Permian time is indicated by the conglomeratic nature of the Sangre de Cristo formation (McKinlay 1956 p 23) which crops out the mountains east of the valley

Mesozoic Era

No sedimentary rocks of Triassic Jurassic or Cretaceous age are known in Taos County consequently the geologic events that occurred in this region during the Mesozoic era cannot be deciphered The great thickness of marine sediments deposited in neighboring parts of the State during the Cretaceous age led Just (1937 p 15) to believe that the Picuris area in the southern Taos County must have been buried by Cretaceous marine sediments If this is so then the absence of sedimentary rocks in the region can be interpreted to indicate deposition followed by active erosion rather than nondeposition during the Cretaceous period Similarly rocks of Triassic and Jurassic age also may have been deposited in the area and then eroded away

The Mesozoic era closed with the Laramide revolution During this revolution or deformational epoch the Rocky Mountain system was formed The revolution was characterized by compression of rocks into great folds and thrust faults and was attended by much volcanism The lines of crustal weakness outlining the basin or trough through which the Rio Grande presently flows may have originated during this revolution although it is believed generally that the actual trough was formed after the large-scale volcanic activity of Miocene time

Cenozoic Era

The Laramide revolution is considered generally to have begun in late Cretaceous time and early Tertiary time During middle(?) to late(?) Tertiary time volcanic activity was renewed on a large scale The San Juan Mountain region in southwestern Colorado immediately to the northwest of Sunshine Valley was one of the major volcanic centers of the period The aggregate thickness of the several groups of lavas and tuffs emitted from the San Juan region is more than 33 000 feet Uplift of the Sangre de Cristo and Conejos prongs along fault zones took place in late(?) Tertiary (Miocene?) time and localized the present outcrops of the middle(?) Tertiary volcanic rocks A Miocene landscape topographically similar to the present landscape was thus created and deposition of valley fill into the downfaulted areas ensued

After Miocene time the deposition of alluvial sediments and lava and the uplift of the highland prongs continued in an almost cyclical fashion The continued uplift of the highlands maintained the depositional trough formed in the Miocene and accompanying subsidence of the trough preserved great thickness of alluvial sediments and lava flows composing the Santa Fe group During Miocene and Pliocene time the deposition of alluvial sediments appears to have been dominant In late(?) Pliocene and early Pleistocene time extrusion of andesite-basalt on a large scale began Guadalupe Mountain Cerro de la Olla San Antonio Peak and Ute Mountain erupted intermittently spewing lava in all directions and constructing a vast lava plateau The intermittent nature of the volcanic activity resulted in an interbedding of lava flows and alluvial sediments near the highlands Uplifts of the Sangre de Cristo Mountains and depression of portions of the valley and the deposition of rock waste into the lowlands is continuing at present

STRUCTURE

Faulting

Faulting was the major diastrophic process in the Sunshine Valley area after the middle Tertiary It created the highlands from which the alluvial sediments were derived and maintained the physiographic outline of the Rio Grande trough

12

The effects of faulting since the middle Tertiary are seen in many places in Taos County and in Sunshine Valley. In the vicinity of Pilar and elsewhere in southern Taos County the Santa Fe group has been downfaulted and is now in direct contact with Precambrian rocks. Elsewhere the lava flows have been faulted. The bold western face of the Sangre de Cristo Mountains and in particular the evidence of triangular facets, fault scarplets, and landslides indicate that these mountains owe their present relief to faulting. McKinlay (1956, p. 21) estimates that east of Sunshine Valley the Sangre de Cristo Mountains were raised 7,000 feet and tilted eastward in Pliocene and Pleistocene time.

The lava flows that cap San Pedro Mesa both in Sunshine Valley and in Colorado are believed by Upson (1941, p. 586) to be uplifted portions of the andesite-basalt lavas that underlie the plateau and the piedmont alluvial plains. The difference in altitude between the lava buried beneath the piedmont alluvial plain west of the mesa and the top of the mesa is an indication of the amount of uplift in the region. The top of the lava that caps San Pedro Mesa north of Cañon Cedro (pl. 1) is at an approximate altitude of 9,400 feet. Chiflo dam-site test hole R-8 (T. 32 S., R. 24 E.) (pl. 2) is the well closest to the mesa for which a log is available and which penetrated lava. In this well the upper surface of the lava is at an altitude of 7,287 feet, 587 feet below the land surface. Assuming that this lava flow did not dip eastward and that this same flow caps the mesa, the minimum uplift along the mountain front must have been about 2,100 feet. This uplift probably has occurred since the cessation of volcanic activity.

Evidence of continuing uplift along the front of the Sangre de Cristo Mountains is offered by a fault scarplet formed in the alluvial fan at the mouth of Cañon Cedro. This scarp is about 1 mile west of the mountain front and a quarter of a mile east of State Highway 3, from which it is clearly visible. It trends slightly east of north and is 1.5 miles long. Near its center it attains a height of about 30 feet above the surrounding land, but tapers off rapidly to the north and south. The scarp need not mark the surficial trace of a fault that extends downward into bedrock, as it may lie at some distance from the master fault and may have originated from tensions set up in the alluvial fan by movement along the major fault zone. The sharp relief of the scarp testifies to its youth, for it could not have lasted long, geologically, in unconsolidated sediments.

The isolated hills of Precambrian rocks such as Cerro Azul and the hills at Tres Piedras (frontispiece) may represent splinter faulting of the basement rock or may indicate that the basement was a region of great relief when downfaulted.

Unconformities

The andesite-basalt lavas of the Santa Fe group unconformably overlie Precambrian rocks at Tres Piedras. The lavas similarly are unconformable on rocks composing the volcanic complex of middle(?) Tertiary age.

The unconformable relation of the plateau lavas to the andesite of middle(?) Tertiary age composing Cerro Chiflo is well exhibited on the cliff cut by the Rio Grande into the plunging east flank of that mountain. When viewed from the east rim of the canyon, the dark-brown andesite-basalt flows are clearly seen to overlap the lighter colored distorted andesite.

The unconformable relation between the lavas and the volcanic glasses of middle(?) Tertiary age composing No Agua Mountains (frontispiece) is indirectly indicated in a cut along U. S. Highway 285 immediately west of the village of No Agua. At this exposure reworked volcanic glasses are buried beneath a lava flow.

ROCK FORMATIONS AND THEIR WATER-BEARING CHARACTERISTICS

PRECAMBRIAN SYSTEM

Precambrian granite, gneiss, schist, and quartzite occur mainly in the Sangre de Cristo Mountains. Materials derived from these rocks compose much of the valley-fill sediments found in the Rio Grande trough in Taos County. Precambrian rocks also compose several buried hills which protrude through the sea of lava underlying the plateau. The village of Tres Piedras derives its name from the three granitic hills that rise above the surface of the plateau. Cerro Azul (Blue Hill) near the southern extremity of the plateau is composed of bluish quartzite.

Thickness and extent of the Precambrian rocks composing Cerro Azul and the hills at Tres Piedras are not known because of their partial burial beneath the thick andesite-basalt lavas of the Santa Fe group.

The Precambrian rocks generally are highly fractured, having undergone multiple periods of deformation during their long geologic history. However, the fractures are usually tightly closed at depth, and these rocks should generally be considered as aquicludes — that is, non-water-bearing rocks. Locally at Tres Piedras small quantities of water are derived from wells dug into granite. These

wells, which appear to act as cisterns and to derive their water from alluvium overlying the granite usually go dry in early summer and in late fall or early winter

PENNSYLVANIAN AND PERMIAN SYSTEMS

Sangre de Cristo Formation

The Sangre de Cristo formation of Pennsylvanian and Permian age crops out in isolated patches high in the Sangre de Cristo Mountains The formation is described by McKinlay (1956 p 11) as well cemented reddish arkosic shales, sandstone and conglomerates composed of Precambrian debris ' Because of its limited occurrence at high altitudes, this formation is not important with regard to the occurrence of ground water in the Sunshine Valley area

TERTIARY SYSTEM

Volcanic Complex

A volcanic complex, consisting of andesite, rhyolite tuffs and flows basalt, granite, and some interbedded sedimentary rocks, forms part of the Sangre de Cristo Mountains and San Pedro Mesa These rocks considered to be of middle(?) to late(?) Tertiary age, are the source of much of the detritus composing the valley fill Cerro Chiflo and No Agua Mountain, two partly buried hills which protrude above the surface of the lava-capped plateau (frontispiece), are composed respectively of andesite and volcanic glasses These rocks are considered to be equivalent in age to the rocks composing the volcanic complex

With regard to the occurrence of ground water in the Sunshine Valley area only the rocks composing Cerro Chiflo and No Agua Mountain by virtue of their presence within the Rio Grande trough, assume importance The description and discussion of these rocks which follow are based largely upon the available literature maps logs of test holes and water wells, and observations made in the field

The andesite composing Cerro Chiflo is hard, fine grained, and largely gray but mottled and banded with pink Flow lines and fractures in the andesite are well exhibited on the cliff cut by the Rio Grande into the plunging east flank of the mountain Subordinate amounts of rhyolite occur with the andesite and the log of test hole 29 12 - 17 434 indicates that volcanic ash is present beneath or within the andesite at a depth of 166 feet

The volcanic glasses composing No Agua Mountain are presently being strip mined for use in the production of cinderblock Locally these volcanic glasses have been referred to as perlite a term which under a broad industrial classification, includes all expansible volcanic glasses However, the several specimens that have been examined do not exhibit a perlitic structure The texture of one sample resembles that of pumice and consists largely of interlocking crystal-clear glass fragments and fibers Other specimens much denser than the pumice-textured sample exhibit a well-defined flow structure consisting of alternating buff and bluish-gray bands Many of the flow structures are highly distorted and exhibit numerous types of miniature folds Much of the rock forming the mountain is fractured to such an extent that little blasting is needed to aid removal of the rock by bulldozers Some of the visible fracturing undergone by the volcanic glasses may be due to erosional load relief which has resulted in parting of the rock along flow lines

The thickness and extent of the andesite composing Cerro Chiflo and the volcanic glasses composing No Agua Mountain are not known, because of their partial burial beneath the thick andesite-basalt lavas of the Santa Fe group which form the tableland west of the Rio Grande

The ability of the andesite and the volcanic glasses to transmit water appears to be poor The grains of these rocks, like those of most igneous rocks are interlocking and provide little or no pore space The movement of ground water through such rocks necessarily depends upon the extent of the fracturing undergone by the rocks either during or after their solidification In contrast to the andesite-basalt lavas of low viscosity, the andesite and volcanic glasses both were derived from a moderately to highly viscous lava The high viscosity of the lava probably limited the areal extent of the individual flows, and they are believed to have accumulated upon one another in thick randomly distributed layers interbedded with ash Logs and exposures indicate that these rocks are fractured, as a result of flow in the fluid state, contraction cooling, or post-solidification stresses The thickness of the flows and their limited areal extent however probably restricted the development of extensive open-fracture systems such as those which developed in the tabular plateau lavas It is believed by the author that both the andesite and the volcanic glasses are not as permeable as the andesite-basalt flows beneath which they are buried, and they probably form barriers to the movement of ground water beneath the plateau

Three Chiflo dam-site test holes (29 12 16 133, 29 12 17 422, and 29 12 17 434) which were drilled to explore the water-bearing properties of the andesite were drilled into that rock to a depth below the water table in the surrounding andesite-basalt flows No mention was made in the drillers' logs of the occurrence of ground water in two of these test holes, however, the third hole (29 12 17 434) encountered water under sufficient hydrostatic pres-

sure to produce a flowing well Well 29 9 16 200 buried beneath U S Highway 285 immediately west of No Agua Mountain reportedly was drilled to a depth of 700 feet without encountering water The cuttings removed during the drilling of this well are reported by longtime residents as having consisted of a white sand which probably was crushed volcanic glass However this dry hole does not necessarily prove that the volcanic glasses composing No Agua Mountain are not water bearing for the regional water table as indicated by figure 7 is probably below the altitude of the bottom of this well

TERTIARY AND QUATERNARY SYSTEMS

Santa Fe Group

The valley-fill materials which have accumulated to a great thickness in the Rio Grande trough since middle(?) Miocene time are collectively called the Santa Fe group* in the Santa Fe area Equivalent rocks occur within the Rio Grande depression from the north end of the San Luis Valley to and beyond El Paso Tex In the Sunshine Valley area they consist largely of alluvial sediments and andesite-basalt lava flows and some lake deposits These rocks are not all of one age for obviously the valley fill deposited in middle(?) Miocene time is older than the detritus removed from the slopes of the highlands during Pleistocene(?) time Nevertheless they are grouped together because all were deposited in a common trough They have a common mode of occurrence and they are all younger than middle Tertiary

The Santa Fe group is the major ground-water reservoir in Taos County The alluvial sediments andesite-basalt flows and lake deposits which compose this group in the Sunshine Valley area differ greatly from each other in their lithology and in their water-transmitting characteristics The three units are discussed below

Alluvial sediments

Alluvial sediments underlie most of the piedmont alluvial plains and are interbedded with the andesite-basalt flows of the plateau They are composed of detritus or rock waste washed down from mountains into the Rio Grande trough Most of the alluvial sediments forming and underlying the piedmont alluvial plains were derived from the Sangre de Cristo Mountains although small amounts were contributed by Ute Mountain and Guadalupe Mountain The alluvial sediments underlying and interbedded with the lavas of the plateau were probably derived both from the Sangre de Cristo Mountains and from the highlands bordering the plateau on the west

*Spiegel Zane and Baldwin Brewster Geology and water resources of the Santa Fe area N Mex U S Geol Survey rept in preparation

The thickness of the alluvial sediments beneath the valley is estimated by McKinlay (1956, p 21) to be about 3 000 feet However the alluvial sediments deposited since the last period of volcanic activity, thin out toward the west and near the contact with the eastward-dipping lava flows they are only a few feet thick (pl 3) The thickness of the alluvial sediments underlying the lavas capping the plateau is not known The greatest thickness of alluvial sediments penetrated by a well (1 73 32 122) is 535 feet The surface distribution of these sediments in Sunshine Valley is shown on the geologic map (pl 1)

Examination of the walls of irrigation ditches and of gravel pits along State Highway 3, reveals the heterogeneous character of the alluvial sediments These sediments commonly buff to dark brown are composed of materials ranging in size from clay particles to cobbles 8 inches long The individual pebbles and cobbles are recognizably derived from the granite schist gneiss and volcanic rocks composing the Sangre de Cristo Mountains, and they range in color from black to gray-green to red

Usually the alluvial sediments are unsorted but locally they are fairly well sorted and contain lenses of gravel sand or clay Well logs show that the horizontal and vertical variability of the alluvial sediments as seen in pits and ditches is also characteristic of the rock at depth

The presence or absence of sorting and the wide variation in lithology of the detritus composing the alluvial sediments may be attributed largely to the varying load capacities of, and the frequent channel shifting by the streams that emerged from the highlands to deposit the sediments During periods of heavy flood, the streams are able to transport materials of all sizes including boulders The large boulders and cobbles, usually deposited near the mouths of canyons at the foot of the mountains may thus be carried some distance from the canyon and dropped over finer sediments laid down on the plains during a minor flood The character of the sediments covering these boulders and cobbles will in turn depend largely on the stream velocities of succeeding floods During periods of moderate stream discharge coarse materials previously deposited may deflect the stream so that its load may overlap the finer sediments deposited at the mouth of a smaller neighboring canyon In such a manner, heterogeneous alluvial fans and cones were built at the mouth of every canyon at the foot of the mountain range As these fans grew and expanded laterally they coalesced forming piedmont alluvial plains

Most of the domestic and stock wells, and all the irrigation wells in Sunshine Valley derive their water principally from the alluvial sediments The water-bearing characteristics of these sediments are of necessity as varied as their lithology Beneath the

water table all the voids or pore spaces between the individual grains are filled with water, that is, the sediments as a whole are saturated The ground water is continually moving slowly through the void spaces in the rock, toward natural outlets or wells that are being pumped The rate of ground-water movement through the void space of these sediments is dependent in part upon the degree of sorting of the grains through which it moves For example coarse-grained, well-sorted sand permits movement of ground water much more readily than gravel that is thoroughly mixed with sand and clay In the gravel stratum the spaces between the pebbles are filled with sand grains and the spaces between sand grains in turn are filled by clay particles, movement of water through this stratum consequently is comparatively slow The well-sorted, coarse-grained sand would offer relatively less resistance to the passage of water

The rate of movement of water through well-sorted materials also varies directly with the coarseness of the grains Thus, a well-sorted sand will not transmit water as readily as a well-sorted gravel, water moving through the sand would have to overcome a greater amount of friction than would be encountered in the gravel Stated in another manner, the ratio of the surface area of a given volume of water occupying a void, to the volume of the void, is greater in small voids than in large voids Small voids therefore offer more resistance to the movement of water than large voids

Owing to the large range in possible degrees of sorting and coarseness of the alluvial sediments, the rate of ground-water movement through this material varies greatly Deep wells tapping these sediments, however generally yield large quantities of water because in most places they tap some strata of well-sorted material in addition to penetrating zones of "tight" clayey or poorly sorted material The yields of irrigation wells tapping the alluvial sediments generally range from 600 to 1 200 gpm although one yield as large as 3 000 gpm has been reported (table 5)

Andesite-basalt

Andesite-basalt lavas underlie most of the plateau in western Taos County (pl 1) and are known to exist beneath, and to be interbedded with, the alluvial sediments composing the piedmont alluvial plains east of the Rio Grande Ute Mountain San Antonio Peak, Cerro de la Olla, Cerro Negro and other volcanoes in the region were the probable sources of these vast lava flows, although some of the flows may have issued from fissures The flows range in composition from basalt to andesite and will be referred to hereafter as andesite-basalt lavas or simply as lavas

The individual andesite-basalt lava flows are generally less than 50 feet thick and are locally interbedded with thin strata of volcanic ash In the northern half of the plateau, the logs of wells 29 11 - 14 410, 31 9 10 320, and 30 10 8 444 show that the lava and associated volcanic ash and cinder beds reach thicknesses of 485, 575, and 600 feet, respectively In the southern half of the plateau the thickness of the lava ranges from 45 feet, north of Tres Piedras to 280 feet, 5 miles north of Taos Junction (logs 28 9 11 200, 26 10 6 200, and 25 10 4 222, table 7) Approximately 670 feet of lava is exposed in the canyon at the Taos Junction bridge

The andesite-basalt flows were derived largely from molten lavas of low viscosity, hence they were able to spread out over the plateau in tabular sheets, often of large extent The sheets were cut by numerous vertical fractures which formed during the cooling of the lava The rapid chilling of the tops and bottoms of individual flows, and later erosion, resulted in a rugged contact between the lava strata In addition, the chilled and broken crusts of the flows probably were often rolled under the advancing front of the lava, and as a result permeable brecciated zones may at times have been formed at the base of individual flows In such a manner, both horizontal and vertical passages were developed in this rock Although some of the andesite-basalt lava is very dense, most of the specimens collected contain vesicles or bubbles formed by gases escaping from the cooling lava The vesicles usually occur near the top of the lava flows Typically, they are spherical or cellular in outline but many are tubular The vesicles range in diameter from the size of a pinpoint to 0 5 inch and are not well interconnected

Although the lava ranges in color from jet black to brownish red, most specimens are gray on the fresh surface The rock commonly weathers to a black, brown or cream color The texture of the flows generally is so fine that the individual grains cannot be distinguished with the naked eye, although some samples are sufficiently coarse textured to permit such distinction The coarse-textured samples may represent the middle portions of thick flows Most specimens exhibit a fine-grained, smooth fracture The lava normally weathers into a clayey soil, on which travel by auto during and after a rainstorm is a painstaking, and at times a hazardous, process

Most of the stock wells in the northern half of the lava-capped plateau obtain their water from the andesite-basalt The ability of this rock to transmit water — that is, its permeability — depends largely upon the extent of its fracturing Unlike alluvial sediments which generally have void spaces between individual grains through which ground water may move, the grains or crystals composing a lava are usually interlocked, thus leaving little or no interconnected void space Ground water in lava

flows therefore moves only through fractures in the rock or along the rough contacts separating the individual flows Vesicles do not seem to be an important medium for ground-water movement through the lava

Because of dependence upon fractures to transmit water andesite or basalt lavas are often described as having a low rock permeability but a high formational permeability That is though small portions of a lava flow are commonly impermeable the lava flow as a whole is capable of transmitting large quantities of ground water Stock wells on the plateau which tap the lava have reportedly yielded 25 to 30 gpm during bailing tests The great depth to water in the lava beneath the plateau and the availability of shallower water in Sunshine Valley from the alluvial sediments has precluded drilling in the lavas for irrigation water

Lake deposits

Logs of numerous wells show that deposits of clay or sandy clay occur beneath the alluvial sediments in the southwestern quarter of Sunshine Valley These deposits, which are believed to have been formed in an ancient lake range in thickness from several feet to 166 feet Most logs describe these sediments as "clay, brown, sandy," 'clay, red," "clay dense brown sticky" Several logs list strata in which sand and gravel occur in a matrix of brown clay The determination of the lithologic characteristics of these deposits is based, of necessity, upon descriptions in well logs, for the deposits have been buried beneath younger alluvial sediments

Although the lake sediments are generally fine grained indicating deposition in relatively quiet waters coarse well-sorted deposits could have formed along the eastern border of the lake as a result of reworking of the flanking alluvial sediments The permeability of the lake deposits is usually low because of their predominantly fine-grained texture Consequently, wells drilled into these deposits will yield relatively small quantities of water

The origin and extent of the lake in which these deposits formed are discussed under "Subsurface geology"

QUATERNARY SYSTEM

Recent Series

Stream deposits, predominantly sand and gravel, crop out along the banks of creeks in the area These deposits generally are fairly well sorted Wells dug along Costilla Creek derive their water largely from floodplain sediments deposited by this creek The thickness and extent of these deposits are not known

SUBSURFACE GEOLOGY

Owing to the different water-bearing capacities of the alluvial sediments the andesite-basalt lavas and the lake deposits the subsurface relations between these rocks directly affect the rate and direction of ground-water movement The relations of these rocks to each other are therefore discussed with special reference to the subsurface geology of Sunshine Valley

Beneath the lava-capped plateau the lava flows and associated ash beds accumulated one upon another to thicknesses ranging from 45 to more than 600 feet These overlie the alluvial sediments and there is no evidence of interbedding of the sediments and the lava beneath the plateau

East of the Rio Grande the lava flows have been buried beneath alluvial sediments and are locally interbedded with them During periods of volcanic activity the alluvial sediments derived from the Sangre de Cristo Mountains were partially buried beneath vast sheets of lava derived from the west With the cessation of volcanic activity the lava flows were in turn buried beneath detritus In such a manner the lava flows and the alluvial sediments which largely compose the Santa Fe group were interbedded along the mountain front This interbedding is clearly seen in the Rio Grande Canyon at Dunn Bridge (fig 2) To the north opposite Sunshine Valley only lava flows are seen in the canyon Well logs (table 7) show however that the lava and alluvial sediments are interbedded east and southeast of Ute Mountain

Since the last period of volcanism the lavas east of the Rio Grande Canyon have been largely buried beneath the alluvial sediments that underlie the piedmont alluvial plains In Sunshine Valley the lava crops out in a narrow strip, half a mile to a mile wide (pl 1) which borders the Rio Grande Canyon on the east Elsewhere in the valley the lava is buried beneath the alluvial sediments

Knowledge of the extent of the lavas beneath the valley is derived from the logs of wells and damsite test holes Figure 8 is a structure contour map prepared from logs, showing the altitude of the uppermost lava flow encountered during the drilling of wells and test holes in the southwest quarter of the valley The structure contours clearly show that the lava strikes nearly north-south and dips eastward The plain, under which the lava is buried, slopes westward consequently, the depth to the lava increases toward the Sangre de Cristo Mountains The lava was encountered at a depth of 102 feet below land surface in test hole 30 12 33 220, 1 5 miles east

streams also head in the Sangre de Cristo Mountains but unlike the above-mentioned streams (Costilla Creek Latir Creek, Rio del Medio Rio Primero and Cañada Piñabete), they flow in a valley incised 100 to 200 feet below the surface of the piedmont alluvial plain rather than upon the surface of the plain Red River shows an appreciable gain in flow in large part from springs on the north and south banks between its mouth and a point about 7 miles upstream at the junction with Cabresto Creek In its lower reaches Cabresto Creek also receives part of its flow from ground water The accretion to Red River is discussed more fully under the section in this report on ground-water accretion to the Rio Grande and Red River

IRRIGATION CANALS AND DITCHES

Acequia Madre Cerro Canal, Cerro community ditch, and Llano ditch (pl 2) are the major irrigation watercourses that divert water from the perennial mountain streams The first two divert water from Costilla Creek, the Cerro community ditch intercepts water from Latir Creek Rio del Medio, and Rio Primero, and Llano ditch diverts from Cabresto Creek Numerous minor ditches (not labeled on pl 2), including Mesa ditch, Middle ditch Alire ditch, and the New Mexico branch of the Cerro Canal, divert water from the ditches named Within the State the network of ditches is largely limited to the northeastern and southeastern corners of the valley In Colorado surface water is applied to much of the land in the vicinity of Garcia and Jarosa The quantity of water flowing in the ditches depends upon the season of the year and the amount of water released from storage in Cabresto and Costilla Reservoirs During the 1955 irrigation season (May-September), Acequia Madre Cerro Canal, and Llano ditch transported respectively about 4,600, 11,700 and 2,000 acre-feet of water past their points of intake The flow in these ditches during the winter is negligible The flow in the Cerro community ditch during the 1955 irrigation season was greater than the 3,200 acre-feet diverted from Latir Creek by the amount of unmeasured intake from Rio Primero and Rio del Medio The flow of Latir Creek is diverted into this ditch the year round None of these ditches are lined to prevent the loss of water through seepage The ditches are commonly floored with sand and gravel and serve as excellent sources of artificial recharge to the ground-water reservoir

GROUND-WATER RESOURCES

SUNSHINE VALLEY

Ground water beneath Sunshine Valley occurs within the alluvial sediments that largely underlie the piedmont alluvial plain and within lava flows that underlie and are interbedded with the alluvial sediments Most wells derive their water from the alluvial sediments that floor the valley Ground water within these sediments is generally found at depths ranging from 2 to 90 feet in the southern half of the valley and from 50 to 271 feet in the northern half Several dam-site test holes and several irrigation wells have been drilled into the lava and the wells derive all or part of their water from that rock Water within the lava is tapped by wells at depths ranging from 90 to 231 feet below the land surface

Wells dug along the banks of Costilla Creek derive their water chiefly from the alluvium of Recent age deposited by this creek

Water in Alluvial Sediments

Occurrence

The alluvial sediments form the principal aquifer within the valley They underlie most of the valley (see pl 1) and contain large quantities of ground water of excellent quality For many years prior to the recent development of ground water for irrigation water within these sediments was used for stock and domestic purposes The quantity of water pumped from this aquifer for irrigation now greatly exceeds all other uses

The depth to water within the alluvial sediments varies considerably in different parts of the valley In the southern half of the valley, water levels are relatively shallow ranging from 2 to 90 feet below land surface In T 30 N R 12 E the water table is within 50 feet of the land surface It nearly parallels the land surface throughout this township, and consequently the depth to water does not increase toward the east despite the rise of the land surface in that direction Plate 3 shows the relation of the water table to the land surface across the center of this township In secs 1, 14, 15, and 23 the land surface and water table converge, the upper surface of the zone of saturation approaching to within 2 feet of the land surface The water table in these sections is at the land surface in several places where watering holes have been dug One of these holes or pits, in the NW¼ sec 1, served as a watering hole in stagecoach days

In the immediate vicinity of Cerro, and southward to Questa, water levels range from 60 to 157 feet below the land surface In this area the land surface rises toward the mountains and toward the low topographic divide separating the two villages at a gradient greater than that of the water table, resulting in greater depths to water in those wells

may be expected from several feet of highly fractured saturated lava The pressure tests conducted on the test holes show clearly, however that a large variation exists in the water-transmitting capacity of the lava In Costilla dam-site test hole 1 or example several zones ranging from 10 to 20 feet in length accepted no water under pressures of 100 pounds

The possibility of obtaining from the lava sufficient water for irrigation has not yet been determined adequately by drilling but appears to depend directly upon the extent of fracturing encountered by a well A well penetrating several hundred feet of saturated lava might tap several highly fractured zones capable of yielding large quantities of water The yields of adjacent wells might differ considerably, however Sufficient water from the lava for stock and domestic needs is considered a certainty Stock wells on the lava-capped plateau west of the Rio Grande which derive their water from saturated lava reportedly were tested with a bailer at 25 to 30 gpm

Chemical quality of the water

Ground water within the lavas is of satisfactory chemical quality for all usual purposes and closely resembles that within the alluvial sediments Table 8 lists the chemical analyses of water samples from three springs that issue from lava in the Rio Grande and Red River Canyons and from a stock well on the lava-capped plateau The hardness of the samples ranged from 63 to 100 ppm

Relation of Water in Alluvial Sediments to Water in Andesite-Basalt

Ground water has been shown to occur in both the alluvial sediments and the andesite-basalt lavas The absence of springs at the surficial contact of the alluvial sediments and the lavas plus the similarity in chemical composition of the water in the lava to that in the overlying alluvial sediments indirectly indicates that water from the sediments moves into the underlying lava

Water is heard running or cascading constantly into wells which have penetrated both saturated alluvial sediments and lava flows This phenomenon is exhibited in irrigation wells drilled east and southeast of Ute Mountain Well 1 74 24 244a for example was drilled through a lava flow between 276 and 290 feet then into more alluvial sediments to a depth of 475 feet where lava was again encountered The water level in this well on July 12, 1955 was 197 9 feet below the ground Water is always heard cascading into this well Irrigation well 1 - 74 24 244 320 feet north of well 1 74 24 244a was drilled through alluvial sediments to a depth of 276 feet and was completed at the top of a lava flow The depth to water in this well on the same date was 195 9 feet below the land surface Water is not heard running into this well A difference of 2 3 feet exists in the altitude of the ground surface at the two wells, when referred to the same datum the water level in the 475-foot well was 4 3 feet below that in the shallower well On the date of measurement water was entering the deep well at a depth of 193 6 feet and cascading to a depth of 197 9 feet Other irrigation wells among them wells 2 74 2 222, 2 74 12 121, 2 74 12 122, and 31 12 35 123, exhibit this phenomenon

Although many of the dam-site test holes penetrated both alluvial sediments and lava water is not heard cascading into these holes This is because the water within the alluvial sediments is sealed off from the water in the lava through the utilization of double casings

The water levels often drop sharply within the casings after the drill has penetrated lava This was best exhibited in irrigation well 30 12 2 444 and in test hole 30 12 23 122 The irrigation well was drilled through 137 feet of alluvial sediments and 62 feet of lake deposits before encountering lava at 199 feet Water in the alluvial sediments was at a depth of 18 feet The lava was penetrated to a depth of 250 feet During drilling to this depth the water level within the casing dropped sharply and water cascaded into the well from the 18-foot level This led the driller to believe that all water had been lost into cavities within the lava The hole was then cemented back to the 199-foot level The water level in this well on August 31, 1955 was 20 feet below land surface

Test hole 30 12 23 122 first encountered ground water within the alluvial sediments 11 feet below ground level At a depth of 110 feet lake deposits were encountered, and at a depth of 212 feet lava was encountered (see log, table 7) Between 232 and 240 feet, while the drill was still in lava the water level in the casing dropped from 11 to 45 feet and water began cascading into the well from saturated sediments above the 45-foot level No water is now heard running into this well, as the water within the alluvial sediments has been cased off

The above-described phenomena reflect a difference in head between the water in the alluvial sediments and that in the underlying lava The hydrologic environment and the probable cause of this head difference are discussed below with reference to figure 9, which generalizes conditions encountered in several dam-site test holes

Part C of figure 9 illustrates a test hole in which ground water was encountered under water-table conditions within the alluvial sediments and was completed just above a lava stratum The fractures in the top of the lava stratum are filled with sediments Ground water within the alluvial sediments

moves to the left toward a point of discharge not shown on the diagram Within the lava stratum a zone of saturation exists in which water also moves to the left toward a point of discharge Water within the lava is under subnormal head, or the water levels in wells tapping this rock stand below the water table within the alluvial sediments Consequently water moves downward from the sediments into the lava This downward movement is retarded by the upper portion of the lava flow where the fractures have been filled by clay sand and gravel Where the lava is directly overlain by the lake deposits as in the western two-thirds of T 30 N, R 12 E these deposits assume importance in retarding downward percolation Although downward movement of water from the upper zone of saturation into the lavas occurs ground water within the alluvial sediments moves laterally also toward points of lower altitude

The upper body of water within the alluvial sediments illustrated in figure 9C is considered to be semiperched with respect to the lower body within the lava No unsaturated rock is present between them and each is considered part of the same zone of saturation The upper portion of the lava stratum whose fractures have been filled with sediments and which in effect separates the two saturated zones by retarding the movement of water between them, may be called a negative confining bed or stratum The concept of a lava flow serving as a negative confining bed appears somewhat ambiguous in the light of previous references to the high permeability of the rock However the upper portions of the numerous fractures in a flow have been filled with clay sand and gravel upon burial beneath the alluvial sediments and it is understandable that the permeability of this rock is reduced locally If the surface of the lava has been exposed to the elements for a length of time the clayey weathering product of this rock also reduces its permeability somewhat Where lake deposits overlie lava they also function as negative confining strata Meinzer (1923 p 40) defines such a stratum as "one that prevents or retards downward movement of ground water where the overlying water has sufficient head to produce a resultant downward pressure '

The amount of downward leakage through the negative confining beds must be appreciable to maintain constant saturation of the underlying zone If the negative confining stratum were impermeable the water in the lower zone of saturation if not recharged from another source would drain to the level of its outlet this would produce a zone of aeration between the upper and lower saturated rocks and the water in the alluvial sediments would be perched Usually such a condition does not exist in the valley The generalized hydrologic conditions discussed and illustrated by figure 9C exist within the valley wherever saturated lava underlies or is interbedded with saturated alluvial sediments

If the well shown in figure 9C were deepened and drilled through the negative confining bed into the lower saturated zone within the lava, the water in the casing would drop below its original level (fig 9D) Water flowing through casing slots into this well from the upper level would then cascade inside the casing to a lower level In effect, the well would represent a large artificial fracture cutting the negative confining layer that separates the upper zone of saturation from the lower Drainage from the upper to the lower zones in the vicinity of the well would immediately take place through the well casing at a rate much greater than that occurring under natural conditions through the negative confining layer The amount of drop in water level in the wells is proportional to the difference in head between the two zones of saturation and their relative permeabilities Examples of wells that exhibit the conditions portrayed by figure 9D were cited at the beginning of this discussion

The situation illustrated in figure 9E shows the manner in which a double casing was used in test holes to isolate the water within the lava from that within the alluvial sediments It should again be noted that the water level within the lava stands within the casing at a point above the top of the lava but below the water table within the alluvial sediments (and also below the level given by fig 9D) The significance of this is threefold (1) No zone of aeration exists between the upper and lower saturated zones If such a zone existed the water level in the lava would be beneath the bottom of the confining strata (2) The water in the lower zone of saturation is under hydrostatic pressure, for the water level stands above the bottom of the confining layer (3) The head of the water in the lava is less than that within the alluvial sediments and therefore constitutes a subnormal pressure head

Difference in head between the water within the alluvial sediments and that within the lavas is attributed to a difference in the permeability of these rocks to the existence of a confining layer, and in part to the low outlet level of the water in the lava The movement of ground water through lava is predominantly by way of fractures and through passageways along bedding planes The fractures are comparatively large and when open offer little impediment to ground-water movement The gradient or head difference required to transmit water through the lava is therefore small Ground water moves in the alluvial sediments through small spaces between the individual grains and consequently meets much resistance A steeper gradient is re-

quired to move an equal quantity of water through such a stratum It is therefore apparent that the subnormal pressure head within the lava is due primarily to the greater permeability of that rock, which is reflected by the low gradients under which the ground water moves The steeper ground-water gradients within the alluvial sediments reflect the lower permeability of this rock

Not every well that pierces a lava stratum beneath saturated alluvial sediments contains water under subnormal pressure head Well 2 74 11 222, for example was drilled through two lava flows 35 and 45 feet thick, sandwiched between alluvial sediments No water is heard cascading into this well nor did the water level reportedly drop in the casing below the depth at which it was first encountered The apparent absence of semiperched conditions at this locality probably indicates that the lava flows penetrated were not fractured to an extent sufficient to transmit water rapidly Where the alluvial cover is thin and the discharge point within the lava is nearby as in the vicinity of well 30 12 21 111, the downward seepage of water is insufficient to saturate the lava and a zone of aeration separates the two aquifers Most wells and test holes penetrating lava beneath saturated alluvial sediments, however have exhibited a drop in water level in the casing and a resulting cascade provided the semiperched water has not been cased out

The relation of the water within the alluvial sediments to that within the lavas may be summarized as follows Beneath the water table within the zone of interbedding of alluvial sediments and lava, downward movement of ground water from the alluvial sediments to a zone of saturation within the lava takes place through a negative confining layer represented by sediment-filled cracks in the upper part of the lava or by lake deposits This downward movement is in response to a difference in head between water within the alluvial sediments and that within the lava Movement through the negative confining layer occurs at a rate not fast enough to drain the overlying alluvial sediments completely but sufficient to saturate the lava Two main zones of saturation result, one above the retarding stratum or negative confining layer, the other below The upper zone is semiperched with respect to the lower Wells drilled through the confining layer and open to both zones accelerate the downward movement of the semiperched water by giving it free access to the underlying zone of saturation The water levels in such wells usually drop after the confining layer is penetrated and water cascades into the well from the semiperched water body

Recharge

Recharge to the ground water in Sunshine Valley is derived from the perennial streams and related irrigation ditches arroyo flood flows, direct infiltration of precipitation, and infiltration of water pumped for irrigation

Recharge to the ground-water body from surface water is well illustrated in the vicinity of the villages of Costilla and Cerro, N Mex Here water levels in wells dug or drilled along the banks of creeks and ditches fluctuate widely with the quantity of surface-water runoff and consequently with the season of the year The depth to water in wells along the banks of Costilla Creek is in many places within 20 feet of the land surface during the summer when more than 71 percent of the runoff occurs at the gaging station 2 miles southeast of the village During the winter the water levels lower rapidly and many shallow wells go dry The seasonal fluctuations of water level in several of these wells is reportedly in excess of 10 feet Surface-water losses apparently supply the water to wells dug along this creek

The shape of contours on the water table around Costilla (see pl 2) is a further indication that Costilla Creek recharges the ground-water body The contours adjacent to the creek are convex downstream, as is common with a "losing" or "influent" stream The elevation of the water table, as shown by the contours is highest adjacent to the creek and progressively lower in a westerly direction indicating that the ground water is moving westward away from the creek Most of the recharge from the creek probably takes place in New Mexico and the area just north of the State line for, owing to diversions, the creek is often dry a few miles north of the Colorado-New Mexico line Recharge from Costilla Creek is principally to the alluvium of Recent age which underlies and borders the creek, but it eventually reaches the underlying alluvial sediments Recharge to the ground-water body from the other perennial streams in the region occurs in a manner similar to that from Costilla Creek.

Ground-water recharge from losses from irrigation ditches in the Costilla area is illustrated by the fluctuations of water level in well 1 73 10 431 on the north side of Cerro Canal The water level in this dug well in July 1955 was 33 feet below the land surface at an altitude of 7,760 feet, higher than the water levels in adjacent wells, indicating a ground-water mound or ridge or possibly a perched or semiperched zone beneath the canal in the vicinity of the well Water must be lost from the canal Furthermore, this well reportedly goes dry after the growing season, presumably in response to a decrease of flow in the canal Sufficient wells to delineate the extent of the ground-water mound beneath the ditch were not available Loss of water

from the gravel-floored canal probably takes place along its entire length

Recharge from irrigation ditches occurs in the vicinity of Cerro also The water levels in several of the wells visited here reportedly fluctuate widely with the season, some of these wells go dry during the winter Well 29 13 18 111 is within a few hundred feet of Cerro community ditch The water surface in this well in August 1955 was 17 to 62 feet higher than water levels in surrounding wells, suggesting a ground-water mound beneath his well created by seepage from the Cerro community ditch and a nearby ditch The altitudes of the water table at this and several nearby wells served to delineate approximately the extent of this area of high water levels This mound is outlined on plate 2 by the configuration of the 7 500-foot contour Because of the rapid response of water levels in wells bordering the ditches to the quantity of water flowing through the ditches the extent of this ground-water mound will vary widely with the season

The amount of water lost from the perennial creeks and the irrigation ditch network in the region is probably great A series of measurements made on Cerro Canal by the New Mexico State Engineer in the early 1930's (1932 p 88) showed that 83 percent of a flow of 8 cubic feet per second (cfs) was lost before the water reached the irrigated land The length of the ditch gaged was not given This loss of course consisted of seepage loss plus evaporation It would seem that the ditches and canals lose a larger percentage of water through seepage than do the creeks The flow in many of the ditches is intermittent being regulated by the season and by allotments Whenever water is diverted to a ditch or canal after a period of nonuse the silt is flushed out and the permeability of the bottom of the water-course is thus increased The creeks on the other hand probably have a fine sand and silt layer flooring their beds which hinders seepage most of the time This is more likely true of Costilla Creek than of the other perennial creeks in the region for its gradient within the region studied is much less than the others

Some recharge from ephemeral creeks to the alluvial sediments at the foot of the Sangre de Cristo Mountains also must occur during the summer, after heavy rainfall

Practically all the recharge surface water from the sources discussed replenishes the alluvial sediments and alluvium of Recent age, as these rocks underlie most of the areas traversed by the creeks and ditches Recharge to the lava aquifer by surface water occurs at infrequent intervals when the runoff in Costilla Creek and Cerro community ditch is of sufficient magnitude to reach the western extremity of the valley, where the lavas are exposed at the surface

The discharge of Latir Creek, Llano ditch, and Costilla Creek (see table 2) at their points of entrance into the valley indicates the magnitude of potential recharge from surface water to the ground-water body beneath the valley The combined average discharge of the creeks and ditch for the period 1948-55 is 31 300 acre-feet per year The surface-water flow over the valley exceeds this quantity by the ungaged flow of Rio Primero, Rio del Medio, and Cañada Piñabete and that occurring in the small canyons after heavy summer rains The discharge of Cabresto Creek, except that diverted by Llano ditch is largely carried beyond the confines of the valley and therefore is not included within the 31,300 acre-feet The total runoff from the sources enumerated is usually completely consumed within the confines of the valley through infiltration, evaporation, and transpiration, although some runoff occasionally reaches the Rio Grande through Cerro community ditch and Costilla Creek The runoff that seeps through the alluvial sediments to the water table may be conservatively estimated to be about one-third of the total runoff, or about 10 000 acre-feet per year It appears unlikely that surface-water losses attributable to infiltration would exceed half the surface flow If the ungaged flows of Rio Primero Rio del Medio, Cañada Piñabete, and other tributaries also are considered, the total annual recharge from surface flows is probably more than 10 000 acre-feet

Recharge also occurs directly from precipitation This recharge is derived principally from snowfall, which constitutes 30 to 40 percent of the annual precipitation as most of the rainfall occurs during the summer when evaporation, transpiration, and soil-moisture deficit are greatest Local ponding of runoff from summer rains however, should also be considered as a potential source of recharge

Ute and Guadalupe Mountains are composed largely of highly fractured andesite-basalt lava, and a significant part of the precipitation on these volcanoes probably percolates to the ground-water body The volcanoes rise respectively 10,151 and 8,735 feet above sea level and approximately 2,600 and 1,200 feet above the adjacent valley floor, and undoubtedly induce greater precipitation upon their flanks and peripheries than the 13 inches recorded within the valley at Cerro

An approximation of the amount of recharge derived from precipitation on the valley floor and on the slopes of the volcanoes can be made on a basis similar to that used in studies by Theis (1937, p 564-568) of the Llano Estacado portion of the southern High Plains Estimates by Theis of the annual recharge from precipitation were based on

three different quantitative approaches and ranged from about 0.1 to 0.7 inch where the mean annual precipitation was about 16 inches. His estimates were derived largely from geologic and hydrologic data collected in Roosevelt and Lea Counties, N. Mex. The average annual temperature in these counties is approximately 15° F higher than at Cerro. The evaporation opportunity on the plains accordingly is much greater than that in Sunshine Valley. In addition, the percentage of precipitation occurring as snowfall is negligible in the southern counties but is about 30 to 40 percent in Sunshine Valley. The snow which intermittently blankets the valley during the winter is conducive to a greater rate of recharge than that afforded by rainfall or melting of a snow cover simulates a continuous downpour of rain which is not dissipated immediately by evapotranspiration. Finally, recharge in the two southern counties is greatly hindered by the presence of a continuous highly impermeable caliche zone beneath the surface. No such zone exists in the alluvial sediments of Sunshine Valley. Recharge from precipitation in Sunshine Valley is therefore considered to be appreciably greater than that in Lea and Roosevelt Counties and probably averages at least 1 inch annually.

If the annual recharge in Sunshine Valley is 1 inch, every 12 acres will receive an acre-foot of recharge annually. The valley Guadalupe Mountain and Ute Mountain cover an area of approximately 110 000 acres. Annual recharge from precipitation on the valley and on the two extinct volcanoes may therefore approximate 10 000 acre-feet. This estimate of recharge, like that of recharge from surface waters was arrived at inferentially and therefore indicates only the order of magnitude.

Some ground-water recharge must occur also from irrigation ditches and from irrigated land. Return of well water, the magnitude of which is unknown, is not natural recharge and in effect represents a decrease in pumpage.

In summary, recharge to the ground water beneath Sunshine Valley is derived primarily from water losses from perennial creeks and related irrigation ditches and from precipitation, the total being of the order of 20 000 acre-feet a year. The recharge from surface waters is estimated to be in excess of 10 000 acre-feet annually and recharge from precipitation is estimated to be not less than 10 000 acre-feet. The recharge is primarily to the ground-water body within the alluvial sediments which are at the surface over most of the valley. Recharge to the lavas within the valley occurs predominantly through leakage from the overlying saturated alluvial sediments and to a lesser extent from precipitation on Ute and Guadalupe Mountains.

Movement and Discharge

Ground water in Sunshine Valley generally moves from areas of higher elevation, the main areas of recharge being at the base of the Sangre de Cristo Mountains on the east side of the valley, to those of lower elevation, the discharge areas along the Rio Grande. The ground water initially moves in a westerly direction through the alluvial sediments which underlie most of the areas receiving recharge and discharge into the lava. It then moves through the lava and discharges into the Rio Grande as spring flow. The gradients under which the water moves through the sediments range from only a few feet to 100 feet to the mile, the steepest gradients occur beneath the recharge areas and east of Ute Mountain but in most of the valley the gradients are less than 50 feet to the mile.

The gradient and direction of ground-water movement within the alluvial sediments are altered in the northwestern quarter of the valley, around the periphery of Ute Mountain. East and southeast of this volcano the alluvial sediments and lava flows are interbedded. There is no evidence of lake deposits. As the ground water moves westward from the areas of recharge and approaches the contact between the alluvial sediments and the lava flows its gradient increases sharply. The contours on the water table (pl. 2) show that within a zone of 1 mile to 1½ miles wide along the east periphery of Ute Mountain the water table drops from an altitude of 7 450 feet in the alluvial sediments to an altitude of 7 325 feet in the lava flows. The sharp change in slope represents a change in the hydrologic conditions under which the ground water occurs. Within the zone of interbedding, ground water in the alluvial sediments drains into the underlying lava. The amount and rate of downward movement of the water probably increases greatly toward the base of the volcano for the percentage of lava in the zone of interbedding increases as the volcano is approached. Eventually all the water in the alluvial sediments drains into the lava. The increase in slope of the water table along the periphery of the volcano thus reflects ground-water drainage from the alluvial sediments toward lower levels within the lava flows.

The direction of ground-water movement in the vicinity of the volcano also is influenced by subsurface conditions. Movement of ground water from the recharge areas is principally westward. However along the periphery of Ute Mountain the contours representing the altitude of the upper surface of the zone of saturation (pl. 2) curve around this volcano indicating that the water within the alluvial sediments is moving toward Ute Mountain from the north, northeast, and southeast as well as from the east. The direction of movement is practically at

right angles to the contact of the lava and the alluvial sediments, as is shown by the similarity in the shape of the water-table contours surrounding the mountain and the geologic contact of the lava and sediments shown on plate 1 Ute Mountain thus appears to serve essentially as a huge infiltration gallery Water within the alluvial sediments drains toward this mountain from the north, east, and south and is discharged into the lava

Guadalupe Mountain also appears to act as an infiltration gallery The 7 450-foot contour of the water table in the alluvial sediments east and northeast of this extinct volcano indicates that ground water within the sediments moves directly toward this mountain

In the southern half of the valley the gradient of ground water within the alluvial sediments is not noticeably altered by semiperched conditions Water moves westward from the areas of recharge toward the Rio Grande No significant change in gradient occurs within the alluvial sediments above the lava flows In the western two-thirds of T 30 N, R 12 E, lake deposits overlie much of the lava and are themselves overlain by partly saturated alluvial sediments Here the negative confining layer, separating the zone of saturation within the alluvial sediments from that within the lavas, is represented not only by sediment-filled fractures in the upper part of the lava flows but also by lake sediments of low permeability Downward leakage of ground water from the alluvial sediments into the lava is consequently retarded to a greater extent here than in the northwestern quarter of the valley, therefore the gradient of the water table within the alluvial sediments above the lava does not increase westward even though semiperched conditions exist

West of the geologic contact of the alluvial sediments and the lavas in T 30 N (pl 1) the water table is within the lava at an altitude nearly the same as that of the Rio Grande (See pl 3) East of this contact water in the alluvial sediments which has not drained into the lavas probably cascades into the lava at or near its contact with the alluvial sediments This is indicated by the absence of springs in the box canyons tributary to the Rio Grande Canyon

Although the lavas in the valley serve as the principal means of discharge for ground water from the alluvial sediments some ground water also discharges from these sediments in the south-central part of the valley through evapotranspiration Within a narrow strip 5 miles long and a quarter to half a mile wide in the south-central part of the valley, the water table is within 2 to 20 feet of the surface This strip trends north-south and extends through sections 1 11 12, 14 23 and 26 of T 30 N, R 12 E, encompassing an area of approximately 3 square miles The water table in several watering holes in this zone is only 2 to 3 feet below the ground surface The proximity of the water table to the surface is conducive to discharge of ground water through evaporation and transpiration Evaporation occurs directly from the surfaces of the watering holes and from the capillary fringe, and transpiration occurs through use of the ground water by vegetation The magnitude of the evapotranspiration in this zone is not known

Wells into which water cascades also may be considered as points through which ground water discharges from the alluvial sediments or as sources of artificial recharge to the lava If numerous wells with casings perforated in the sediments were to pierce the negative confining stratum, drainage into the lava would be increased and water levels in the semiperched water body in the alluvial sediments would be lowered

Water that seeps into the lava from sediments moves in various directions toward the Rio Grande, into which it discharges (fig 10) In the southern half of the valley and beneath Guadalupe Mountain ground water in the lava moves westward and southwestward toward the Rio Grande, which has incised its bed below the water table Ground water moves through the lava under gradients ranging from 10 to 100 feet to the mile The range in gradients apparently is due largely to the profile of the river The lowest gradients, 10 to 25 feet to the mile, occur in T 30 N, R 12 E, through which the river flows under a gradient ranging from less than 10 to nearly 20 feet to the mile Opposite Guadalupe Mountain the gradient of the river ranges from about 15 to 100 feet to the mile and the slope of the water table toward the river and accretion to the river are greater This increase in gradient represents an adjustment to the lowering of the discharge point A similar increase in the gradient of the water table occurs west of the river

Ground water within the lava in the northern half of the valley moves under very low gradients Between the proposed State line dam site (4½ miles north of the Colorado-New Mexico line) on the north and about 2 miles downstream from the proposed Ute Mountain dam site on the south, and in a strip 4 to 5 miles wide on either side of the canyon the water table in the lava is below river level At the proposed State line dam site the water table is 66 feet below the river (Sloan, 1938, p 516) and at the proposed Costilla dam site, about 40 feet East of Ute Mountain ground water within the zone of interbedding of the lava and alluvial sediments is respectively 50 and 31 feet below river level in wells 1 74 15 224 and 1 74 23 222 The shape of the water table where it lies below river level is that of a

broad, flat trough, as is indicated by the 7,325-foot contour (pl 2)

About 2 miles downstream from the proposed Ute Mountain dam site the river intercepts the water table and springs appear in the canyon Ground water moves through the lava toward this point of initial discharge from the east west and north under low gradients Because of the low gradient of the water table in the lava it was necessary to change the contour interval in order to represent the water table within this rock on plate 2 Between the 7 335-foot contour in Colorado and the 7 325-foot contour in New Mexico the water table slopes 2 5 feet per mile in a southerly direction Between the 7 325-foot contour and test hole 31 12 31 140 the southward slope of the water table along the Rio Grande is 2 feet to the mile In the same stretch the gradient of the river exceeds 8 feet to the mile These low gradients of the water table and the highly fractured nature of the lava are indicative of the relatively high permeability of the lava

The wide troughlike shape of the water table around Ute Mountain indicates that the rocks underlying this area are of relatively high permeability It would appear that the peripheral zone rather than the core of the mountain has the greater permeability In addition to the fractures that formed in the lava during solidification of the rock composing this volcano each eruption would of itself shatter and fracture the solidified flows around the periphery of the vent(s) through which the molten rock reached the surface thereby increasing the permeability of the peripheral rocks The water levels in wells 1 74 23 222 and 1 74 15 224 east of the volcano test holes 1 74 6 400 and 1 74 7 111 northwest of the mountain and wells 32 11 28 430 and 31 11 16 333 west of the volcano are at practically the same altitude showing that ground water moves through at least the periphery of this volcano with little impedance

Ground water similarly moves through the peripheral zone if not the core of Guadalupe Mountain The water levels in three of the proposed Chiflo dam-site test holes (29 12 21 114 29 12 21 411 and 29 12 21 441), drilled about half a mile apart on the western slope of the mountain encountered the water table at altitudes differing by only 2 feet The 7,150-foot contour east of the Rio Grande essentially represents the altitude of the water table encountered in these holes As movement of ground water normally is at right angles to the contours in the downslope direction ground water apparently is moving through this volcano in a southwesterly direction However because of the irregularity of fractures in lava, the movement of ground water through these volcanoes at a particular place may not be exactly at right angles to the contours as drawn, and although direct information on the water conditions near the center of the mountain is lacking the possibility that the water moves in a circuitous route possibly through the periphery of the volcano should not be overlooked

By way of summation, ground water within the alluvial sediments moves from the recharge areas along the east side of the valley toward the west In the zone of interbedded alluvial sediments and lava most of the ground water in the sediments is slowly discharged into the underlying lava Some discharge occurs also through evapotranspiration in the south-central part of the valley where the water table is very shallow Ground water within the lava moves from the areas of recharge, which underlie saturated alluvial sediments, toward the Rio Grande, into which it discharges as spring flow

LAVA-CAPPED PLATEAU

The lava-capped plateau lies west of the Rio Grande Beneath the plateau, ground water occurs within the lava and the alluvial sediments at depths ranging from about 250 to 750 feet below the land surface There are also isolated shallow perched ground-water bodies, generally within 40 feet of the surface Wells that penetrate these perched water bodies are usually assured of a water supply for only short periods each year

Occurrence of Ground Water

Owing to the small number of wells drilled and dug into the tableland knowledge of the occurrence of water is limited, and is almost wholly confined to the northern half of the plateau (fig 7)

Perched ground-water bodies — that is bodies of water separated from the major water table in the region by a zone of aeration — at present provide a limited source of well water for stock and domestic purposes The perched bodies commonly are in arroyos which are cut into the lava surface and floored with clay sand and gravel During periods of surface-water runoff generally following spring snowmelt or summer rains the alluvium filling the draws is temporarily saturated and will supply water to wells dug into these arroyo floors With cessation of the spring snowmelt and summer rains, the alluvium filling the draws is no longer replenished and the accumulated water drains into the underlying lava The water levels in wells dug into these arroyos then recede and the wells often go dry This situation appears generally to hold for shallow wells dug into the alluvium flooring Arroyo Aguaje de la Petaca (fig 7) One resident reported that when the clay that floors the arroyos is dug through, all the shallow perched water percolates downward

It seems probable that ground water is occasionally perched also by strata of volcanic ash, which in

In summary, ground-water discharge was of uniform magnitude during the 1928 measurements and during those made from 1948 through 1955. The Rio Grande gains about 25 cfs in 7.5 miles between a point below the proposed Ute Mountain dam site and Latir Creek, 25 cfs in 4.5 miles between Latir Creek and the Cerro gaging station, and 40 cfs in 6 miles between the Cerro gaging station and a point 1 mile above the Red River. Assuming that the accretion to the Rio Grande in the 1-mile stretch above the Red River equals that in the stretch below the Cerro gage (about 9 cfs per mile), the total gain from about the dam site to the Red River, a distance of 19 river miles, is about 96 cfs or approximately 70,000 acre-feet annually. The profile of the Rio Grande from Red River to the State line and the accretion to the river are shown in figure 11.

Ground-water accretion to the Red River, a tributary of the Rio Grande which bounds the region studied on the southeast, is also known to occur. Between the mouth of Red River and the head of its canyon, a distance of 5.5 miles, there are numerous springs that discharge from lava on the north and south sides of the canyon, the largest reportedly being on the north side. Approximately 3,000 gpm is reportedly developed from springs along both sides of Red River Canyon for use in the State Fish Hatchery at the mouth of Lama Canyon. Two groups of springs on the north side of the canyon reportedly flow 3,700 gpm or approximately 8 cfs. Several of the springs are shown on plate 2. In connection with the seepage study of the Rio Grande, Bliss (1928, p. 30) made a seepage run along Red River from the head of the canyon to its mouth, a stretch of 7 miles. His measurements showed a gain of about [illegible] cfs out of a total flow at the mouth of 84 cfs. Records of flow at gaging stations on Capresto Creek near Questa and Red River near Questa and at its mouth, for 1950-54 during the winter months when surface flow, evaporation, and diversions for irrigation are at a minimum, show a gain of 33 cfs (U.S. Geol. Survey, 1952-56). Though a stretch of river between these gages is somewhat greater than that measured by Bliss, the data appear consistent and indicate that the gain in Red River is in the lower 7 miles. As the largest springs are on the north side of Red River, it appears that at least half the accretion to Red River, about 16 cfs or 12,000 acre-feet per year, originates from Sunshine Valley.

The total accretion to the Rio Grande and the Red River between the Lobatos gaging station in Colorado and the confluence of these rivers is thus on the order of 80,000 acre-feet per year.

Between about the Ute Mountain dam site and Latir Creek the gradient of the river averages 11 feet to the mile (fig. 11 and Herron and others,

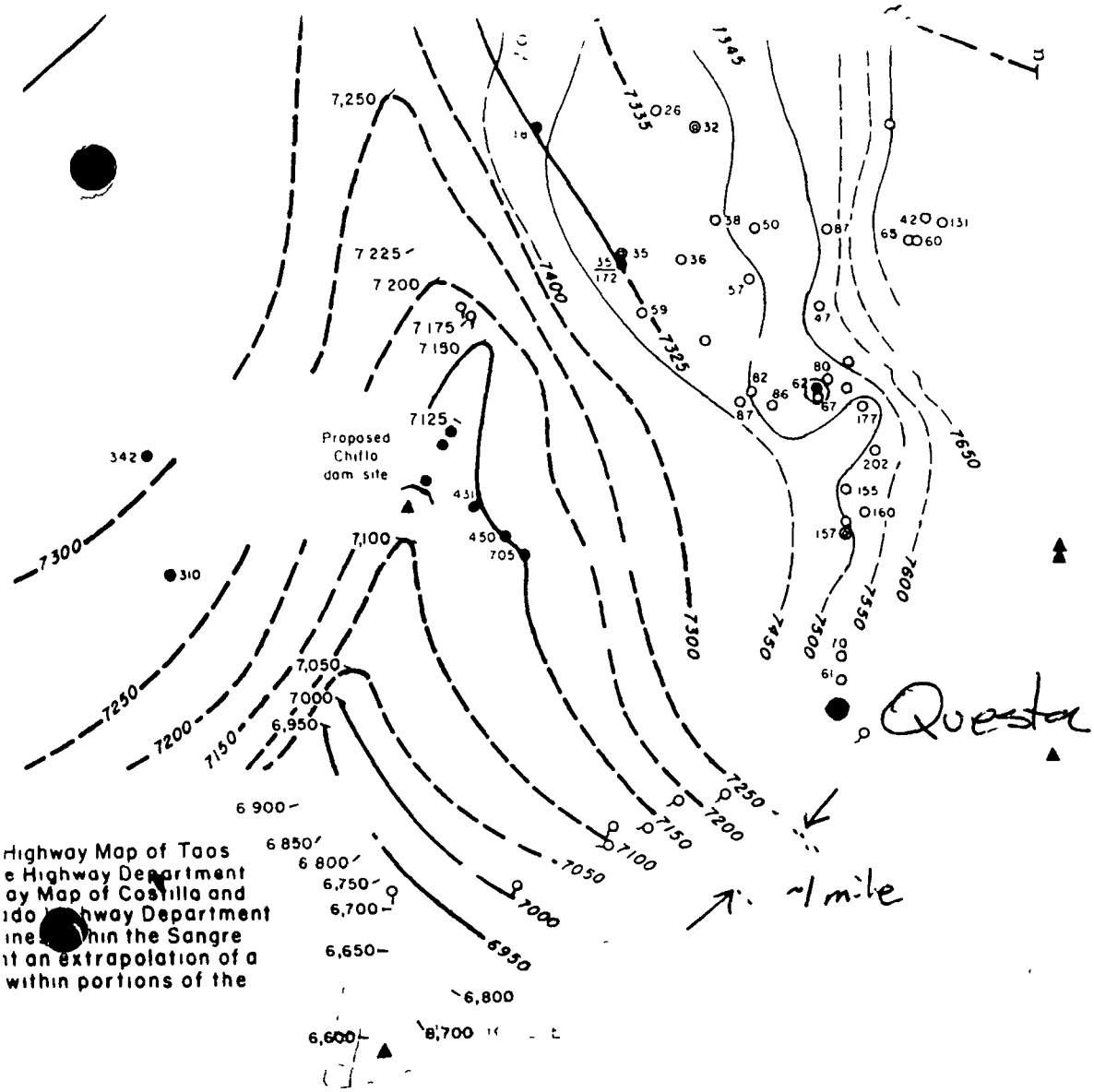
[illegible] and the average pickup is 2.3 cfs. In the next stretch between Latir Creek and the Cerro gaging station the gradient of the river averages 31 feet to the mile and the gain is 6.2 cfs per mile. Finally, between the Cerro gaging station and a point 1 mile above Red River the gradient of the Rio Grande averages 73 feet to the mile and the river gains 6.2 cfs per mile. The difference in the quantity of pickup per mile within the three stretches of the river discussed is due partly to the difference in gradient of the river within these stretches. In the lower two stretches the Rio Grande is incised more deeply below the level of the water table. This results in an increased gradient of the water table in the vicinity of the river and in turn an increase in the quantity of inflow to the river from the adjacent rocks. The Rio Grande is somewhat analogous to a drain. In its first section it penetrates a small thickness of aquifer. In the next section it penetrates a greater thickness of the aquifer and the quantity of water discharged consequently increases. In the third section a still greater thickness of aquifer is penetrated but the invisible inflow per mile is no greater than in the second section, possibly because the aquifer is less permeable in the third section.

The annual accretion from the ground-water reservoir constitutes a considerable portion of the flow of the Rio Grande in northern Taos County. Assuming a constant pickup of 50 cfs upstream from the Cerro gaging station, the annual accretion to the river between 1948 and 1955 accounted for 6 to 40 percent of the annual flow at this station. During the same period accretion accounted for 10 to 55 percent of the flow in the river just above the confluence of Red River. During the months of lowest runoff near Lobatos, the recorded pickup ranged from 25 to 97 percent of the flow at Cerro. Ground water thus serves as a major source of replenishment to the flow of the river in northern Taos County during periods of low flow at Lobatos. Consequently, concern has arisen regarding the possible effects of heavy ground-water withdrawals for irrigation in Sunshine Valley. The effects of pumping upon ground-water discharge are discussed in the following section of this report.

EFFECTS OF GROUND-WATER WITHDRAWALS IN SUNSHINE VALLEY UPON SPRING FLOW INTO THE RIO GRANDE AND THE RED RIVER

Under natural conditions over a climatic cycle, discharge from an aquifer or underground reservoir is equal to the recharge which it receives, that is, the system is essentially in equilibrium. Pumping is a new discharge imposed upon the system and tends to establish a new equilibrium in which there must be a reduction in natural discharge, an increase in recharge, or a combination of these effects, by an

Plate 2



Highway Map of Taos
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EXPLANATION

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per surface
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ediments
imate

Irrigation well

Stock or domestic well

Dam-site test hole

O 72

Number beside symbol represents the depth to water in the well Where two numbers are shown, the upper represents the depth to water in the alluvial sediments, the lower the depth to water in the andesite-basalt after the water within the alluvial sediments was cased off

1 0 1 2 3 Miles

Spring

7,250

Altitude of Rio Grande above sea level Data from U S Geological Survey Water-Supply Paper 421, 1916

Watering hole Trench or pit dug below upper surface of the zone of saturation

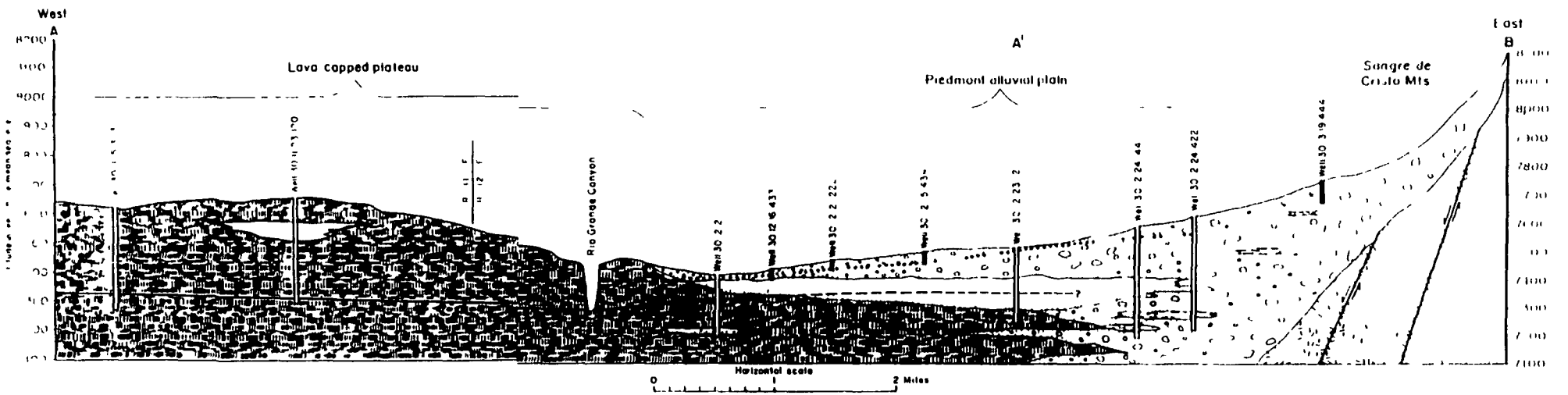
U S Geological Survey stream gaging station

Axis of proposed dam site

A A' B

Line of cross section shown on plate 3

TER-TABLE CONTOUR MAP OF SUNSHINE VALLEY AND VICINITY, TAOS COUNTY, N MEX.



EXPLANATION

Alluvial sediments Detritus composed of sand and gravel and some clay and silt

Andesite-basalt Composed of numerous lava flows generally less than 50 feet in thickness derived largely from the west Includes volcanic ash cinders and thin clay strata

Well for which log and water-level measurement are available

Water table in alluvial sediments Semiperched where underlain by saturated andesite basalt Perched in vicinity of test hole 30 12 21 111

Lake deposits Predominantly clay and sandy clay

Granite gneiss and associated rock

Well for which water-level measurement is available

Water table in andesite-basalt Solid line indicates water table, dashes indicate piezometric surface of water confined in andesite-basalt under subnormal artesian pressure Water in alluvium is semiperched from about well 30 12 16 433 to a point east of well 30 12 23 122, perched from about well 30 12 16 433 to a point west of well 30 12 21 111

Plate 3 - Generalized geologic section across Sunshine Valley, Taos County, N Mex Location shown on plates 1 and 2

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
ROOM 115, FEDERAL BUILDING
SANTA FE, NEW MEXICO 87501

SEEPAGE INVESTIGATION

RIO GRANDE BASIN

Red River - Zwergle damsite to regular gage near Questa, New Mexico.

Reach--From discontinued gage "below Zwergle damsite near Red River" (08264500) to regular gage "near Questa" (08265000).

Previous Investigations--1959, 1963, 1966.

Date-- October 25, 1988.

Summary--Weather clear with no precipitation. No ice effect. Conditions at the sites through the reach were as follows:

Red River near Questa (station 08265000)-discharge remained practically constant from 0900 to 1630 hours.

South ditch near Questa diversion at mile 9.3 - no change in diversion.

Molycorp, Inc. diversion at mill at mile 15.4 - no change in diversion.

Results of this investigation are rated fair to good. This seepage investigation was conducted in conjunction with a water quality survey of the Red River by the New Mexico Environmental Improvement Division. Results of the survey are available from this agency.

Red River Mile	Location	Time	Discharge, cubic feet per second: Main Stream	Discharge, cubic feet per second: Tributary or diversion
24.1	Red River below Zwergle damsite near Red River (discontinued gaging station 08264500)	0915	11	
23.7	Goose Creek at mouth	1005		+1.8
	Bobcat Creek at mouth	1020		+0.1 est.
	Placer Creek at mouth	1025		No flow
	Bitter Creek at mouth	1030		No flow
	Mallette Creek at mouth	1035		+0.4 est.
-	Pioneer Creek above Arrowhead Lodge at Red River	1100		+0.78
	Wastewater treatment plant discharge at Elephant Rock Campground near Red River			+0.35[a]
17.6	Red River at Elephant Rock Campground, below treatment plant, 20 ft below footbridge to Fawn Lakes, SW¼NE¼, sec.33, T.29 N., R.14 E. near Red River.	1140	16	
15.7	Red River above Molycorp mill near Red River, SE¼SE¼, sec.31, T.29 N., R.14 E.	1315	20	
	Molycorp diversion at mill	1340		0.00[b]
13.2	Red River 300 ft above mouth of Columbine Creek	1430	19	
13.1	Columbine Creek at mouth	1420		+6.0
			25	

+40 cfs

Red River Mile	Location	Time	Discharge, cubic feet per second: Main Stream	Tributary or diversion
10.3	Red River 0.2 miles above mouth of Bear Canyon near Questa	1545	29	
9.3	South ditch			-0.3 est.[b]
9.0	Red River near Questa, (regular gaging station 08265000) NE¼SE¼, sec.32, T.29 N., R.13 E.	1615	30[c]	

a Average discharge provided by treatment plant operator.

b No changes in diversion for duration of investigation.

c Discharge decreasing very gradually; stage fell 0.02 ft during investigation.

ANALYSIS OF TAILINGS POND SEEPAGE FLOW TO RED RIVER

AT

UNOCAL 76 MOLYCORP, INC.

QUESTA DIVISION

VAIL ENGINEERING, INC.

SANTA FE, NEW MEXICO

SEPTEMBER 24, 1993

ANALYSIS OF TAILINGS POND SEEPAGE FLOW TO RED RIVER

TABLE OF CONTENTS

	Page #
OVERVIEW	1
SURVEY OF RED RIVER	3
DATA BASE	4
Flow in Red River	4
Accretions to Red River	8
Fish Hatchery Diversion	8
Ambient Ground Water Quality	10
Tailings Seepage Water Quality	12
ANALYSIS	12
SUMMARY AND CONCLUSIONS	18

LIST OF TABLES

TABLE 1	
Lower Red River Survey 4-12-93	5
TABLE 2	
Water Quality Analysis Survey	6
TABLE 3	
USGS Stream Flow Data	9
TABLE 4	
Ambient Water Quality	11
TABLE 5	
Selected Analytical Values	12

VAIL ENGINEERING, INC.

PHONE (505) 988-3575

1588 SAN MATEO LANE
SANTA FE, NEW MEXICO
87501

(1)

ANALYSIS OF TAILINGS POND SEEPAGE FLOW TO RED RIVER

OVERVIEW

Molycorp's tailings dams are located primarily in Sections 35 (Dam Nos 4 & 5) and 36 (Dam No 1), of Township 29N Range 12E NMPM, one to two miles west of the Town of Questa, Taos County, New Mexico Red River flows to the west past the tailings ponds at a distance of approximately one-half mile south of the ponds Leachate from the tailings ponds seeps to the ground water which flows generally in a southwesterly direction and discharges to Red River

The seepage from the ponds contains elevated concentrations of sulfates (840± mg/l), molybdenum (2± mg/l), manganese (1 4± mg/l), and total dissolved solids (1700± mg/l) Several other elements are present at moderately elevated but below significant levels It appears that most of the molybdenum is being absorbed during seepage flow in the vadose zone and along the ground water flow path

During the 1970's Molycorp excavated trenches and installed french drains to intercept the seepage flow south of Dam No 1 and southeast of Dam No 4 These seepage barriers appeared to be fairly effective for some time but recently there has been evidence that an increased amount of seepage from the tailings ponds flows past these barriers This seepage flow is generally in the shallow alluvium and the fairly high constituent concentrations this area.

(2)

It is probable that a large percentage of the seepage from section 35 is transported by the ground water flow in the volcanic formations which underlie most of this pond area It is believed that most of this ground water flow is discharged to Red River at the numerous springs along the Red River Gorge The accretion to Red River from spring flow between the head of the gorge to the State fish hatchery is on the order of 18 cfs indicating a large amount of ground water flow in the volcanic formation.

In April 1993 a water quality survey was made along Red River between the State Road 3 highway bridge and the Red River Fish Hatchery The primary purposes for this survey study were·

(1) Determination of the concentration of significant pond seepage water constituents in the ground water and spring water entering Red River

(2) Determination of the amount of seepage water contained in the ground water and spring flows along specific reaches of Red River

(3) Determination of the effect on Red River of the pond seepage discharge

This study was conducted in conjunction with a ground water study, being prepared by South Pass Resources, Inc., to determine the characteristics of the ground water aquifer south of Dam No. 1 and the distribution and concentration of significant tailings pond water constituents in the ground water immediately down gradient of the pond areas.

Both studies were being conducted to determine the desirability and feasibility of further action by Molycorp to reduce the effect of seepage from the pond areas.

A schematic diagram showing the above distribution of accretion flow and all of the other measured and derived spring and river flows and SO_4 concentrations is included at the end of this report

SUMMARY AND CONCLUSIONS

At the time of the stream survey (April 12, 1993) the quality of the water in Red River (relative to constituents associated with Molycorp's operations) was better below the fish hatchery than at the State Highway bridge The sulfate concentration was nearly the same. The concentrations of aluminum, iron, copper, zinc and manganese were all lower at the downstream point Concentrations of molybdenum, cadmium and lead at both the upstream and downstream ends of this reach, were all below the detection limits for the laboratory methods used. Except for manganese, all constituents analyzed were below drinking water and stream water quality standards. The high manganese concentration are due to concentrations in the river upstream of the tailings pond area.

The quality of the natural ground water in the area is excellent. The average sulfate concentration is low at only slightly more than 20 mg/l.

Except for TDS and SO_4, the seepage flow from the tailings ponds compares favorably with Red River water quality.

The majority of the natural spring flow along the survey reach is intercepted by the fish hatchery water supply system. Analysis of the hatchery water supply indicates a moderate increase in sulfate; however, the concentration (63 - 80 mg/l) is still far below drinking and ground water standards. The maximum SO_4 concentration found for any individual spring was 126 mg/l. (Sampling

points 9 and 10 are believed to be field drainage and shallow alluvium aquifer flow rather than spring flow)

High concentrations of sulfate (660 - 690 mg/l) were found down gradient of the junction manhole from 002 and 003 which is located in the natural drainage channel below Dam No 1 and about 1/4 mile north of Red River. Other data indicates elevated SO_4 concentrations in some monitor and private wells in and down gradient of this area. The highest SO_4 concentration detected near the river was 504 mg/l at Station No 9 We believe that the field drainage below Dam No 1 and 003 is concentrated at this location. Molycorp is presently investigating the feasibility of constructing additional seepage barriers and/or other facilities to substantially reduce the seepage flow down gradient of the tailings ponds in this area.

Data from the stream survey indicates that at that time, the total tailings pond seepage flow entering Red River (including the fish hatchery supply) was about 2 29 cfs (including discharge from 002 and 003) Of this about 0 6 cfs was flowing from 002 and 003 0 7 cfs were in the field drainage and shallow alluvium aquifer flow east of the volcanic formations. These seepage flows are presumably from the tailings ponds in Section 36 and the easterly part of the tailings ponds in Section 35. An additional seepage flow of about one cfs was indicated to be contained in the cold spring flow at upper end of the gorge and in the warm springs along the gorge. It is believed that this seepage flow is from the west side of the pond area in Section 35 and from the pond area above Dam No 5. Survey data indicates that the seepage path from these areas extends downstream to within about 1/2 mile east of the fish hatchery

TABLE 1
LOWER RED RIVER SURVEY 4-12-93
Summary of Survey Data

SAMPLE POINT	DESCRIPTION	RED RIVER COND	RED RIVER TEMP	RED RIVER SO 4	SPRINGS & DRAINAGE COND	SPRINGS & DRAINAGE TEMP	SPRINGS & DRAINAGE SO 4
1	Below Hwy Bridge	345	8 3	119			
2	Spring in field				398	10 5	92
2A	Field Drainage				456	8 3	--
3	Field Drainage				415	11 2	92
4	Field Drainage				926	17 8	172
4A	RR above 3/4	369	9 3	--			
5	RR above 002	376	9 1	118			
6	002				1984	9 7	840
6A.	Field Drainage				450	9 3	
6B	Seepage @ 002				1800	9 8	
7	Field Drainage				863	10.1	228
8	RR above Big Spr.	418	9 8	141			
9	Big Spring				1390	7 8	504
10	Pipe @ Big Spr				870	7 1	210
11	RR below BS	412	10 3	138			
11A.	RR above Pope	410	10 4	--			
11B.	RR above Pope	409	10 5	--			
11C.	RR @ Pope	410	10 5	--			
11D	RR below Pope	410	10 4	--			
11E	RR below Pope	410	10 4	--			
12.	Spring				388	15.3	115
13	RR above S12	410	10 5	128			
13A	Spring				407	15 8	--
13B.	Seep				410	14	--
13C	Spring				436	14 5	--
13D.	RR	410	10 5				
14	South Side Spr				450	16 9	126
14A	RR above S14	410	10 9				
15	Spring				238	16 4	20
15A	RR				284	16.3	
15B	RR	404	11 2				
15C	Spring				284	16 4	
16	RR	407	11	129			
16A	RR @ Div Dam	407	11				
17	Hatchery Cold Spr.				430	8 3	80
18	Hat-Warm Spr				320	15.8	63
19	Irrg Ditch 002/003				1550	10.5	660
20.	Drain Below 002/003				1520	8 9	790

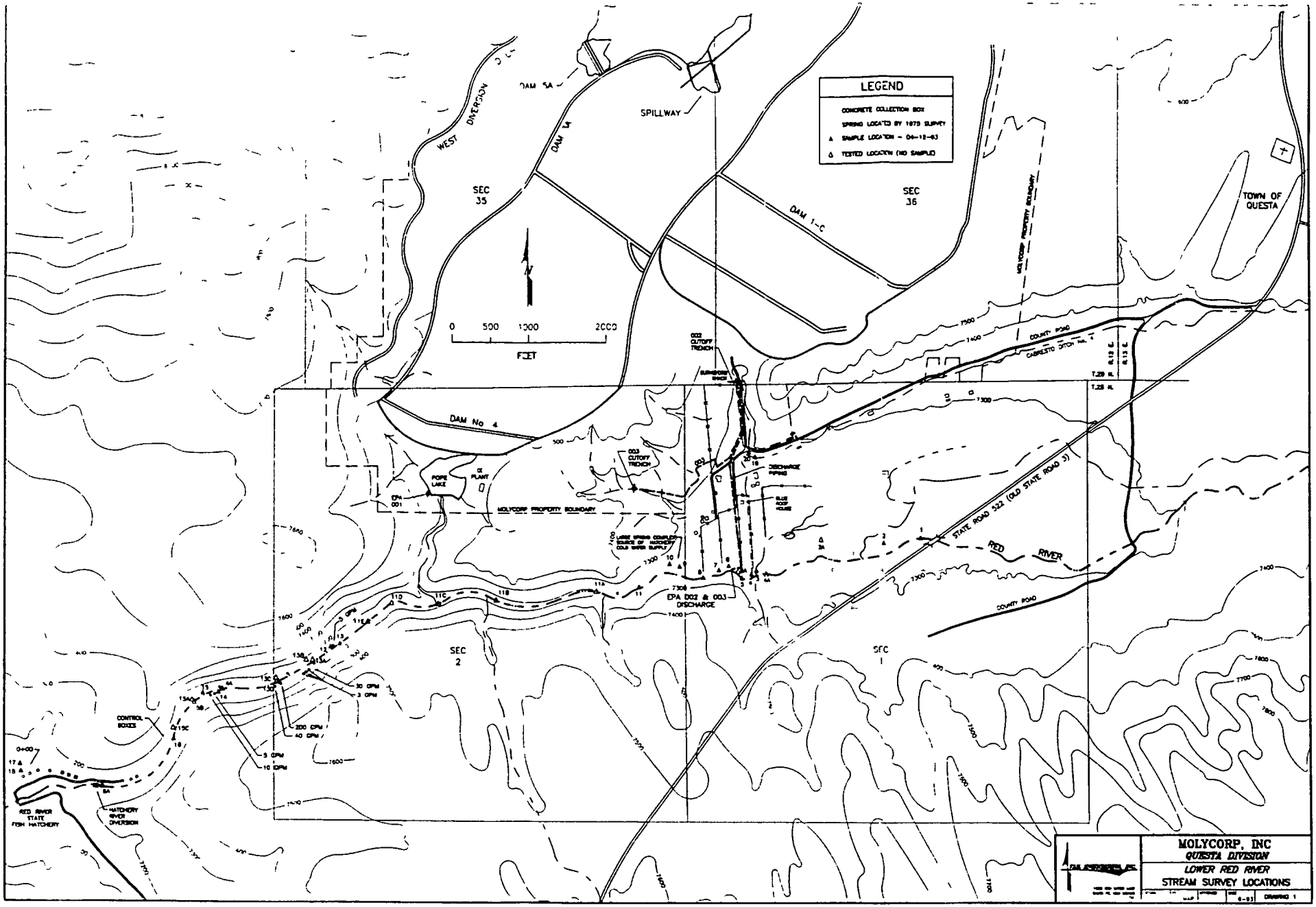
TABLE NO 2
WATER QUALITY SURVEY ALONG RED RIVER
BETWEEN STATE ROAD 522 AND FISH HATCERY
APRIL 12, 1993

SAMPLE SOURCE	PH	TOT ALK	F	TDS	SO4	TSS	DIS MO	DIS AL	DIS CD	SUS AL	FE	PB	CU	ZN	MN
#1 R/R Below Highway Bridge	7 23	38	0 84	255	119	31	< 03	< 5	< 005	7 8	0 594	< 1	0 036	0 250	0 92
#2 Spring N Side R/R	6 76	90	0 55	247	92	20	< 03	< 5	< 005	0 5	0 543	< 1	0 007	0 021	0 02
#3 Field Drainage to R/R 500'E of 002	7 44	99	0 60	246	92	7	0 20	< 5	< 005	< 5	0 405	< 1	< 005	0 047	0 05
#4 Field Drainage to R/R 450'E of 002	8 22	94	0 46	648	172	6	< 03	< 5	< 005	< 5	0 115	< 1	0 008	0 012	0 05
#5 R/R 300'E of 002	7 60	43	0 90	240	118	22	< 03	< 5	< 005	8 0	0 569	< 1	0 028	0 222	0 88
#6 Outfall 002	7 26	152	1 90	1764	840	2 0	1 80	< 5	< 005	< 5	0 102	< 1	< 005	0 010	1 40
#7 Field Drainage 75'W of 002	7 20	165	0 80	727	228	39	0 20	< 5	< 005	2 7	1 090	< 1	0 009	0 017	0 03
#8 R/R Above Questa Spring	7 14	50	0 88	268	141	21	< 03	< 5	< 005	6 2	0 573	< 1	0 029	0 207	0 88
#9 Near Questa Springs SE of Conc Box	7 02	158	0 38	1094	504	88	< 03	< 5	< 005	8 5	2 940	< 1	0 016	0 047	0 07
#10 Near Questa Springs End of Old Pipe	7 50	177	0 60	576	210	7	< 03	< 5	< 005	< 5	< 05	< 1	0 005	0 010	0 01
#11 R/R 500'W of Questa Springs	7 45	54	0 90	269	138	22	< 03	< 5	< 005	3 10	0 618	< 1	0 033	0 215	0 88

TABLE NO 2 (Cont)
WATER QUALITY SURVEY ALONG RED RIVER
BETWEEN STATE ROAD 522 AND FISH HATCERY
APRIL 12, 1993

SAMPLE SOURCE	PH	TOT ALK	F	TDS	SO4	TSS	DIS MO	DIS AL	SUS CD	SUS AL	FE	PB	CU	ZN	MN
#12 Spring–N Side R/R Sta 47 + 20	6 94	82	0 80	271	115	47	< 03	< 5	< 005	1 70	2 36	< 1	0 011	0 046	0 13
#13 R/R Sta 47+70 Above Hatchery	7 45	51	0 90	259	128	22	< 03	< 5	< 005	3 00	0 590	< 1	0 026	0 206	0 83
#14 Spring S Side R/R Sta 36+80	8 14	82	0 80	304	126	<1	< 03	< 5	< 005	< 5	< 05	< 1	< 005	0 005	0 01
#15 Spring N Side R/R Sta 36+40	7 26	80	1 10	145	20	<1	< 03	< 5	< 005	< 5	< 05	< 1	< 005	< 005	< 0
#16 R/R Sta	7 80	49	0 90	247	129	24	< 03	< 5	< 005	3 10	0 527	< 1	0 024	0 191	0 781
#17 Hatchery Inlet Cold Water	7 14	43	0 64	176	80		< 03	< 5	< 005	< 5	0 138	< 1	< 005	< 005	< 0
#18 Hatchery Inlet Warm Water	7 87	77	1 10	284	63		< 03	< 5	< 005	< 5	0 181	< 1	< 005	0 010	< 0
#19 Seep Water in Irrigation Ditch Above 002 Line X @ Road	7 73	174	0 54	1304	660		< 03	< 5	< 005	< 5	0 160	< 1	< 005	0 013	0 05
#20 Molycorp Drain Below Culver Above Ditch	8 10	153	1 90	1702	790		1 70	< 5	< 005	4 00	2 4	< 1	0 016	0 010	2 00

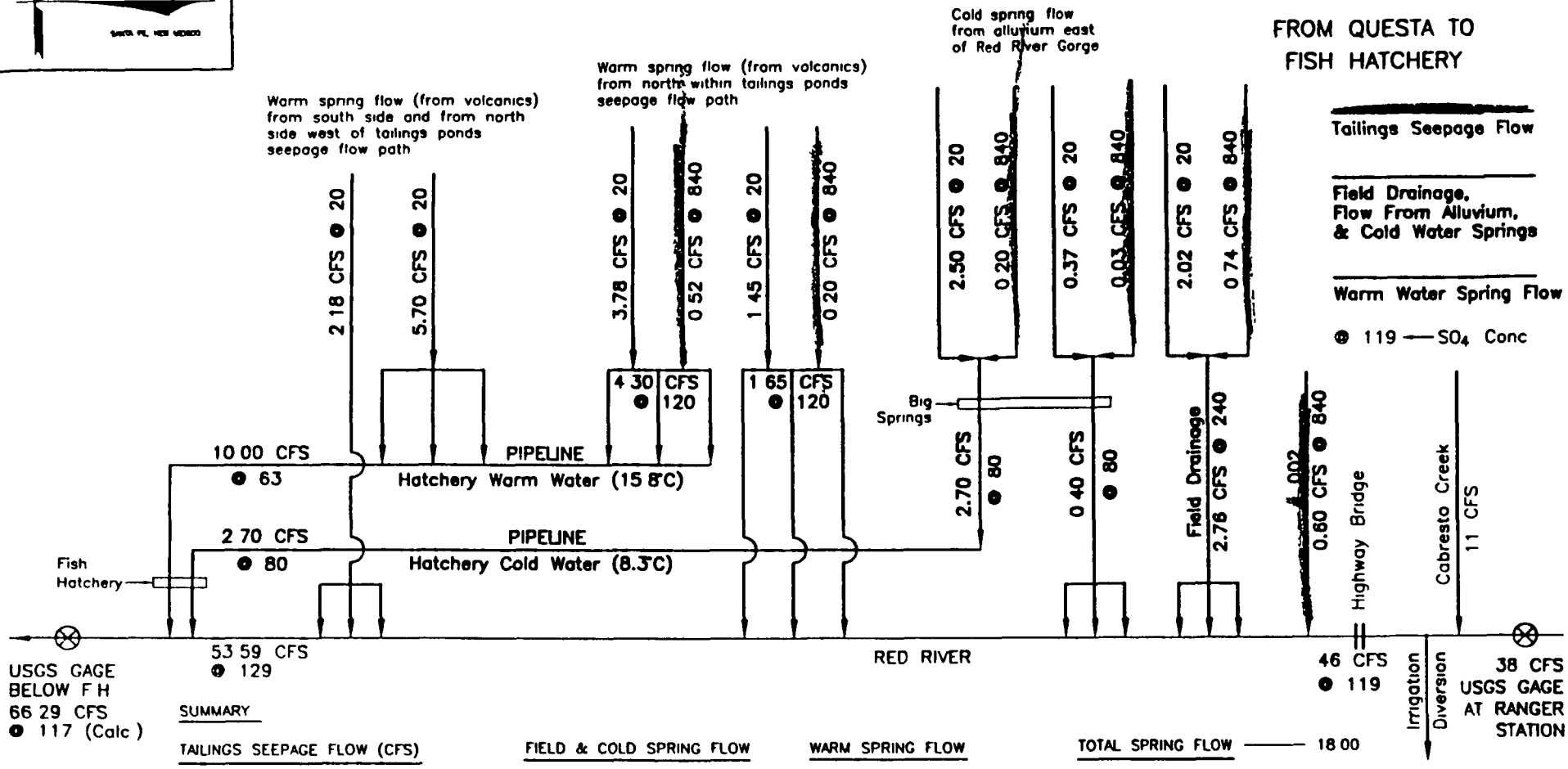
23


LEGEND
CONCRETE COLLECTION BOX
SPRING LOCATED BY 1975 SURVEY
SAMPLE LOCATION - 04-12-83
TESTED LOCATION (NO SAMPLE)
SEC 35
SEC 36
SEC 2
SEC 1
DAM 5A
SPILLWAY
WEST DIVERSION
DAM 5
DAM 1-C
DAM No 4
TOWN OF QUESTA
MOLYCORP PROPERTY BOUNDARY
COUNTY ROAD
CABRESTO DITCH
003 CUTOFF TRENCH
POPE LAKE
MILL PLANT
DISCHARGE PIPING
BLUE ROOF HOUSE
STATE ROAD 522 (OLD STATE ROAD 3)
RED RIVER
EPA 002 & 003 DISCHARGE
CONTROL BOXES
RED RIVER STATE FISH HATCHERY
HATCHERY RIVER DIVERSION
0 500 1000 2000
FEET
MOLYCORP, INC
QUESTA DIVISION
LOWER RED RIVER
STREAM SURVEY LOCATIONS

VAIL ENGINEERING, INC

ANALYSIS OF ACCRETIONS TO RED RIVER

FROM QUESTA TO FISH HATCHERY



SUMMARY

TAILINGS SEEPAGE FLOW (CFS)

002	0 60
Field Drainage	0 74
Big Springs to River	0 03
Big Springs to Pipeline	0 20
Warm Water Springs to River	0 20
Warm Water Springs to Pipeline	0 52
TOTAL	2 29

FIELD & COLD SPRING FLOW

Field Drainage	2 02
Big Springs to River	0 37
Big Springs to Pipeline	2 50
TOTAL COLD	4 89

WARM SPRING FLOW

In Seepage Path	
To River	1 45
To Pipeline	3 78
From South & to West of Seepage Path	
To River	2 18
To Pipeline	5 70
TOTAL WARM	13 11

TOTAL SPRING FLOW — 18 00

RIVER FLOW

Red River ● Ranger Sta	35 00
Cabresto Creek	11 00
Field & Cold Spring Flow	4 68
Warm Spring Flow	13 11
Tailings Ponds Seepage	2 29
TOTAL	66 29

RECORD OF TELEPHONE CONVERSATION

Time:	Date: 4-30-93
Originating Party: Stuart Kent	Other Parties: Ben Herrera
NMED - Superfund	Village of Questa Superintendent

Subject: Location of community wells & Public Supply wells in/near Questa

Discussion:

+ There are several community wells near or w/in town limits:

1) Adjacent to Village of Questa offices which is approx. 1 mile north of the cutoff to Red River (i.e. Hwy 38). Serves 10-15 houses

2) n Cerro de Oro (1/2 mile north of village office along Hwy 522), serves 10-15 Hses

3) at Eagle Rock Lake where the well services ~ 10 trailers

+ The hotel located SW of town at Red River Bridge has its own well

+ All other residences serviced by public well incl South of Hwy 522, east to Eagle Rock Trailer Park and north along Cabresto Rd to Forest Service Property

+ Town of Cerro has 3 community wells

Stuart Kent

Signed

RECORD OF TELEPHONE CONVERSATION

Time:	Date: 6-16-93
Originating Party:	Other Parties: Ben Herrera Village of Questa Superintendent

Subject: Questa water supply system

Discussion:

+ He has worked there for ~ 2 1/2 5

+ #3 well was not used when he started, and he's unsure if it closed due to contamination

+ The 2 supplying wells service equal numbers (i.e. pumping rate is roughly equal)

Signed

A - Not Applicable
N - Not Available
E - Estimated

Community Water Supply System

Inspection Form

NM Health and Environment Department
Environmental Improvement Division

ction A - GENERAL INFORMATION

SS CODE 068-29	WATER SUPPLY SYSTEM NAME Village of Questa	COUNTY: Taos
		Inspection Date: May15, 1991

stem Address/LOCATION P.O. Box 260, Questa, New Mexico 87556

OWNER:	OWNER ADDRESS (if different than above)	PHONE
Village of Questa	same	586-0694

Population Served	# Connections	# Meters	Max System Production	Average System Production
1644	560	447 meter in use	110-115,000 GPD Poten. ☒ Actual ☐	95,000 GPD

System Source (Check Approp Boxes) Distribution Only ☐ Well(s) ☒ # of Wells 3

Spring(s) ☐ Infiltration Gallery ☐ Surface ☐

Additional or Qualifying Information:

See attached for water rates.

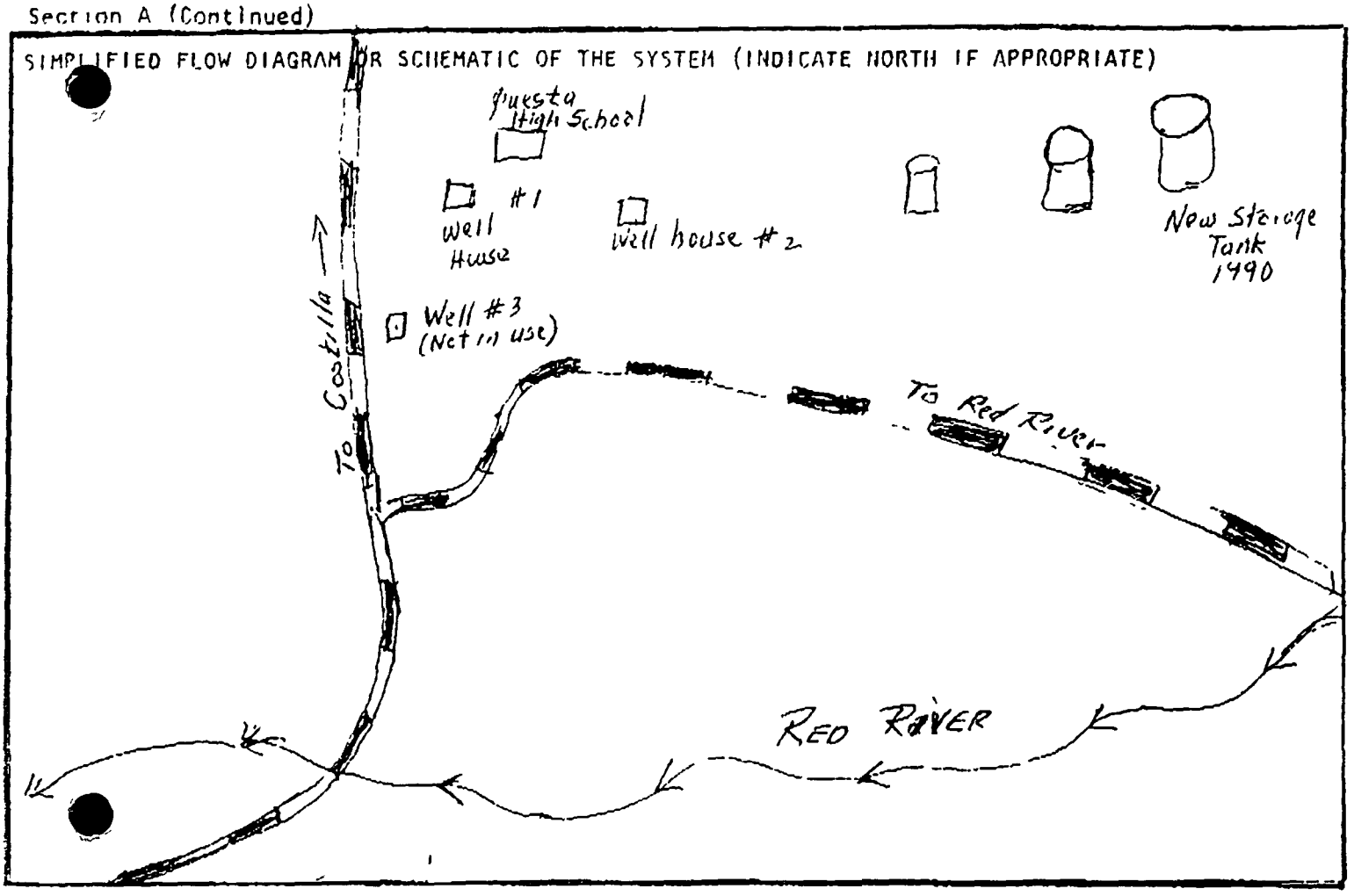
New storage tank installed in 1990.

System Personnel - Name/Classification	Level of Certification Required	Level of Certification Obtained
Lawrence Gallegos, Mayor	N/A	
Frank Rael, Administrator		
~~Michael Cordova~~, Superintendent		
Lawrence Ballon, Maintenance		
Glor[redacted] Martinez, Utility Clerk		

Information furnished by: Lawrence Ballon	Business Phone: 586-0694
Survey Performed by: Juan P. Ortega	Business Phone: 758-8808

Section A (Continued)

SIMPLIFIED FLOW DIAGRAM OR SCHEMATIC OF THE SYSTEM (INDICATE NORTH IF APPROPRIATE)



Section B - Source Information

WELL Identification	Well Depth	Pump Depth	Pump Capacity GPM	Well Drawdown feet	Pump Type	Static Water Level	Age of Pump	Date Well Drilled
Well #1	250	200	100	N/Av	subm	N/Av	N/Av	1972
Well #2	400	350	25	N/Av	subm	N/Av	N/Av	1966
Well #3	300	250			subm	N/Av		

Remarks, Deficiencies, and Recommendations

Source	Number (each)	Total Capacity	Remarks, Deficiencies, and Recommendations
Artes[redacted] Wells	N/A		
orings	N/A		
Infiltration Galleries	N/A		

Section C - Gravity Storage and Pressure Tank Reservoirs

Gravity Storage Reservoir Indent.	Storage Capacity (gallons)	Date Built	Exterior Condition	Tank Material	Cathodic Protection	Tank Openings Secured	Overflow Screened	Vent Screen
Tank #1	100,000		good	steel	no	yes	yes	yes
Tank #2	50,000		good	steel	no	yes	yes	yes
Tank #3	25,000		good	steel	no	no	no	yes

Pressure Tank I D.	Volume (gallons)	Age	Exterior Condition	Additional Information

Remarks, Deficiencies or Recommendations

Section D - WATER DISTRIBUTION

Booster Pump Station	Total Number of Stations 1	Remarks, Deficiencies or Recommendations
Type of Disinfection Facilities		Remarks, etc
System Pressure	Max. 65 psi Min 50 psi	Remarks, etc
Pipe Materials in system	PVC [X] STEEL [X] C. I. [ ] Other [X]	Deficiencies (including cross-connections observed) transite pipe
Type of Distribution System	Gravity [X]	Pressure [ ] Both [ ]

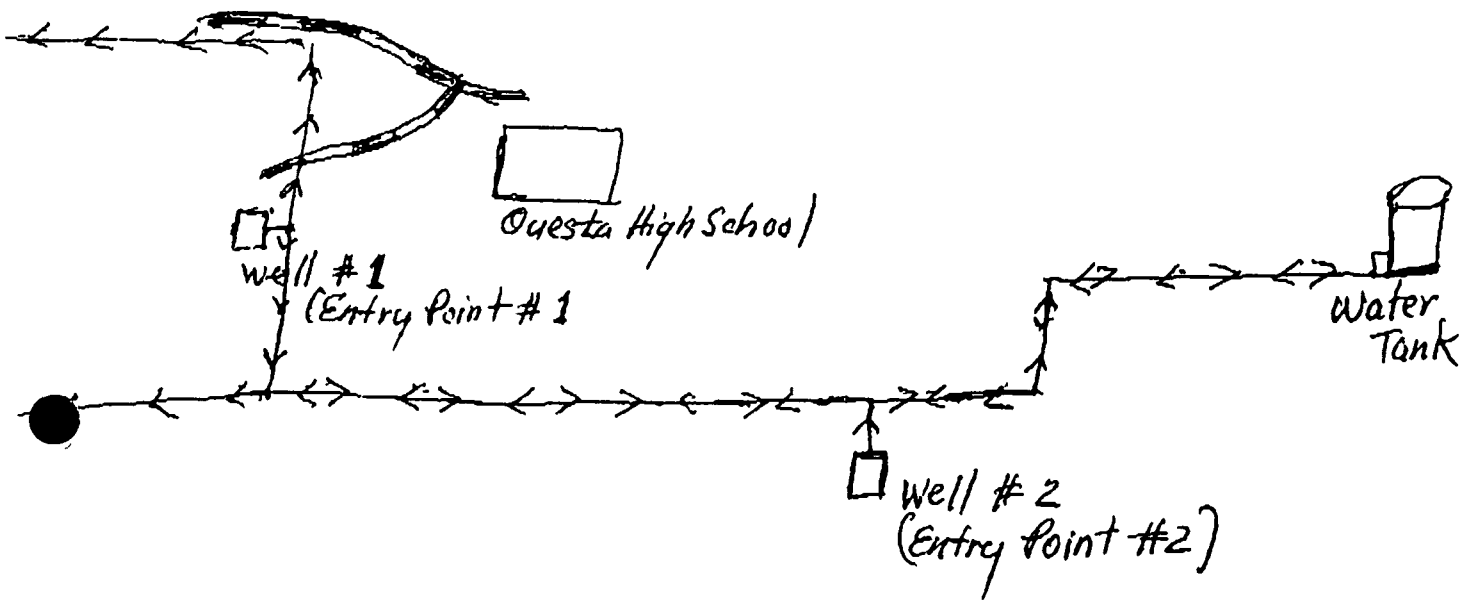
Contaminant	Next Sample Date	Sample Frequency	Remarks
Micro-biological		2/mo	
Turbidity			
Organics			
Inorganic	9/90		
Radiological	9/91		
Secondary			

Section E - GENERAL OPERATION AND MAINTENANCE (O & M)

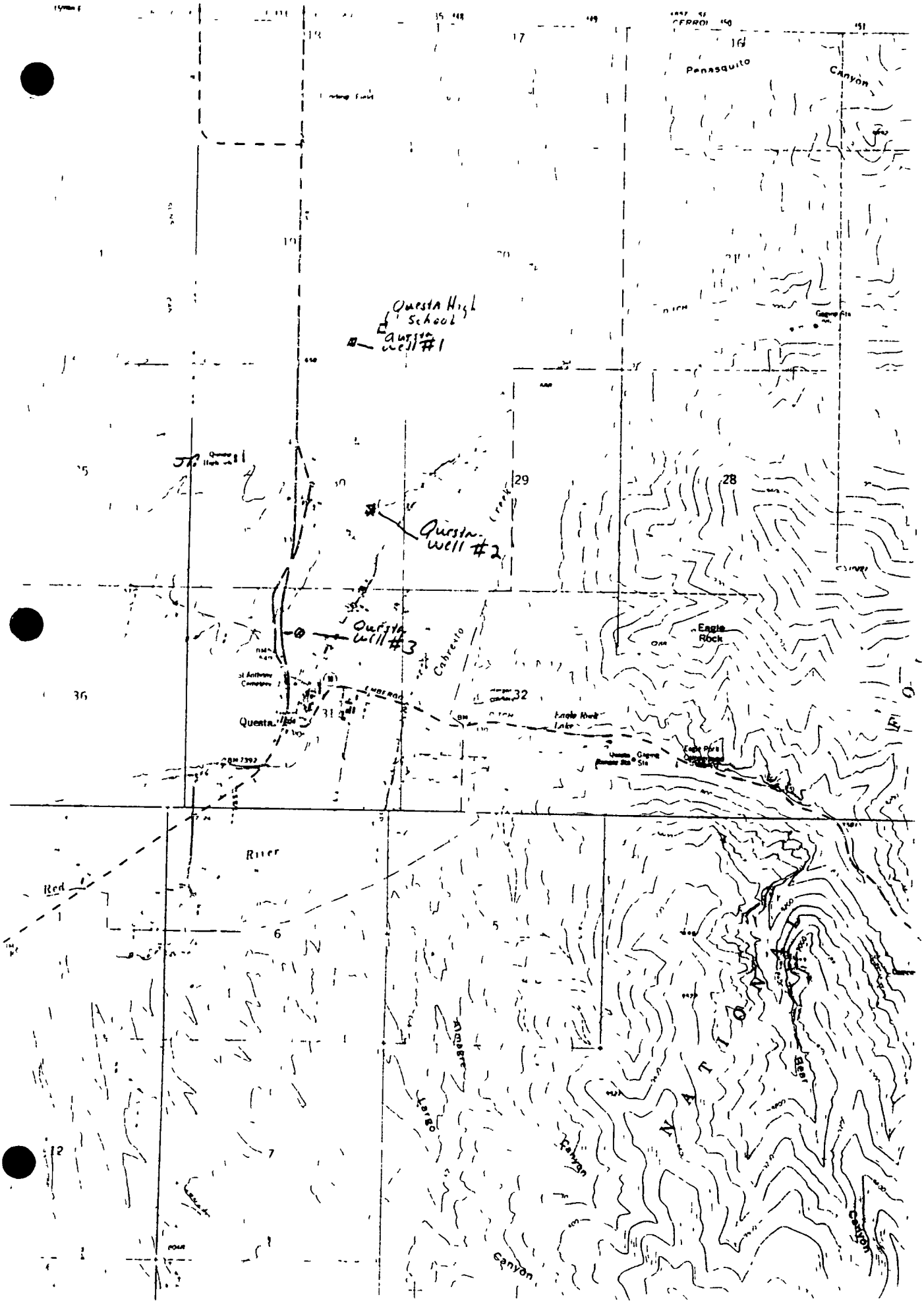
Does the system keep up-to-date O&M records?	Yes [X]	No [ ]
Are preventative maintenance activities routinely practiced?	Yes [X]	No [ ]
The importance of Cross Connection Control was discussed with the Operator	Yes [X]	No [ ]

Village of Questa
WSS # 068-29

Diagram for Entry Points



...ED STATES
...T OF THE INTERIOR
...GICAL SURVEY



RG-123		Dom.	Manuel Orte	Depth	wtr				
RG-10696	N½NW¼	Dom.	Feliciano R						
RG-11021	NE¼NE¼	Dom.	Felipe Ortega	50'	6'	15	25	10	50
RG-17088	NE¼NE¼	Dom.	John W. Coward						
RG-17352	NE¼SE¼	Domestic	Feliciano Vigil						
RG-30443	SW¼NW¼SW¼	Dom.	F. E. Vigil						
RG-30620	SE¼NW¼NW¼	Monit.	Molycorp, Inc.						

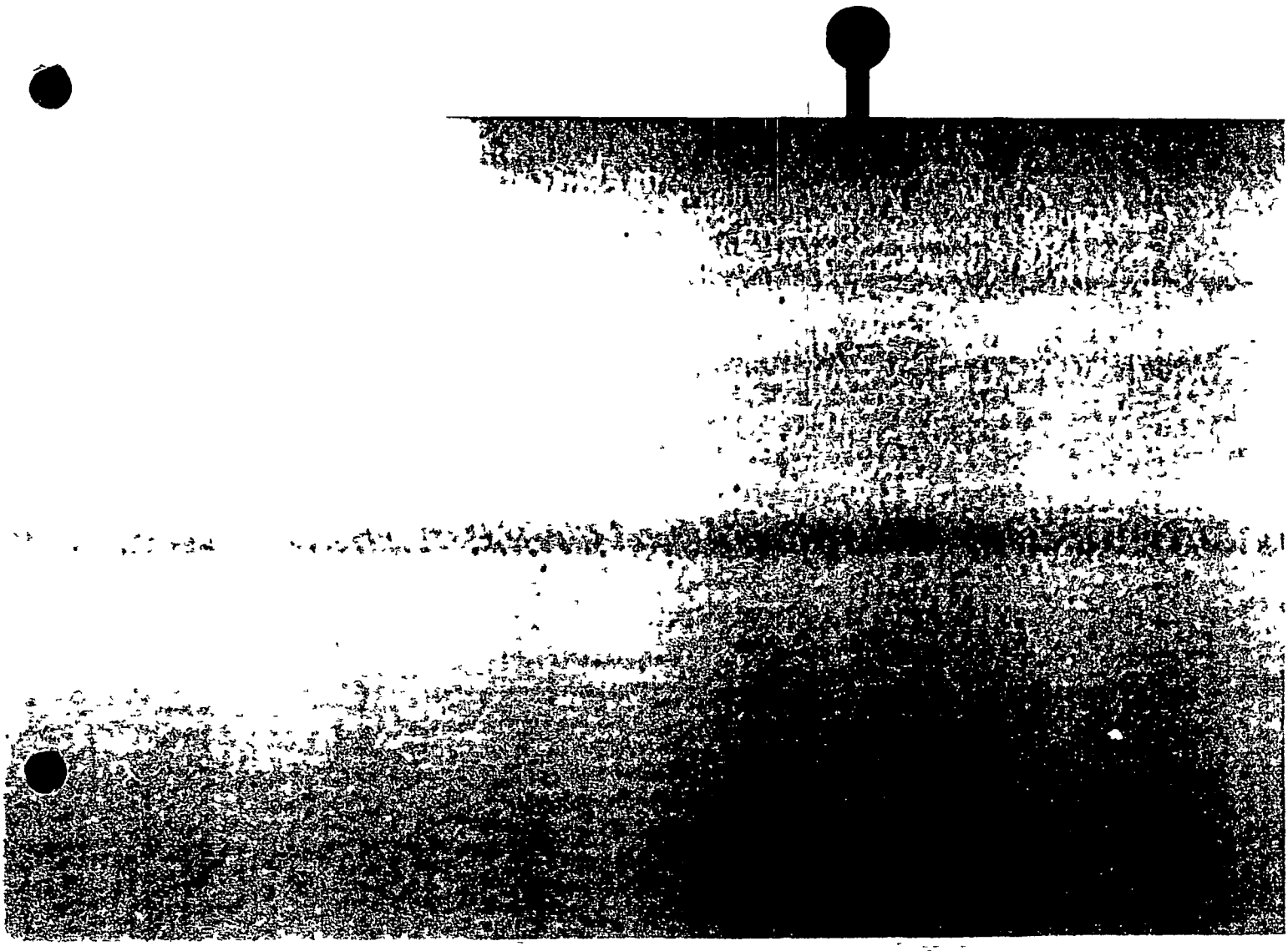
Township 28 North Range 12 East Section 12

NE¼NE¼	RG-10499	Other than irrigation
NE¼NE¼	RG-10500	Other than irrigation
NE¼NE¼SE¼	RG-10584	Other than irrigation
NE¼NE¼SE¼	RG-10585	Other than irrigation

RG-149	SE¼SE¼NW¼	Dom.	Abran Ortega
RG-52118	NW¼SW¼	Dom.	MCCUTCHAN, RC Go

Township 28 North Range 12 East Section

RG-16128	SW¼	Domestic	Lama Water Associat:
RG-45562	SE¼NE¼	"	James M. Hays, III
RG-51873	SE¼NW¼	Dom.	REIFSNYDER, William



Township 28 North Range 12 East Section 13

RG-52460 SW¼SW¼SE¼ Dom. SUTHERLAND, Al/Julie

Township 28 North Range 12 East Section 1

NE¼NE¼	RG-10499	Other than irrigation
NE¼NE¼	RG-10500	Other than irrigation
NE¼NE¼SE¼	RG-10584	Other than irrigation
NE¼NE¼SE¼	RG-10585	Other than irrigation

Township 28 North Range 12 East Section 11

RG-13698 NE¼SE¼SE¼ domestic Alfredo Duran

Township 28 North (1) Range 12 East Section 5

RG-17986 SE¼SE¼ Stk. & San. BLM

	(1)	Range 13 East		Section 36
RG-18761	SW¼NW¼		Constr.	N.M. Highway Dept.

Township 29 North Rnge 13 East Section 32

RG-4783	NW¼NW¼SW¼		other than irrigation
RG-5286	SE¼SW¼SE¼		" " "
RG-10720	NE¼SW¼		" " "
RG-11804	S½SW¼	Domestic & Sanitary	Osmar A. Vaughn
RG-12425	NW¼SE¼	Domestic	Milton J. Singleton
RG-13074	SHC 5309, Tr 1 (See Section 5)	San.& dom	Richard Varela
RG-14220	NE¼SE¼SW¼	Dom.	James T. McCartney
RG-15727	Lot 1 & 2 (See also Sec. 29)	Domestic	Felomeno Vigil
RG-15761	East	Domestic	Andres Gonzales
RG-17295	Trc. No. 1	Dom-San.	Cipriano Quintana
RG-17659	N½S½½S	Domestic	Horace Gonzales

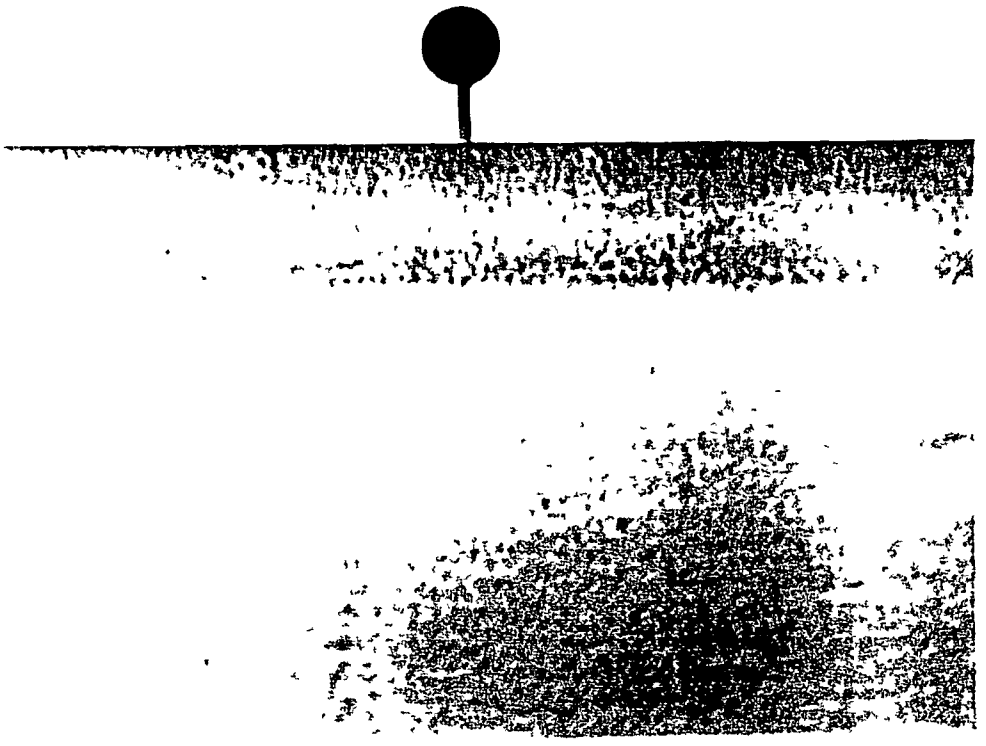
RG-12935	SE¼SW¼SW¼	mine,mill,domestic	Moly Corp
RG-54172	SW¼NE¼NE¼	dom	Herman R. Ortiz

Township 28 North (1) Range 13 East (Proj.)Section

RG-17116	SW¼	Domestic	G. W. Green
RG-44856 thru Expl-2	NW¼NW¼NW¼	Expl.	Molycorp, Inc.
RG-44856-3 thru Expl-4	NE¼NW¼NW¼	Expl.	Molycorp, Inc.
RG-44856-Expl.	NW¼NW¼NW¼	exp.	Molycorp, Inc.
RG-44856-Expl.-2	NW¼NW¼NW¼	exp.	Molycorp, Inc.
RG-44856-Expl.-3	NE¼NW¼NW¼	exp.	Molycorp, Inc.
RG-44856-Expl.-4	NE¼NW¼NW¼	exp.	Molycorp, Inc.

Township 28 North Range 13 East Section 6

RG-9858	NW¼SW¼SW¼	Other than irrigation	
RG-2693	NE¼SE¼	"	
RG-9856		"	
RG-10240	SW¼NW¼SW¼	"	
RG-12874	Trc.48	domestic	D.K.Kelly
RG-15003	NE¼NE¼NE¼	Domestic	James Holladay
RG-28495	SW¼NE¼	"	Alex J. Quintana
RG-32000	Blk 14	"	Steve Sanchez
RG-54173	NE¼SW¼NE¼	dom	Michael A. Ortiz



Township 29 North Range 12 East Section

RG-40566	SE¼NE¼NE¼	D-stk	Melesio Quintana
RG-56615	SW¼NE¼SE¼	dom	Richard Hall/Janet Schreiber

Township 29 North Range 12 East Section 11

RG-5498	Tr. 34 Map 9 Sur 8	other than irrigation

Township 29 South Range 12 East Section 1

RG-13128	domestic	NE¼NE¼	Gilbert Vig
RG-30364	Dom-stk	NE¼NE¼	Eddie & Dolores Garcia
RG-55979	NW¼NW¼NE¼	dom	Luis R. Montoya

Township 29 North Range 12 East Section 3

RG-3022	SE¼SE¼	other than irrigation	
RG-3080		Dom.	Feliberto Jiron
RG-4510	SW¼SW¼NE¼	"	" "
RG-10881	SW¼NE¼SE¼	"	" "
RG-10901	S½NE¼	"	" "
RG-15305	S½SE¼SE¼	Domestic	John Cleator
RG-16667	NW¼SW¼	Domestic	Tony Romero
RG-23192	NW¼NE¼NE¼	Domestic	Tiotisle E.Ortez
RG-23483	SE¼SE¼	Domestic	Joe Bagby
RG-40567	NW¼NE¼NW¼	Domestic	George Passino
RG-42047	NW¼NE¼	"	Virgil Martinez

RG-45630 Part of 2 E½SE¼ domestic Robert E. Presnall

TOWNSHIP 29 NORTH RANGE 14 EAST SECTION 33

RG-53622	NE¼NE¼SW¼	dom	USA Forest Service, Carson National Forest
RG-54203	NE¼SW¼NW¼	dri & sanit	Town of Red River AWWT Facil:

Township 29 North (1) Range 14 East Section 34

RG-25176	N½	Dr-San.	Lewis Ranch, Inc
RG-27084	SW¼NE¼NE¼	DR-San.	C. E. Lewis
RG-27546	NW¼SE¼SW¼	Drlng.	Cities Service Minera.
RG-46164	SW¼NE¼NE¼	D-stk	Cliff Lewis
RG-53621	NW¼SE¼NW¼	dom	USDA Forest Service, Carso National Forest

Township 29 North	Range 13 East	Section 19	
RG-7127	$SE\frac{1}{4}SW\frac{1}{4}$	Other than irrigation	
RG-7127 amending 999	$SE\frac{1}{4}SW\frac{1}{4}$	" "	"
RG-8730		" "	"
RG-11178	$SW\frac{1}{4}SW\frac{1}{4}SE\frac{1}{4}$	" "	"
RG-13129	$W\frac{1}{2}$	domestic	Lupe Young
RG-13710	$SE\frac{1}{4}SW\frac{1}{4}SE\frac{1}{4}$	domestic	John H Yaple
RG-14128	$NE\frac{1}{4}$	domestic	Donald M Hamilton
RG-14228	$N\frac{1}{2}NW\frac{1}{4}$	Dom.	Frank Stublefi
RG-23097	$NE\frac{1}{4}NE\frac{1}{4}NW\frac{1}{4}$	Dom.	Jerry B. Sanch

Township 29 North	Range 13 East	Section 2(	
$N\frac{1}{2}N\frac{1}{2}N\frac{1}{2}NW\frac{1}{4}$	Dom & San.	RG-12205	Eugene A. Harris
Trc.19,Map 4, NMRS 7	Dom.	RG-24452	Arnold Joe Rael
RG-42013	$SE\frac{1}{4}SE\frac{1}{4}SE\frac{1}{4}$	Dom	Nick W. Cisneros
RG-42588	$SE\frac{1}{4}$	Dom.	Jimmy Martinez
RG-44270	$SE\frac{1}{4}$	Dom.	John Scott Buchaman

Township 29 North (1)	Range 13 East	Section 1	
RG-24571	$NW\frac{1}{4}$	Dom-Stk.	W. C. Lorenzen
RG-24571	$NW\frac{1}{4}$	DOm-Stock	Robert Owens
RG-8730-X	$E\frac{1}{2}$	Dom	Pat Martinez
RG-30603	$W\frac{1}{2}$	Constr.	T. Brown Constructi
RG-37097	$NW\frac{1}{4}$	D-stk	Andamo Sanchez
RG-37824	$NW\frac{1}{4}$	Dri-sani	Pendleton Oil & Ga

RG-147	NW¼NW¼NW¼	Dom.	Selmo Rael
RG-407	SE¼NE¼NW¼	Dom.	
RG-4407	NE¼SW¼	Dom.	
RG-4728	NW¼NW¼SE¼	Dom.	
RG-4784	NE¼NE¼SE¼	Dom.	
RG-10698	NW¼NW¼NW¼	Dom.	
RG-10707	SW¼SW¼NE¼	Dom.	
RG-10722	NE¼NE¼SE¼	Dom.	
RG-10723	SE¼SE¼NE¼	Dom.	
RG-10756	NE¼	Dom.	
RG-11271	NW¼SE¼	Dom.	
RG-11552		Dom.	
RG-11156	SE Corn.	Dom.	
RG-11112 Am. 999	SE Corn.	Dom.	

Township 29 North Range 13 East Section 32

RG-25481	SE¼NE¼SW¼	Trailer, laundry	Geo.H.Wisehar
RG-11804	S½SW¼	Dom.	Jess BARcala
RG-11804	S½SW¼	Dom.	Donald & Bonn: Schneider

Township 29 North (2) Range 13 East Section 31

RG-11459	NE¼SW¼	Dom.	
RG-12022	HC 1951, Trc.2 HC 2116, Trc. 1	Dom.	Mt. States Tel & T
RG-12867	Trc. 3	Dom.	Fred A. Rael
RG-13037	Trc. 1	Dom.	Claudio Rael
RG-13171	Trc 192	dom.	Jose Samuel Gonzales
RG-14326	Trc. 146	Domestic	Mrs. Emma LaForett
RG-19329	NW¼NW¼SE¼	Domestic	Andres Laforett
RG-42647	NW¼NW¼SE¼	"	Joe D. Martinez
RG-50150	SE¼SE¼SE¼	DOM.	A. WILFRED RAEL

RG-148	SW¼SW¼SW¼	Dom.	Frank A. Cisne
RG-6917	Trc. 26	Dom.	
RG-10359	NE¼NW¼	Dom	
RG-11645		DOM.	
RG-11980	SE¼NE¼NW¼	Dom.	Marcelino Mart
RG-14227	SH Claim 1942	Dom.	Donald E.McGhe
RG-15727	Lot 1 & 2 (See also Sec. 32)	Domestic	Felomeno Vigil
RG-16937	Tr.24,Mp.4 of School Dist. No.9	Domestic	Agustin Rael
RG-25933	SW¼SW¼	"	Bernard H.Loughre

Township 29 North Range 13 East Section 30

RG-6478	SE¼NW¼	Dom.	
RG-9762	SW¼SW¼SW¼	Dom.	
RG-10732	S½NW¼	Dom.	
RG-12715	SE¼SE¼	Dom.	J. H. Oldland
RG-12762	SE¼NW¼	Dom.	Questa Baptist Mis
RG-10479	SE¼NE¼NW¼	Expl.	Robert C. Bryant
RG-30619	SW¼	Monit.	Molycorp, Inc.

Township 29 North Range 13 East Section 27

RG-35102	Dom.	J. R. McWilliams

Township 29 North Range 13 East Section 25

RG-13607 SH Claim 298 San. Max Ortega

Township 29 North Range 13 East Section 24

RG-29659 NW¼SW¼ Dom. Howard O. Reed

Township 29 North (1) Range 13 East Section 2

RG-19035 SE¼NE¼SE¼ Sanitary John Baker & Carl F. Hatch

RG-23243 SW¼SW¼ Domestic Michael Nolan

RG-35156 N½SE¼ Domestic Helen E. O'Brien

RG-36970 NW¼SE¼SW¼ D-stk J R. McWilliams

RG-38741 SE¼SW¼ Domestic O. L. McGaha

Township 29 North Range 13 East Section 22

RG-14512 HEF #334 Domestic Margaret Smith K

RG-33184 SE¼SE¼SE¼ Dom Don Fennema

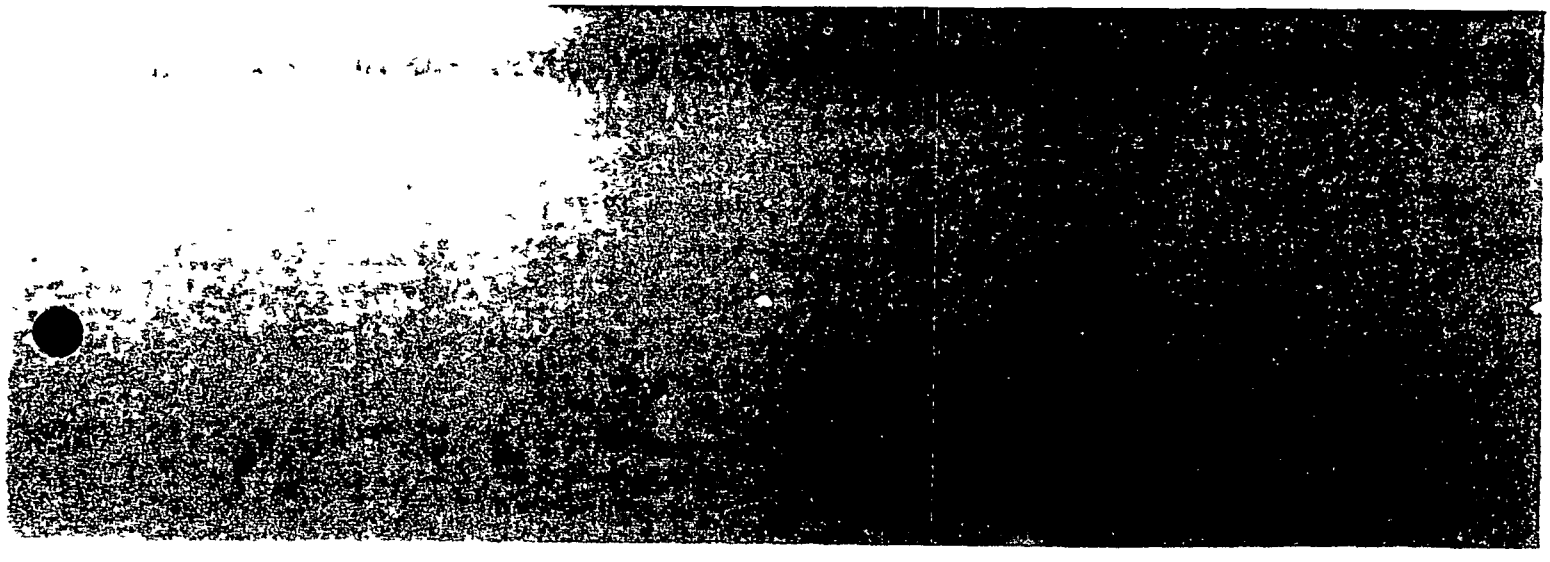
RG-11796	$SW\frac{1}{4}SE\frac{1}{4}SE\frac{1}{4}$	Domestic	Bobby E. McKinley
RG-11986	$N\frac{1}{2}N\frac{1}{2}NW\frac{1}{4}NW\frac{1}{4}$	Domestic	L M Banister
RG-12002	$SW\frac{1}{4}$	Domestic	Kenneth O. Compton
RG-16758	$SE\frac{1}{4}N\ SW\frac{1}{4}$	Domestic	Mrs. Amada Sanchez
RG-18764	$NW\frac{1}{4}SW\frac{1}{4}SW\frac{1}{4}$	Domestic	Johnny A. Torres
RG-30872	$NW\frac{1}{4}SW\frac{1}{4}$	Dom-stk	Romolo O. Blea
RG-34282	$NW\frac{1}{4}NE\frac{1}{4}SE\frac{1}{4}$	Expl.	Robert Medina
RG-34282	$NW\frac{1}{4}NE\frac{1}{4}SE\frac{1}{4}$	Domestic	Herman Medina
RG-37095	$SE\frac{1}{4}$	D-stk	Mary S Arellano
RG-37094	$NE\frac{1}{4}$	Stock	Wanda McGee Trust
RG-50215	$NW\frac{1}{4}SW\frac{1}{4}$	D-stk	Blea, Bernie

Township 29 North Range 13 East Section 17

RG-35512	$SE\frac{1}{4}SE\frac{1}{4}$	D-stk	Romolo O Baca
RG-40650	$SW\frac{1}{4}NE\frac{1}{4}NE\frac{1}{4}$	Dom.	Gilbert J Garcia

Township 29 North Range 13 East Section 9

RG-30582	$S\frac{1}{2}SW\frac{1}{4}$	dom-stk.	ROMOLO O. BLEA
RG-38463	$S\frac{1}{2}SW\frac{1}{4}$	Dom.	Jennie Vallejos
RG-42429	$SW\frac{1}{4}SW\frac{1}{4}SW\frac{1}{4}$	D-stk	Javier Gutierrez



Township 29 North Range 13 East Section 8

RG-34734	SE¼SE¼	D-stk	Clarence T. Kern
RG-34714	S½SE¼	Dom.	Arlen R. Kolstad
RG-35513	SE¼SE¼	D-stk	Romolo O. Baca
RG-41726	SE¼NE¼SE¼	Dom	Robert Skoog
RG-46514	SE¼SE¼SW¼	dom.	Peter Wood

Township 29 North Range 13 East Section

RG-3669	Lot 14	other than irrigation	
RG-7965	NW¼SW¼SE¼	domestic & sanitation	
RG-13789	NE¼SE¼	stock	C Ryan & Son
RG-15302	NW¼NW¼	Domestic	Johnnie Gomez
RG-19863	NW¼	Domestic	Jose Roger Garcia
RG-13789	NE¼SE¼	"	Hollingsworth & Thornton
RG-37355	NE¼NE¼NW¼	"	Ricky M. Leon

Township 29 North Range 13 East Section 6

>4m RG-6340	NE¼NE¼NE¼		Other than irrigatic
" RG-12906	NE¼NE¼	domestic	Jose H Segu
" RG-13805	NE¼NW¼NW¼	domestic	Gilbert Segura
" RG-17917	NE¼NE¼NE¼	Domestic	Tony M. Segura
RG-37356	SE¼SW¼SE¼	Domestic	Joseph R. Leon

Township 29 North Range 13 East Section

RG-6765 Other than irrigation
RG=7958 Other than irrigation
RG-15342 1 mi. N. of Questa, on Cabresto Rd. Dom. John A. Vi

Township 29 North Range 12 East Section 36

RG-24740 (exp) $NW\frac{1}{4}SW\frac{1}{4}$ Exp. MOLY Corp. of America

Township 29 North Range 12 East Section 33

RG-44586-Expl-6 $SW\frac{1}{4}SW\frac{1}{4}NE\frac{1}{4}$ Expl. Molycorp, Inc.

Township 29 North Range 13 East Section 5

RG-4896	**$SE\frac{1}{4}$ $NE\frac{1}{4}$ $NE\frac{1}{4}$**	**other than irrigation**	
RG-5054	**$NW\frac{1}{4}NW\frac{1}{4}NW\frac{1}{4}$**	**" " "**	
RG-13074	SHC 5309 Tr. 1	Dom. & San	Richard Varela
RG-31792	$SW\frac{1}{4}NW\frac{1}{4}NW\frac{1}{4}$	Dom-stk.	R. L. Waltrip
RG-31793	$SE\frac{1}{4}SW\frac{1}{4}SE\frac{1}{4}$	Stock	R. L. Waltrip
RG-40947-X	$NE\frac{1}{4}NE\frac{1}{4}NW\frac{1}{4}$	Dom.	Wanda McGee Trust 1973

SW¼SE¼	RG-10479	Other than irrigation
SE¼NE¼SE¼	RG-11443	Other than irrigation
SW¼SE¼SE¼	RG-11457	Other than irrigation

Township 29 North Range 12 East Section 24

RG-16433 Trc. 2 Domestic Allen N. Vickrey

Township 29 North Range 12 East Section 22

RG-44586-Expl. 5 NE¼SE¼SE¼ Expl. Molycorp, Inc.

Township 29 North (1) Range 12 East Section 20

RG-17985 NE¼NE¼ Stk.& San. Bureau of Land Mgmt.

Township 29 North Range 12 East Section 32

RG-39658 SE¼ Dom Robert Cohn

RECORD OF TELEPHONE CONVERSATION

Time: 10:30	Date: 6-17-93
Originating Party: Stuart Kent	Other Parties: Mr. Bob Parry (754-2277)
NMED - SuperFund	Red River Superintendent

Subject: Water Distribution Systems (Community Wells) near Cerro, Red River WWTP

Discussion:

+ 3 water systems exist: Cerro East, Cerro West and Placita del Medio

+ Placita del Medio has ~15 service connections

+ 2 wells at RR WWTP

- #1) 10 yrs old; Well depth = 210', Water Level = 165' pH is 3.9 - 4.2; Aquifer is alluvial gravels

#2) 1.5 yrs old; Well depth = ~~80~~ 165' SK Water Level = 80'

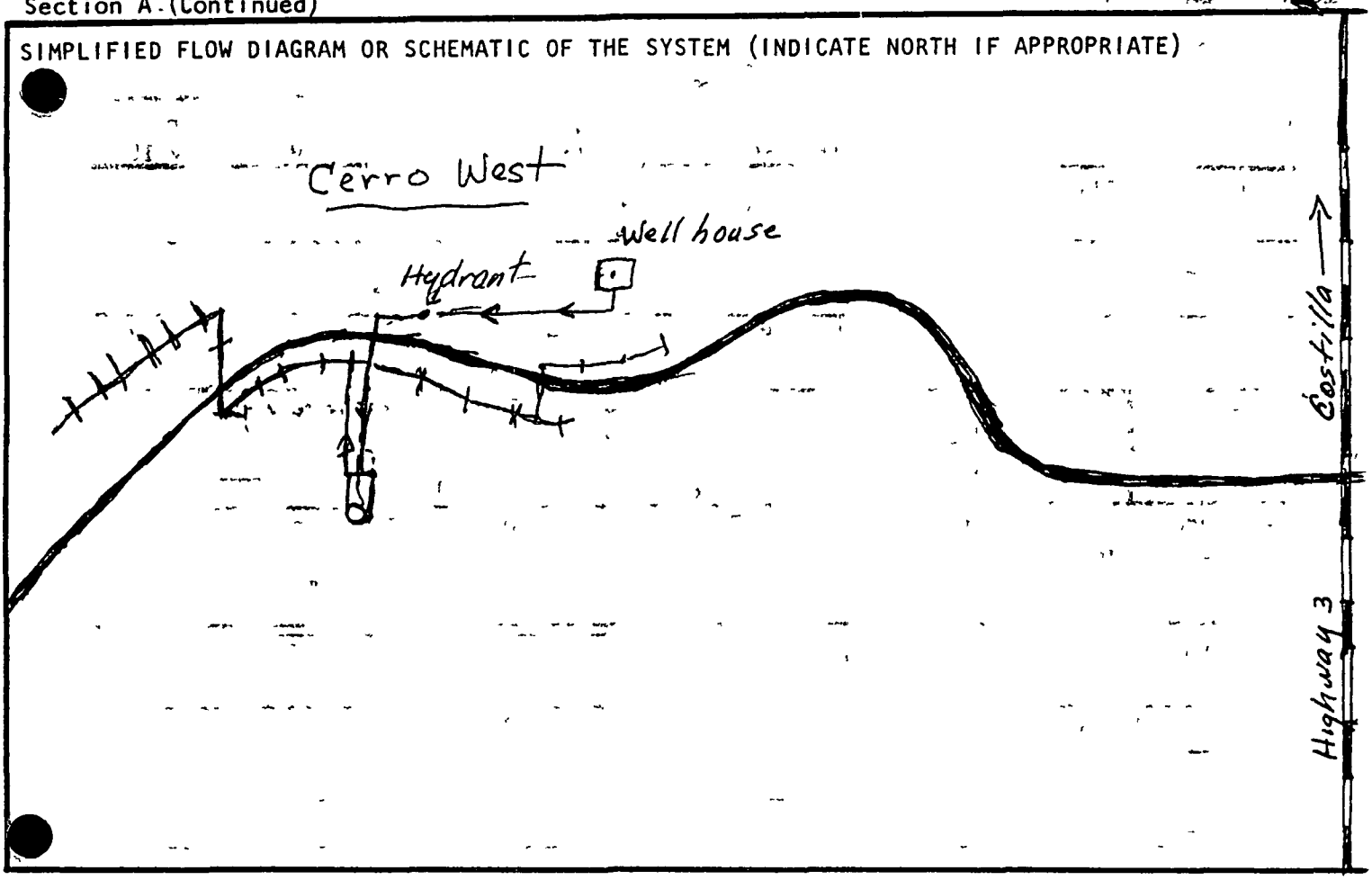
Water quality is "even worse"

+ Both wells are drilled to bedrock

Stuart Kent
Signed

Section A (Continued)

SIMPLIFIED FLOW DIAGRAM OR SCHEMATIC OF THE SYSTEM (INDICATE NORTH IF APPROPRIATE)



Section B - Source Information

WELL Identification	Well Depth	Pump Depth	Pump Capacity GPM	Well Drawdown feet	Pump Type	Static Water Level	Age of Pump	Date Well Drilled
well #1	140'	118'	18	N/Av	subm	N/Av	1984	N/Av

Remarks, Deficiencies, and Recommendations

Well casing not adequately sealed.

Source	Number (each)	Total Capacity	Remarks, Deficiencies, and Recommendations
Artesian Wells			N/A
Springs			
Infiltration Galleries			

State of New Mexico
HEALTH and ENVIRONMENT DEPARTMENT
SCIENTIFIC
LABORATORY DIVISION

CHEMICAL PHYSICAL ANALYSES for WATER SAMPLE

Date received | Lab No. | SLD user code No

CONSULT SLD Lab Annex L for proper presentation of samples. TYPE or PRINT with Ball Point Pen

CHEMICAL ANALYSES: *Check individual items for analysis [Mark appropriate box(es)]*

INTERIM PRIMARY PARAMETER GROUP ☐ 1 ☐ 2 ☐ 3

TYPE of CHEMICAL ANALYSIS ☐ Complete Secondary ☐ Organic ☐ Radiological

Water Supply System Name	Water Supply System Code No	City or Location	County	Check one
CERRO WEST				☐ TREATED WATER ☐ RAW WATER

Collection Date	Collection Time	Collection Point	Collector's remarks	Report to
2-17-79				Address
Collected By		Owner		

TYPE of SYSTEM *(Check one)* ✓ ☐ PRIVATE PUBLIC ☐ Community ☐ Non-community

SOURCE: ☐ Spring ☐ Lake ☐ Well-Depth ☐ Drain ☐ Stream ☐ Pool ☐ Other *(specify)*

LAT ° ' "
LONG ° ' "

CATIONS	mg/l	ANIONS	mg/l	PHYSICAL		HEAVY METALS	mg/l	PARAMETER		ORGANIC	mg/l
00930 Sodium (as Na)	11.5	00940 Chloride (as Cl)	8.5	70300 Total Filterable Residue	mg/l 214	01000 Arsenic				39390 Endrin	
00935 Potassium (as K)	1.56	00950 Fluoride (as F)	0.33	38260 Foaming Agents (as Las)	<0.05	01005 Barium				39732 Lindane	
00900 Tot. Hardness (as $CaCO_3$)	140	00620 Nitrate (as N)	1.87	00095 Conductance Micromhos 25°C	345	01025 Cadmium				38370 Methoxychlor	
00915 Calcium (as Ca)	36.8	00430 Alkalinity (as $CaCO_3$)	108	00400 pH	7.59	01030 Chromium		RADIOLOGICAL pCi/l 01501 Gross Alpha		39400 Toxaphene	
00925 Magnesium (as Mg)	11.7	00440 Bicarbonate (as HCO_3)	131.4	01330 Odor		01049 Lead		03501 Gross Beta	pCi/l	39730 2, 4-D	
01045 Iron - Total (as Fe)	<0.25	00445 Carbonate (as CO_3)	0	00080 Color	mg/l 0	07130 Mercury		09501 Radium-226	pCi/l	39740 2, 4, 5-TP (Silvex)	
01056 Manganese (as Mn)	<0.05	00945 Sulfate (as SO_4)	51.4	00070 Turbidity	0.2	01145 Selenium		11501 Radium-228	pCi/l		
						01075 Silver					

LABORATORY REMARKS

Reviewed by

Date reported 5/28/79

SLD 702 Form Revised 4 78

DISTRIBUTION: White - Water Supply Regulation SF • Canary - WS System • Pink - EPA Regional Office • Goldenrod - SLD Lab

State of New Mexico
HEALTH and ENVIRONMENT DEPARTMENT
SCIENTIFIC
LABORATORY DIVISION

CHEMICAL and PHYSICAL ANALYSES for WATER SAMPLES

Date received	Lab No.	SLD user code No.

CONSULT SLD Lab Annex L for proper presentation of samples TYPE or PRINT with Ball Point Pen

CHEMICAL ANALYSES Check individual items for analysis [Mark appropriate box(es)]

INTERIM PRIMARY PARAMETER GROUP ☐ 1 ☐ 2 ☐ 3 ☐ Complete Secondary

TYPE of CHEMICAL ANALYSIS ☐ Organic ☐ Radiological

Water Supply System Name	Water Supply System Code No.	City or Location	County	Check one
Cerro EAST MOWCA				☐ TREATED WATER ☐ RAW WATER

Collection Date	Collection Time	Collection Point	Collector's remarks	Report to
1/24/79		TAP		
Collected By		Owner		Address

TYPE of SYSTEM (Check one) ☐ PRIVATE ☐ PUBLIC ☐ Community ☐ Non-community

SOURCE ☐ Spring ☐ Well Depth ☐ Dug ☐ Stream ☐ Pool ☐ Other (specify) LAT. LONG

CATIONS	mg/l	ANIONS	mg/l	PHYSICAL		HEAVY METALS	mg/l	PARAMETER		ORGANIC	mg/l
00930 Sodium (as Na)	184	00940 Chloride (as Cl)	102	70300 Total Filterable Residue	254	01000 Arsenic				39390 Endrin	
00935 Potassium (as K)	234	00950 Fluoride (as F)	0.30	38260 Foaming Agents (as LAS)	< 0.05	01005 Barium				39732 Lindane	
00900 Tot. Hardness (as $CaCO_3$)	180	00620 Nitrate (as N)	4.10	00095 Conductance Micromhos 25°C	423	01025 Cadmium				38270 Metnoxychlor	
00915 Calcium (as Ca)	51.6	00430 Alkalinity (as $CaCO_3$)	165	00400 pH	8.23	01030 Chromium		RADIOLOGICAL pCi/l 01501 Gross Alpha		39400 Toxaphene	
00925 Magnesium (as Mg)	12.4	00440 Bicarbonate (as HCO_3)	201.2	00080 Color		01049 Lead		03501 Gross Beta	pCi/l	39720 2, 4-D	
01045 Iron-Total (as Fe)	< 0.25	00445 Carbonate (as CO_3)	0.	00080 Color	mg/l 0	07180 Mercury		09501 Radium-226	pCi/l	39740 2, 4, 5-TP (Silvex)	
01056 Manganese (as Mn)	< 0.05	00945 Sulfate (as SO_4)	29.6	00070 Turbidity	1.04	01145 Selenium		11501 Radium-228	pCi/l		
						01075 Silver					

LABORATORY REMARKS

Reviewed by

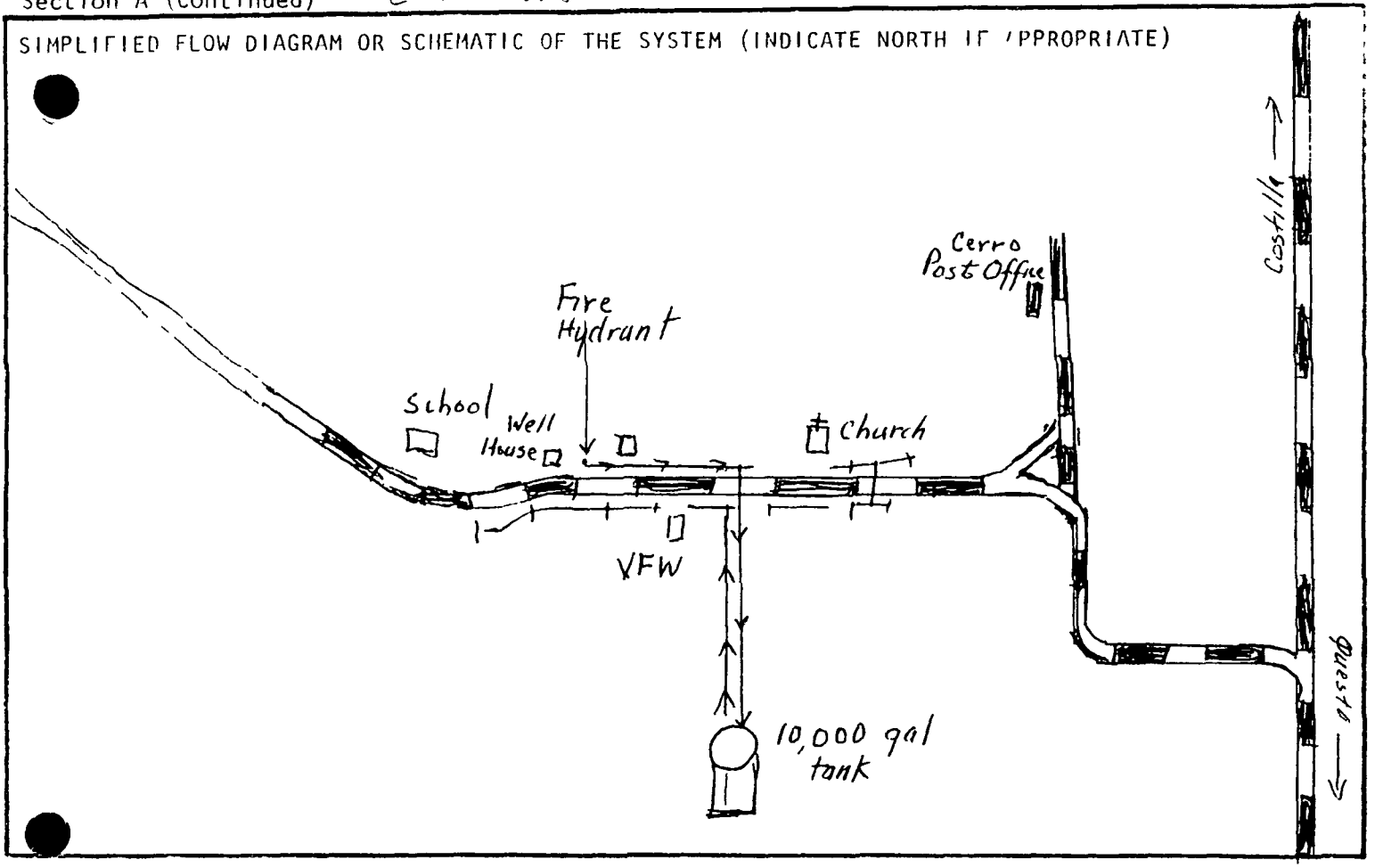
Date reported 5/28/79

SLD 702 Form Revised 4 76

DISTRIBUTION White - Water Supply Regulation, SF • Canary - WS System • Pink - EIA Regional Office • Goldenrod - SLD Lab

Section A (Continued) Cerro East

SIMPLIFIED FLOW DIAGRAM OR SCHEMATIC OF THE SYSTEM (INDICATE NORTH IF APPROPRIATE)



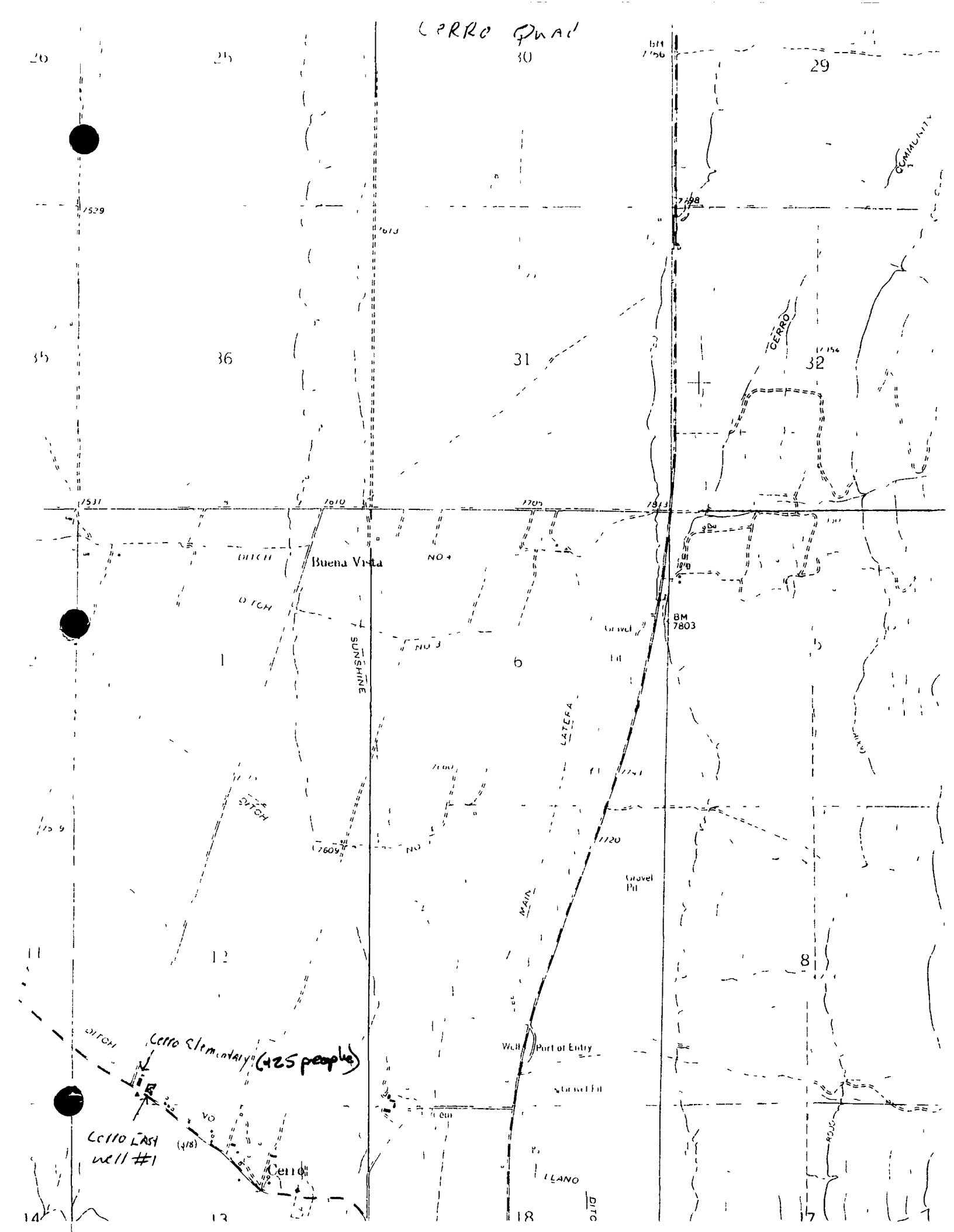
Section B - Source Information

WELL Identification	Well Depth	Pump Depth	Pump Capacity GPM	Well Drawdown feet	Pump Type	Static Water Level	Age of Pump	Date Well Drilled
#1	150	100	20	N/Av	2 hp	N/Av	5	1968

Remarks, Deficiencies, and Recommendations

1 Well needs to be chlorinated.
2. Well floor was sealed in the summer of 1990.
3 Stove-pipe type of ventilation recommended.

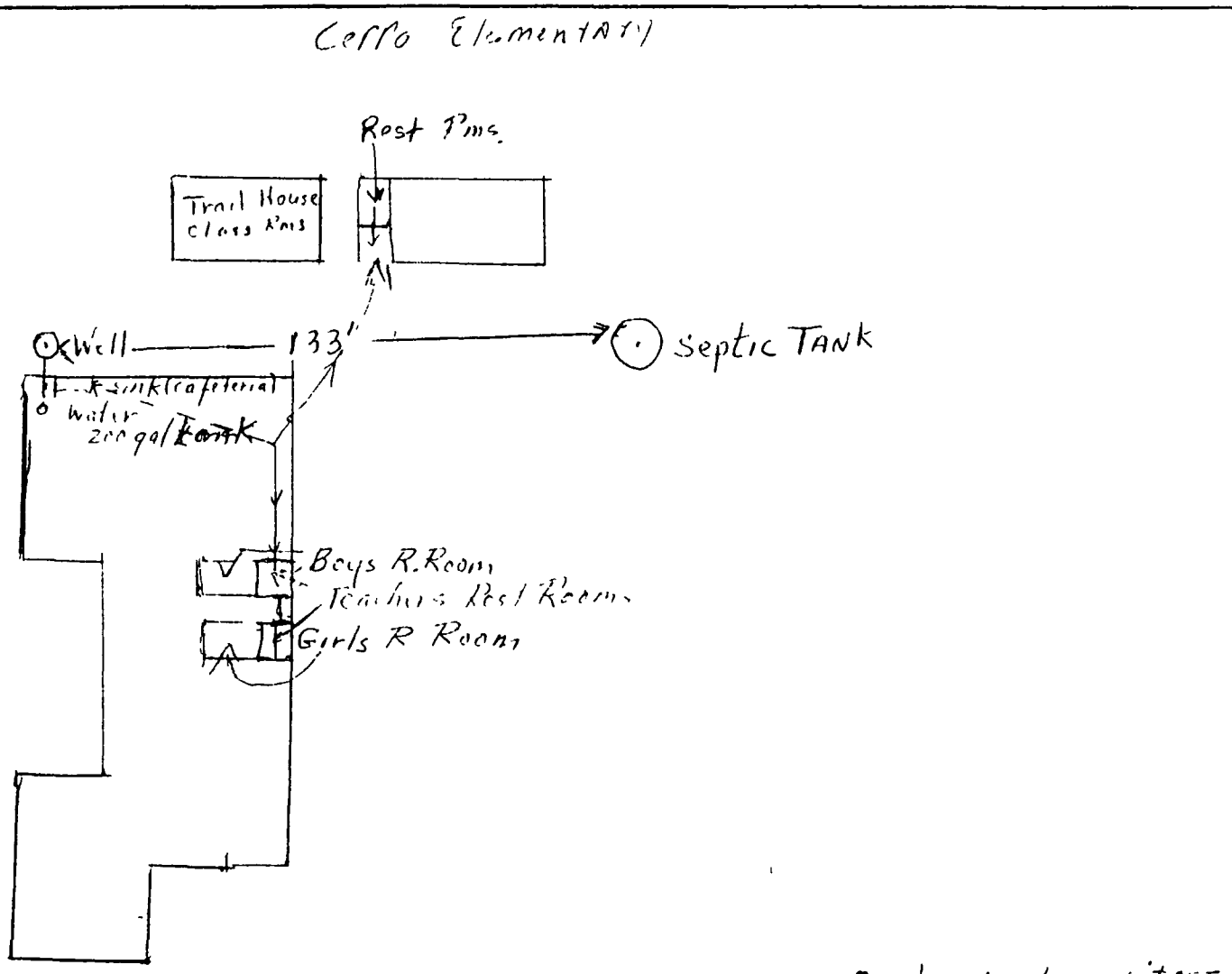
Source	Number (each)	Total Capacity	Remarks, Deficiencies, and Recommendations
Artesian Wells			N/A
Springs			N/A
Infiltration Galleries			N/A


CERRO Quad
Buena Vista
DITCH
SUNSHINE
LATERA
MAIN
CERRO
COMMUNITY
BM 7803
Gravel Pit
Well
Port of Entry
LLANO
Cerro Elementary (425 people)
Cerro LASH well #1
Cerro

ION C - WATER DISTRIBU N SYSTEM

ce of Distribution tem Pressure:	☐ - Gravity	☒ - Pump(s) 1	☐ - Both	
oster ump Stations	Total Number of Stations: none	Remarks or Recommendations: none in use		
Pipe Materials in System	☐ - PVC ☒ - Galvanized ☐ - DI/CI ☐ - Other	Remarks or Recommendations		
	☐ - AC ____ % Year Last Installed			

SECTION D - SIMPLIFIED FLOW DIAGRAM OR SCHEMATIC OF THE SYSTEM (Indicate North if Appropriate)



Remarks or Recommendations:

School was built in the late thirty's (1937 - 1939) It is unknown when the septic system was installed. Recommend that water system be tested annually for nitrates.

MOLYBDENUM CORPORATION OF AMERICA
6 CORPORATE PARK DRIVE, WHITE PLAINS, N. Y. 10604 • TEL. 914-694-1700

REPLY TO: QUESTA DIVISION
QUESTA, N.M. [illegible]
TWX 910-[illegible]
TEL: 505/586 0212

July 29, 1974

Mr. Roger Herrera
P. O. Box 204
Questa, New Mexico 87556

Dear Mr. Herrera:

The Village of Questa plans to extend a main of the municipal water system westward along Embargo Road, and it will pass near your property. Molycorp is participating in this project because it is at least remotely possible that unavoidable seepage from the Molycorp tailings pond could at times infiltrate some aquifers immediately below the pond, and conceivably the water quality of shallow wells in the vicinity might be affected.

To forstall even this remote possibility of affecting your domestic water supply, Molycorp will, with your consent, connect your domestic water system to the Questa water main, and provide necessary plumbing, installation and a water meter at no cost to you. Work will be done at your convenience using a route selected by you. Although there are no known detrimental effects from our effluent at this time, Molycorp would do this work as a precautionary measure.

Please advise if this program meets with your approval by signing a copy of this memo in the space provided below.

Mr. Al Greslin of Molycorp will contact you regarding the time and route location of the connection.

Your cooperation in this matter is ernestly solicited, and if you have any questions, please contact Mr. Greslin or myself at any time. This matter has been discussed with the Questa Mayor and Village Council, and they are in full accord.

Sincerely,

R. Gene Dewey,
General Manager

cc: file

[ ] I agree to connection to Questa water as outlined above.

[ ] I do not wish to be connected to Questa water as outlined above.

SIGNED:

RECORD OF TELEPHONE CONVERSATION

Time: 2 30 PM	Date: 11-19-93
Originating Party: Stuart Kent	Other Parties: Dave Shoemaker 586-0212 x3001
NMED - Superfund Program	Molycorp Site Manager

Subject: Switching of wells south of tailings pond to community water supply

Discussion:

+ When I last visited w/ Mr Shoemaker (10-29-93) he spoke of several wells below the ponds which had not been switched to community water

+ Today, he identified these wells:
P-4b well – Feliciano Rael
P-5 well - Danny Duran
P-9 well - Delmiria Medina

+ These wells are currently, or have very recently (w/in weeks) being switched to community supply wells.

+ Recent analysis of water from these wells (sampled 9-27-93) show low sulfate, TDS levels

+ Mr Shoemaker checked with water board & found that NO additional private wells are currently used below the tailings dams

Stuart Kent
Signed

SOUTH PASS RESOURCES, Inc.

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GROUND WATER BUREAU

Hydrogeologic Evaluation of Tailings Ponds

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TABLE OF CONTENTS

	Page
1 0 INTRODUCTION	1
2 0 GEOLOGIC SETTING	3
2 1 Regional Geology	3
2 2 Site Geology	3
3 0 HYDROGEOLOGY	8
3 1 Hydrogeologic Units	8
3 2 Flow Directions and Hydraulic Gradients	12
3.3 Seepage Velocity and Unit Discharge	13
3 4 Dilution Effects	14
3.5 Chemistry	15
3 6 Summary of Hydrogeology	18
4 0 RECOMMENDATIONS	19
5 0 REFERENCES	21

APPENDICES

Appendix A - Borehole Logs
Appendix B - Results of Laboratory Analyses of Aquitard Samples
Appendix C - Results of Laboratory Analyses of Water Samples (August 17-18, 1993)
Appendix D - Constant Rate and Recovery Test Results
Appendix E - Drilling and Construction of Monitor Wells

LIST OF FIGURES

Figure 1. Location Map
Figure 2. Geologic Map. Tailings Pond Area
Figure 3. Borehole Stratigraphy. Tailings Pond Area
Figure 4 Geologic Cross-Section A-A'
Figure 5. Geologic Cross-Section B-B'
Figure 6 Ground-Water Flow Directions
Figure 7 Monitor Well Ground-Water Chemistry
Figure 8. Location of Proposed Extraction Systems

1.0 INTRODUCTION

This report presents an analysis of the hydrogeologic conditions in the vicinity of the Molycorp tailings ponds near Questa, New Mexico The purpose of this work is to evaluate ground-water flow conditions and water-quality distributions in aquifers that connect impacted water beneath the ponds with discharge areas (such as private wells and the Red River south of the facility) The outcome of the analysis is 1) an explanation of the controlling hydrogeologic parameters; and 2) recommendations for additional work to clarify and extend the hydrogeologic data and for controlling, monitoring, and, if necessary, remediating impacted ground water.

The tailings ponds are located about 1 mile west of Questa, New Mexico (Taos County) and 0 5 mile north of the Red River (Figure 1) Since 1965, tailings slurry has been piped along the Red River from the mill near the Molycorp molybdenum mine, which is located approximately 8 miles east of the tailings disposal sites. The disposal sites currently cover about 550 acres and have been maintained since the mine ceased underground operations in 1992.

History of the Operation

The Questa open-pit mining and tailings disposal operations began in 1965 with the construction of an earth fill starter Dam No 1 in a large arroyo at the southern end of Section 36 The upstream face of the dam was sealed with the slime faction of the tailings The water clarification pond was at the dam face. Clarified water was piped via decant structures raised on the upstream dam face, through culvert tunnels under the dam, and then by ditch to the Red River

Raises and operation of Dam No 1 continued until 1969 when a second dam (Dam No. 2) was constructed at the north end of Section 36 The clarification pond was then shifted to the north, and the existing decant structures were abandoned for a new overflow weir structure constructed in the bank alongside the new Dam No 2 Clarified water overflowed the weir and traveled down a decant ditch cut around the west side of Section 35 to a small holding pond called Pope Lake (located at the southern end of Section 35) From Pope Lake, the water flowed over a Parshall flume (later called Outfall 001) and to the Red River

In 1969, the final 7520-foot and 7525-foot elevation raises on Dam No 1 were shifted upstream (west) of the existing dam and were constructed on tailings. These lifts were of compacted earthfill.

In 1971, additional tailings storage was created by constructing starter Dam No. 4 in Section 35. This dam and all its subsequent lifts were constructed of earthfill and had internal drain systems. The upstream dam face was also covered with an asphalt or plastic membrane. A decant weir was built to the north of the dam so that the clarification pond could be kept away

from the dam face. Clarified water was released over the weir structure into the west ditch to Pope Lake and then to the Red River

In 1974, east and west diversion ditches were constructed around both tailings storage areas in order to divert all natural drainage away from the impounded tailings Diverted water re-entered the watershed below Dams 1 and 4

In 1975, seepage barriers were constructed below Dam No. 1 and to the east of the ridge separating Dam No. 4 and Dam No. 1 areas. These barriers were excavated to clay, sealed on the downstream side, and filled with suitable drain material so that seepage from the tailings storage ponds could be collected and diverted around the dwellings situated downstream of the tailings storage area. This water was then piped to the Red River through Outfall 002.

In 1983, an ion exchange water treatment plant (I-X building) was constructed alongside Pope Lake. This plant processed all tailings decant water before it was discharged into the Red River.

2.0 GEOLOGIC SETTING

The tailings disposal site overlies a series of northeast-trending ridges and washes that have eroded into the sedimentary and volcanic rocks of the Santa Fe Formation The Santa Fe Formation underlies a lowland bounded on the west by the Guadalupe Mountains and on the east by the Sangre de Cristo Mountains The Guadalupe Mountains reach elevations just over 8,700 feet and the Sangre de Cristo Mountains just over 10,000 feet. Elevations in the lowland are on the order of 7,000 to 7,600 feet. The Red River, which lies south of the tailings ponds, is entrenched across the Tertiary sedimentary and volcanic rocks creating a gorge southwest of the site. Springs fed by perched or regional ground water occur in the volcanics along the walls of the gorge

2.1 Regional Geology

Regionally, the site is located within the Rio Grande rift zone, a northeast-/southwest-trending fault-bound structural depression of Mid- to Late-Tertiary age, that extends across New Mexico into southern Colorado. The depression is composed of a number of structural subbasins including the San Luis Basin, which is located at the northern end of the rift. The San Luis Basin is bounded on the east by the Sangre de Cristo Range which was uplifted contemporaneously with the formation of the basin along high-angle normal faults extending parallel to the west front of the range The basin filled with coarser alluvial sediments along the range front Farther to the west, the basin fill consists of finer clays and silts deposited in lakes. At the tailings disposal site, the lacustrine (lake) sediments are interbedded with the alluvial sands and gravels. The San Luis Basin fill is assigned to the Santa Fe Formation (Miocene to Early-Pliocene in age) and is believed to be on the order of 15,000 feet thick.

Numerous volcanic fields developed as the result of the rifting and basin formation in Mid- to Late-Tertiary time. The volcanic units that underlie the Guadalupe Mountains along the west side of the site consist of lava flows and ash flow tuffs that range from rhyolite to basalt in composition and that are believed to be Oligocene to Early-Miocene in age (unpublished stratigraphic section, Molycorp files) These volcanics may intertongue with at least the lower Santa Fe Formation. Miocene basalts are intercalated with the Santa Fe Formation. Both the Santa Fe Formation and the older volcanic units are unconformably overlain by the Servilleta Basalt of Pliocene age

2.2 Site Geology

Stratigraphy

The highly generalized lithologic logs for monitor wells (MW-1, -2, -3, and -4) drilled in 1979 suggested a simple stratigraphy for the site including an upper gravel unit, an underlying yellow clay, and, in one monitor well (MW-1), a volcanic unit beneath gravel (see Figures 2 and

3) Logs of five monitor wells drilled in 1993 show a more complex interlayering of gravel, sand, and clay in the Santa Fe Formation and a wider distribution of the volcanic rocks reported at MW-1 Recent alluvial sediments contain material reworked from the poorly consolidated Santa Fe Formation and appear to be largely confined to the washes Field reconnaissance, combined with an earlier unpublished geologic map (Vail, 1987) and the borehole data, have demonstrated that two different volcanic units are in the area and that a thin sequence of volcanic sediments, distinct from other Santa Fe units, occurs in a small area south of the face of Dam 4

Santa Fe Formation

Based on the borehole logs, the Santa Fe Formation in the area of the tailings ponds consists of.

- an Upper Aquifer Unit (UAU) composed of brown sandy gravels and gravelly sands with a subordinate component of pale red brown silty, sandy clay (Recent sediment was not distinguished from the poorly consolidated UAU during logging);
- a Middle Aquitard Unit (MAU) in which pale red brown clay and gravelly clay are the dominant sediments; and
- a Lower Aquifer Unit (LAU) composed of sandy or clayey gravel Thin beds of tightly cemented sandstone were noted in MW-7 and MW-10.

These three lithologic divisions are based on dominant textural characteristics, but each unit contains subordinate amounts of the other lithologies (for example: clay beds occur within the UAU and LAU). There are no marker beds to establish lateral equivalence between borehole sections, such that parts of the MAU may be temporally equivalent to the lower part of the UAU, or the upper part of the LAU In general, the internal structure of a sequence of alluvial or alluvial/lacustrine (lake) sediments is expected to be lensoid in character and have sand and gravel lenses intertongueing and have clay-rich units (Galloway and Hobday, 1983). Borehole logs are presented in Appendix A

Gravels range from very fine gravel (0 08 to 0 16 inch) to cobble sizes (2.4 to 10.24 inches), but most of the material appears to be below cobble size. Geotechnical drilling for Dam No. 1 (pre-dam cross-section along the proposed axis of Dam No 1, Molycorp files) indicated boulder size material is present in the UAU Clast composition in the gravels seems to largely reflect sources in the Sangre de Cristo Range to the east A variety of volcanic rock types (flows, ash flow tuffs), intrusive igneous rocks (pegmatite, granite, quartz monzonite), and metamorphic rocks (gneisses) occur in the gravels.

A thin sequence of brown, silty highly burrowed sands, black coarsely grained volcanic sands, and gravelly clayey sands outcrop in the vicinity of MW-11 The gravels in this unit are entirely composed of volcanic clasts Similar sediments were penetrated in the upper 29 feet of MW-11 and in several borings near the toe of Dam No 4 This unit is shown separately (as T_{vs}) on the geologic map (Figure 2) and is here considered a unit in the Santa Fe Formation.

Volcanic Units

Lithologic information for the volcanic rocks penetrated by the monitor wells comes primarily from cuttings descriptions The flow rock is a finely crystalline olivine basalt containing brown millimeter-size phenocrysts of altered olivine and of pyroxene (augite?). White phenocrysts of feldspar were also noted A few cuttings showed glassy textures which probably indicate the tops or bases of individual flows Both vesicular, and to a greater extent, non-vesicular basalt are present in the section Flow banding was observed in some cuttings. White and pale blue quartz/chalcedony fills some vesicules and occurs along a few fractures. Thin volcanic breccias consisting of black to gray angular volcanic fragments in a red volcanic matrix are interlayered with the flows Exposures of the basalt along the walls of Pope Wash, south of MW-11, show that the basalt is highly fractured with sets of vertical fractures coupled with units showing a distinct horizontal parting.

Volcanics observed along the east side of the Guadalupe Mountains were examined during a half-day reconnaissance of the area These are dominantly medium gray ash flow tuffs characterized by flattened brown to tan pumice fragments and by the presence of black basal vitrophyres. Based on the Questa area volcanic stratigraphy (unpublished section in Molycorp files), and the presence of the basalt unit and the ash flow tuffs unconformably below Santa Fe Formation sediments, it would appear that the basalt is either a tongue within the Santa Fe Formation or belongs to a sequence of older ashflow tuffs and basalts that partly underlie and intertongue with lower Santa Fe Without further stratigraphic information, such as a lower contact for the basalt (no monitor well penetrates the unit), petrographic data or radiometric age information the stratigraphic position of the basalt can not be completely resolved.

Geologic Structure

Reconnaissance mapping, combined with a description of subsurface geology based on borehole data, indicates the presence of four northeast-trending faults displacing Santa Fe Formation sediments relative to various volcanic units (Figures 4 and 5) The apparent movement along some of the faults is down to the east (a strike-slip component can not be ruled out).

Vail (unpublished geologic map, 1987) mapped a northeast-trending high-angle fault along the east flank of the Guadalupe Mountains This fault appears to follow the west side of a linear, northeast-trending wash, now largely covered by the tailings behind Dam No. 4 The ash

flow tuffs along the east flank of the mountain are moderately tilted along the fault line and in places unconformably overlain by Santa Fe Formation on younger gravels The Santa Fe volcanic sediments and the basalt unit south of Dam No 4 lie east of the fault and appear to be truncated by the structure The ash flow tuffs probably correlate with volcanics that are either equivalent to the lower Santa Fe or older than the Santa Fe and indicate that the fault block to the east has moved relatively downward.

In the Work Plan for the tailings pond facility study (GeoWest Group, 1993), the linear, northeast-trending pattern of the ridge between Dam No 1 and Dam No. 4 and the wash to the east of the ridge was identified The wash between MW-1 and MW-2 was postulated to follow a high-angle fault because of the apparent displacement of the volcanic unit in MW-1 relative to the sediments (at the same elevation) in MW-2 (Figures 4 and 5) and because of the linearity of the wash Wells MW-8 and MW-7, drilled 1,500 feet to the north of MW-1 and MW-2, show a similar structural relationship confirming a linear structure extending northeast along the wash. The volcanics were not encountered in MW-9, drilled to elevations well below the level of the volcanics in MW-1 (Figure 4) However, the volcanic unit does appear at deeper levels farther east in the lower part of Private Well-4 and in MW-10 (Figure 5) The conclusion is that the volcanic unit is offset along a fault that aligns with the wash and that the displacement is down to the east. The eastern block may be slightly tilted to the west.

The cross-sections (Figures 4 and 5) suggest a northeast-trending fault may also extend beneath the ridge that divides Dam No 1 and Dam No 4 This structure is based on the difference in elevation between the basalt outcrop immediately east of the I-X building and the top of the volcanic unit in MW-1 (a difference of 157 feet) and the linearity of the ridge. However, at the I-X outcrop, Santa Fe gravels unconformably overlie the basalt, and the basalt ridge could be an erosional feature The presence of documented faults in the area with the same trend and the linearity of the ridge when coupled with the Tertiary extensional history related to the Rio Grande Rift favors a fault interpretation.

The volcanic sediments outcropping below Dam No 4 and noted in several boreholes appear to be truncated by the basalt unit unconformably overlain by the Santa Fe Formation immediately east of the I-X building. The volcanic sediments (T_{vs}) were not observed in the exposures of the Santa Fe Formation east of the I-X building. The apparent truncation of the stratigraphic units and the absence of the volcanic sediments are the basis for the fault shown east of the I-X building on the geologic map

Both the borehole data and the field exposures are concentrated in a narrow band along the front of Dam No 1 and Dam No. 4 We believe that the structure and the lithologic units, particularly the basalt unit, extend northward beneath the tailings pond facility and southward at least to the Red River Of hydrogeologic significance is.

3.0 HYDROGEOLOGY

3.1 Hydrogeologic Units

Part of the Santa Fe Formation can be divided into three sedimentary divisions of hydrogeological significance: the UAU, MAU, and LAU (discussed earlier in Section 2.2 - Stratigraphy; see also borehole logs in Appendix A and Figure 3). Each of these units, plus the volcanic unit, are discussed below Well construction data is given in Appendix E.

Laboratory measurements of vertical hydraulic conductivity are given in centimeters per second (cm/sec). When these values are converted to gallons per day per square foot ($g/d/ft^2$), cm/sec is multiplied by a constant of 21220. Horizontal hydraulic conductivity was calculated by dividing transmissivity (derived from pump or recovery test data) by the saturated thickness of the aquifer The monitor wells do not fully penetrate the aquifers, which results in greater amounts of drawdown and lower calculated transmissivity. Saturated thickness was estimated as the distance between static water level and the bottom of the screen (volcanic aquifer) or the thickness of the confined beds in the case of the LAU at MW-10 The calculations for seepage velocity are in feet/day which, when divided by 86,400 seconds (number of seconds in a day), becomes feet/second Discharge equals velocity (feet/second) times the cross-sectional area ($feet^2$) resulting in a flow reported in cubic feet per second (cfs).

Upper Aquifer Unit (UAU)

The UAU is characterized by sandy gravels and gravelly sands, but lenses of clay occur. Wells MW-A, -B, -C, and -9A are screened in the UAU. MW-A (total depth 38 feet) and MW-C (total depth 14 5 feet) commonly have measurable water levels (water-level elevations of 7,282.7 feet and 7,312 feet, respectively) MW-B (total depth 18 feet) was dry in May 1993 but contained measurable water in August 1993 with a water-level elevation of 7,302.77 feet. These three wells are within 100 to 150 feet of each other Yet the difference in water level-elevations are significant (for example. 20 07 feet between MW-A and MW-B, and 29 3 feet between MW-A and MW-C) Logs of these borings are not available, but the most likely explanation is that these piezometers have intercepted perched zones within the UAU Evidence of possible perched zones in the UAU include.

- In MW-9A screened from 32 to 42 feet, sandy gravel at 35 feet is underlain by gravelly clays that might have caused perched conditions
- Air rather than water was used to drill some of the monitor wells in parts of the UAU, field notes commonly reference moist and dry zones at multiple levels in the UAU suggesting possible perched zones

- Field observations in the area of seepage barrier No 2 revealed lines of willows or other plants at clay/gravel-sand contacts which are also indicative of perched water

Although the UAU may be a zone of numerous perched water bodies above a static level in the underlying MAU, at this point, the UAU is not completely characterized. An irregularly shaped water table could occur in the lower UAU, with highs related to preferential discharge areas caused by variations in the alluvial stratigraphy (the elevation of gravelly units underlain by clay) and the distribution of heads beneath the tailings pond. [The term ***head*** refers to elevations of the water-level surface] Differences in elevation, or head, cause ground water to flow from points of higher total head to lower total head.

Heads throughout the UAU are higher than those in the MAU, LAU, and volcanic unit such that, in all cases, a downward gradient exists Perched water bodies, developed over lenses of clay in the UAU, contribute to the vertical infiltration of tailings pond water to the MAU. Water infiltrates the clayey sediments (gravelly clays, sandy clays) and also moves beyond the lateral edges of the clay lenses to infiltrate to lower levels. The ephemeral nature of perched zones is probably illustrated by MW-B, which is normally dry but contained measurable water in August. Seasonal or other longer term changes in heads beneath the tailings ponds may cause some zones to be ephemeral.

Middle Aquitard Unit (MAU)

The Middle Aquitard Unit (MAU) consists of interbedded tan to pale red brown sandy/silty clay and gravelly clay with minor lenses of sandy gravels and sands. MW-7A and MW-7B are screened entirely in the MAU MW-2, MW-3, and MW-4 are screened in the upper MAU, but the upper part of the screened interval may include some UAU sediments. At MW-9, a series of split-tube drive samples (2-inch diameter, 6-inch brass tubes) were collected in the 55- to 56-foot and 85- to 86-foot intervals within the aquitard The results of the laboratory analyses for vertical hydraulic conductivity, moisture content at saturation (porosity), and grain size distribution are given in Appendix B and are summarized below. The ASTM D 2434-68 fixed wall method was used to find the hydraulic conductivity

An aquifer test (described in Appendix D) was conducted at MW-10 for an estimate of transmissivity The LAU is a confined aquifer, since the top of the unit is at 86 feet bgs and the water level was at 39 feet Step tests at 15 and 5 gpm were attempted, but the well pumped dry almost immediately The test was conducted at a constant rate of 2 gpm for a period of 100 minutes at which time drawdown began to level off at 79 feet bgs. The test had to be stopped before drawdown dropped below pump level.

The constant rate test extended across three log cycles. Applying the Cooper/Jacob Straight Line Method for transmissivity (T) and dividing the T value (9 01 g/d/ft) by saturated thickness (50 feet), the resulting horizontal hydraulic conductivity (Kh) is 0.1802 g/d/ft^2 (8.5E-06 cm/sec). This value would correspond to a clayey fine sand or silt (Walton, 1988). Because the drawdown at MW-10 did not stabilize during the test period, the results from the Cooper-Jacob Straight Line Method cannot be considered accurate.

Another approach to estimating hydraulic conductivity (Kh) is to use the empirical relationship between specific capacity and transmissivity for a confined aquifer (Driscoll, 1986). Specific capacity (Q/S) would equal 0 025 (2/79) and T would equal 50 63 g/d/ft (2,025 x 0 025) The T value divided by saturated thickness (50 feet) results in a Kh value of 1.01 g/d/ft^2 (4 8E-5 cm/sec) This value also corresponds to a clayey fine sand or silt. Again, since maximum drawdown was not reached, the results may not accurately reflect the conductivity of the unit at MW-10 However, the log for MW-10 indicates that clayey gravels and sandy clays make up more than 50 percent of the saturated LAU and, consequently, a low Kh value might be anticipated

Volcanic Unit

Based on the borehole log for MW-11 and nearby outcrops, the volcanic unit is composed of highly fractured vesicular and non-vesicular basalt. Volcanic breccias and volcanic sediments (at the top of the unit) are a very minor component of the section penetrated by MW-11. During drilling, after static water level was intercepted, the return water was estimated to be in excess of 200 gpm Medium-grained sand used as a filter pack was carried into the fractures by the strong ground-water flow and ⅜-inch gravel was used instead.

Step, constant rate, and recovery tests were conducted at MW-11 (August 18, 1993). Test results are in Appendix D Because the 8-inch schedule 80 PVC casing used at MW-11 has an inside diameter of 7 62 inches, the largest pump that could be used had a maximum rate of 660 gpm A step test of 43 minutes duration at 530 gpm produced 2.21 feet of drawdown. The constant rate test was conducted at 660 gpm for a period of 140 minutes after which drawdown had stabilized. Water level oscillated several feet during the first 15 seconds (well storage effects) before a uniform drawdown curve could be generated. Using the Cooper-Jacobs Straight Line Method and the saturated thickness of the well, a hydraulic conductivity (Kh) of 34,472.9

g/d/ft^2 was calculated This value is very high, corresponding with the higher Kh values published for permeable basalt flows (E04 to E05 g/d/ft^2) in Freeze and Cherry (1979) The recovery curve using the straight line equation resulted in a calculated Kh of 14,102 56 g/d/ft^2 Recovery tests are generally considered to give better estimates for Kh than pump tests since minor fluctuations in the pump discharge during pumping do not allow a constant rate to be achieved Specific capacity can also be used to estimate transmissivity and hydraulic conductivity. From the drawdown curve, the maximum drawdown was 2 58 feet. The specific capacity (Q/S) was calculated to be 660/2 58, which is 255 81 g/ft. Using the empirical equation Q/S = T/1500 for an unconfined aquifer, T = 383,715 0 g/d/ft and Kh = T/b (b is the saturated thickness, 56 16 feet), which results in a Kh of 6,832.53 g/d/ft^2. The results from the specific capacity and recovery test gave horizontal hydraulic conductivities that range from 6,833 to 14,102 g/d/ft^2, which is well within published values for permeable basalts

3.2 Flow Directions and Hydraulic Gradients

Because the Upper Aquifer Unit is likely characterized by several perched water zones, a distinct static water-level surface could not be recognized Water levels for all of the wells screened only in the UAU were higher than water levels in the MAU, LAU, and volcanic units, thus indicating a downward gradient.

Flow direction and lateral hydraulic gradient for the MAU was based on solving a three-point problem based on water-level elevations in MW-7A, MW-2, and MW-3. Water levels for MW-2 and MW-3 may not be entirely representative of MAU levels because the 1979 logs show the screens extending across a gravel/clay contact From comparison with the more detailed log of MW-9 (close to both wells), it appears that the top of the screens may include the lower 5 feet of the UAU at best The flow direction for the MAU is S47°W with a hydraulic gradient of 0 02 foot/foot. The vertical hydraulic gradient within the MAU is downward and fairly steep at 0 97 foot/foot between MW-7A and MW-7B (head is 25.8 feet and the mid-screen to mid-screen length is 26.6 feet) The vertical gradient between the upper part of the MAU (MW-7A) and the LAU (MW-7C) is downward at 0 33 foot/foot With respect to the lower MAU (MW-7B) and the LAU (MW-7C), the vertical gradient is upward -- indicating the LAU is either confined or within a regional ground-water discharge zone

In the case of the Lower Aquifer Unit, using water-level elevations for MW-7, MW-9, and MW-10, the flow direction is S6°W at a hydraulic gradient of 0 026 foot/foot Water-level elevations at MW-7B, MW-7C, and at MW-10 with respect to the adjacent MW-4 show upward gradients -- indicating the LAU is a confined aquifer or is in a ground-water discharge area. MW-9B is screened in the LAU and the water level is near the bottom of the screen at 142 feet bgs. Prior to well construction, the water level was slightly higher (130 feet bgs) and the well water was described as very muddy It is possible that because of the presence of clay in the LAU, the lower screen has been partially plugged by clay/silt forced into the well bore during

development causing the low water level The pre-construction water level at MW-9B was used to evaluate flow direction and gradient for the LAU

Water-level elevations at MW-1, MW-8 and MW-11 were used to calculate a flow direction of S55°W and a hydraulic gradient of 0 029 foot/foot for the basalt aquifer. The southwesterly flow direction is similar to the regional flow directions reported by Dames and Moore, 1986. The water level used for MW-8 was measured at the completion of well construction and has not been confirmed by later measurements (due to partial collapse of the casing at a depth of 40 feet; the drilling contractor is scheduled to repair the well in September). The calculated gradient here is an order of magnitude higher than those reported from the Guadalupe Mountain study, but is probably caused by proximity to discharge along the Red River.

3.3 Seepage Velocity and Unit Discharge

Seepage velocity can be calculated from the equation

$$Vs = \frac{KI}{7\ 48\ ne}$$

where K = hydraulic conductivity,
I = hydraulic gradient,
ne = effective porosity,
7 48 = a constant that converts the result to feet/day when K is in g/d/ft^2

For the Lower Aquifer Unit, the hydraulic conductivity ranges from 0 1802 to 1 01 g/d/ft^2, the hydraulic gradient is 0.026 foot/foot, and the porosity was estimated at 20 percent. The seepage velocity as a function of the range in hydraulic conductivity ranges from 0.003 foot/day (3 5E-08 feet/second) to 0 018 foot/day (2.08E-07 feet/second).

The rate of flow through a LAU cross-section 50 feet thick and 100 feet in length (5,000 ft^2) can be calculated from the equation Q = VA, where V is the seepage velocity, A is the cross-sectional area, and Q is the discharge Discharge ranges from 1.74E-04 to 1.04E-03 cfs for this LAU cross-section Because of the high clay content in the upper LAU, it is likely that similar discharges could be calculated for parts of the MAU.

In the case of the basalt aquifer in the vicinity of MW-11, the seepage velocity ranges from 0 001 to 0.003 feet/second based on the hydraulic conductivities (6,832.53 and 14,102 g/d/ft^2), an hydraulic gradient of 0 029 foot/foot, and an effective porosity of 25 percent.

Effective porosity for permeable basalts range from 10 percent to over 50 percent. The 25 percent value is sufficiently conservative given the highly fractured state of the unit. Discharge through a 50-foot thick by 100-foot long cross-section of basalt ranges from 5 cfs at the lower seepage velocity to 15 cfs at the higher one

3.4 Dilution Effects

An estimate of the effect of the high rate of underflow in the basalt unit with respect to downward moving ground water in the LAU impacted by tailings pond leachate can be calculated using seepage velocities and a mixing equation. Vertical seepage in the LAU will be largely controlled by the scattered clay units Using the lowest and the average vertical hydraulic conductivity (0 011 and 1 569E+02 g/d/ft^2) from the laboratory results for the MAU (which contains similar lithologies) and a downward vertical gradient between MW-7A (MAU) and MW-7C (LAU) of 0 33 foot/foot, a range of vertical seepage velocity can be calculated. Porosity was estimated to be 20 percent

$$Vs = \frac{KI}{7\ 48\ ne}$$

Seepage velocity ranges from 2 8 E-08 to 4 006 E-04 feet/second.

Vertical discharge from the LAU along a 10,000 ft^2 surface at the top of the basalt ranges from 2 71E-04 cfs to 4 006 cfs (Q = VA)

The dilution effect of the underflow in the basalt on ground water discharging from the LAU can be calculated from a mixing formula using the following equation:

$$Cm = \frac{(Cb\ Qb) + (C_{LA}\ Q_{LA})}{Qb + Q_{LA}}$$

where Cm = concentration in underflow due to mixing.

Cb = sulfate (SO_4) concentration in ground water from the basalt (MW-11 = 78 mg/L).

Qb = discharge through a 50-foot thick by 100-foot long cross-section of basalt

C_{LA} = sulfate concentration (MW-7C = 613 mg/L) in the LAU.

Q_{LA} = vertical discharge over a 10,000 ft^2 surface (100 feet by 100 feet).

Using the range of discharges calculated for the LAU (Q_{LA}), the resulting sulfate concentration in the underflow through the basalt would range from 43 32 mg/L to 315 98 mg/L These results suggest that underflow in the volcanic unit can dilute LAU seepage to concentrations well below State standards

Since the Red River cuts through the Santa Fe Formation east of Questa Springs, the mixing equation was used to estimate the dilution effect of the Red River flow on a discharge from the LAU. Unpublished results from a 1993 study of the Red River by Vail Engineering gave a flow rate for the Red River above Questa Springs of 31 4 cfs and a sulfate concentration of 141 mg/L. Using the higher discharge from the LAU calculations (1 04E-03 cfs) and a sulphate concentration of 613 mg/L (MW-7C), the resulting mixing concentration would be 141.00 mg/L Ground water discharging from the LAU into the Red River at the elevated sulfate concentration would have no effect on the water quality of the river. Discharge from the MAU would be in the same range as the upper LAU and similar dilution effects would be anticipated.

3.5 Chemistry

This discussion of the ground water chemistry is based on the analytic results of monitor well water samples collected as split samples with the New Mexico Environmental Department on August 17 and 18, 1993 The results of the chemical analyses are presented in Appendix C, Plate C-1 Additional chemistry data from documents in Molycorp files or from other consultants' reports are also presented in this discussion

Plate C-2 shows a series of STIFF diagrams comparing the ground-water chemistry of the monitoring wells MW-10, MW-11, and MW-CH belong to a different set of water quality measurements than the rest of the monitoring wells. Wells MW-10 and MW-11, which are located down-gradient from the tailings ponds, produce high quality water and are characterized by low Total Dissolved Solids (TDS) and low sulphate content. Water from these wells is of higher quality than a recently (April 1993) collected water sample form the Red River upstream of Questa Springs which showed a TDS at 268 mg/L and sulphate at 141 mg/L. The third well of this group is the change house well (MW-CH) which appears to be screened in the MAU and LAU (based on depth of the perforated intervals; no lithologic log is available). This well has a slightly higher TDS, a lower sulphate, and a higher sodium, potassium, and bicarbonate content compared to all of the other wells. MW-CH is located east of the tailings pond behind Dam No. 1 and, based on flow directions for the MAU and LAU, may be indicative of some of the upgradient water chemistry. The water chemistry at the remaining monitoring wells can be characterized as a high TDS, calcium-sulphate water.

The principal components of the tailings pond leachate that exceed New Mexico State Standards are Total Dissolved Solids (TDS) and sulphate (Appendix C, Plates C-1 and C-2). The higher concentrations of TDS and sulphate occur in wells located east of Dam No 4 and south

and east of Dam No. 1 (see Figure 7) TDS and sulphate concentrations are high in the UAU and MAU units over the same area Significantly, concentrations are lower in the LAU (MW-7C and MW-10) where the LAU (based on head relationships) appears to be a confined aquifer or part of a regional ground-water discharge zone. A conductivity measurement at MW-9B (LAU) gave a reading of 230 micromhos (08/18/93) similar to the measurement at MW-10 (240 micromhos) where the TDS and sulphate values are quite low. Although the head relationship between the MAU and the LAU are unknown at MW-9, the hydraulic gradient may be upward here as well (based on the low conductivity reading) The water sample at MW-9B was described as very muddy, so the reliability of the conductivity measurement is questionable.

The water-level surface within the tailings pond material (Molycorp data) slopes southward toward the Dam No 1 at a hydraulic gradient of 0 22 foot/foot, significantly steeper than gradients within the Santa Fe units. MW-7C (LAU) has elevated concentrations of TDS and sulfate, compared to other LAU wells to the south of Dam No 1. This condition suggests that heads in the UAU and MAU beneath the tailings ponds are higher than those in the underlying LAU and that some leachate-impacted ground water moves down into the LAU. Below the ponds, the bulk of the downward-moving leachate may be concentrated in perched zones within the UAU and may migrate south and west in the MAU From the toe of the Dam No. 1 southward, the heads are such that the vertical gradient is upward between the LAU and the higher units and the TDS and sulfate remain concentrated in the UAU/MAU. With southward flow, TDS and sulfate are attenuated in the confined LAU, and monitor wells intercepting this unit have low concentrations of TDS and sulfate The elevated concentrations of TDS and sulfate southeast of Dam No 1 in MW-4 (UAU/MAU well) are likely caused by the head build up behind the east-trending ridge between the pond and MW-4

Plate C-3 illustrates a series of histograms showing changes in TDS and sulfate for the period 1988 to 1993, for MW-1 through -4 and for MW-A, -B, and -C Except for a decline in these components at MW-1, the changes at MW-2, -3, and -4 seem to fluctuate. This fluctuation may be a function of head changes in the pond area possibly related to year-to-year variations in natural recharge from melting snow In contrast, MW-A and MW-C show a trend of increasing concentration with time. These increases occur in the shallow UAU, in wells constructed near the toe of Dam No 1 The rising concentration may also result from changes in head. If the head within the pond material declines with time because no new tailings are accumulating, then residence time for the water within the pond sediment increases and concentrations may rise. Shallow wells near the toe of the dam would be particularly responsive to such changes.

South of Dam No 4, the basalt aquifer, which has a high rate of underflow (see Section 3.4), lies at a shallow level beneath the tailings pond. The water sample from this well shows very low concentrations of TDS (267 mg/L) and sulfate (78 mg/L) This sulphate concentration is lower than that in the Red River north of Questa Springs (141 mg/L) according to unpublished data from Vail Engineering (1993) If tailings leachate is moving down into the basalt aquifer, it

is rapidly diluted by the southwesterly underflow in the basalt and the monitor well near the toe of the dam produces high quality water (for example, see STIFF diagram, Plate C-2)

Southeast of Dam No 4, MW-1 is screened in the volcanic unit. This well has slightly elevated TDS (1,051 mg/L) and sulfate (540 mg/L) with respect to State standards Head relationships between the volcanic unit and the overlying sediments are unknown here and it is possible that water from the overlying units has moved down into the aquifer However the heads in the sedimentary section above the basalt at MW-8 was lower (132 feet bgs) than the head in the screened basalt (105 feet bgs) at the time of well construction The water-level elevation for the basalt can not be confirmed until after MW-8 is repaired. If these head relationships are correct, this would indicate the basalt is confined east of Dam No. 4 and leachate-impacted water would be derived from upgradient sources where higher heads in the sediments might cause a downward gradient. It is also possible that, since flow in the MAU is to the southwest, some ground water having high TDS/sulfate concentrations might move across the fault zone into the basalt. Farther to the west, the normal underflow in the basalt is able to dilute tailings pond concentrations Once MW-8 is repaired, water level and water quality can be measured and further clarification of the ground-water movement in this area may be possible.

There is some evidence that the fault east of MW-1 may exert some control on the movement of ground water toward the Red River If this fault is projected to the river, it would approximately correspond to the Questa Springs area and the springs may be directly related to the structure. Water from Questa Springs is piped to the fish hatchery (approximately 4 5 downstream from the springs). This water has a TDS of 173 mg/L and a sulphate concentration of 80 mg/L (Vail Engineering data, 1993) These concentrations are comparable with LAU or volcanic aquifer water It is possible that, with the southerly flow direction in the LAU, there is a component of flow parallel to the structure. The temperature of this water (8.3°C) is perhaps more compatible with shallow ground water than the temperature (16°C) of the deeper flow system in the volcanics (Vail Engineering data, 1993).

The deeper private wells (P-4 and P-5) south of the tailings ponds have good quality water in terms of TDS and sulfate. Although the P-4 data are fairly old (1988), TDS was 270 mg/L and sulfate was 88 mg/L. Well P-4 is a deep well (175 bgs), is partly screened in the volcanic unit, and is partly in the overlying sedimentary material. Well P-5 is 131 feet deep, which is enough to be into the LAU (perforated interval unknown). The TDS concentration for P-5 is 270 mg/L and sulphate is 112 mg/L (09/15/93) The high concentrations of TDS and sulfate in the shallower wells (67 to 90 feet bgs) may result from these wells being largely screened in the UAU and MAU Existing logs for these wells are too generalized to be certain of the stratigraphy south of the monitor wells

3.6 Summary of Hydrogeology

The major points derived from the analyses of the hydrogeological conditions in the area of the tailings ponds are

- Underflow of high quality water in the regional volcanic aquifer that extends beneath the site appears, through dilution, to reduce the highest concentrations of pond-related TDS and sulfate in ground water from the LAU to levels well below State standards.

- Ground water that flows to the Red River from the MAU or LAU moves with sufficiently low seepage velocity and resulting low discharges that dilution is accomplished by the large flows that move through the channel of the river.

- Ground water from the LAU may be diverted toward the river along a hydrogeological boundary created by the fault east of MW-1 and appears to reach the surface at Questa Springs. Questa Springs water is a cold, low TDS/low sulphate water that is closer in chemistry to the LAU or possibly the deeper volcanic aquifer water (if there is an upward gradient along the fault) than to the MAU or LAU ground water.

- The bulk of the pond-related ground water is concentrated in the UAU and MAU. Concentrations of TDS and sulphate are affected by proximity to the tailings ponds, particularly Dam No. 1, and to heads developed within the tailings pond material and the underlying hydrogeological units.

- The LAU contains high quality water except near the toe of Dam No. 1 From the dam northward, heads may build up in the overlying units such that leachate may move down into the LAU. South of the dam, decreasing heads in the UAU and MAU and upward hydraulic gradient conditions in the LAU (higher heads relative to the overlying units) may result in no downward movement of pond-related water to the LAU.

- The deeper private wells (P4 and P5) are screened partly in the LAU and the volcanic unit and produce good quality water. The shallower private wells (less than 100 feet bgs) appeared to be screened mainly in the MAU or UAU These wells have the high concentrations of TDS and sulfate.

4.0 RECOMMENDATIONS

Several responses may be implemented for further investigation and remediation of ground water containing TDS and sulfate concentrations associated with leachate from the tailings ponds These responses fall into two categories 1) intercepting and extracting seepage and ground water containing high levels of TDS and sulfate, and 2) monitoring the water quality to ascertain any changes in input as well as extraction processes Although the water quality issues addressed in this report have focused on TDS and sulfate, the extraction of ground water having high levels of TDS and sulfate will also lead to reduction in other components that exceed State standards (for example Molybdenum at MW-2 and MW-C, manganese at MW-2, MW-C, and MW-10, and fluoride at MW-C) Recommended responses to the issues addressed in the report are

- Extract seepage waters in the UAU by expanding seepage barrier No 2 system west of MW-1
- Construct a line of wellpoints by auger drilling to a depth of 15 feet along an east-west line south of MW-2 to extract seepage from the UAU. The volume of seepage extracted will be used to evaluate feasibility of a seepage barrier or grout curtain.
- Site and construct four extraction wells (Figure 8) to remove impacted ground water primarily from the MAU These wells would be sited within the current Molycorp property boundary Extraction Well No 1 would be constructed northwest of MW-1 and downgradient from the seepage barrier No 2 Extraction Well No. 2 would be located northeast of MW-7 Extraction Well No. 3 would be located northeast of MW-2 Extraction Well No 4 would be located just up slope from MW-4. Extractions Wells 2 and 3 might be more effective if they were located southwest of their plotted position. This relocation would depend on access or availability of the parcel of private land between MW-1 and MW-2 Extraction wells in this private parcel of land would require a downgradient monitor well with piezometers in the UAU, MAU, and LAU to monitor water quality changes
- Prior to the construction of any of the proposed extraction wells, a pump would be placed in MW-4 to test the response of the MAU to pumping at different rates Discharge from MW-4 will be transported in a tanker truck and disposed of through Outfall 002
- Because the MAU is dominated by clay-rich units and contains only minor sandy gravel beds, constructing an effective extraction well will

require drilling an initial test well at Site 2 or 3 (see Figure 8) The test hole would be used to evaluate whether a well screened in water-bearing zones within the MAU would create a capture zone or cone of depression that effectively extracted MAU ground water It may be necessary to consider screens in the LAU, which might more effectively dewater the MAU and extract high TDS/sulfate ground water Because there is an upward gradient from the LAU to the MAU, pumping in the LAU should not cause degradation of the LAU, particularly if the extent of the dewatered zone is maintained within the MAU by controlling the pumping rate. If the LAU is used in this manner, it should be drilled to a depth greater than the existing monitor wells in order to get beyond the clay-bearing zone at the top of the unit.

- Water recovered from the extraction wells would either be added to the 002 Outfall system (if it did not exceed NPDES requirements), or it would be pumped to Dam 5A along the west side of the Dam No 4 complex.

- A deep (approximately 400 feet bgs) test hole should be drilled along the ridge between Dam No 1 and MW-4 The purpose of the borehole would be to.

    1) evaluate heads or water-level surface elevations for the three hydrogeologic units versus heads in the pond area and heads down-gradient of the test hole;

    2) define high TDS/sulfate producing zones using geophysical logging (for example, resistivity logs); and

    3) evaluate the stratigraphic section through both lithologic and geophysical logging.

- Continue to monitor water levels and water quality on a semi-annual basis. The purpose of the monitoring is to evaluate any changes in water chemistry related to head changes in the tailings pond area and to evaluate the effectiveness of the extraction system. Key sites along the Red River, in particular Questa Springs, should be part of this monitoring program. The results of the monitoring program should be reviewed on a semi-annual basis to evaluate the need for additional monitoring or extraction wells.

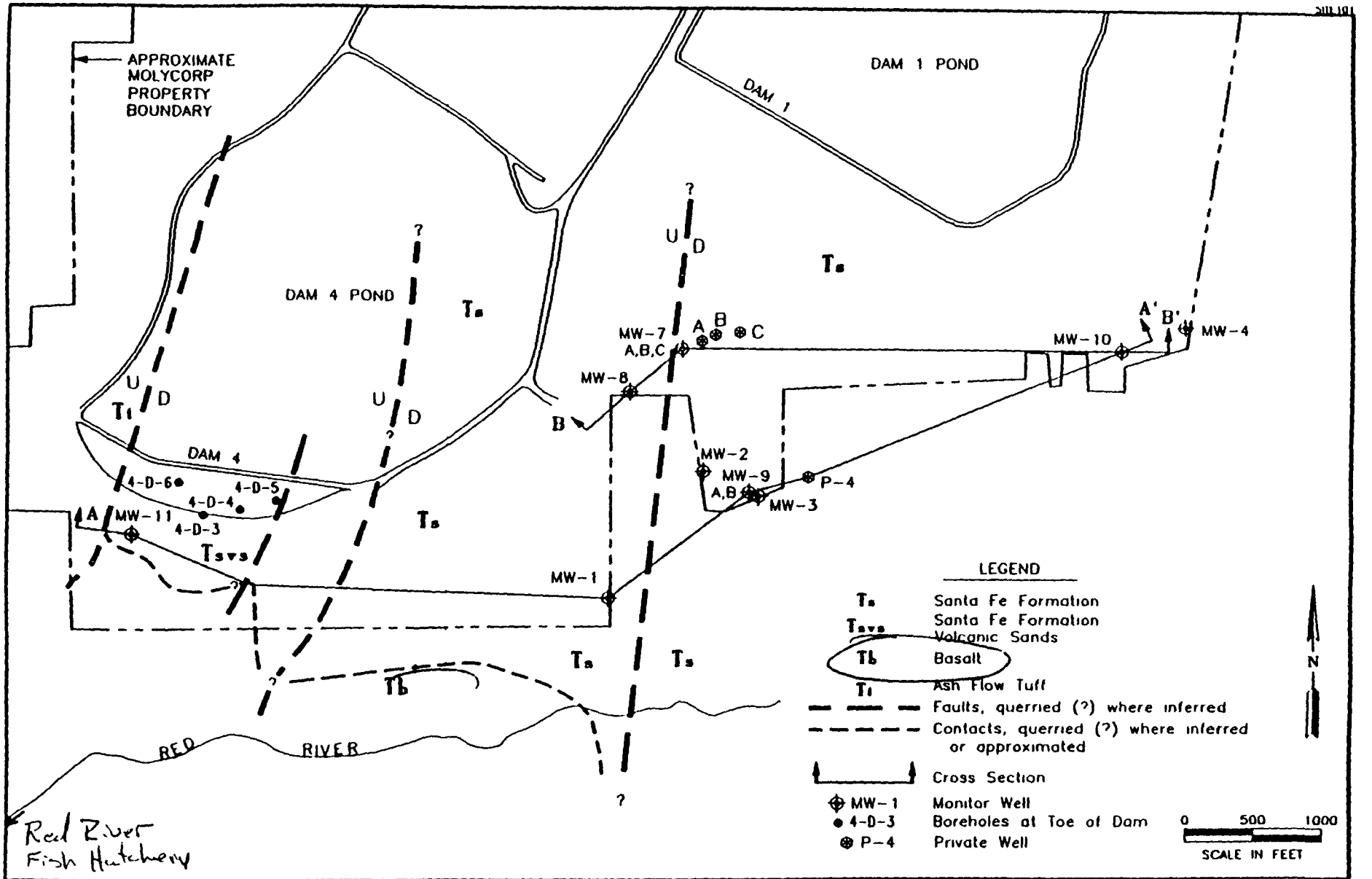


FIGURE 2

SOUTH PASS RESOURCES, Inc.

PROJECT No	DATE	AUTHOR	DRAWN BY
001.02	9-20-93	VH	MOM

GEOLOGIC MAP – TAILINGS PONDS AREA

Molycorp, Inc
Questa, New Mexico

12

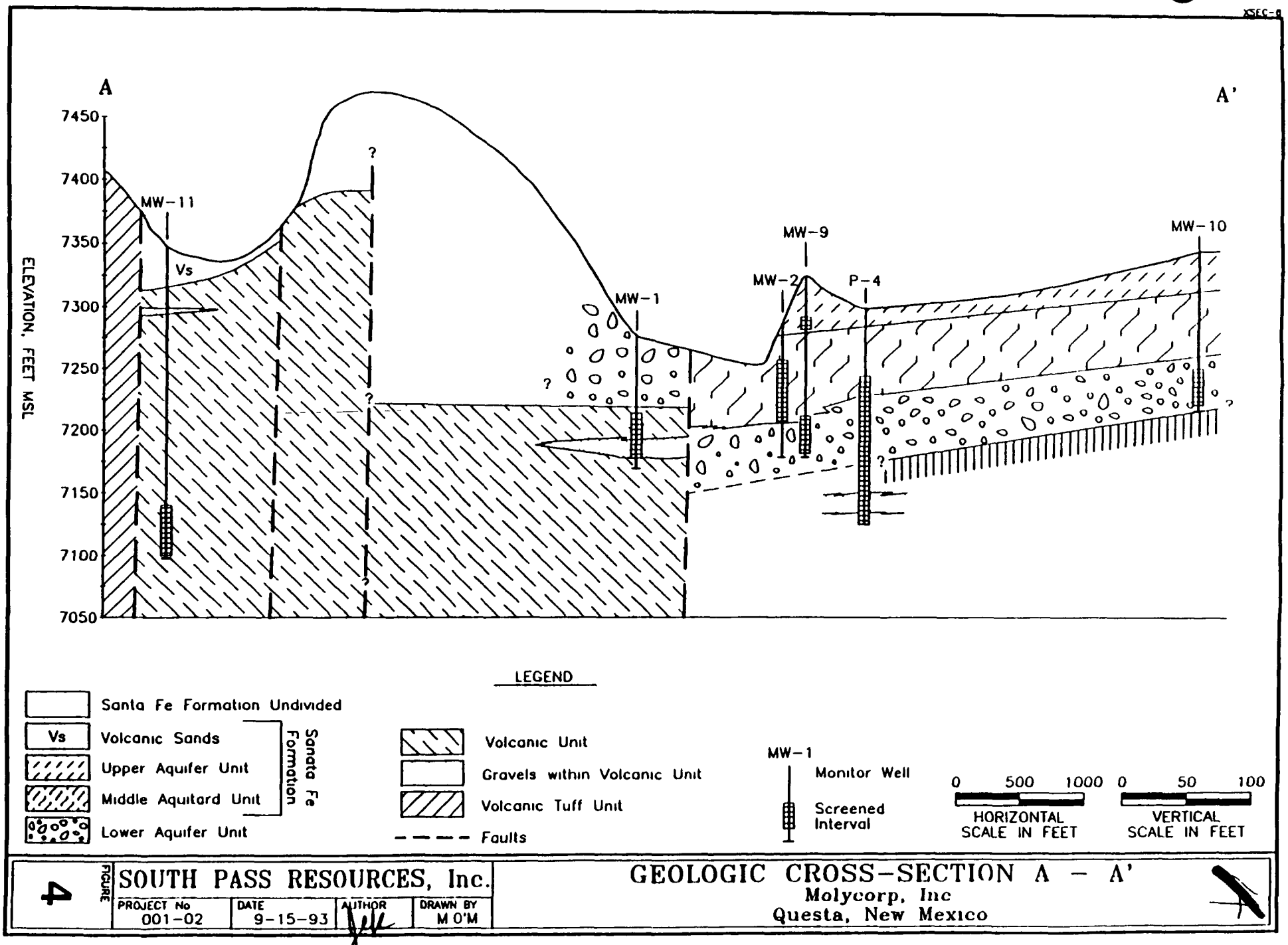


FIGURE	SOUTH PASS RESOURCES, Inc.			
4	PROJECT No 001-02	DATE 9-15-93	AUTHOR	DRAWN BY M O'M

GEOLOGIC CROSS-SECTION A – A'

Molycorp, Inc
Questa, New Mexico

22

TABLE C-1
MONITOR WELL CHEMISTRY

Boring or Monitor Well #	MW-1	MW-2	MW-3	MW-4	MW-A	MW-C	MW-7A	MW-7B	MW-7C	MW-9A	MW-10	MW-11	CH
pH	7 9	7 7	7 4	7 3	7 4	7 2	7 1	8 9	10 6	7 6	8 1	8 1	7 7
TDS	1051	1553	1393	1021	1115	1940	1046	1220	990	759	191	267	305
Sulfate	540	900	793	543	603	1113	571	651	613	355	54	78	57
Sodium	56	102	72	86	58	117	41	80	81	47	36	32	98
Potassium	3 5	4 7	3 5	1 4	2 4	6 5	1 9	<1 0	157	1 3	1 8	3 1	117
Calcium	169	231	219	155	189	339	185	163	119	130	18	34	30
Magnesium	39	52	48	38	38	61	36	3 1	<1	26	3 3	11	6
Arsenic	< 005	< 005	< 005	< 005	< 005	< 005	< 005	< 005	< 005	< 005	< 005	< 005	< 005
Aluminum	< 05	< 05	< 05	< 05	< 05	< 05	< 05	< 05	< 05	< 05	< 05	< 05	< 05
Cadmium	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005	< 0005
Chromium	< 001	< 001	< 001	< 001	< 001	< 001	< 001	< 001	0 034	< 001	0 002	0 001	0 003
Lead	< 002	< 002	< 002	< 002	< 002	< 002	< 002	< 002	0 006	< 002	< 002	< 002	< 002
Molybdenum	0 08	1 8	< 005	0 21	0 50	2 8	0 04	< 005	< 005	0 02	0 02	0 09	< 005
Iron	0 06	0 06	0 03	0 05	0 20	0 05	< 02	< 02	0 03	< 02	0 03	< 02	< 02
Manganese	0 03	0 58	< 01	< 01	0 05	2 6	< 01	< 01	< 01	1 2	< 01	0 01	< 01
Copper	< 01	< 01	< 01	< 01	< 01	< 01	< 01	< 01	< 01	< 01	< 01	< 01	< 01
Zinc	0 014	0 00	0 00	0 00	0 00	0 00	0 03	0 20	0 008	0 12	0 038	0 014	0 007
Carbonate Alkalinity	<1	<1	<1	<1	<1	<1	<1	10	24	<1	<1	<1	<1
Bicarbonate Alkalinity	148	116	17	18	156	18	134	<1	<1	169	66	81	187
Hydroxide Alkalinity	<1	<1	<1	<1	<1	<1	<1	3	300	<1	<1	<1	<1
Fluoride	0 34	0 92	0 45	0 71	0 37	2 8	0 25	0 19	0 78	0 16	0 65	0 66	1 20

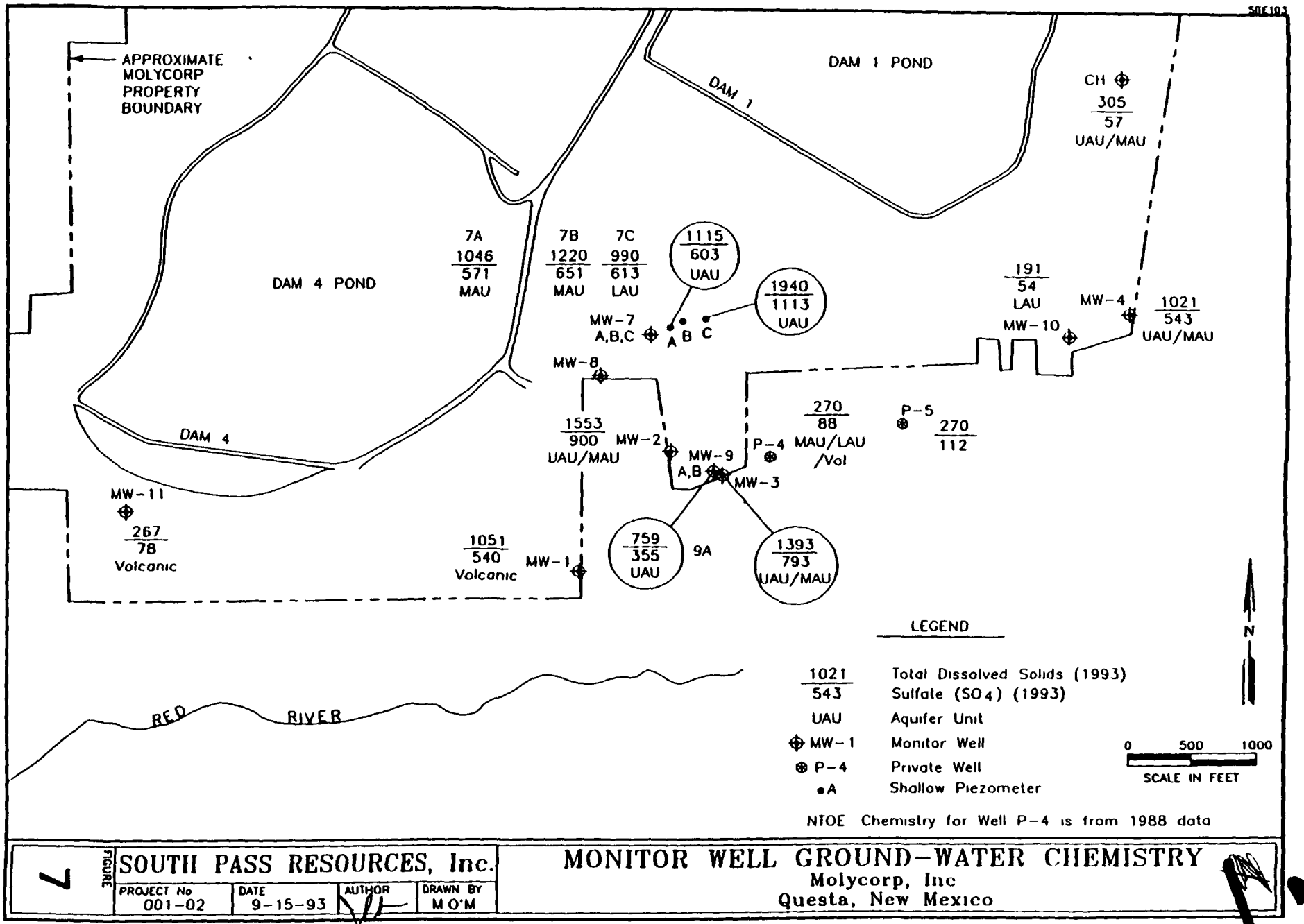


FIGURE 7

SOUTH PASS RESOURCES, Inc.

PROJECT No	DATE	AUTHOR	DRAWN BY
001-02	9-15-93		M O'M

MONITOR WELL GROUND-WATER CHEMISTRY

Molycorp, Inc
Questa, New Mexico

Molycorp Inc

Questa Division
P O Box 469
Questa New Mexico 87556
Telephone (505) 586-0212

UNOCAL 76
MOLYCORP

November 2, 1993

Karen McCormack
Environment Department
Water Resource Specialist
Ground Water Section
P O Box 26110 - Runnels Bldg
Santa Fe, NM 87502

Dear Ms McCormack

Enclosed are the analyses of the three private wells we recently sampled When the analysis of MW-8 is complete, we will send you the results If you have any questions, please call me at 586-0212, extension 3001

Yours truly,

David R Shoemaker
Mine Manager

DRS/bjd

enclosures

RECEIVED
NOV 05 1993
GROUND WATER BUR

Molycorp, Inc.

Questa Division
P O. Box 469
Questa, New Mexico 87556
Telephone. (505) 586-0212

2

UNOCAL 76
MOLYCORP

October 4, 1993

Daniel Duran
Embargo Road
PO Box 24
Questa, NM 87556

Dear Mr. Duran:

Molycorp would like to extend its thanks to you for allowing us to sample water from your private well. This sampling program is part of a hydrogeolgic study to evaluate the groundwater conditions at our tails disposal area.

The attached Molycorp chemical analysis report of your well water (which you should already have a copy of) shows that all chemical elements and combinations that we analyzed for are well below NM water quality standards limits. However, in order to guard against the possibility of future surface or near-surface runoff contaminating your well, Molycorp, with this letter, is offering to connect your residence to Questa Village water. Molycorp will pay for the water meter installation and hookup by the Village, the fee for the property owner not transferring water rights to the village, and the cost of a licensed plumber to connect the meter to the house supply line.

Please note that the minimum water bill, you the customer, will pay to the village, will be $14.50 per month plus tax ($174.00 per year); and is based on the consumption of 3,000 gallons of water. The Village has informed us that this minimum is typical for most residents.

Please contact Molycorp's laboratory supervisor Fernando Martinez if you wish to accept the offer, or have any further questions.

Yours truly,

David R. Shoemaker
Mine Manager

MolyCorp, Inc
A Unocal Company
Questa Division
P O Box 469
Questa, New Mexico 87556
Telephone (505) 586-0212

3

UNOCAL 76
MOLYCORP

MONITOR WELL P4-B FELICIANO RAEL PRIVATE WELL
SAMPLED 9/27/93
NORTH SIDE EMBARGO ROAD

CH-Well (ref. 43)

			NEW MEXICO WATER QUALITY STANDARDS
PH	7.5 (STANDARD UNITS)		PH 6-9 SU
SO4	(SULFATES) 97 PPM		SO4 600 PPM
TDS	(TOTAL DISSOLVED SOLIDS) 398 PPM		TDS 1000 PPM
MO	(MOLYBDENUM)	<.005 PPM	MO 1.0 PPM
FE	(IRON)	<.05 PPM	FE 1.0 PPM
MN	(MANGANESE)	<.01 PPM	MN 0.2 PPM
CD	(CADMIUM)	<.005 PPM	CD .010 PPM
CU	(COPPER)	.010 PPM	CU 1.0 PPM
PB	(LEAD)	<0.1 PPM	PB .05 PPM
F-	(FLUORIDE)	.45 PPM	F- 1.6 PPM
ZN	(ZINC)	.89	ZN 10.0 PPM

.007

Questa Division
P O Box 469
Questa, New Mexico 87556
Telephone (505) 586-0212

4

UNOCAL 76
MOLYCORP

MONITOR WELL P5 DANNY DURAN PRIVATE WELL
SAMPLED 9/15/93

CH-Well
(res 43)

			NEW MEXICO WATER QUALITY STANDARDS	
PH	7.7 (STANDARD UNITS)		PH	6-9 SU
SO4	(SULFATES) 112 PPM		SO4	600 PPM
TDS	(TOTAL DISSOLVED SOLIDS) 276 PPM		TDS	1000 PPM
MO	(MOLYBDENUM)	<.005 PPM	MO	1.0 PPM
FE	(IRON)	0.08 PPM	FE	1.0 PPM
MN	(MANGANESE)	<.01 PPM	MN	0.2 PPM
CD	(CADMIUM)	<.005 PPM	CD	.010 PPM
CU	(COPPER)	<.01 PPM	CU	1.0 PPM
PB	(LEAD)	<.1 PPM	PB	.05 PPM
ZN	(ZINC)	.21 PPM	ZN	10.0 PPM
F-	(FLUORIDE)	.42 PPM	F-	1.6 PPM

.007

MONITOR WELL FORMERLY
SAMUEL DURAN

Molycorp Inc
A Unocal Company
Questa Division
P O Box 469
Questa New Mexico 87556
Telephone (505) 586-0212

5

UNOCAL 76
MOLYCORP

MONITOR WELL P9 DELMIRIA MEDINA PRIVATE WELL
SAMPLED 9/17/93
EMBARGO ROAD

CH-Well (ref. 43)

			NEW MEXICO WATER QUALITY STANDARDS	
PH	(STANDARD UNITS)	7.3	PH 6-9 SU	
SO4	(SULFATES)	94 PPM	SO4 600	PPM
TDS	(TOTAL DISSOLVED SOLIDS)	270 PPM	TDS 1000	PPM
MO	(MOLYBDENUM)	<.005 PPM	MO 1.0	PPM
FE	(IRON)	0.120 PPM	FE 1.0	PPM
MN	(MANGANESE)	<.143 PPM	MN 0.2	PPM
CD	(CADMIUM)	<.005 PPM	CD .010	PPM
CU	(COPPER)	.01 PPM	CU 1.0	PPM
PB	(LEAD)	<.1 PPM	PB .05	PPM
.007 ZN	(ZINC)	.08 PPM	ZN 10.0	PPM
F-	(FLUORIDE)	.70 PPM	F- 1.6	PPM

RECORD OF TELEPHONE CONVERSATION

Time: 530 PM	Date: 8-30-95
Originating Party: Stuart Kent	Other Parties: Janie Duran
NMED - Superfund Program	Private Well owner below Tailings Pond

Subject: Groundwater use

Discussion:

+ Mr Duran stated that he & his wife no longer use water from their well for drinking purposes, now they use & solely for washing cars & watering lawn

+ Water supply was switched on Molycorp in late 1993 to early 994

+ Referred to Irrigation Ditch as Acequia de Media (= Medina?)

= tried to call Delmira Medina, other private well user but ph # unlisted(?)

Stuart Kent

Signed

1990 CPH-1-33

1990 Census of Population and Housing

Summary Population and Housing Characteristics

New Mexico

Issued August 1991

U.S. Department of Commerce
Robert A. Mosbacher, Secretary
Rockwell A. Schnabel, Deputy Secretary

Economics and Statistics Administration
Michael R. Darby, Under Secretary
for Economic Affairs and Administrator

BUREAU OF THE CENSUS
Barbara Everitt Bryant, Director

CONTENTS

Page

List of Statistical Tables iv
How to Use This Census Report I-1
Table Finding Guide II-1
User Notes III-1

Statistical Tables (For detailed list of statistical tables, see page iv) 1

APPENDIXES

A Area Classifications A-1
B Definitions of Subject Characteristics B-1
C Accuracy of the Data C-1
D Collection and Processing Procedures D-1
E Facsimiles of Respondent Instructions and Questionnaire Pages E-1
F Data Products and User Assistance F-1
G Maps G-1

LIST OF STATISTICAL TABLES

An asterisk (*) indicates that the table was omitted because there were no qualifying geographic areas or population groups.

Table		Page
1.	**Age: 1990** State County County Subdivision Place	1
2.	**Age: 1990** State County Place and (In Selected States) County Subdivision	7
3.	**Sex, Race, and Hispanic Origin: 1990** State County County Subdivision Place	11
4.	**Sex, Race, and Hispanic Origin: 1990** State County Place and (In Selected States) County Subdivision	17
5.	**Household, Family, and Group Quarters Characteristics: 1990** State County County Subdivision Place	21
6.	**Household, Family, and Group Quarters Characteristics: 1990** State County Place and (In Selected States) County Subdivision	25
7.	**Structural and Vacancy Characteristics: 1990** State County County Subdivision Place	28
8.	**Structural and Vacancy Characteristics: 1990** State County Place and (In Selected States) County Subdivision	32
9.	**Occupancy and Financial Characteristics for Owner-Occupied Housing Units: 1990** State County County Subdivision Place	35
10.	**Occupancy and Financial Characteristics for Owner-Occupied Housing Units: 1990** State County Place and (In Selected States) County Subdivision	39
11.	**Occupancy and Financial Characteristics for Renter-Occupied Housing Units: 1990** State County County Subdivision Place	42
12.	**Occupancy and Financial Characteristics for Renter-Occupied Housing Units: 1990** State County Place and (In Selected States) County Subdivision	46
13.	**Occupied Housing Units by Race and Hispanic Origin of Householder: 1990** State County County Subdivision Place	49
14.	**Occupied Housing Units by Race and Hispanic Origin of Householder: 1990** State County Place and (In Selected States) County Subdivision	53
15.	**Land Area and Population Density: 1990** State County County Subdivision Place	56
16.	**Land Area and Population Density: 1990** State County Place and (In Selected States) County Subdivision	58

[For definitions of terms and meanings of symbols, see text]

State Co[illegible] Co[illegible] Subdivision Place	Persons in households	All households	Family households: Total	Married-couple family	Female householder, no husband present	Nonfamily households: Total	Householder living alone: Total	65 years and over: Total	65 years and over: Female	Persons per—: Household	Persons per—: Family	Persons in group quarters: Total	Institutionalized persons	Other persons in group quarters
San Miguel County	24 454	8 701	6 405	[illegible] 486	1 408	2 296	1 980	757	522	2.81	3.31	289	444	345
Conchas Dam division	298	131	95	5	3	[illegible]	34	23	9	2.27	2.72	-	-	-
Mosquero village (pt.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Las Vegas division	18 782	6 735	[illegible] 906	[illegible]	1 199	[illegible] 829	1 589	503	429	2.79	3.30	289	444	345
Las Vegas city	[illegible] 320	5 131	[illegible] 655	2 [illegible]	[illegible] 017	[illegible]	1 299	[illegible]95	365	2.73	3.27	33	112	[illegible]21
Pecos division	3 [illegible]52	1 165	894	[illegible]9	126	[illegible]	212	53	44	2.96	[illegible]0	-	-	-
Pecos village	[illegible]12	335	261	[illegible]7	40	[illegible]	[illegible]0	[illegible]4	9	3.02	[illegible]43	-	-	-
Trementina division	238	115	[illegible]3	[illegible]	6	[illegible]	[illegible]0	21	9	2.07	2.60	-	-	-
Villanueva division	684	555	[illegible]37	[illegible]	74	[illegible]	55	[illegible]7	31	3.03	[illegible]46	-	-	-
Santa Fe County	9[illegible] 289	37 840	25 041	[illegible]	4 363	12 799	10 181	2 822	2 162	2.54	[illegible]12	2 639	1 666	73
Santa Fe division	60 629	25 164	15 577	[illegible]	3 045	9 [illegible]7	7 645	2 245	1 759	2.41	3.04	322	504	[illegible]18
Agua Fria CDP	3 7 7	1 339	959	[illegible]9	172	[illegible]0	[illegible]87	[illegible]4	41	2.78	[illegible]24	-	-	-
Santa Fe city (pt.)	[illegible]4 425	[illegible]2 741	3 898	[illegible] 177	2 804	[illegible] 843	7 061	2 147	1 687	2.38	3.02	316	[illegible]04	[illegible]12
Tesuque CDP (pt.)	[illegible]	2	2	-	-	-	-	-	-	6.00	6.00	-	-	-
Santa Fe North division	1[illegible] 975	5 471	3 981	2 937	687	1 [illegible]0	1 237	347	254	2.74	3.23	35	-	35
Chimayo CDP (pt.)	639	224	165	6	32	[illegible]	[illegible]0	17	16	2.85	[illegible]39	-	-	-
Cuyamungue CDP	[illegible]29	117	92	[illegible]	12	[illegible]	[illegible]8	3	3	2.81	3.18	-	-	-
Espanola city (pt.)	2 [illegible]79	794	[illegible]79	[illegible]3	156	[illegible]	[illegible]87	93	69	2.74	[illegible]24	-	-	-
Jaconita CDP	375	136	[illegible]01	6	9	[illegible]	31	12	8	2.76	3.25	-	-	-
Nambe CDP	246	475	336	[illegible]63	48	[illegible]9	20	36	25	2.62	3.20	-	-	-
Pojoaque CDP	[illegible] 037	365	268	[illegible]8	49	[illegible]7	81	11	8	2.84	3.32	-	-	-
San Ildefonso Pueblo CDP	[illegible]47	145	118	[illegible]	27	[illegible]	23	9	4	3.08	3.47	-	-	-
Santa Cruz CDP	2 504	821	665	[illegible]30	107	[illegible]6	[illegible]24	30	19	3.05	3.37	-	-	-
Santa Fe city (pt.)	[illegible]4	24	9		1		5	[illegible]	1	2.25	[illegible]53	-	-	-
Tesuque CDP (pt.)	1 478	657	388	235	60	[illegible]9	220	48	33	2.25	2.86	-	-	-
Santa Fe South division	20 685	7 205	5 483	[illegible]	631	[illegible] 722	1 299	230	149	2.87	3.29	282	1 162	120
Edgewood CDP (pt.)	2 880	943	800	722	49	[illegible]31	117	36	29	3.05	3.35	-	-	-
Eldorado at Santa Fe CDP	2 260	838	647	[illegible]73	54	[illegible]1	[illegible]30	[illegible]6	10	2.70	3.01	-	-	-
La Cienega CDP	[illegible]066	363	271	2[illegible]7	33	[illegible]2	73	21	8	2.94	3.46	-	-	-
Santa Fe city (pt.)	80	24	19	[illegible]7	-	-	4	1	-	3.33	3.74	[illegible]84	184	-
Sierra County	9 569	4 428	2 834	2 380	335	1 594	1 460	891	553	2.16	2.72	343	254	89
Truth or Consequences East division	7 630	3 640	2 265	1 873	295	1 375	1 269	799	502	2.10	2.66	340	254	86
Truth or Consequences city	5 884	2 835	1 685	1 354	252	1 [illegible]50	1 068	694	442	2.08	2.70	337	254	83
Williamsburg village	454	222	145	8	20	77	69	41	29	2.05	2.48	2	-	2
Truth or Consequences West division	1 939	788	569	[illegible]37	40	2[illegible]9	191	92	51	2.46	2.93	3	-	3
Socorro County	14 333	5 217	3 705	2 933	554	[illegible]12	1 254	[illegible]04	267	2.75	3.31	431	113	18
Claunch division	[illegible]22	46	34	[illegible]	3	[illegible]	[illegible]0	[illegible]	-	2.65	3.12	-	-	-
Magdalena division	2 804	835	666	[illegible]32	89	[illegible]9	154	50	24	3.36	3.88	-	-	-
Magdalena village	861	304	[illegible]30	[illegible]61	37	[illegible]	69	26	14	2.83	3.36	-	-	-
Socorro city (pt.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rio Grande division	11 407	4 336	[illegible] 005	2 [illegible]7[illegible]	[illegible]62	[illegible]	1 090	353	243	2.63	3.19	[illegible]31	113	318
[illegible]o city (pt.)	7 [illegible]69	3 015	2 035	[illegible]60	359	[illegible]0	791	262	187	2.58	3.15	[illegible]90	72	318
Taos [illegible]	23 089	8 752	[illegible] 131	[illegible]38	[illegible]155	[illegible]	2 240	746	546	2.64	3.20	29	19	10
Arroyo Hondo division	2 679	1 053	696	[illegible]6	103	[illegible]7	276	67	43	2.54	3.13	-	-	-
Questa village (pt.)	-	5	3	-	-		2	1	-	1.60	2.00	-	-	-
Penasco division	[illegible]257	434	323	[illegible]8	[illegible]47		[illegible]02	44	30	2.90	[illegible]47	-	-	-
Picuris division	[illegible]82	640	493	[illegible]50	107	[illegible]7	[illegible]34	69	47	2.94	3.41	-	-	-
Chamisal CDP	272	103	73	[illegible]	23	[illegible]	[illegible]9	17	14	2.64	3.22	-	-	-
Penasco CDP	[illegible]48	225	168	[illegible]	38	[illegible]	[illegible]	23	14	2.88	[illegible]40	-	-	-
Vadito CDP	[illegible]33	89	75	[illegible]4	8	[illegible]	[illegible]3	3	5	3.18	[illegible]53	-	-	-
Questa division	3 376	229	926	[illegible]3	122	[illegible]3	271	90	68	2.75	3.24	-	-	-
Questa village (pt.)	[illegible]99	575	[illegible]54	[illegible]4	68	[illegible]	[illegible]07	[illegible]3	32	2.95	3.40	-	-	-
Red River town	[illegible]37	163	[illegible]18	[illegible]9	7	[illegible]	37	4	3	2.37	2.82	-	-	-
Taos division	[illegible]1 236	4 437	[illegible] 991	[illegible]85	624	1 [illegible]46	1 231	392	297	2.53	3.12	29	19	0
Ranchos De Taos CDP	[illegible] 779	624	479	[illegible]9	85	[illegible]5	[illegible]19	28	17	2.85	3.26	-	-	-
Taos town (pt.)	3 980	[illegible] 698	1 052	[illegible]99	278	[illegible]	[illegible]62	208	171	2.34	3.01	29	19	10
Taos Pueblo division	2 206	784	[illegible]86	[illegible]38	139	[illegible]8	[illegible]73	68	52	2.81	[illegible]29	-	-	-
Taos town (pt.)	[illegible]6	27	[illegible]7		5		[illegible]	[illegible]	4	2.07	2.65	-	-	-
Taos Pueblo CDP	1 [illegible]87	400	308	[illegible]2	85	[illegible]	85	39	28	2.97	3.43	-	-	-
Tres Piedras division	[illegible]53	[illegible]75	116	[illegible]3	13	[illegible]	[illegible]3	16	9	2.59	[illegible]28	-	-	-
Torrance County	10 272	3 670	2 785	[illegible]2	330	[illegible]85	771	321	217	2.80	3.26	13	13	-
Encino division	536	213	[illegible]52	[illegible]5	9	[illegible]	55	19	13	2.52	3.06	-	-	-
Encino village	31	50	[illegible]9	[illegible]	3		11	7	3	2.62	3.08	-	-	-
Estancia division	8 018	[illegible] 806	2 169	1 [illegible]05	250	[illegible]37	543	207	136	2.86	3.29	13	13	-
Edgewood CDP (pt.)	[illegible]44	156	22	[illegible]	8	[illegible]	30	4	3	2.85	3.30	-	-	-
Estancia town	779	308	216	[illegible]	45	[illegible]2	86	51	38	2.53	3.08	13	13	-
Moriarty city	1 399	513	381	[illegible]99	71	32	115	55	38	2.73	3.23	-	-	-
Mountainair division	1 718	651	464	[illegible]72	71	[illegible]87	173	95	68	2.64	3.20	-	-	-
Mountainair town	926	358	239	[illegible]	51	[illegible]	110	65	49	2.59	3.24	-	-	-
Willard village	83	70	47	[illegible]9	6	[illegible]	21	11	8	2.61	3.36	-	-	-
Union County	4 069	615	1 150	956	146	[illegible]65	439	242	179	2.52	3.07	55	55	-
Clayton North division	860	341	251	224	20	[illegible]0	86	42	31	2.52	3.02	-	-	-
Clayton town (pt.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Des Moines village	168	71	46	41	4	[illegible]5	24	10	7	2.37	3.04	-	-	-
Folsom village	71	32	19	[illegible]	4	[illegible]	12	5	4	2.22	2.79	-	-	-
Grenville village	24	10	7	-	-		3	2	2	2.40	3.00	-	-	-
Clayton South division	3 209	1 274	899	732	126	37[illegible]	353	200	148	2.52	3.09	55	55	-
Clayton town (pt.)	2 429	989	670	523	116	[illegible]19	301	179	134	2.46	3.08	55	55	-
Valencia County	43 897	5 170	11 992	9 631	1 689	3 1[illegible]8	2 626	1 049	756	2.89	3.27	1 338	1 336	2
Belen division	14 748	5 365	4 074	3 204	655	1 [illegible]91	1 130	585	441	2.75	3.19	112	112	-
Belen city	6 435	2 310	1 711	1 214	396	[illegible]99	534	258	199	2.79	3.29	112	112	-
Los Chaves CDP (pt.)	[illegible]4	16	10	[illegible]	3	[illegible]	5	2	2	2.75	3.70	-	-	-
Los Trujillos-Gabaldon CDP (pt.)	1 841	622	495	[illegible]99	58	27[illegible]	107	51	38	2.96	3.33	-	-	-
Rio Communities CDP	3 233	[illegible] 356	[illegible] 014	[illegible]78	108	[illegible]42	305	201	163	2.38	2.78	-	-	-
Los Lunas division	29 149	[illegible] 805	[illegible] 918	6 427	[illegible] 034	1 [illegible]87	1 496	464	315	2.97	3.32	1 226	1 224	2
Bosque Farms village	3 791	310	[illegible] 110	[illegible]73	88	[illegible]00	149	44	29	2.89	3.13	-	-	-
Isleta Pueblo CDP (pt.)	348	103	79	[illegible]7	12	[illegible]	23	7	3	3.38	3.92	-	-	-
[illegible]aves CDP (pt.)	3 828	[illegible] 301	1 062	[illegible]36	104	[illegible]9	189	62	39	2.94	3.28	-	-	-
[illegible]nas village	5 936	2 059	1 602	1 124	374	[illegible]57	364	115	84	2.88	3.27	77	77	-
[illegible]rujillos-Gabaldon CDP (pt.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meadow Lake CDP	1 590	519	401	343	33	[illegible]18	96	31	19	3.06	3.51	-	-	-
Peralta CDP	3 182	1 111	892	757	97	[illegible]19	174	67	43	2.86	3.22	-	-	-
Tome-Adelino CDP	1 695	573	461	379	63	[illegible]12	94	31	27	2.96	3.31	-	-	-
Valencia CDP	3 907	1 289	1 060	[illegible]79	117	[illegible]29	177	53	34	3.03	3.34	10	10	-

RECORD OF TELEPHONE CONVERSATION

Time: 10.00	Date: 6-16-93
Originating Party: Stuart Kent	Other Parties: Mrs Perry US Postoffice
NMED - Superfund	Questa

Subject: # of people in Cerro

Discussion:

+ She used to work in the Cerro Postoffice

+ She wasn't sure of the total population but did say there were 144 mail boxes

Calculations:

From 1990 Census, # persons / household in Cerro (Questa Division) is 2.75

Population of Cerro = 144 mailboxes x household / 1 mailbox x 2.75 persons / hshld

= 396

Stuart Kent
Signed

Split Analysis from Molycorp (partial)

Rael Well

(1)

&'Times New Roman"&BMolycorp Laboratory Data &'Times New Roman"&BApril 1994 Sampling Event

Groundwater (private wells)								
W-5	W-5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Aluminum	25 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Antimony	40 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Arsenic	2 UJ	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Barium	70 8 B	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Beryllium	2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Cadmium	5 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Calcium	90000	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Chromium	10 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Cobalt	10 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Copper	5 1 B	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Iron	25 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Lead	2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Magnesium	16900	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Manganese	5 7 B	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Mercury	0 2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Nickel	20 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Potassium	760 B	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Selenium	3 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Silver	10 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Sodium	28100	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Thallium	2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Vanadium	10 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Zinc	216	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Aluminum	71 2 UJ	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Antimony	40 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Arsenic	2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Barium	69 4 B	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Beryllium	2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Cadmium	5 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Calcium	88100	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Chromium	10 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Cobalt	10 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Copper	7 7 B	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Iron	1310 J	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Lead	2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Magnesium	16100	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Manganese	8 B	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Mercury	0 2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Nickel	20 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Potassium	1460 B	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Selenium	3 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Silver	10 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Sodium	27100	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Thallium	2 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Vanadium	10 U	ug/l
W-5	W-5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Zinc	367	ug/l

Herrera Well

&'Times New Roman &BMolycorp Laboratory Data & 'Times New Roman"&BApril 1994 Sampling Event

W-6 5	W 6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Aluminum	25	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Antimony	40	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Arsenic	2	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Barium	34 3	B	ug/l
W-6 5	W 6 5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Beryllium	2	U	ug/l
W-6 5	W-6 5M	21-Apr 94	Groundwater	CLP-Metals (Dissolved)	Water	Cadmium	5	U	ug/l
W-6 5	W 6 5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Calcium	231000		ug/l
W-6 5	W 6 5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Chromium	10	U	ug/l
W-6 5	W 6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Cobalt	10	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Copper	11 2	B	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Iron	226		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Lead	2	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Magnesium	45500		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Manganese	23 4		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Mercury	0 2	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Nickel	26 1	B	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Potassium	2900	J	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Selenium	3	UJ	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Silver	11 8		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Sodium	70200		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Thallium	2	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Vanadium	10	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Zinc	10 8	B	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Aluminum	3080		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Antimony	40	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Arsenic	3 4	B	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Barium	303		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Beryllium	2	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Cadmium	5	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Calcium	240000		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Chromium	10 8		ug/l
6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Cobalt	10	U	ug/l
-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Copper	18 9	B	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Iron	18600		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Lead	2	U	ug/l
W-6 5	W 6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Magnesium	47400		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Manganese	211		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Mercury	0 2	U	ug/l
W-6 5	W 6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Nickel	32 6	B	ug/l
W 6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Potassium	3010	B	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Selenium	3	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Silver	13		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Sodium	71900		ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Thallium	2	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP-Metals (Total)	Water	Vanadium	10	U	ug/l
W-6 5	W-6 5M	21-Apr-94	Groundwater	CLP Metals (Total)	Water	Zinc	19 1	B	ug/l

(3)

Duran Well

mes New Roman"&BMolycorp Laboratory Data &' Times New Roman"&BApril 1994 Sampling Event

W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Aluminum	25	U	ug/l
W-5X	W-5MX	25 Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Antimony	40	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Arsenic	2	UJ	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Barium	58 5	B	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Beryllium	2	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Cadmium	5	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Calcium	49500		ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Chromium	10	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Cobalt	10	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Copper	5	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Iron	25	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Lead	2	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Magnesium	11100		ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Manganese	158		ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Mercury	0 2	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Nickel	20	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Potassium	878	B	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Selenium	3	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Silver	10	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Sodium	16700		ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Thallium	2	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Vanadium	10	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Zinc	108		ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Aluminum	71 5	UJ	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Antimony	40	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Arsenic	2	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Barium	58	B	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Beryllium	2	U	ug/l
W-5X	W-5MX	25 Apr-94	Groundwater	CLP Metals (Total)	Water	Cadmium	5	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Calcium	46900		ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Chromium	10	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Cobalt	10	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Copper	5	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Iron	1330	J	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Lead	2 9	B	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Magnesium	10300		ug/l
W-5X	W-5MX	25 Apr-94	Groundwater	CLP Metals (Total)	Water	Manganese	170		ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Mercury	0 2	U	ug/l
W-5X	W-5MX	25 Apr-94	Groundwater	CLP Metals (Total)	Water	Nickel	20	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Potassium	1130	B	ug/l
W-5X	W-5MX	25 Apr-94	Groundwater	CLP-Metals (Total)	Water	Selenium	3	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Silver	10	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Sodium	15800		ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Thallium	2	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Vanadium	10	U	ug/l
W-5X	W-5MX	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Zinc	162		ug/l

Duran Well (Duplicate)

"Times New Roman"&BMolycorp Laboratory Data & Times New Roman"&BApril 1994 Sampling Event

W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Aluminum	25	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Antimony	40	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Arsenic	2	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Barium	58 5	B	ug/l
W-5 5 (FD)	W-5 5M (FD)	25 Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Beryllium	2	U	ug/l
W-5 5 (FD)	W 5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Cadmium	5	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP Metals (Dissolved)	Water	Calcium	48900		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Chromium	10	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Cobalt	10	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Copper	5	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Iron	25	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Lead	3 8		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Magnesium	10900		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Manganese	153		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Mercury	0 2	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Nickel	20	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Potassium	648	B	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Selenium	3	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25 Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Silver	10	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Sodium	16600		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Thallium	2	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Vanadium	10	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Dissolved)	Water	Zinc	117		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Aluminum	34 2	UJ	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Antimony	40	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Arsenic	2	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Barium	58	B	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Beryllium	2	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Cadmium	5	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Calcium	47200		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Chromium	10	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Cobalt	10	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Copper	5	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Iron	1270	J	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Lead	2	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Magnesium	10400		ug/l
W-5 5 (FD)	W-5 5M (FD)	25 Apr-94	Groundwater	CLP-Metals (Total)	Water	Manganese	167		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Mercury	0 2	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Nickel	20	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Potassium	1150	B	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Selenium	3	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Silver	10	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25 Apr-94	Groundwater	CLP-Metals (Total)	Water	Sodium	15600		ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Thallium	2	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP Metals (Total)	Water	Vanadium	10	U	ug/l
W-5 5 (FD)	W-5 5M (FD)	25-Apr-94	Groundwater	CLP-Metals (Total)	Water	Zinc	161		ug/l

RECORD OF TELEPHONE CONVERSATION

Time: 2 00 PM	Date: 6-15-95
Originating Party: Stuart Kent	Other Parties: George Long (505) 586-0520
NMED - Superfund Program	U S Forest Service - Questa Station

Subject: Red River Fishery + Sensitive Environments

Discussion:

+ Mr Long stated that contributors other than Molycorp have impacted the Red River including the construction of the Hwy too close to the river in several areas

+ He spoke of a "Dead Zone" which extends from Molycorp to the crossing of Hwy 522 (south of Questa) of the Red River

- This reach is heavily stocked by NM Game & Fish
- Fish are affected by high acidity which inhibit fry from developing and eggs die due to lack of dissolved oxygen

+ He spoke of the Red River being an historical habitat for the Rio Grande Cutthroat which has been decreased to only 3% of original size due to competition w/ Rainbow Trout + German Brown Tr

+ He stated that one sighting of Southwestern Willows Flycatcher along the Red River has been recorded but that the Red River is poor habitat since the species requires slow meandering waters and presence of willows

+ He stated the Peregrine Falcon occurs in the Red River Valley; that it ranges upto 20 miles to forage for food and that it would likely go out onto Rio Grande Valley where it overlaps with the range of the Prairie Falcon

Stuart Kent

Signed

RECORD OF TELEPHONE CONVERSATION

Time. 2 30 PM	Date: 7-10-93
Originating Party: Stuart Kent - IRS II MED - Superfund	Other Parties: Gene Santistevan - W Wildlife Conservat'n Red River Fish Hatchery (505) 586-0222

Subject:

Fish Productions in Red River

Discussion:

- Annual production for hatchery is ~ 300,000 lbs

+ Stocking of Red River occurs between May & Sept & is bi-weekly (i.e. everyother week)

+ Stocking fish are of catchable size (> 9")

+ Each truck load of fish (catchable) has approx 2,000 fish with 2 fish/lb. that equals 1000 lbs per stocking event

Calc + May thru Sept ≈ 22 weeks or 11 stocking events

11 stocking events/yr x 1000 lbs/event = 11,000 lbs/yr

+ Stocking also occurs on Rio Grande at Taos Jnct [This is beyond 15-mile target distance limit]

+ Winter stocking of Brown Trout fingerlings (2"-3") also occurs at hatch from hatchery site but lbs/yr was unknown (by this individual)

- Victor Trujillo is Hatchery Manager

Stuart Kent

Signed

C

RECORD OF TELEPHONE CONVERSATION

Time: 3.00	Date: 2-1-94
Originating Party: Stuart Kent 827-0037	Other Parties: Victor Trujillo (505) 586-0222
NMED	Red River Hatchery Mngr

Subject: Water Supply at Hatchery

Discussion:

+ Hatchery constructed in 1940's

+ He's unsure when the 2nd spring was tapped into as a water source (Mr Trujillo has been at hatchery for ~10 yrs)

+ Currently, approx. 8,000 gpm (gal/min) comes from springs
  - Bulk of which comes from spring 1/4 mi. upstream
  " 6,000 gpm comes from Red River

+ No fish kills have occurred at hatchery since he's been manager (even when Molycorp spills had been reported)

+ Sample collection (for analysis) is realistically only possible at junction (collection) box - not at the springs

Stuart Kent

Signed

RECORD OF TELEPHONE CONVERSATION

Time: 2:15 PM	Date: 10-2-95
Originating Party: Stuart Kent 827-0037	Other Parties: Wilfred Rael (505) 586-1734
NMED	Questa Citizen; Member La Gente Primera

Subject: Surface Water Ditches on Red River

Discussion:

+ Mr Rael stated there are 4 surface water diversions on Red River near Questa, NM

	Location:
1) South Ditch	Molycorp Pipeline Crossing
2) Molino Ditch	Near Molycorp Pipeline Sump
3) North Ditch	Questa Ranger Station
4) Middle Ditch	Near Molycorp Pipeline Sump

+ First 2 supply water South of the Red River

+ Last 2 supply water North of the Red River

+ Control of ditches is by "Citizen Ditch Assoc."

+ Mr. Rael stated the size of land supplied by the ditches varies from approx. 1/4-acre to over 40 acres. Average size is approx 20 acres. Total acreage for all 4 ditches was estimated at 700 acres.

+ Commercial agriculture & grazing does take place.

Stuart Kent

Signed

RECORD OF TELEPHONE CONVERSATION

Time: 9 10	Date: 7-9-93
Originating Party: Stuart Kent	Other Parties: Ken McCallum (505) 758-9808
NMED - Superfund	NMED - Taos Dist office

Subject:

Surface water intakes along Red River & Rio Grande

Discussion:

+ No surface water intakes exist within (15-mile Target Distance Limit) Red River & Rio Grande near Taos + above

+ Use of water from acequias for drinking is unlikely, Not documented

Stuart Kent
Signed

1992 Draft

Federally Listed and Candidate Species Distribution in New Mexico by County

This information is not for public distribution

Only animals and plants classified as Federal endangered threatened proposed or candidates are included Category 1 species are taxa for which the Service currently has substantial information on biological vulnerability and threats to support listing as threatened or endangered Category 2 species are taxa for which information indicates proposing to the list as endangered or threatened may be appropriate, but conclusive biological data are not available

STATEWIDE

Black-footed ferret, Mustela nigripes, endangered, in association with prairie dog towns in grassland plains and surrounding mountain basins up to 10,500 feet elevation Surveys for black-footed ferrets are required if the prairie dog town is over 80 acres for black-tailed prairie dogs, and 200 hundred acres for white-tailed and Gunnison's prairie dogs If the prairie dog town is greater than 1,000 acres, then the area should be evaluated for possible reintroduction of black-footed ferrets. Three counties that must list for black-footed ferret at all times McKinley, Rio Arriba and San Juan.

Bald eagle, Haliaeetus leucocephalus, endangered, over-winters in most counties from October through April, from the northern stateline, southward regularly to the Gila, lower Rio Grande, middle Pecos and Canadian valleys Nest have been reported in San Juan, Colfax and Catron counties Key winter habitat areas include such areas as Navajo Lake, Chama valley (Rio Arriba), Cochiti Lake, northeastern lakes (Raton to Las Vegas), lower Canadian valleys, Sumner Lake, Elephant Butte Lake, Caballo Lake, upper Gila Basin, Santa Rosa Lake, Tucumcari and Ute Lakes Dry land areas Region between Pecos Valley and the Sandias and Manzanos, Capitan and Sacramento Mountains, and the Mogollon Plateau.

American peregrine falcon, Falco peregrinus anatum, endangered, summers in montane areas almost statewide, mainly in northern and Mogollon highlands Nests in areas with steep cliffs and wooded/forested habitats, often near water Prefers 6,500-8,500 feet elevations, but can be found from 3,500-9,000 feet Migrates and winters almost statewide

Ferruginous hawk, Buteo regalis, Category 2 candidate, resident locally almost statewide, most regular in summer in the eastern plains and the San Agustin Plains Key habitat are wide open grasslands and prairies at lower and middle elevations Migrates and winters almost statewide

SOUTHWESTERN WILLOW FLYCATCHER

(Empidonax traillii extimus)

STATUS Category 2 candidate

DESCRIPTION A sparrow-sized dark headed, olive green flycatcher with a whitish throat, pale olive breast and pale yellow belly Lacks conspicuous eye ring Dusky wings have two whitish bars Has a habit of flicking tail upward Song is a sneezy "Fitz-bew", a whistle superimposed on a buzz

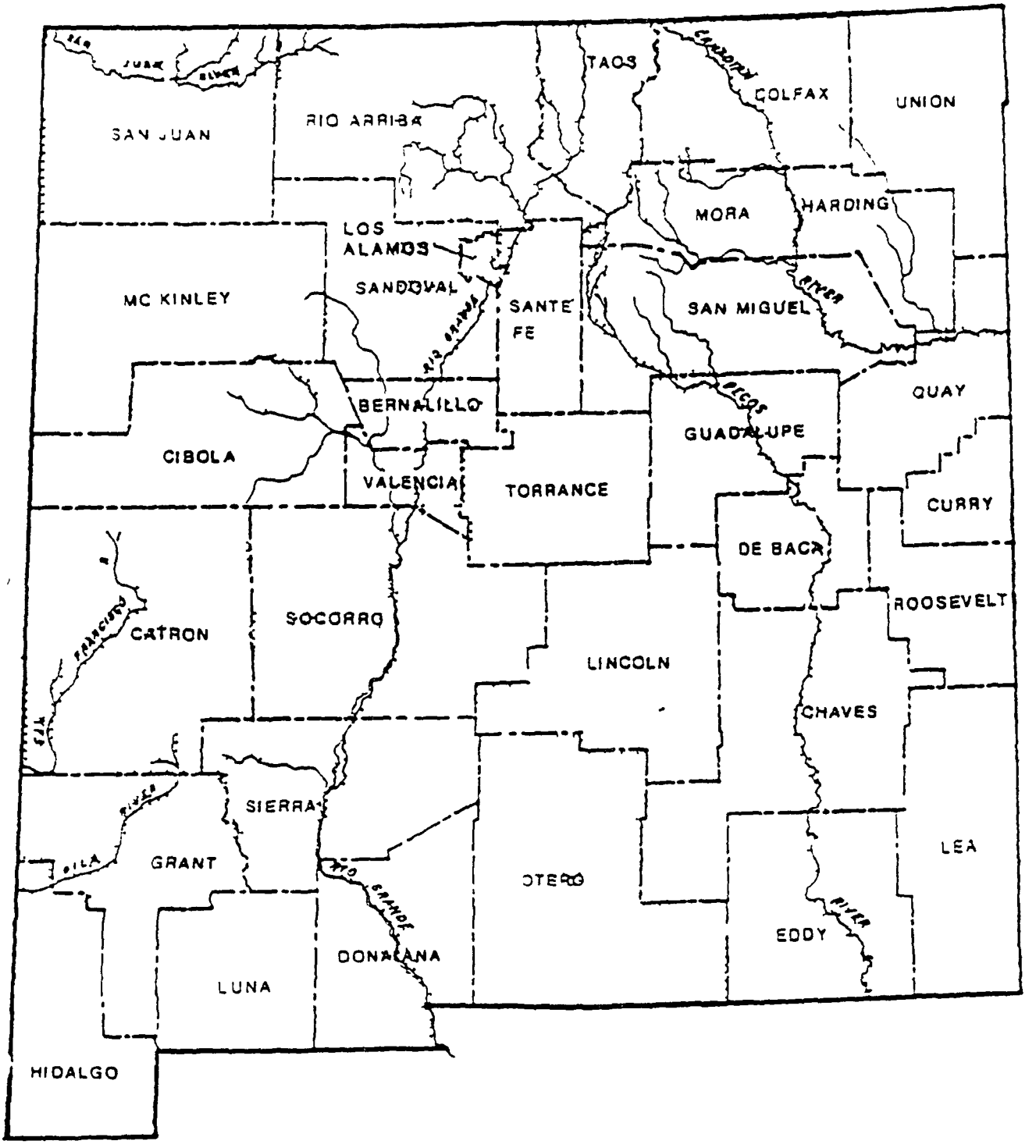
HABITAT Deep shaded mature woodlands, swamps, willow or alder thickets, along streams, bogs, muskegs, edges of mountain meadows, orchards, and dry, brushy upland pastures Nests in a neat but loosely woven cup nest in an upright crotch of a low shrub Found over a wide elevational range, but primarily between 1,100-1,700 m (3,700-5,500 feet)

DISTRIBUTION See map Current population centers are small and widely dispersed Populations in New Mexico are estimated at 100 pairs Summers in the San Juan, Chama, Rio Grande, San Francisco, Gila valleys, and San Juan Mts Breeding areas records include the Jemez Mts , Red River, Carson National Forest, Eagle Nest Lake, Colfax Co , Philmont Scout Camp, Colfax Co , Maxwell NWR, Colfax Co , Las Vegas, San Miguel Co , Santa Rosa, Guadalupe Co , Bitter Lake NWR, Silver City, Grant Co , and Artesia, Eddy Co

REASONS FOR DECLINE Loss of riparian habitat Brown-headed cowbird parasitism is considered a serious threat to the subspecies

MANAGEMENT RECOMMENDATIONS

1 Monitor sample populations to determine condition and trends
2 Protect existing riparian in the southwest, and promote the native revegetation of stream corridors



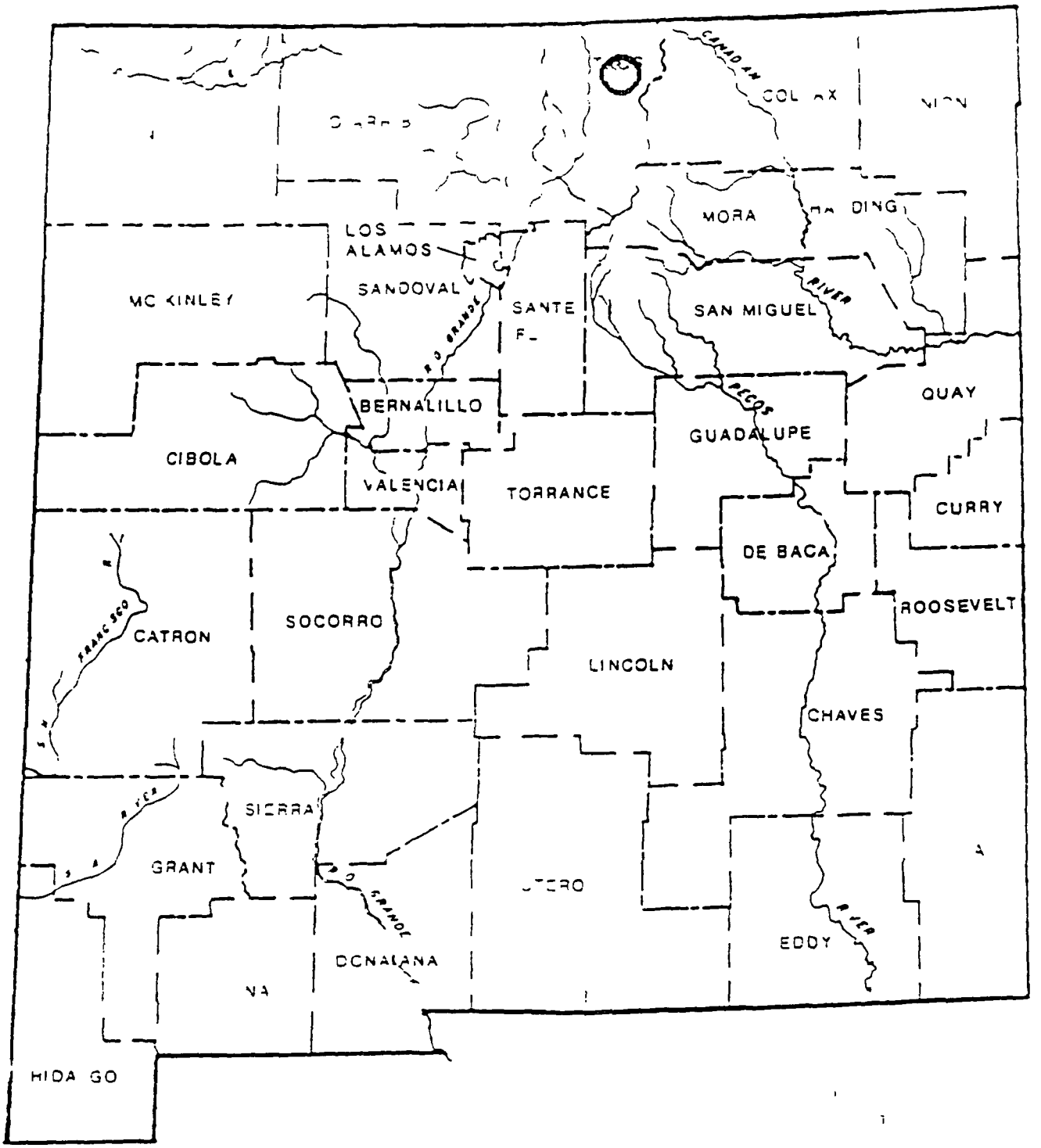
RANGE - POTENTIAL SUITABLE HABITAT

ONLY KNOWN OCCURANCE

SPECIFIC RECORD

NEW MEXICO

SOUTHWESTERN WILLOW FLYCATCHER



○ RANGE - POTENTIAL SUITABLE HABITAT

◎ ONLY KNOWN OCCURANCE

● SPECIFIC RECORD

NEW MEXICO

SMALL-HEADED GOLDENWEED

SMALL-HEADED GOLDENWEED

(Haplopappus microcephalus)

STATUS: Category 2 candidate

DESCRIPTION: Asteraceae family. Mat-forming perennial with spreading stems to 5 cm long; leaves numerous, lanceolate, 2-4 cm long to 3.5 mm wide, usually without toothed margins or with occasional minute tooth; flower heads, 6-8 mm high, several to many in a rather flat-topped cluster, the outer flowers of each head with inconspicuous yellow rays about 3 mm long; involucral bracts firm, translucent, in several series, the outermost bracts gradually tapering to a point. Flowers in June and July.

HABITAT: Crevices on granite rocks, usually in ponderosa forests; 2,450-2,600 m (8,000-8,500 ft).

DISTRIBUTION: See map. This species is known only from one collection from the western Sangre de Cristo Mountains in Taos county, New Mexico.

REASONS FOR DECLINE: Population trends and threats to taxon are unknown.

MANAGEMENT RECOMMENDATIONS:

1. Survey and inventory additional populations.
2. Regularly monitor the population to determine condition and trends.
3. Initiate studies characterizing habitat.

GOVERNOR
Gary E Johnson

STATE OF NEW MEXICO
DEPARTMENT OF GAME & FISH
Villagra Building
PO Box 5112
Santa Fe, N M 87504

DIRECTOR AND SECRETARY
TO THE COMMISSION
Gerald A Maracchini

JUL 1995
RECEIVED

July 3, 1995

Mr Stuart Kent
New Mexico Environment Department
Ground Water Protection and Remediation Bureau
Superfund Program
P O Box 26110
Santa Fe, New Mexico 87502

Dear Mr Kent

This is in response to our request for information on endangered species in the vicinity of the Molycorp Mine near Questa Taos County

The fish community of the Red River consists almost entirely of introduced salmonids as shown below

Rainbow trout (*Oncorhynchus mykiss*)
Cutthroat trout (*Oncorhynchus clarki* sp.)
Brown trout (*Salmo trutta*)
Brook trout (*Salvelinus fontinalis*)
White sucker (*Catostomus commersoni*)

These same species occur in the Rio Grande at and downstream of the confluence of Red River State-listed species that may occur in the area are shown below

Bald Eagle	*Haliaeetus leucocephalus alascanus*
American Peregrine Falcon	*Falco peregrinus anatum*
Southwestern Willow Flycatcher	*Empidonax traillii extimus*
Gray vireo	*Vireo vicinior*
Baird's Sparrow	*Ammodramus bairdii*
Meadow Jumping Mouse	*Zapus hudsonius luteus*

State Endangered

State Threatened

Occurrence of all of these species, except the bald eagle, has not been verified within a four mile radius of the site and 12 miles downstream Bald eagles may occur in the area as winter migrants or residents

Thank you for the opportunity to provide information on state-listed species Please contact John Pittenger of this office at 827-9907 if you have any questions

Sincerely,

Jerry A Maracchini
Director

JAM/jsp

cc Jennifer Fowler-Propst (Ecological Services Supervisor, USFWS)
Andrew Sandoval (Conservation Services Division Chief, NMGF)
Joanna Prukop Lackey (Northeast Operations Division Chief, NMGF)
Jim Bailey (Conservation Services Assistant Division Chief, NMGF)

STATE OF NEW MEXICO

STANDARDS FOR INTERSTATE AND INTRASTATE STREAMS

Filed with State Records Center
December 23, 1994
as 20 NMAC 6 1
Effective January 23, 1995

New Mexico Water Quality Control Commission
Harold Runnels Building
1190 St Francis Drive P O Box 26110
Santa Fe New Mexico 87502

CONSTITUENT AGENCIES

Environment Department
State Engineer and Interstate Stream Commission
Game and Fish Department
Oil Conservation Division
Department of Agriculture
State Park and Recreation Division
Soil and Water Conservation Division
Bureau of Mines and Mineral Resources
Members-at-Large

Printed on recycled paper

STANDARDS FOR
INTERSTATE AND INTRASTATE STREAMS

Table of Contents

Section		Page
1100	Purpose and Authority	1
1101	Antidegradation Policy and Implementation Plan	2
1102	General Standards	4
1103	Sampling and Analysis	6
1104	Review of Standards, Need for Additional Studies	7
1105	Applicability of Water Quality Standards	8
1106	Compliance with Water Quality Standards	10
1107	Use Attainability Analysis	10
2100	Rio Grande Basin	13
2200	Pecos River Basin	22
2300	Canadian River Basin	28
2400	San Juan River Basin	31
2500	Gila River Basin	34
2600	San Francisco River Basin	35
2700	Dry Cimarron River	36
2800	Closed Basins Rio Tularosa, Three Rivers, Mimbres and Sacramento Rivers	36
3100	Definitions	39
3101	Standards Applicable to Attainable or Designated Uses	44

B Standards

1 In any single sample conductivity shall not exceed 300 μmhos, pH shall be within the range of 6 6 to 8 8, temperature shall not exceed 20 C (68 F), and turbidity shall not exceed 10 NTU The use-specific numeric standards set forth in Section 3101 are applicable to the designated uses listed above in Section 2118 A

2 The monthly geometric mean of fecal coliform bacteria shall not exceed 100/100 ml, no single sample shall exceed 200/100 ml (see Section 1103 B)

2119. The main stem of the Rio Grande from Taos Junction Bridge upstream to the New Mexico-Colorado line, the Red River from its mouth on the Rio Grande upstream to the mouth of Placer Creek, and the Rio Pueblo de Taos from its mouth on the Rio Grande upstream to the mouth of the Rio Grande del Rancho

A Designated Uses coldwater fishery fish culture irrigation, livestock watering, wildlife habitat, and secondary contact

B Standards

1 In any single sample pH shall be within the range of 6 6 to 8 8 temperature shall not exceed 20 C (68 F) and turbidity shall not exceed 50 NTU The use-specific numeric standards set forth in Section 3101 are applicable to the designated uses listed above in Section 2119 A

2 The monthly geometric mean of fecal coliform bacteria shall not exceed 100/100 ml no single sample shall exceed 200/100 ml (see Section 1103 B)

2120. The Red River upstream of the mouth of Placer Creek all tributaries to the Red River and all other perennial reaches of tributaries to the Rio Grande in Taos and Rio Arriba counties unless included in other segments

A Designated Uses domestic water supply, fish culture, high quality coldwater fishery irrigation livestock watering, wildlife habitat, and secondary contact

B Standards

1 In any single sample conductivity shall not exceed 400 μmhos (500 μmhos for the Rio Fernando de Taos) pH shall be within the range of 6 6 to 8 8, temperature shall not exceed 20 C (68 F), and turbidity shall not exceed 25 NTU The use-specific numeric standards set forth in Section 3101 are applicable to the designated uses listed above in Section 2120 A

J The following schedule of numeric standards and equations for the substances listed shall apply to the subcategories of fisheries identified in Section 3101 of these standards

1 Acute Standards[2]

Dissolved aluminum	750	µg/l
Dissolved beryllium	130	µg/l
Total mercury	2 4	µg/l
Total recoverable selenium	20 0	µg/l
Dissolved silver[3]	e(1 72[ln(hardness)]-6 52)	µg/l
Cyanide amenable to chlorination	22 0	µg/l
Total chlordane	2 4	µg/l
Dissolved cadmium	e(1 128[ln(hardness)]-3 828)	µg/l
Dissolved chromium[3]	e(0 819[ln(hardness)]+3 688)	µg/l
Dissolved copper	e(0 9422[ln(hardness)]-1 464)	µg/l
Dissolved lead	e(1 273[ln(hardness)]-1 46)	µg/l
Dissolved nickel	e(0 8460[ln(hardness)]+3 3612)	µg/l
Dissolved zinc	e(0 8473[ln(hardness)]+0 8604)	µg/l
Total chlorine residual	19	µg/l

2 Chronic Standards[2]

Dissolved aluminum	87 0	µg/l
Dissolved beryllium	5 3	µg/l
Total mercury	0 012	µg/l
Total recoverable selenium	2 0	µg/l
Cyanide amenable to chlorination	5 2	µg/l
Total chlordane	0 0043	µg/l
Dissolved cadmium[4]	e(0 7852[ln(hardness)]-3 49)	µg/l
Dissolved chromium[5]	e(0 819[ln(hardness)]+1 561)	µg/l
Dissolved copper	e(0 8545[ln(hardness)]-1 465)	µg/l
Dissolved lead	e(1 273[ln(hardness)]-4 705)	µg/l
Dissolved nickel	e(0 846[ln(hardness)]+1 1645)	µg/l
Dissolved zinc	e(0 8473[ln(hardness)]+0 7614)	µg/l
Total chlorine residual	11	µg/l

K Livestock Watering The following numeric standards shall not be exceeded

Dissolved aluminum	5 0	mg/l
Dissolved arsenic	0 2	mg/l
Dissolved boron	5 0	mg/l
Dissolved cadmium	0 05	mg/l
Dissolved chromium[5]	1 0	mg/l
Dissolved cobalt	1 0	mg/l

Dissolved copper	0 5	mg/l
Dissolved lead	0 1	mg/l
Total mercury	0 01	mg/l
Dissolved selenium	0 05	mg/l
Dissolved vanadium	0 1	mg/l
Dissolved zinc	25 0	mg/l
Radium-226 + radium-228	30 0	pCi/l
Tritium	20,000	pCi/l
Gross alpha	15	pCi/l

L Wildlife Habitat The following narrative standard shall apply

1 Except as provided below in Paragraph 2 of this section, no discharge shall contain any substance, including, but not limited to selenium, DDT, PCB's and dioxin, at a level which, when added to background concentrations, can lead to bioaccumulation to toxic levels in any animal species In the absence of site-specific information, this requirement shall be interpreted as establishing a stream standard of 2 μg/l for total recoverable selenium and of 0 012 μg/l for total mercury

2 The discharge of substances that bioaccumulate in excess of levels specified above in Paragraph 1 is allowed if and only to the extent that, the substances are present in the intake waters which are diverted and utilized prior to discharge, and then only if the discharger utilizes best available treatment technology to reduce the amount of bioaccumulating substances which are discharged

3 Discharges to waters which are designated for wildlife habitat uses, but not for fisheries uses, shall not contain levels of ammonia or chlorine in amounts which reduce biological productivity and/or species diversity to levels below those which occur naturally, and in no case shall contain chlorine in excess of 1 mg/l nor ammonia in excess of levels which can be accomplished through best reasonable operating practices at existing treatment facilities

4 A discharge which contains any heavy metal at concentrations in excess of the concentrations set forth in Section 3101 J 1 of these standards shall not be permitted in an amount, measured by total mass, which exceeds by more than 5 percent the amount present in the intake waters which are diverted and utilized prior to the discharge, unless the discharger has taken steps (an approved program to require industrial pretreatment, or a corrosion program) appropriate to reduce influent concentrations to the extent practicable

3101 STANDARDS[1] APPLICABLE TO ATTAINABLE OR DESIGNATED USES UNLESS OTHERWISE SPECIFIED IN SUBPART II OF THESE STANDARDS (SECTIONS 2100 through 2805).

A Coldwater Fishery Dissolved oxygen shall not be less than 6 0 mg/l, temperature shall not exceed 20 C (68 F) and pH shall be within the range of 6 6 to 8 8 The acute and chronic standards set out in Section 3101 J are applicable to this use The total ammonia standards set out in Section 3101 N are applicable to this use

B Domestic Water Supply Waters designated for use as domestic water supplies shall not contain substances in concentrations that create a lifetime cancer risk of more than one cancer per 100 000 exposed persons The following numeric standards shall not be exceeded

Dissolved arsenic	0 05	mg/l
Dissolved barium	1	mg/l
Dissolved cadmium	0 010	mg/l
Dissolved chromium	0 05	mg/l
Dissolved lead	0 05	mg/l
Total mercury	0 002	mg/l
Dissolved nitrate (as N)	10	mg/l
Dissolved selenium	0 05	mg/l
Dissolved silver	0 05	mg/l
Dissolved cyanide	0 2	mg/l
Dissolved uranium	5 0	mg/l
Radium-226 + radium-228	30 0	pCi/l
Tritium	20,000	pCi/l
Gross alpha	15	pCi/l

C High Quality Coldwater Fishery Dissolved oxygen shall not be less than 6 0 mg/l, temperature shall not exceed 20 C (68 F) pH shall be within the range of 6 6 to 8 8, total phosphorus (as P) shall not exceed 0 1 mg/l total organic carbon shall not exceed 7 mg/l, turbidity shall not exceed 10 NTU (25 NTU in certain reaches where natural background prevents attainment of lower turbidity) and conductivity (at 25 C) shall not exceed a limit varying between 300 μmhos/cm and 1 500 μmhos/cm depending on the natural background in particular stream reaches (the intent of this standard is to prevent excessive increases in dissolved solids which would result in changes in stream community structure) The acute and chronic standards set out in Section 3101 J are applicable to this use The total ammonia standards set out in Section 3101 N are applicable to this use

D Irrigation The monthly geometric mean of fecal coliform bacteria shall not exceed 1 000/100 ml, no single sample shall exceed 2 000/100 ml The following numeric standards shall not be exceeded

Dissolved aluminum	5 0	mg/l
Dissolved arsenic	0 10	mg/l
Dissolved boron	0 75	mg/l
Dissolved cadmium	0 01	mg/l
Dissolved chromium	0 10	mg/l
Dissolved cobalt	0 05	mg/l
Dissolved copper	0 20	mg/l
Dissolved lead	5 0	mg/l
Dissolved molybdenum	1 0	mg/l
Dissolved selenium	0 13	mg/l
Dissolved selenium in presence of >500 mg/l SO_4	0 25	mg/l
Dissolved vanadium	0 1	mg/l
Dissolved zinc	2 0	mg/l

E Limited Warmwater Fishery Dissolved oxygen shall not be less than 5 mg/l, pH shall be within the range of 6 5 to 9 0 and on a case by case basis maximum temperatures may exceed 32 2 C The acute and chronic standards set out in Section 3101 J are applicable to this use The total ammonia standards set out in Section 3101 M are applicable to this use

F Marginal Coldwater Fishery Dissolved oxygen shall not be less than 6 mg/l, on a case by case basis maximum temperatures may exceed 25 C and the pH may range from 6 6 to 9 0 The acute and chronic standards set out in Section 3101 J are applicable to this use The total ammonia standards set out in Section 3101 N are applicable to this use

G Primary Contact The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 ml, no single sample shall exceed 400/100 ml, pH shall be within the range of 6 6 to 8 8 and turbidity shall not exceed 25 NTU

H Warmwater Fishery Dissolved oxygen shall not be less than 5 mg/l, temperature shall not exceed 32 2 C (90 F) and pH shall be within the range of 6 5 to 9 0 The acute and chronic standards set out in Section 3101 J are applicable to this use The total ammonia standards set out in Section 3101 M are applicable to this use

I Fish culture, secondary contact, and municipal and industrial water supply and storage are also designated in particular stream reaches where these uses are actually being realized However, no numeric standards apply uniquely to these uses Water quality adequate for these uses is ensured by the general standards and numeric standards for bacterial quality, pH, and temperature which are established for all stream reaches listed in Subpart II of these standards (Sections 2100 through 2805)

RECORD OF TELEPHONE CONVERSATION

Time: 10:30	Date: 7-23-93
Originating Party: Stuart Kent	Other Parties: Bill Renison
NMED - Superfund Program	Molycorp, Inc.

Subject: Soil cap on tailings pond

Discussion:

+ Capping is virtually done; 1 more week
  - 10" → 2' Average is ~ 1' Depth
+ Hydroseeding to start
  - crested wheat
  - sweet clover
  - 3rd type of grass
+ After capping, approx. 30 acres to be uncapped but will have soil stabilized

Stuart Kent

Signed

SUMMARY REPORT

AMBIENT AIR QUALITY DATA AND ASSOCIATED DATA

COLLECTED IN THE QUESTA, NEW MEXICO AREA

(1979 - 1983)

Cecilia Williams, Environmental Specialist

State of New Mexico
Environmental Improvement Division
Air Quality Bureau

April 11, 1985

TABLE OF CONTENTS

		Page
I.	INTRODUCTION	
	A. Statement of Purpose	1
	B. Background	1
II.	DISCUSSION OF THE DATA	
	A. Federal and State Standards	2
	B. Air Quality Bureau Ambient Air Quality Monitoring and Photographic Data	4
	C. Tailings and Soil Data From Molycorp and EID	6
	D. Airborne Particulate Matter and Health Effects	6
	E. Reagents Used in Processing Ore	8
	F. Air Quality Bureau Atmospheric Modeling	8
	G. Uncertainty in the Ambient Air Quality Data	9
III.	CONCLUSIONS	9
IV.	FOLLOW-UP	10
V.	REFERENCES	17
VI.	APPENDICES	
	A. Molycorp Registration Information	A-1
	B. Molycorp Summary Report	B-1
	C. Union Oil Company Report	C-1
	D. Letter dated March 20, 1985, from EPA to Governor Anaya regarding the Inhalable Particulate Matter Standard	D-1

LIST OF TABLES

Page

TABLE I — Total Suspended Particulate (TSP) Matter Summary Questa High School, Questa, New Mexico 1979-1983 11

TABLE II — Average Heavy Metals Data (from TSP samples) Questa High School, Questa, New Mexico 12

TABLE III — Comparison of Heavy Metals Data (TSP) to New York State and Michigan State Guidelines 13

TABLE IV — Federal Ambient Air Standards and Occupational Standards and Guidelines 14

TABLE V — Average Heavy Metals Data (from TSP samples) From Molycorp Mill Tailings Questa, New Mexico 16

GLOSSARY

Units and Measurements

g = gram

Hr. = hour

m^3 = cubic meter

mg = milligram = 10^{-3} gram or .001 gram

u = micron = 10^{-6} meter, micrometer

mppcf = million particles per cubic foot

ug/m^3 = micrograms per cubic meter

ppm = ppmv = parts per million (by volume). When ambient air quality standards or measurements are listed by ppm, it is in parts per million by volumes of gases.

ppm = ppmm = parts per million (by mass). When tailings deposits or other mass measurements are discussed and listed in ppm, it is in parts per million by masses of materials.

ug/g = microgram per gram. This is also a weight per weight unit and is equivalent to ppmm listed above.

Organizations

EID - State of New Mexico Environmental Improvement Division, Division of the Health & Environment Department (HED)

SLD - State of New Mexico Scientific Laboratory Division, Division of HED

Molycorp- Molycorp Incorporated, a subsidiary of Union Oil Company

I. INTRODUCTION

A. Statement of Purpose

This report has been prepared in order to discuss in summary form air quality data and other data collected in the Questa, New Mexico area through 1983. These data will be evaluated with respect to the possible adverse health effects of Molycorp mill tailings on the residents of the Questa area. The data discussed in this report consist of all data previously collected, made public, and analyzed by the State of New Mexico EID Air Quality Bureau or by Molycorp Incorporated before 1984. The Bureau will discuss data collected by Molycorp Incorporated or collected by other entities for Molycorp Incorporated, and made public, but the Bureau cannot attest to its quality, particularly in cases where the Bureau has not collected similar data to use as a comparison.

The majority of the data evaluated in this report consists of: ore composition data; mill tailings analyses; soil sample analyses; total suspended particulate matter samples, which have been analyzed for mass per volume (ug/m^3 for 24 hrs.), and analyses of total suspended particulate matter samples for various heavy metals. Not reviewed in this report are existing total suspended particulate matter data collected by Molycorp and requested by the Environmental Improvement Division in a letter dated January 10, 1984, which have not been received by the Division. Molycorp has operated as many as four hi-volume samplers simultaneously in the Questa area. This report does review limited non-ambient air quality data released publicly by Molycorp.

B. Background

The Molycorp Mining Company has mined in the Questa area since 1923, beginning with the underground mining of molybdenite ore. Large scale open pit mining began in 1965, the ore remaining after the molybdenum has been removed, known as tailings, has been placed at a site owned by Molycorp southwest of the Questa High School. The perimeter of the tailings area is approximately one-quarter to one-half mile from Questa High School. Questa High School opened at its current site in 1963. The area of tailings deposits has grown over the years to a current size of about 500 acres, or approximately one square mile.

Beginning in 1978, the first written complaint concerning the blowing of the Molycorp mill tailings was received by the Air Quality Bureau. In response to the complaints, limited sampling for total suspended particulate matter began, with analysis of some of the total suspended particulate matter for a number of heavy metals. The majority of complaints with regard to windborne tailings have involved complaints about air quality and tailings deposition at Questa High School, close to and frequently downwind directly from the tailings.

Complaints have continued to be sent to various public officials and the Air Quality Bureau by individuals concerned about the effects of the windborne mill tailings. Complaints were received in 1981 and again in 1983, in the form of letters to the Governor's Office and to the EID. The presence

of silica (SiO_2) in the mill tailings, its possible health effects and the inadequacy of sampling frequency were among the issues raised in the 1983 letter from the Concerned citizens of Questa to the Governor's Office.

Molycorp Mining Company voluntarily began efforts to control the extent to which their mill tailings became windborne beginning in 1979 (Appendix B, Page B-5) with the application of chemical stabilizers on the tailings. The chemical stabilizers when applied to the surface of the tailings form a thin crust. If the crust remains intact, and covers all tailings not covered by water, the stabilizers should aid in controlling the extent to which the ore tailings become windborne.

No New Mexico Air Quality Control Regulations require or regulate such efforts on the part of the company or require an air quality permit from Molycorp for their tailings operation However, if valid evidence demonstrates that high particulate levels in Questa are responsible for a federal nonattainment area due to violations of the National Ambient Air Quality Standards for particulate matter, the Bureau would then be obliged to develop a regulatory control strategy under the federal Clean Air Act. This strategy would become part of the Bureau's overall State Implementation Plan. See the letter, from EPA to Governor Anaya of March 20, 1985, attached at Appendix D. New National Ambient Air Quality Standards for airborne particulates may change the significance of these data (discussed below).

II. DISCUSSION OF THE DATA

The tailings samples and ore analysis data that are discussed in this report have been collected by either the State of New Mexico Environmental Improvement Division Air Quality Bureau or by Molycorp or a company hired by Molycorp. The Division has not received any of Molycorp's air monitoring data. Samples collected by the Air Quality Bureau have been analyzed by the State of New Mexico Scientific Laboratory Division. These data are summarized in tables at the end of Section IV Data collected and analyzed by and for Molycorp have been attached as appendices to this report. The Air Quality Bureau does not vouch for the validity of data collected by other entities.

A. Federal and State Standards

The applicable federal health standards with which to compare ambient air quality data are the primary National Ambient Air Quality Standards (NAAQS), and the secondary National Ambient Air Quality Standards. Of these, those which pertain to the data collected are the NAAQS for total suspended particulate matter (TSP) and lead. These standards are summarized in Table IV. Other federal air quality standards which exist for metals which have been measured in Questa are the National Emission Standards for Hazardous Air Pollutants (NESHAP). NESHAP emission standards exist for beryllium and mercury; however, these emission standards are for specific industrial source categories and do not regulate Molycorp industrial facilities. The state ambient air quality standards are also summarized in Table IV.

Other standards frequently used in an effort to discern health effects are standards or guidelines which have been created for occupational

exposures. These standards include the federal Occupational Safety and Health Administration (OSHA) standards. Also used frequently are a group of occupational exposure guidelines published by the American Conference of Governmental Industrial Hygienists (ACGIH). These guidelines are termed Threshold Limit Values (TLV) for chemical substances in the environment. Both federal occupational standards and Threshold Limit Values are based on different assumptions than those underlying ambient air quality standards. Thus, they must be used cautiously in analyzing ambient air quality data and non-occupational data for possible health effects. The ACGIH urges caution in the use of TLVs for other than evaluating occupational exposures under the stated conditions (1). For example, the TLV varies for different physical and chemical forms of mercury listed by the ACGIH, and all TLVs listed for mercury are for exposure via the skin. Therefore, the application of TLVs for mercury to concentrations in the ambient air must be viewed with those restrictions in mind.

Occupational standards generally allow much higher concentrations than NAAQS for the same substance because of the assumptions concerning the group at risk and the exposure time. For example, the OSHA standard for carbon monoxide is 50 parts per million (ppm) for an 8-hour average while the NAAQS for carbon monoxide is 9 ppm for an eight hour average and 35 ppm for a one hour average.

The primary differences in ambient air quality standards and occupational standards consist of:

1. Different populations at risk: Occupational standards assume a relatively young, healthy group exposed to the chemical. Ambient standards take into account a much wider population; including the elderly, the young and those with health problems; and

2. Differing exposure times: Occupational standards assume an eight-to-ten hour exposure in 24 hours with total exposure limited to 40 hours per week. Ambient standards assume the possibility of a continuous 24-hour exposure. The occupational standards assume as much as a sixteen hour exposure-free time per 24 hours in which to recuperate from exposure to hazardous substances.

Despite the described uncertainties, the frequent use of occupational standards and guidelines is beneficial and necessary for estimating potential health hazards where specific ambient air quality standards do not exist. A variety of schemes are used for converting the occupational standards and Threshold Limit Values to 24-hour, seven-days-a-week average concentrations, as well as incorporating an estimated margin of safety for sensitive populations.

The State of Michigan and New York have adopted the use of a small numerical fraction of the TLV as an emission limit guideline for evaluating new sources applying for air quality permits in cases where there are no applicable federal or state regulations (2, 3). Currently, this is a relatively uncommon application of the TLV and can be considered a

conservative application of the ACGIH guidelines, since both states use small percentages of the existing TLV's. The state of Michigan uses 1/180 of the TLV for continuous emission from a source and the State of New York uses 1/300 of the TLV for an annual average.

Occupational standards and Threshold Limit Values are compared to ambient values in this report in an attempt to ascertain information on potential health effects since ambient standards are unavailable for such comparisons. The State of New York and State of Michigan emission guidelines described above are also compared to data reviewed in this report.

B. Air Quality Bureau Ambient Air Quality Monitoring and Photographic Data

The Air Quality Bureau has operated a total suspended particulate matter high-volume (hi-vol) sampler on the Questa High School roof, under a full EPA-approved sampling schedule (once every six days for 24 hours) for 1981, 1982 and 1983. A limited number of samples were collected in 1979 (9 samples) and 1980 (18 samples). The TSP data for 1979 through 1983 are summarized in Table I. The NAAQS for TSP, by definition, is not to be exceeded more than once per year. Thus, if only one sample collected during the calendar year exceeds the NAAQS for TSP, it is an "exceedance" and not a violation of the standard. There was one exceedance of the federal primary 24-hour standard in 1979 (9 samples), one exceedance of the federal primary 24-hour standard in 1981 (54 samples collected) and again in 1982 (52 samples collected). Three violations of the secondary NAAQS occurred in 1981 and two violations of the secondary NAAQS occurred in 1982 (Table I). The secondary NAAQS is, like the primary NAAQS, not to be exceeded more than once per year.

There has been one violation of the state 24-hour standard in 1979, four violations of the state 24-hour standard in 1981, three violations of the state 24-hour standard in 1982, and one violation of the state standard in 1983 (Table I). There have been no values approaching the federal NAAQS for lead.

The Bureau considers the TSP monitor on the high school roof to be a high impact site because of its close promixity, one-half mile, from the tailings piles, and because the highest frequency of complaints from citizens and students has been due to dust conditions at Questa High School.

The decrease in the annual geometric means for TSP from 1981 through 1983 cannot yet be attributed to improvements in Molycorp's tailings stabilization without additional information, primarily meteorological data in the area, which the state of New Mexico does not have for the period 1979 through 1983. The changes in annual geometric means could easily reflect meteorological differences from year to year.

The EPA national sampling schedule for total suspended particulate matter calls for sampling once every six days. It is likely, based on the number of exceedances of the primary NAAQS and the five violations of the

secondary NAAQS, that violations of the TSP federal primary and secondary NAAQS were missed when windy days occurred between sampling days. The TSP samples were collected by an EID Environmentalist located in the area. The chemical analyses were performed by the state HED Scientific Laboratory Division (SLD).

A small number of the TSP samples collected by the hi-vol at Questa High School have been analyzed for heavy metals. The heavy metal concentrations analyzed from TSP samples and collected by the Air Quality Bureau range from a high value of 1.4403 ug/m^3 for iron to a low value of .0007 ug/m^3 for uranium. The heavy metal concentrations have been compared to the OSHA standards and ACGIH guidelines in this report by calculating the percentage of the standard, or guideline the concentration comprises. The metals data have been summarized by their means and can be found on Table II, which also contains the percent calculations. The percent calculations range from the highest value of one-fourth of one percent for the ACGIH TLV for beryllium (.25%), to the smallest percentage for molybdenum which is four ten-thousands of one percent (4×10^{-5}%).

When the heavy metals data from TSP samples are compared to the State of New York and the State of Michigan guidelines which use a small fraction of the TLV, shown on Table III, only iron exceeds both the New York guidelines for an annual average and the Michigan guidelines for a 24 hour average. Iron is frequently found in soils, in concentrations exceeding 19,000 ppm. Cobalt measured from TSP samples exceeds the New York guideline for an annual average. The amount of iron or cobalt in the respirable particulate matter size range cannot be determined from the TSP data.

The Air Quality Bureau operated a time-lapse camera from the roof of a Questa High School building, facing towards the tailings deposits, from September 1, 1982, through June 10, 1983. The camera operated automatically for approximately twelve hours per day using eight millimeter (mm) color silent movie film, with one frame exposed per minute. This photographic record is contained in 34 reels of film. The period of time for which the camera operated represents a period in 1983 during which Molycorp changed the type of chemical stabilizer.

The time lapse film is descriptive, qualitative information. Throughout the approximate ten-month span during which the camera operated, there are periods when airborne ore tailings are visible on the film. The amount of tailings that become airborne, the length of time the tailings remain airborne and the frequency of their becomming airborne varied during the ten-month period. After review of the film by Bureau staff, a quantitative statement cannot be made about a decrease in airborne tailings in frequency or amount as a result of the change in use of chemical stabilizers by Molycorp. Changes in meteorological conditions could readily account for changes in the frequency and severity of occurrences of airborne tailings, random meteorological variation may be more significant than the change in chemical stabilizers. The film does provide, however, a certain record verifying that the tailings deposits do become airborne despite the application of chemical stabilizers.

C. Tailings and Soil Data From Molycorp and EID

Data collected by Molycorp Corporation and released publicly to date consist of tailings samples and soil samples which have been analyzed by Union Oil Company, the Colorado School of Mines and Camp Dresser Mckee Incorporated. These data are in the form of a summary report by Molycorp attached to this report in Appendix B. Appendix A of this report contains the registration information submitted by Molycorp to the Air Quality Bureau in 1973, which contains an analysis of the ore processed by Molycorp.

The Colorado School of Mines performed two analyses of Molycorp mill tailings deposits for 23 metals and 8 additional substances; the first report is shown on page B-13 of Appendix B. The initial value reported for arsenic was 450 ppm and 100 ppm for selenium. The tailings were again analyzed for arsenic and selenium. The second analysis yielded 3 ppm for the wet tailings sample and 8 ppm for the dry tailings sample for arsenic and less than 5 ppm for selenium for both wet and dry tailings samples. A letter from the Colorado School of Mines, page B-14, 15 and 16 of Appendix B, attributes the first measured concentrations to laboratory error.

The State of New Mexico also analyzed tailings samples in 1979 for arsenic and selenium. The Scientific Laboratory Division reported 5.7 micrograms per gram (ug/g) for arsenic, which is equivalent to parts per million by mass (ppmm), and reported less than 0.25 ug/g (ppmm), for selenium. The State of New Mexico analyses for heavy metals in tailings deposits, are shown in Table V. The second value reported by the Colorado School of Mines for arsenic is approximately one part per million by mass less than the State of New Mexico value. The second values reported by the Colorado School of Mines for selenium are about 12 (3ppm) times and 32 (8ppm) times larger than the State of New Mexico results. Therefore, based on the comparison of the State of New Mexico laboratory results and the Colorado School of Mines laboratory results for arsenic and selenium, the explanation of laboratory error could be acceptable at face value. Further analyses would not be scientifically inappropriate, however.

D. Airborne Particulate Matter and Health Effects

There has been considerable scientific controversy concerning the relationship of total suspended particulate matter measurements to public health. Recent information indicates that the health effects of airborne particulate matter depend strongly on that portion which can be inhaled into different regions of the human respiratory system including the nasal passages, tracheobronchial region and the bronchioles and alveoli (4). The human respiratory system has different responses and clearing times depending on where materials are deposited. The U. S. Environmental Protection Agency has proposed a new standard for "inhalable" particulate matter. The new standard is stated in terms of "inhalable" particulate matter of less than a nominal 10 microns in diameter. Total suspended particulate matter includes particulate matter with an upper limit of 25-45 microns in diameter depending on wind speed and other factors (4). Thus, the TSP measurements for the Questa area contain an un-quantified portion of particulate matter which may not affect public health as directly as the deeply respirable portion of the airborne particulate matter.

The proposed federal PM-10 primary NAAQS for particulate matter is linked even more directly to the deeply inhalable, very fine particles of acute concern in terms of serious health threats. To the degree that the tailings may contribute substantially to particulate matter in the inhalable size range, serious health concerns remain. The tailings, in large proportion, are probably finer than most local soils because of the mechanical grinding which occurs during milling. If such is the case, the tailings could certainly present a large, significant proportion of the airborne particulate matter in Questa in the inhalable size range. Fine particulate matter can become airborne more readily at lower windspeeds and remain airborne longer than larger dust particles.

The presence of silica (SiO_2) in the mill tailings and its possible health effects on Questa area residents were raised as issues in a 1984 letter from the Concerned Citizens of Questa to the Department of Health and Environment. The health effects of silica are well documented for many workers who are occupationally exposed (5,6). There are Occupational Safety and Health Administration standards for crystalline silica; amorphous silica and total respirable dusts (Table IV). The National Institute for Occupational Safety and Health (NIOSH) has recommended that these standards be greatly lowered to an average exposure of 50 micrograms of silica per cubic meter of air for no more than a ten-hour exposure during a forty-hour maximum work week (5, 6). There are also TLVs for different silica dusts for which lower TLVs have been recommended (1). Silica is the single largest component of the Molycorp mill tailings. Appendix A, Page A-2, contains the composition of ores processed by Molycorp. The two main ores contain between 60 and 70 percent silica. It is unknown how much of the silica is in the inhalable particulate size range after processing. There are no ambient air quality standards for silica separate from the particulate NAAQS. The Air Quality Bureau was unable to analyze total suspended particulate matter samples for silica because the samples are collected on glass fiber filters. The glass fiber filters are composed primarily of SiO_2. Attempts by the Bureau in the past to use cellulose filters for hi-vol samplers as an alternative to glass fiber problems met with difficulties in accurate mass determinations. The cellulose fiber filters proved to be highly hydrophilic, so that pre-sampling and post-sampling weights were inaccurate.

Silicosis and other less serious physiological changes in the structure and function of the lung have been established as serious risks in occupational case studies after years of exposure. The major exception to this is extremely high exposures to crystalline silica during sandblasting, which can cause silicosis and death in a relatively short time after exposure (5).

Studies of desert inhabitants exposed to silica dusts have shown changes in lung structure, including pneumoconiosis (7). High silica content has been measured in lung tissue samples taken from the desert inhabitants (7). Injection of silica into the lungs of rats has resulted in changes in lung structure (8).

Measurements of the amount of airborne silica in the inhalable size range, as well as its physical shape, would provide more information on the specific silica exposures to which Questa area residents are exposed. There

will be substantial uncertainty, however, in applying occupational standards and experimental case studies to 24-hour residential exposures in the Questa area.

E. Reagents Used in Processing Ore

During the processing of the molybdenite ore, it is crushed and reagents are used to separate the molybdenum from other minerals present in the raw ore. As reported by Molycorp (9), listed in the table below are some of the substances used in the ore processing.

REAGENTS USED IN ORE PROCESSING (9)

	Reagent	Amount Used in lb/ton
1.	Vapor oil	0.132, 0.013 *
2.	Pine oil	0.045, 0.008 *
3.	Methyl isobutyl carbonol	0.038, 0.013 *
4.	Lime	0.145, 0.020 *
5.	Nokes (P_2S_5)	0.039
6.	Sodium cyanide	0.013
7.	Sodium thiosulfate	0.010

* The two values shown indicate amounts used in different parts of ore processing.

The State of New Mexico does not have data concerning the amount of total organic carbon or hydro-carbon compounds in tailings samples, which might result from the presence of some of the above reagents as residues in the tailings deposits after processing. Molycorp has had measurements of total organics and cyanide analyzed in tailings samples. These data are in Appendix C, page C-3, 4. Since the State of New Mexico does not have similar data, Molycorp's results cannot be verified. More information on ore processing at Molycorp can be found in the report by A. Filyk, Molycorp Mill Superintendent(9).

F. Air Quality Bureau Atmospheric Modeling

Atmospheric or dispersion modeling is another technique used by air resources professionals when trying to determine the effect of a potential emitter on surrounding air quality. Using a set of equations which simulate atmospheric conditions, the modeler can use different emission factors for different emitting source categories to predict downwind concentrations of pollutants.

In addition to the small quantity of scientifically acceptable air quality data collected from 1979 through 1983, the Air Quality Bureau conducted some preliminary modeling analysis for demonstration purposes. These analyses raise scientifically reasonable concerns that under high wind conditions, the existing tailings facility could cause 24-hour average ambient particulate concentrations as high as 322 ug/m^3 in the town of Questa. Even if the Section 36 tailings impoundment is removed as a source from the

modeling calculations, 24-hour average ambient particulate concentrations in town could be 259 ug/m^3. As shown in Table IV, the federal health-related primary 24-hour NAAQS is 260 ug/m^3, not to be exceeded more than once a year, the secondary NAAQS, and the state 24-hour standard are 150 ug/m^3. The secondary NAAQS is also not to be exceeded more than once per year; the state standard is not to be exceeded at all.

G. Uncertainty in the Data

The number of TSP samples averages approximately fifty samples per year for 1981-1983. Since the TSP sample collection was fifty 24-hour samples out of a possible 365 24-hour samples per year, and particularly since there were exceedences of the federal primary NAAQS, the possibility of undetected violations of the primary NAAQS is significant. In order for a single monitor to measure a violation, several events must coincide. The wind must blow in the right direction from the source of the particulate matter to the monitor at the same time the particulate matter is being emitted. In most cases, the likelihood is very low of a monitor being in the right place at the right time to detect an exceedance. The likelihood of a single monitor picking up the maximum concentration is very low. Therefore, when a single monitor picks up an exeedance of the standards, it is indicative of the high potential for even higher concentrations somewhere else and the high potential for unacceptable frequencies of exceedances; violations of the standards. This is further reinforced by the aforementioned modeling analyses. Even in the middle of the Town of Questa, which is further from the tailings and substantially below the level of the tailings than the EID monitor, the expected ambient TSP levels will be well above the health-related primary NAAQS.

III. CONCLUSIONS

As a result of the review of the limited air quality data available from 1979-1983, significant concerns exist concerning adverse health effects due to exceedances of and a high probability of violations of the primary NAAQS, violations of the secondary NAAQS and violations of the state 24- hour standard. The probability of undetected violations of the primary NAAQS is very significant.

Based on the data reviewed for this report, there were unanswered questions concerning the portion of the TSP which is in the deeply inhalable size range. Unanswered questions also remained concerning the portion of TSP and respirable particulate matter which originate from the tailings. Additionally, the type and proportion of silica in windborne particulate matter, crystalline or amorphous, was unknown. The type of silica which becomes windborne is important; the severity of adverse health effects is significantly worse for crystalline silica.

Other deficiencies in the available data included lack of Air Quality Bureau measurements for cyanide, and organics in the tailings and in windborne particulate matter.

IV. FOLLOW-UP

As a result of the preliminary review conducted of the available data in preparation for this report, the Bureau recommended and designed a short-term study for 1984 in an attempt to provide additional information on the potential adverse effects due to windborne tailings material in the Questa area. EID will release a summary report on the short-term study in May, 1985.

The special study was designed to include the operation of four samplers at two sites, collecting samples twice a week. The two sampling sites are at Questa High School, which is frequently downwind of the tailings deposits, and the Red River Fish Hatchery which appears to be generally upwind of the tailings deposits. The Red River Fish Hatchery site was chosen to provide background measurements which are unaffected by any tailings deposits that become airborne during windy episodes which would affect the High School site. The Bureau also collected wind speed and wind direction data during part of the study to determine actual patterns of prevailing winds in the area. Each site contained one hi-volume sampler, which measures TSP, and one dichotomous particulate matter sampler, which measures particulate matter of less than 15 microns in diameter. Measurements from the dichotomous sampler will provide information on that portion of particulate matter which can be inhaled and is thus of greater concern with respect to health effects. Although EPA has proposed a particulate matter standard of a nominal 10 microns, measurement of a nominal 15 microns, as in the Bureau's study, provides a more conservative measurement that collects more of that portion of particulate matter depositing in the upper regions of the respiratory system (4). Health effects in the upper respiratory system which larger particles can reach have been reported from exposures to airborne silica (10). A comparison of the TSP and inhalable particulate matter samples will provide information on the portion of TSP in the inhalable size range.

Related information collected during the special study includes the collection and analysis of additional Molycorp mill tailings samples and soil samples in the area, analyzed for cyanide and heavy metals. Additionally, a time lapse camera operated at the Questa High School facing in the direction of the tailings deposits which are visible from the high school. Operation of the camera provided qualitative information on the source of high concentrations measured at Questa High School during the duration of the special study.

Clearly, the very limited scope of this short-term follow-up study does not provide the capacity to develop final answers on potentially serious health-related issues. However, the Bureau expects to be able to more adequately identify the scope of additional research necessary to answer these questions as a result of the short-term study.

TOTAL SUSPENDED PARTICULATE (TSP) MATTER
DATA IN MICROGRAMS PER CUBIC METER (ug/m^3)
For a 24 - HOUR AVERAGE

Questa High School
Questa, New Mexico

Collecting Agency

State of New Mexico
EID Air Quality Bureau

Collection Year	High 24 Hr Ave	2nd High 24 Hr Ave.	Annual Geometric Mean	Total Number of Samples Collected	Exceedances of the primary NAAQS	Exceedances of the State 24 hr std and secondary NAAQS	Violations of the secondary NAAQS
					Samples 260 ug/m^3	Samples 150 ug/m^3	
1979	216	145	85	9	0	1	0
1980	82	75	45	18	0	0	0
1981	399	180	49	54	1	4	3*
1982	301	161	34	52	1	3	2+
1983	187	137	29	48	0	1	0

Federal Primary Standards
24 Hour - 260 ug/m^3,
" not to be exceeded more than once per year" (40 CFR Part 50)
Annual Geo Mean -75 ug/m^3

Federal Secondary Standards
24 Hour - 150 ug/m^3,
" not to be exceeded more than once per year" (40 CFR Part 50)
Annual Geo Mean - 60 ug/m^3

State Standards
24 Hour - 150 ug/m^3
Annual Geo Mean - 60 ug/m^3

*1981 Secondary NAAQS Violations in ug/m^3 were 180, 399, 153

+1982 Secondary NAAQS Violations in ug/m^3 were 161, 301

TABLE II

Average Heavy Metals Data (TSP samples)
Samples Collected in 1979 and 1981
(Data in ug/m^3 for a 24 hr. Ave.)
Questa High School
Questa, New Mexico

Collecting Agency
State of New Mexico
EID Air Quality Bureau

	Average ug/m^3		Number of Samples		Percent of the OSHA std.		Percent of the ACGIH TLV	
	1979	1981	1979	1981	1979	1981	1979	1981
Lead	09		11		.18%		.06%	
Arsenic	.003	0016	11	10	03%		.005%	
Beryllium	0005*		11		.25%		.25%	
Mercury	0002		11		.004%		.04%	
Selenium	.001		11		.0005%		.0005%	
Chromium	005		2		001%		001%	
Zinc	028	1713	11	10	006%			
Molybdenum	002		2		4×10^{-5}%		4×10^{-5}%	
Uranium	0007		2		0003%			
Iron		1 4403		10		014%		144%
Cobalt		1441		7		14%		144%
Cadmium	0014		11		007%		.0028%	

* A less than symbol ( ) indicates that at least one value in the mean was reported at less than the lowest analytical standard range for that metal

Air Quality Standards for Heavy Metals

1 National Ambient Air Quality Standards (NAAQS)
Lead. 1 5 ug/m^3 for a 3-month calendar average.

2 National Emission Standards for Hazardous Air Pollutants (NESHAP)
Beryllium 0 01 ug/m^3 for a 30-day average for specific emission sources.
Mercury· 3200 g/24-hr period for specific emission sources

Table III

Comparison of Heavy Metals Data (TSP)
to New York State and Michigan State Guidelines

als	Time Weighted Average Threshold Limit Value TLV-TWA mg/m^3, ug/m^3	New York Dept. of Conservation Acceptable Ambient Air Level for an Annual Average - AAL. AAL = (TWA-TLV)/300 ug/m^3	Michigan Air Pollution Control Commission Emission Guidelines (TWA -TLV) x .024 mg/m^3	N.M. EID Heavy Metals Data From TSP Samples Arithmetic Mean for All Samples			N.M. EID Heavy Metals Data from TSP Samples High 24 Hour Concentrations		
				12/9,1981 ug/m^3	Exceeds New York Guidelines	Exceeds Michigan Guidelines	ug/m^3	Exceeds New York Guidelines	Exceeds Michigan Guidelines
.d	0.15, 150	0.500	3.6	.09	No	No	0.16	No	No
.enic	0.2, 200	0.667	4.8	.003, .0016	No	No	0.0032	No	No
yllium	0.002, 2.0	0.007	0.048	.005	No	No	.005	No	No
lmium	0.05, 50	0.167	1.200	.0014	No	No	.0039	No	No
·cury[A]	0.01, 10	0.033	0.240	.0002	No	No	.0005	No	No
	0.05, 50	0.167	1.200						
	0.10, 100	0.333	2.400						
lenium	0.2, 200	0.667	4.8	.001	No	No	.0016	No	No
·omium[B]	0.05, 50	0.167	1.2	0.0005	No	No	.0005	No	No
ic[C]	10.0, 10,000	33.333	240.0	.028, .1713	No	No	.2517	No	No
	5.0, 5,000	16.667	120.0						
lybdenum	5.0, 5,000	16.667	12.0						
	10.0, 10,000	33.333	240.0	.002	No	No	.003	No	No
nium	0.2, 200	.667	4.80	.0007	No	No	.0008	No	No
atural)									
on[D]	1.0, 1,000	3.33	24.0	1.4403	No	No	7.2420	Yes	Yes
balt[E]	0.1, 100	0.333	2.40	.1441	No	No	1.0	Yes	No

TWA-TLV's for Mercury are listed for 3 different forms: Alkyl compounds (0.01 mg/m^3), all forms except alkyl vapor (0.05 mg/m^3), d aryl and inorganic compounds (0.1 mg/m^3).

The TWA-TLV listed for chromium is for Chromium (VI) compounds including water soluble and certain water insoluble compounds. ere is a less restrictive TWA-TLV of 0.5 mg/m^3 for Chromium I, II and III compounds.

The TWA-TLVs listed are for zinc oxide dust where dust is less than 1% quartz (10 mg/m^3) or 5 mg/m^3 for respirable dust. ere are TWA-TLV's listed by the ACGIH for other zinc compounds: 5 mg/m^3 for zinc oxide fumes, 1 mg $1m^3$ for zinc.

The TWA-TLV listed is for soluble iron salts, as Fe.

The TWA-TLV listed is for cobalt metal, dust and fumes as Co. The ACGIH has proposed that the TWA TLV be changed to 0.05 mg/m^3.

TABLE IV
FEDERAL STANDARDS OR GUIDELINES

	Primary National Ambient Air Quality Standards (NAAQS)	National Emission Standards for Hazardous Air Pollutants (NESHAP)	Occupational Safety and Health Administration Standards (OSHA) 8 Hr Exposure	American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value, (TLV) for 1983-84 8 Hr Exposure
Total Suspended Particulate Matter	260 ug/m^3, 24 Hr Std 75 ug/m^3, Annual geo mean			
Lead (Pb)	1.5 ug/m^3 month calendar qtr		50 ug/m^3	Lead, inorganic, dusts & fume, as Pb 0.15 mg/m^3
Arsenic (As)			10 ug/m^3, inorganic As	0.2 mg/m^3 Time Weighted Average (TWA)
Beryllium (Be)		10 g/24 hr source emissions, 01 ug/m^3 stationary NESHAP source specific	2 ug/m^3	B 0.002 mg/m^3
Cadmium (Cd)			02 mg/m^3	Dust and Salts, as Cd 0.05 mg/m^3
Mercury (Hg)		3200 grams/24 hr period for specific NESHAP sources	1.0 $mg/10\ m^3$	C 0.01 mg/m^3, Alkyl cmpds C 0.05 mg/m^3, all forms except Alkyl vapor C 0.1 mg/m^3, aryl and inorganic cmpds
Selenium (Se)			0.2 mg/m^3	Selenium cmpds, as Se 0.2 mg/m^3
Chromium (Cr)			0.5 mg/m^3	Cr metal, compounds (II, III) as Cr 0.5 mg/m^3 0.05 mg/m^3 for Cr VI cmpds, water soluble
Zinc (Zn)			Zinc oxide fume 5 mg/m^3	D Zinc oxide dust
Cadmium (Cd)			5-15 mg/m^3	0.1 mg/m^3, soluble cmpd

TABLE IV (Continued)
FEDERAL STANDARDS OR GUIDELINES

	Primary National Ambient Air Quality Standards (NAAQS)	National Emission Standards for Hazardous Air Pollutants (NESHAP)	Occupational Safety and Health Administration Standards (OSHA) 8-hr Exposure	American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) for 1983-84
anium (U)			5 - 25 mg/m^3	
on (Ir)			Iron oxide fume 10 mg/m^3	Iron salt, soluble, as Fe 1.0 mg/m^3
balt (Co)			0.1 mg/m^3	Metal, dust and fume, as Co 0.1 mg/m^3
rystalline silica (SiO_2)			A 10 mg SiO_2/m^3 air +by % SiO_2 +2 Averaged over 8 hour shift	20 mppcf
morphous silica (SiO_2)			20 x 10^6 particles/ ft^3 air (mppcf)	6 mg/m^3 total dust 3 mg/m^3 respirable dust

The National Institute of Occupational Safety and Health (NIOSH) has recommended that the permissible exposure limit be changed to 50 micrograms respirable free silica per cubic meter of air (ug/m^3) averaged over a work shift of up to 10 hrs/day, 40 hrs/week

Listed as a suspected human carcinogen by ACGIH

All guidelines listed for mercury are for exposure through the skin

Zinc oxide dust, listed under nuisance dust, has a TLV of 10 mppcf or 10 mg/m^3 of total dust 1% quartz, or, 5 mg/m^3 respirable dust, other TLVs for zinc compounds includes 5 mg/m^3 for zinc oxide fumes, 1 mg/m^3 for zinc chloride fumes, and 0.05 mg/m^3 for zinc chromate, which is listed as a suspected human carcinogen

ACGIH has proposed a change to 0.05 mg/m^3

ACGIH has proposed to change to 5 mg/m^3 for respirable dust, 10 mg/m^3, total dust

Table V
Heavy Metals Data
Molycorp Mill Tailings Samples
Questa, New Mexico

micrograms per gram (ug/g)

Collecting Agency
State of New Mexico
EID Air Quality Bureau

	Lead Pb	Arsenic As	Beryllium Be	Cadmium Cd	Mercury Hg	Selenium Se	Chromium Cr	Zinc Zn	Molybdenum Mo	Uranium U
Fine Screening 250/u diam	164 80	10 80	0 40	L A*	I A	0.25+	30 50	168 0	273 20	1 85
Coarse Screening 250 u diam	58 60	5 80	0 58	L A	0 003	0 25	26 40	218 0	325 40	1 94
Unscreened Sample	76.90	5 70	0.57	0 57	0.011	0.25	23.50	166 0	292.1	1 49

*L. A is an abbreviation for laboratory accident

+ = less than

V REFERENCES

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2 "A Proposed Framework for Processing Air Quality Permit Applications for New Emission Sources of Non-Criteria Pollutants", Final Report of the Special Air Advisory Committee to the Michigan Air Pollution Control Commission. Michigan Department of National Resources. November 16, 1981.

3. "Air Guide-1 Application of 6 NYCRR Part 212-Toxic Air Contaminants", New York State Department of Environmental Conservation, Robert Flacke, Commissioner. Albany, New York. Revised on November 11, 1982.

4 "Review of the National Ambient Air Quality Standards for Particulate Matter Assessment of Scientific and Technical Information". U. S. Environmental Protection Agency, Research Triangle Park, N C. January 1982. NTIS Publication Number PB 82-177874

5. "Occupational Health Guideline for Amorphous Silica", U. S. Department of Health and Human Services and the U S Department of Labor September 1978.

6 "Occupational Health Guideline for Crystalline Silica", U.S. Department of Health and Human Services and the U. S. Department of Labor September 1978.

7 "Simple Siliceous Pneumoconiosis in Negev Bedoins", J. BarZiv, and G. M Goldberg. Archives of Environmental Health. 1974 Vol 29, 121-126.

8 "Pulmonary Toxicity of Mount St. Helens Volcanic Ash", C L. Sanders, A W Conklin, R A. Gelman, R R. Adee, and K. Rhoads Environmental Research Vol. 27, 118-135, 1982

9 "A Review of Plant Practice at Molycorp Inc., Questa Division", by A Filyk, Mill Superintendent. Flotation, Volume 2, M C Fuerstenau, Editor. American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc New York 1976.

10. "Criteria for a Recommended Standard - Occupational Exposure to Crystalline Silica" National Institute for Occupational Safety and Health, Rockville Maryland. 1979. NTIS Publication Number PB-246 697

RECORD OF TELEPHONE CONVERSATION

Time: 3:00 PM	Date: 6-16-95
Originating Party: Stuart Kent	Other Parties: Mary Harrison - Former Nurse
NMED - Superfund Program	Questa School District

Subject: Blowing Dust at Questa JR High School

Discussion:

+ Mrs Harrison worked as the district nurse from 1984-94

+ She noted occasions of blowing tailings which would leave a fine white greasy film occur ~ Once per week. Effects on kids included eye irritation, increases in allergic reactions (several of which were "severe") and respiratory problems

+ Once in 1993 the school had to be closed due to blowing tailings & 4 or 5 times recess could not be held outdoors.

+ Once after Molycorp began using surfactants as dust suppressant several people on truck team had difficulty breathing.

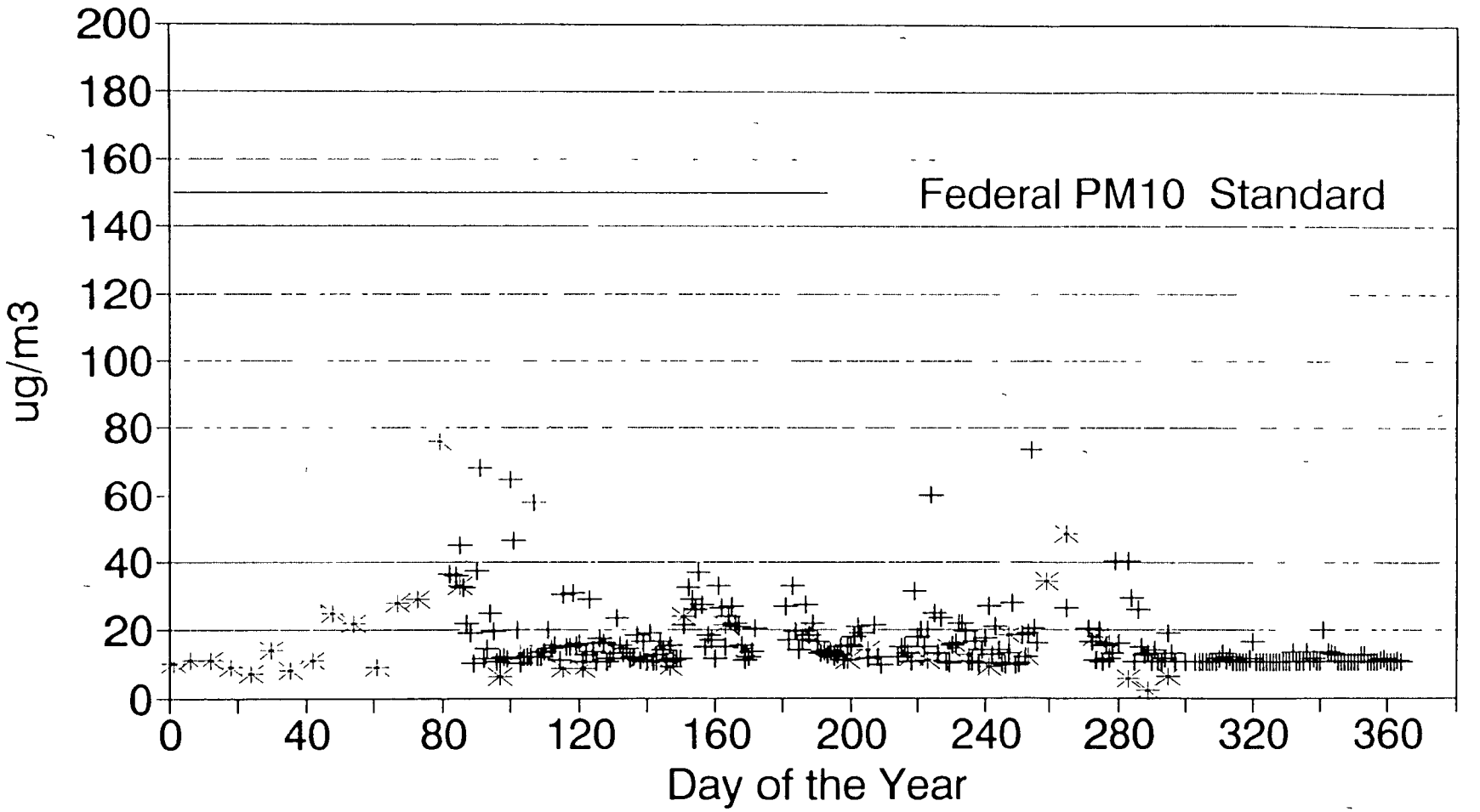
+ She thought number of symptoms likely have decreased since tailings have been capped

Stuart Kent

Signed

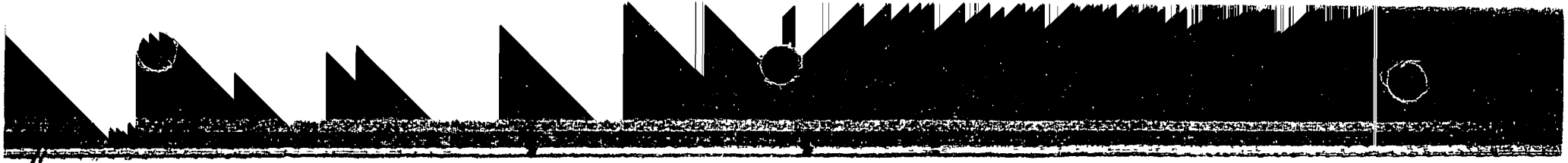
QUESTA PM-10 VALUES

1993 - 24 HOUR averages



+ Continuous Monitor * High Volume Sampler

NMED - Air Quality Bureau



DATE 03/15/95 — EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS) — PAGE 319
AMP350
AIR QUALITY SUBSYSTEM
RAW DATA REPORT 1-HOUR TIMING

(81102) PM10 TOTAL 0-10UM — CAS NUMBER

STATE (35) NEW MEXICO
JAN 1994

SITE-ID 35-055-0006 POC 1 — AQCR (115) UPPER RIO GRANDE VALLEY — LATITUDE 36 43 18 N
COUNTY (055) TAOS CO — URBAN-AREA (0000) NOT IN AN URBAN AREA — LONGITUDE 105 36 07 W
CITY (00000) NOT IN A CITY — LAND USE (2) INDUSTRIAL — UTM ZONE 13
SITE ADDRESS QUESTA MIDDLE SCHOOL — LOCATION SETTING (3) RURAL — UTM NORTHING 4065943
SUPPORT AGENCY (0001) NEW MEXICO ENVIRONMENT DEPARTMENT — UTM EASTING 446256
SITE COMMENTS — ELEVATION MSL 7018 FT
MONITOR COMMENT — REPORT PERIOD 31
MONITOR TYPE (3) OTHER — REPORTING AGENCY — INTERVAL 1
UNITS (001) UG/CU METER (25 C) — REPORTING ORGANIZATION (001) NEW MEXICO ENVIRONMENT DEPARTM
COLLECTION AND ANALYSIS METHOD (081) INSTRUMENTAL-REDDING-AUTOMATIC BETA-RAY ATTENUATION

DAY/HOUR

DAY	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	0.5	MEAN
1	10	10	11	11	10	11	11	11	11	10	11	11	11	11	11	11	10	11	11	11	11	11	11	11	24	11
2	11	10	11	11	17	13	12	12	11	10	11	10	10	11		10	11	11	11	11	11	10	11	10	23	11
3	10	11	11	11	10	10	10	11	11	10	11	11	11	11	11	11	11	11	16	15	13	12	11	10	24	11
4	11	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	28	21	19	17	11	11	11	24	13
5	11	11	11	11	11	11	11	11	11	11	11	11	10	10	11	11	11	10	11	11	11	10	11	11	24	11
6	11	11	11	11	11	11	11	11	11	10	10	11	11	10	11	10	10	10	11	10	11	11	11	10	10	24	11
7	10	10	10	11	10	11	10	10	10	11	11	11	11	10	11	11	11	11	11	10	11	12	11	11	24	11
8	10	11	11	10	10	11	10	11	11	10	10	11	11	11	11	26	21	17	16	10	11	11	11	10	24	12
9	11	11	11	11	11	11	10	10	11	11	11	11	11	11	11	11	11	11	11	11	11	43	32	26	24	14
10	27	11	10	11	10	10	11	11	10	10	10	11	11	10	10	11	11	11	11	11	11	11	11	11	24	11
11	10	10	10	10	11	11	10	10	11	11	11	10	11	10	11	11	11	11	11	11	11	11	11	11	24	11
12	10	11	10	10	10	10	10	10	11	10	10	10	11	11	11	11	11	23	18	16	16	10	10	10	24	12
13	11	10	11	10	10	10	11	10	10	11	10	11	11	11	11	11	11	11	11	11	11	11	11	11	24	11
14	11	10	11	11	10	11	10	10	10	11	11	11	11	11	11	11	11	10	11	11	11	11	11	10	24	11
15	10	10	10	10	11	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	11	11	11	11	24	11
16	11	11	11	11	11	11	11	11	11	11	11	11	11	10	11	11	11	11	10	10	10	10	10	10	24	11
17	11	10	12	11	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	24	11
18	11	11	11	11	11	11	10	10	11	11	11	11	11	11	11	11	29	51	39	32	21	11	11	11	24	16
19	10	11	14	13	11	10	11	10	10	10	10	11	11	11	11	11	23	19	17	15	10	11	11	11	24	12
20	10	10	10	10	10	10	10	10	10	10	11	10	11	11	10	11	40	34	30	26	13	11	11	11	24	14
21	11	11	11	11	11	11	10	11	10	11	11	11	11	11	17	14	14	38	26	21	19	10	11	10	24	14
22	11	10	10	10	10	10	10	10	10	10	11	11	11	11	11	11	11	58	42	34	29	11	10	11	24	16
23	11	10	10	11	11	10	10	11	10	11	10	11	11	10	10	10	42	32	27	24	11	11	11	11	24	14
24	11	11	11	11	10	11	11	11	11	11	11	11	11	11	11	11	27	21	19	17	11	11	11	11	24	13
25	11	10	11	11	11	10	11	11	11	11	11	11	11	36	28	24	22	23	19	17	15	11	11	11	24	15
26	11	11	11	12	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	24	11
27	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	11	11	11	24	11
28	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	24	11
29	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	24	11
30	11	11	11	11	11	11	11	11	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	24	11
31	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	11	11	11	11	24	11

Std
150 µg

NO	31	31	31	31	31	31	31	31	31	31	31	31	31	31	30	31	31	31	31						
MAX	27	11	14	13	17	13	12	12	11	11	11	11	11	36	28	40	42	58	42	34	29	45	32	26	
ME	11	11	11	11	11	11	11	11	11	11	11	11	11	12	12	13	15	18	16	14	13	12	12	11	

MONTHLY OBSERVATIONS 743 MONTHLY MEAN 12 MONTHLY MAXIMUM 58

RAW DATA REPORT 1-HOUR LISTING

(81102) PM10 TOTAL 0-10UM CAS NUMBER

STATE (35) NEW MEXICO

FEB 1994

SITE-ID 35-055-0006 POC 1 AQCR (157) UPPER RIO GRANDE VALLEY LATITUDE 0 0 0 N

COUNTY (055) TAOS CO URBAN-AREA (0000) NOT IN AN URBAN AREA LONGITUDE 105 56 07 W

CITY (00000) NOT IN A CITY LAND USE ( ) INDUSTRIAL UTM ZONE 13

SITE ADDRESS QUESTA MIDDLE SCHOOL LOCATION SETTING (3) RURAL UTM-NORTHING 4063?40

SUPPORT AGENCY [redacted] NEW MEXICO ENVIRONMENT DEPARTMENT UTM EASTING 44?254

SITE COMMENTS ELEVATION-MSL 2520 M

MONITOR COMMENTS PROBE HEIGHT M

MONITOR TYPE (3) OTHER MINIMUM DETECTABLE 4 INTER AI 1

UNITS (001) UG/CU METER (25 C) REPORTING ORGANIZATION (001) NEW MEXICO ENVIRONMENT DEPARTM

COLLECTION AND ANALYSIS METHOD (081) INSTRUMENTAL-REDDING-AUTOMATIC BETA-RAY-ATTENUATION

DAY/HOUR	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	083	ME
1	10	11	11	10	11	10	10	10	10	11	11	11	10	10	11	10	11	11	11	11	11	10	11	10	24	11
2	10	11	10	11	11	11	10	10	10	10	11	10	10	11	11	10	11	11	11	10	10	10	10	11	24	10
3	10	11	11	11	11	10	11	11	11	11	11	11	11	11	11	11	11	10	11	10	11	11	10	11	24	11
4	10	11	11	11	11	11	11	11	11	11	11	10	11	10	11	11	11	11	11	11	11	11	11	11	24	11
5	11	11	11	11	10	11	11	11	10	11	11	10	10	11	11	11	11	11	11	10	11	11	11	11	24	11
6	11	10	11	10	10	10	11	10	10	10	11	11	11	11	11	11	11	10	11	10	11	10	10	11	24	11
7	11	11	11	11	11	11	11	11	11	10	11	11	11	11	11	11	10	10	11	11	11	11	10	11	24	11
8	11	11	11	11	10	11	11	10	10	10	11	11	10	11	11	11	11	10	11	10	10	11	11	11	24	11
9	11	11	10	10	10	11	11	11	11	11	11	11	11	11	10	11	11	11	11	11	11	11	11	10	24	11
10	11	11	11	11	11	11	11	10	11	10	10	11	11	10	11	10	10	11	11	11	11	11	11	11	24	11
11	11	12	10	11	10	11	10	10	11	10	10	10	10	11	10	10	10	11	11	10	10	10	11	10	24	10
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14	11	11	10	10	10	10	10	10	10	10	18	16	15	15	11	11	11	11	11	11	11	11	10	11	24	11
15	11	10	10	10	11	10	11	10	10	10	10	10	11	11	11	11	11	11	10	11	11	11	10	11	24	11
16	11	11	10	11	11	11	10	11	11	11	11	11	11	11	10	11	11	11	11	10	11	11	11	11	24	11
17	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	29	23	19	18	11	11	11	11	10	24	15
18	10	11	11	10	11	11	10	11	10	10	12	10			10	10	10	11	10	11	11	10	10	11	24	11
19	10	11	11	10	10	11	10	11	10	10	11	11	11	11	11	10	10	11	11	10	11	10	11	10	24	11
20	10	10	10	10	11	10	11	10	10	10	10	11	11	11	11	11	11	10	11	11	11	11	11	11	24	11
21	11	10	10	11	10	10	10	10	10	11	10	11	11	11	11	10	10	10	11	11	11	11	11	11	24	11
22	11	10	11	10	11	10	11	11	10	10	11	11	10	11	11	11	11	11	10	11	10	11	11	10	24	11
23	11	11	10	10	10	10	10	10	11	11	10	10	11	11	11	11	10	11	10	10	11	11	10	11	24	11
24	11	11	11	10	11	10	10	10	10	10	10	10	11	11	11	11	11	11	11	11	11	11	11	10	11	11
25	11	11	11	10	11	11	11	11	11	10	11	11	11	11	11	11	10	10	11	11	11	11	10	11	24	11
26	10	11	11	11	11	11	11	11	10	11	11	11	10	25	20	18	18	15	13	11	11	11	10	11	24	13
27	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	15	74	74	53	39	12	11	11	11	24	19
28	11	11	11	11	11	11	11	10	11	11	11	11	10	11	11	11	11	11	11	10	11	11	11	11	24	11
29																										
30																										
31																										
NO	28	28	28	28	28	28	28	28	28	28	28	28	27	27	28	28	28	28	28	28	28	28	28	28	28	
MA	11	12	11	11	11	11	11	11	11	11	18	16	15	25	20	29	74	74	53	39	12	11	11	11		
MEAN	11	11	11	11	11	11	11	10	10	10	11	11	11	11	11	12	14	13	13	12	11	11	11	11		

MONTHLY OBSERVATIONS 670 MONTHLY MEAN 11 MONTHLY MAXIMUM 74

AIR QUALITY SUBSYSTEM
RAW DATA REPORT 1-HOUR LISTING

(81102) PM10 TOTAL 0-10UM — CAS NUMBER

STATE (35) NEW MEXICO
MAR 1994

SITE-ID 35-055-0006 POC 1 AQCR (157) UPPER RIO GRANDE VALLEY LATITUDE 36 43 16 N
COUNTY (055) TAOS CO URBANIZED AREA (0000) NOT IN AN URBAN AREA LONGITUDE 105 36 07 W
CITY (00000) NOT IN A CITY LAND USE (3) INDUSTRIAL UTM ZONE 13
SITE ADDRESS QUESTA MIDDLE SCHOOL LOCATION SETTING (3) RURAL UTM NORTHING 4060 40
SUPPORT AGENCY (0001) NEW MEXICO ENVIRONMENT DEPARTMENT UTM-EASTING 446254
SITE COMMENTS ELEVATION-MSL 2520 M
MONITOR COMMENTS PROBE HEIGHT M
MONITOR TYPE (3) OTHER MINIMUM DETECTABLE 4 INTERVAL 1
UNITS (001) UG/CU METER (25 C) REPORTING ORGANIZATION (001) NEW MEXICO ENVIRONMENT DEPARTM
COLLECTION AND ANALYSIS METHOD (063) INSTRUMENTAL BEDDING-AUTOMATIC BETA-RAY-ATTENUATION

DAY/HOUR

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	HIGH
1	11	11	20	19	18	31	20	17	12	10	11	11	11	11	11	10	11	11	11	11	11	11	11	11	15
2	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	27	21	19	17	11	11	11	11	11	15
3	11	11	11	11	11	11	11	11	11	11	26	20	18	17	33	24	20	44	26	21	19	11	11	11	17
4	10	11	10	11	11	11	11	11	11	11	31	15	10	10	10	11	10	11	57	42	34	29	11	11	17
5	11	11	11	11	11	11	11	11	11	11	10	19	16	14	55	50	38	31	21	11	11	11	11	11	17
6	11	11	11	11	11	11	11	11	11	10	10	11	11	11	10	10	10	11	11	11	11	11	11	1	11
7	11	11	11	11	11	11	11	11	10	11	10	10	11	11	11	11	31	24	21	19	11	11	11	11	13
8	11	11	11	11	11	11	11	11	11	11	10	10	11	11	11	11	10	11	11	11	11	11	10	24	11
9	11	10	11	11	11	11	11	11	11	11	11	11	11	11	11	28	22	19	17	11	11	11	11	11	13
10	11	11	11	11	11	11	11	11	12	11	11	11	12	33	28	23	18	11	11	11	11	11	11	11	14
11	11	11	11	11	11	11	11	11	11	11	10	10	11	11	10	19	15	51	38	28	24	11	11	11	15
12	10	11	11	11	10	11	10	10	10	11	10	11	11	11	10	11	11	11	11	11	11	11	27	22	12
13	19	17	10	11	11	10	10	10	10	10	11	10	11	11	11	11	10	11	11	11	11	11	11	11	11
14	11	11	11	11	11	11	11	10	11	11	11	11	31	24	20	34	20	17	15	11	11	11	11	11	14
15	10	10	11	11	18	15	14	13	11	11	11	11	29	22	17	15	11	10	11	11	11	11	11	11	13
16	11	11	11	11	11	11	11	11	11	11	11	11	35	26	23	20	10	52	38	31	27	11	11	10	18
17	11	11	11	11	11	11	11	11	11	10	10	10	10	10	10	18	14	14	12	11	13	14	13	13	12
18	11	11	11	11	11	10	11	11	11	10	10	11	31	24	17	35	19	17	15	11	11	11	11	11	14
19	11	13	11	11	11	11	11	11	11	11	11	11	11	10	10	11	11	11	11	11	11	11	11	11	11
20	11	11	12	10	10	10	11	11	10	11	11	11	11	11	11	11	11	106	105	74	56	13	11	11	23
21	11	11	11	11	11	11	11	11	11	11	11	11			11	10	11	10	11	11	10	10	11	11	11
22	11	11	11	11	11	11	11	11	11	10	11	11	11	11	11	11	11	10	11	11	11	11	11	11	11
23	11	10	11	11	10	10	11	11	11	10	11	10	11	17	12	12	35	23	17	13	11	11	11	11	13
24	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	32	23	19	17	11	11	13
25	11	11	11	11	11	11	11	11	11	11	11	11	11	11	31	24	24	19	11	11	11	11	11	11	13
26	11	11	12	11	11	11	11	11	11	11	56	42	34	29	11	11	11	10	11	11	11	11	10	10	16
27	11	10	10	10	11	11	11	11	10	10	11	10	10	11	10	11	10	11	11	11	10	11	11	11	11
28	11	11	11	11	11	11	11	11	11	11	11	10	11	11	10	11	11	11	11	11	11	11	11	11	11
29	11	11	11	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	11	10	11	11	11
30	11	11	11	11	11	11	11	11	11	11	11	11	11	34	24	18	14	10	11	11	11	11	11	11	13
31	11	11	11	11	11	11	11	11	11	10	23	18	17	15	10	10	11	10	11	11	11	11	11	11	12
NO	31	31	31	31	31	31	31	31	31	31	31	31	30	30	31	31	31	31	31	31	31	31	31	31	
MAX	19	17	20	19	18	31	20	17	12	11	56	42	34	34	35	50	52	106	105	74	56	29	27	22	
MEAN	11	11	11	11	11	12	11	11	11	11	14	13	15	15	15	17	17	20	20	16	14	12	12	11	

MONTHLY OBSERVATIONS 742 MONTHLY MEAN 13 MONTHLY MAXIMUM 106

SITE-ID 35-[redacted]-0006 POC 1
COUNTY (055) TAOS CO
CITY (00000) NOT IN A CITY
SITE-ADDRESS QUESTA MIDDLE SCHOOL
SUPPORT AGENC[redacted] ENVIRONMENT DEPARTMENT
SITE COMMENTS
MONITOR COMMENTS
MONITOR TYPE (3) OTHER
UNITS (001) UG/CU METER (25 C)
COLLECTION AND ANALYSIS METHOD (081) IN HORIZONTAL MONITOR-AUTOMATIC BETA RAY ATTENUATION

AQCR (157) UPPER RIO GRANDE VALLEY
URBAN-AREA (0000) [redacted]N AN URBAN AREA
LAND USE ( ) INDU[redacted]AL
LOCATION SETTING (3) RURAL

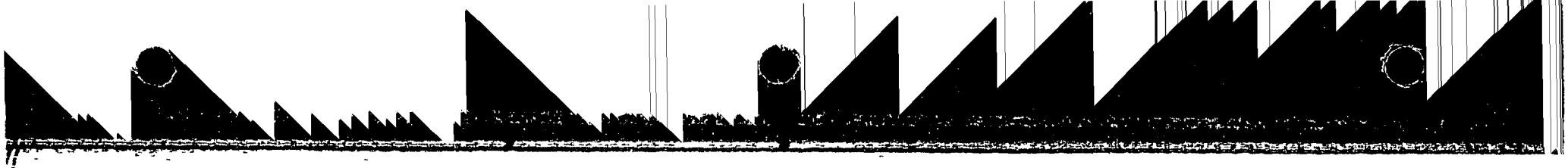
LATITUDE [redacted] 18 N
LONGITUDE 105 36 07 W
UTM ZONE 13
UTM-NORTHING [redacted]
UTM-EASTING 446254
ELEVATION MSL 2320 M
PROBE HEIGHT M
INTERVAL 1

DAY/HOUR

DAY	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	0[illegible]	MEAN
1	11	11	11	11	11	11	11	11	11	10	10	11	10	36	58	46	26	24	11	10	11	11	11	11	24	17
2	11	11	11	11	11	11	11	11	11	10	10	11	11	11	41	31	43	33	16	14	11	11	11	11	24	16
3	11	11	11	11	11	11	11	11	11	11	11	11	11	10	10	10	11	11	11	11	11	11	11	11	24	11
4	11	11	11	11	11	11	11	11	11	11	11	10	49	56	30	26	11	11	11	10	11	11	10	11	24	15
5	11	11	10	11	11	10	11	10	11	10	11	35	38	24	22	12	11	11	11	11	11	11	11	11	24	14
6	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	20	34	26	21	14	11	11	24	14
7	11	11	11	11	11	11	11	10	10	10	11	10	10	11	36	28	40	31	18	15	11	11	11	11	24	15
8	11	11	18	15	13	13	11	11	11	10	20	17	15	15	11	10	11	10	11	11	11	11	11	11	24	12
9	11	11	11	11	11	11	10	11	10	10	11	11	10	10	11	43	41	33	84	51	38	32	11	11	24	21
10	11	11	11	11	11	11	11	11	11	11	11	11	10	11	11	11	11	11	11	11	11	11	11	11	24	11
11	11	10	11	11	11	11	11	11	10	11	10	10	11	10	21	17	16	25	25	23	11	11	11	11	*	15
12	11	11	11	11	10	11	11	11	11	11	13	11	11	10	10	10	11	11	11	11	11	11	11	11	*	11
13	11	11	11	11	11	11	11	11	11	11	11	11	11	10	10	66	57	60	43	14	12	11	11	11	24	17
14	11	11	11	11	11	11	11	11	10	10	11	31	*	24	23	70	47	119	81	*	33	11	11	11	*	7
15	11	11	11	10	11	11	11	11	10	11	25	21	17	26	15	15	12	10	18	16	13	13	10	11	24	14
16	11	11	11	25	20	18	17	11	11	17	14	50	26	27	23	10	10	10	10	11	11	10	11	11	24	17
17	11	11	11	11	11	11	11	11	10	12	10	10	10	10	10	40	30	25	55	31	25	23	11	11	24	17
18	11	11	14	12	11	11	11	11	11	10	68	66	49	125	72	50	42	10	48	36	30	26	11	11	24	31
19	11	10	19	15	15	13	13	12	11	11	11	10	10	19	16	14	13	10	10	10	11	52	48	38	24	17
20	31	15	13	12	11	11	11	10	10	39	29	25	23	10	10	50	35	29	25	10	10	10	35	27	24	21
21	23	21	11	11	11	11	17	14	17	31	19	15	10	23	16	15	11	10	17	14	13	13	10	24	24	16
22	18	14	13	11	11	11	11	11	10	10	11	10	10	11	10	10	155	108	84	77	17	16	16	12	24	23
23	11	11	11	11	11	10	11	11	10	23	18	17	166	111	86	71	71	58	58	53	37	36	33	11	24	29
24	11	11	11	11	11	11	11	11	11	30	24	20	18	11	10	37	28	23	19	10	11	11	10	11	24	16
25	11	11	14	13	12	11	11	11	11	11	11	19	16	14	14	11	27	21	33	26	17	14	11	11	24	15
26	10	11	11	11	10	11	10	11	11	11	10	10	10	11	10	11	11	11	11	11	11	11	11	10	24	11
27	11	10	11	11	10	10	11	11	11	11	11	10	10	11	11	10	10	10	11	11	11	11	11	11	24	11
28	11	11	11	10	10	10	11	11	11	11	10	18	31	25	20	15	11	11	11	11	10	10	11	11	24	13
29	11	11	11	11	11	11	11	11	11	11	11	11	10	11	11	11	11	10	10	11	11	10	11	11	24	11
30	11	11	11	11	11	11	11	11	11	11	10	11	10	11	56	41	34	29	12	11	11	11	11	11	24	16
31																										
NO	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30		
MAX	31	21	19	25	20	18	17	14	17	39	68	66	166	125	86	71	155	119	84	77	38	52	48	38		
MEAN	12	11	12	12	11	11	11	11	11	14	15	18	22	23	23	27	30	27	27	20	15	15	14	13		

MONTHLY OBSERVATIONS 720 MONTHLY MEAN 17 MONTHLY MAXIMUM 166

With PRESTEX® Cycles
that resist moisture, wipe clean,



DATE 03/15/95 EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS) PAGE 523
AMP350 AIR QUALITY SUBSYSTEM
RAW DATA REPORT 1-HOUR LISTING

(81102) PM10 TOTAL 0-10UM CAS NUMBER

STATE (35) NEW MEXICO ICO
MAY 1994

SITE-ID 35-055-0006 POC 1 AQCR (157) UPPER RIO GRANDE VALLEY LATITUDE 36 43 18 N
COUNTY (055) TAOS CO URBAN-AREA (0000) NOT IN AN URBAN AREA LONGITUDE 105 36 07 W
CITY (00000) NOT IN A CITY LAND USE (2) INDUSTRIAL UTM ZONE 13
SITE ADDRES QUESTA MIDDLE SCHOOL LOCATION SETTING (3) RURAL UTM NORTHING 4065 40
SUPPORT AGENCY (001) [redacted] ENVIRONMENT DEPARTMENT UTM EASTING 456 24
SITE COMMENT ELEVATION (FT) 8 0 0
MONITOR COMMENT PROBE HEIGHT M
MONITOR TYPE (3) OTHER MINIMUM DETECTABLE 4 INTERVAL 1
UNITS (001) UG/CU METER (25 C) REPORTING ORGANIZATION (001) NEW MEXICO ICO ENVIRONMENT DEPARTM
COLLECTION AND ANALYSIS METHOD (081) INSTRUMENTAL-NEPHELOMETRY-AUTOMATIC BETA-RAY-ATTENUATION

DAY/HOUR

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MEAN
1	11	11	11	11	11	11	11	11	10	10	10	11	11	10	15	12	37	28	21	18	11	11	11	11	24	14
2	11	11	11	10					11	37	28	10	33	12	10	55	51	35	29	11	11	11	11	11	20	20
3	11	11	11	11	11	11	11	11	11	11	12	10	11	10	10	11	11	27	21	19	17	11	11	11	24	13
4	11	11	11	11	10	11	11	11	31	46	35	29	19	18	15	14	13	10	11	11	11	11	10	11	24	16
5	50	50	40	33	15	11	11	10	10	21	17	15	14	13	12	11	10	10	10	10	11	11	23	19	24	18
6	17	15	11	11	11	11	11	10	10	15	13	12	11	10	10	10	10	10	10	42	32	27	24	11	24	15
7	11	11	11	11	11	11	11	10	10	24	19	19	15	10	10	15	68	100	73	56	29	27	28	20	24	25
8	17	10	11	11	11	11	11	10	10	10	10	10	10	10	10	15	12	11	10	11	10	21	18	15	24	12
9	14	15	13	11	10	11	12	10	10	10	87	61	48	40	13	11	11		11	10	10	11	11	11	23	20
10	10	10	10	10	10	11	11	11	10	10	11	11	10	11	11	24	19	35	29	21	19	12	11	11	24	14
11	11	11	11	11	10	11	11	10	10	11	11	10	10	10	10	77	55	165	118	71	59	10	10	51	23	33
12	31	27	11	10	11	11	11	10	10	11	11	10	10	11	11	11	10	11	10	10	11	11	11	10	11	24	12
13	11	11	11	11	10	11	11	10	11	10	10	10	11	10	10	10	10	28	21	19	17	10	26	21	24	15
14	20	18	12	11	10	10	10	11	10	11	11	10	10	10	102	72	56	47	50	36	30	26	11	11	24	25
15	10	11	10	10	11	11	11	10	11	11	10	10	20	14	12	11	10	10	10	11	11	10	27	28	24	13
16	28	27	15	10	11	11	10	10	10	10	10	10	10	18	22	199	136	101	80	21	17	15	13	10	24	34
17	11	36	28	28	23	12	11	10	10	10	10	11	10	10	10	10	10	10	10	10	10	10	10	11	24	13
18	11	10	11	11	10	11	11	10	10	10	10	39	35	49	37	21	17	16	17	12	11	10	11	10	24	17
19	11	11			95	48	29	10	10	31	18	14	12	18	13	156	105	75	61	11	10	11	10	11	22	35
20	39	30	25	21	10	10	11	10	10	10	10	10	10	28	22	19	17	11	10	10	11	11	10	10	24	15
21	11	10	11	11	10	11	11	10	23	23	18	15	10	10	10	10	10	10	10	10	11	10	51	44	24	15
22	35	30	12	10	11	43	31	26	27	10	11	10	10	21	17	15	74	50	40	62	29	24	21	14	24	20
23	12	11	11	11	11	11	11	10	10	62	45	36	10	10	10	10	30	23	76	74	51	42	18	23	24	26
24	19	17	15	11	10	11	10	10	11	11	10	10	10	10	10	10	10	10	11	11	10	10	11	10	24	11
25	11	10	35	27	27	22	10	65	56	43	41	16	10	10	10	10	11	17	56	55	39	27	14	10	24	26
26	10	11	10	11	10	11	10	10	11	10	16	24	18	107	112	123	202	105	91	43	20	17	12	10	24	49
27	10	10	10	10	10	11	11	37	28	24	23	10	10	71	46	75	55	70	50	26	21	11	10		23	28
28	11	11	11	11	11	11	11	10	10	10	10	10	10	79	56	46	45	45	35	30	23	13			22	23
29	67	32	10	3	11	5	12	5	11	13	6	15	8	8	2	5	12	7	8	10	4	6	9	6	24	11
30	6	6	11	10	8	4	5	8	4	35	65	54	34	22	49	31	29	20	26	82	60	43	31	47	24	29
31	108	106	70		20	10	13	13	15	90	63	62														

MAX	108	106	70	53	95	48	31	65	56	90	87	62	48	167	112	223	202	118	91	82	60	43	51	47
MEAN	21	19	16	13	15	13	12	13	14	21	21	19	15	24	26	39	42	36	32	27	19	16	18	16

[redacted]ITHLY OBSERVATIONS 721 MONTHLY MEA[redacted] 21 MONTHLY MAXIMUM 223

RAW DATA REPORT 1-HOUR LISTING

(81102) PM10 TOTAL 0-10UM CAS NUMBER

STATE (3) NEW MEXICO

JUN 1 94

SITE-ID 35 055-0006 POC 1 AQCR (170) UPPER RIO GRANDE VALLEY LATITUDE 36 [illegible] 13 N

COUNTY (055) TAOS CO URBAN-ARE (0000) NOT IN AN URBAN AREA LONGITUDE 105 36 07 W

CITY (00000) NOT IN A CITY LAND USE (3) INDUSTRIAL UTM ZONE 13

SITE ADDRESS QUESTA MIDDLE SCHOOL LOCATION SETTING (3) RURAL UTM-NORTHING [illegible]

SUPPORT AGENC[redacted] NEW MEXICO ENVIRONMENT DEPARTMENT UTM EASTING [illegible]

SITE COMMENTS ELEVATION M [illegible] 0 M

MONITOR COMMENTS PROBE HEIGHT M

MONITOR TYPE (3) OTHER MINIMUM DETECTABLE 4 INTERVAL 1

UNITS (001) UG/CU METER (25 C) REPORTING ORGANIZATION (001) NEW MEXICO ENVIRONMENT DEPARTM

COLLECTION AND ANALYSIS METHOD (081) INSTRUMENTAL-REDDING-AUTOMATIC BETA-RAY-ATTENUATION

DAY/HOUR

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	MEAN
1				4	11	11	12	10	3	6	14	4	15	4	12	58	150	108	82	55	7	5	15	8	21	27
2	4	14	6	12	9	9	18	4	15			13	5	7	14	1	12	26	22	36	27	14	10	6	22	13
3	11	5	17	40	51	9	20	9	12	15	7	6	14	[illegible]	21			56	30	9		7	3	11	1	17
4	10	14	46	51	32	17	9	10	11	5	1	8	13	7	15	63	48	26	25	11	1	14	5	5	24	21
5	4	7	6	5	9	5	7	5	16	12	7	5	11	19	14	7	1	32	16	24	10	12	[illegible]	5	24	10
6	12	14	14	25	14	14	10	4	15	25	6	7	2		52	48	29	13	15	18	14	5	9	16	25	17
7	5	7	12	2	10	10	9	6	4	8	22	17	17	6	20	18	19	10	15	10	4	12	8	6	24	11
8	2	15	17	26	10	12	15	10	10	4	7	-3	4	8	5	7	8	11	12	17	12	11	1	3	24	10
9	14	14	17	27	27	26	19	10	29	8	35	18	15	6	3	8	4	1	2		-4	-4	16	6	25	14
10	9	14	12	6	15	13	8	4	4	14	50	15	27	18	13	12	2	3	11	1	3	14	5	8	24	12
11	6	10	31	55	43	37	21	16	66	38	35	67	115	88	307	236	165	162	16		5	7	7	17	23	70
12	6	6	49	37	26	26	18	1	15	9	11	14	10	5	2	156	146	120	98	17	10	6	10	12	24	34
13	4	10	4	9	12	6	10	4	26	67	53	45	26	9	14	66	48	43	24	4		3	9	15	25	22
14	14	12	15	20	24	19	20	13	14	15	17	16	10	15	14	13		2	5	-1	5	6	11	8	25	13
15	9	68	49	31	27	12	14	14	14	2	16	8	7	11	6	15	15	13	3	17	5	12	16	3	24	16
16	25	20	17	10	7	6	11	10	9	3	21	15	14	19	10	4	29	28	20	18	10	6	8	3	24	13
17	13	11	14	10	9	5	10	12	45	51	88	68	49	28	3	10	13	18	50	41	18	21		7	25	25
18	13	11	16	5	12	6	4	2	13	11	47	36	51	42	76	49	51	31	8	10	11	13	6	8	24	22
19	-1	9	3	5	9	4	40	37	64	47	63	93	97	63	93	151	83	68	48	6	6	5	20	3	24	43
20	4	11	13	14	13	38	32	21	18	7	14	3	47	40	105	80	53	46	8	9	4	10	5	-1	24	25
21	9	18	14	12	12	10	9	10	7	10	21	13	15	16	38	28	23	24	12	4	15	10	11	7	24	15
22	-1	1	5	15	16	18	25	10	8	53	42	44	31	22	62	90	69	47	20	82	53	51	38	6	24	34
23	66	70	59	49	17	10	7	5	5	16	39	16	35	30	49	24	17	9	36	102	95	67	49	1	24	36
24		14	8	24	22	9	18	3	3	14	58	48	37	32	40	42	43	26	25	3	12	5	-1	17	25	22
25	11	28	14	26	39	28	20	14	15	9	9	11	18	26	7	12	5		7	14	11	-1	7	11	23	15
26	2	11	6	9	12	4	17	16	8	44	45	35	18	6	6	-2	19	14	17	-2	5	14	-4	4	24	13
27	6		5	3	14	58	30	41	27	58	48	41	49	15	1	20	15	4	3	15	12	27	15	9	25	22
28	7	12	16		15	2	14	15	15	26	33	11	12	8	11	13	2	7	7	70	45	42	31	2	25	16
29	11	-5	9	2	4	15		11	10	9	6	10	24	9	48	30	17	29	115	112	83	69	18	3	25	28
30	8	1	5	3	12	14	6	4	11		101	62	42	29	10	9	22	14	68	59	38	36	12	-3	23	20
31																										
NO	28	28	29	29	30	30	29	30	30	28	29	30	30	29	30	29	28	29	30	28	26	30	29	30		
MAX	66	70	59	55	43	58	40	41	66	67	101	93	115	88	307	236	165	162	115	112	95	69	44	17		
MEAN	10	17	17	18	17	16	16	11	17	21	32	25	28	21	38	43	40	34	28	27	19	17	12	7		

MONTHLY OBSERVATIONS 760 MONTHLY MEAN [illegible] MONTHLY MAXIMUM 307

(81102) PM10 TOTAL 0-10UM CAS NUMBER

STATE (35) NEW MEXICO
JUL 1994

SITE ID 35-055-0006 POC 1
COUNTY (055) TAOS CO
CITY (00000) NOT IN A CITY
SITE ADDRESS QUESTA MIDDLE SCHOOL
SUPPORT AGENCY (0001) NEW MEXICO ENVIRONMENT DEPARTMENT
SITE COMMENTS
MONITOR COMMENTS
MONITOR TYPE (2) OTHER
UNITS (0011) UG/CUBIC METER (25 C)
COLLECTION AND ANALYSIS METHOD (0811) INSTRUMENTAL MEDIUM VOL HI BETA RAY-ATTENUATION

AQCR (157) UPPER RIO GRANDE VALLEY
URBAN-AREA (00000) NOT IN AN URBAN AREA
LAND USE (3) INDUSTRIAL
LOCATION SETTING (3) RURAL

LATITUDE 36 43 18 N
LONGITUDE 105 36 07 W
UTM ZONE 13
UTM NORTHING 4063910
UTM-EASTING 446251
ELEVATION-MSL 2320 M
PROBE HEIGHT M
INTERVAL 1
MINIMUM DETECTABLE
REPORTING ORGANIZATION (0001) NEW MEXICO ENVIRONMENT DEPARTM

Std = 150 µg/m³

DAY/HOUR

DAY	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	DAY MEAN
1	9	5	4	7	11	10	16	14	16	25	28	42	25	52	12	27		1	1	2	4	7	0	14	16
2	13	18	8	19	11	19		12	14	47	26	33	8	10	3	9	84	69	229	145	101	61	7	8	42
3	8	8	7	12	12	2	12	33	63	42	48	29	21	111	152	104	214	122	272	197	90	89	12	8	70
4	9	1	3	8	16	5	7	5	15	19	10	15	11		2	19	15	16	2	2	11	8	5	6	9
5	12	15	12	4	14	13	9	9	11	40	38	32	4	19	5	18	15	1	16	1	4	9		9	14
6	9	10	13	6	11	9	2	8	16	15	23	20	24	32	5	8	7	17	18	6	15	11	13	16	14
7	51	49	32	21	16	18	29	21	15			267	139	41	14	16	15	49	27	57	32	28	21	13	44
8	3	15	9	17	5	6	15	9	50	34	20	12	22	4	6		15	18	12	46	33	28	58	34	20
9	29	62	52	40	21	7	6	14	10	13		8	120	82	51	65	64	37	28	182	100	90	73	3	50
10	17	9	9	12	14	8	55	43	25	31	17	13		10	17	6	73	48	45	39	16	4	3	16	23
11	7	6	16	14	5	25	30	32	18	11	38	120	66	376	251	252	250	259	187	123	85	16	21	9	97
12	15	7	8	64	68	43	36	21	5	12	16	79	50	49	31	116	65	61	69	13	16	28	8	6	36
13	5	12	32	27	19	16	30	22	9	13	19	9	133	127	90	74	17	15	5	18	14	20	10	10	31
14	9	9	5	5	39	24	23	32	13	23	24	9	22	8	165	229	158	326	203	127	98	6	14	4	60
15	6	14	3	9	9	2	11	20	4	15		1	137	97				6	29	32	17	33	7	11	23
16	25	56	60	108	58	48	40	23	26	21	16	2	14	147	105	79	52	2	24	19	25	27	18	5	42
17	19	18	9	8	3	7	11	19	3	1	47	27	69	87	31	32	13	27	15		12	17	20	4	23
18	9	15	6	18	60	73	75	51	90	45	78	110	59	30	13	10	26	6	18	8		1		5	37
19	1	12	15		13	57	26	38	46	21	26	33	5	2	30	24	102	67	44	50	11	20	19	10	29
20	12	15	10	8	15	13		14	21	2	115	72	183	106	34	35	16	19	21	21	1	20	11	4	33
21	9	10	1	17	14	6	13	14	3	19	20	13	9	265	179	105	94	25	23	10	10	9		13	38
22	5	18	10	7	19	13	5	45	11	11	80	20	27	50	26	8	45	2	33	28	2	16	14	13	22
23	19	18	3	29	39	51	62	49	21	6	60	33	48	25	5	4	10	9	18	2	6	2	2	15	29
24	2	3	4	6	15	7	12	74	48	57	89	32	53	18	4	96	74	74	75	28	18	6	7	6	34
25	17	4	15	20	47	15	30	3	23	3	16	27	29	5	32	8	21	39	27	16	33	4	21		20
26	8	18	16	17	4	5	13	2	2	16	19	14	34		15	16	97	79	61	36	2	19	5	1	42
27	3	3	20	8	10	10	10	10	3	15	15	25	11	46	54	25	34	10	17	18	11	19	17	18	17
28	17	3	13	1	9	12	29	46	27	37	11	12	57	50	38	239	189	126	138	37	8	9	14	5	47
29	6	13	6	20	35	18	37	19	24	5	48	21	47	147	102	69	65	31	33	28	20	8	9	16	34
30	3	37	26	37	18	1		17	12	8	35	29	16	30	63	159	299	213	148	160	124	100	72	35	72
31	51	25	31	42	7	62	15	11	22	27	32	35	7	3	131	61	77	46		14	14	5	10	19	32
NO	31	31	31	30	31	31	28	31	31	30	28	31	30	29	30	29	29	31	30	30	30	31	28	30	
MAX	51	62	60	108	68	73	75	74	90	57	115	267	183	376	251	352	299	326	272	197	124	100	73	35	
MEAN	13	16	14	20	21	20	23	23	21	21	36	39	50	70	56	69	77	59	61	49	31	23	18	12	

MONTHLY MEAN 35 MONTHLY MAXIMUM 376

Highest Daily Average Sept 1994

(81102) THIO TOTAL U-100H

STATE (SI) [illegible]
AUG 1994

SITE-ID 35-055-0006 POC 1
COUNTY (055) TAOS CO
CITY (00000) NOT IN A CITY
SITE ADDRESS QUESTA MIDDLE SCHOOL
SUPPORT AGENCY (0001) NEW MEXICO ENVIRONMENT DEPARTMENT
SITE COMMENTS
MONITOR COMMENTS
MONITOR TYPE (3) OTHER
UNITS (001) UG/CU METER (25 C)
COLLECTION AND ANALYSIS METHOD (081) INSTRUMENTAL-REDDING-AUTOMATIC BETA-RAY ATTENUATION

AQCR (157) UPPER [illegible] GRANDE VALLEY
URBAN-AREA (0000) NOT IN AN URBAN AREA
LAND USE (3) INDUSTRIAL
LOCATION SETTING (3) RURAL

MINIMUM DETECTABLE [illegible]
REPORTING ORGANIZATION (0001) NEW MEXICO ENVIRONMENT DEPARTM

LATITUDE [illegible] 18 N
LONGITUDE 105 [illegible] 07 W
UTM ZONE 13
UTM-NORTHING [illegible]240
UTM-EASTING 446234
ELEVATION-MSL 2320 M
PROBE HEIGHT M
INTER AL 1

DAY/HOUR

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	083	MEAN
1	1	4	13	11	6	7	15	7	16	55	41	41	5	19	18			4	7	26	20	23	1			17
2	5	2	4	1	37	17	6	36	22	16	15	9	22	28	34	*	25	56	29	40	35	11	23		23	21
3	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
4	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
5	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
6	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
7	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
8	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
9	15	1	21	2	8	18	22	21	15	103	116	86	92	8	35	15	68	279	163	151	50	14	1	10	24	55
10	6	16	7	3	9	10	8	7	20	23	18	3	*	13	143	109	102	16	20	6		7	4	17	25	33
11	18	15	3	14	4	10	4	22	25	16	15		6	31	76	27	41	3	3	5		15	15	*	3	18
12	1	12	14	22	6	6	19	21	18	24	53	49	50	20	34	25	218	177	116			5	20	*	2	47
13	7	19	10	2	4	20	11	12	5	10	33	39	27	32	24	6	47			7	8	9	*	3	22	16
14	23	21	2	8	22	15	10	18	17	22	22	37	60	22	130	84	79	74	4	14	13	11	17	25	24	32
15	18	27	18	13	10	13	6	3	11	9	136	186	114	104	85	33	57	40	7	9	23	3	10	23	24	42
16	14	3	13	9	10	6	8	4	7	1	46	39	18	28	18		27	16	4	16	24	12	6	8	23	15
17	19	7	19	4		19	4	22	9	15	11	11	29	39	67	61	12	1	8	18	25	1	5	9	23	20
18	12	18	14	6	19	2	54	133	129	111	94	29	56	251			22	2	3	6	8	10	13	4	22	45
19	17		19	6	18	24	9	49	24	23	42	43	48	106	73	33	54	1	70	55	12	35	19	21	23	35
20	98	77	37	63	33	44	12	2	3	23	8		3	18	16	60	33	68	29	1	1	2	26	23	23	30
21	2	19	5	5	9	21	13	6	21	2	15	11	6	144	117	120	87	1	20	8	14	18	16	21	24	29
22	11	13	13	1	10	6	2	11	46				8	18	102	104	71	54	13	9	9	1	13	2	21	25
23	3	2	15	7	16	17	13	7	9	9	16	16	20	6	86	44	52	84	53	20	7	6	40	4	24	25
24	21	10	10	18	4	1	7	48	31	29	8	19	8	54	27	4	23	3	10	7	1	1	69	64	24	20
25	41	39	9	5	21	12	9	47	29	29	54	13	14	10	13	21	8	122	103	82	62	9		3	25	32
26	10	14	90	53	28	42	2	9	6	29	3	4		15	17										14	
27	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
28	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
29	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988		
30														29	9	22	3	13	16	5		9	11	9	10	
31	7	8	10	9	10	12	15	8	9	1	4	10	13	4	17	10	24	4	23	4	7	10		8	25	10
NO	21	20	21	21	20	21	21	21	21	20	20	18	20	22	21	18	20	20	20	20	18	21	19	20		
MAX	98	77	90	63	33	44	54	133	129	111	136	186	114	251	143	120	218	279	163	131	62	35	69	64		
MEAN	17	16	16	13	14	15	12	24	22	28	37	36	34	58	55	43	53	51	35	25	19	10	17	14		

MONTHLY OBSERVATIONS 484 MONTHLY MEAN 28 MONTHLY MAXIMUM 279

With PRESSTEX® Covers

SITE-ID 35-0[redacted]0006 POC 1
COUNTY (055[redacted]) [redacted]AOS CO
CITY (00000) NOT IN A CITY
SITE ADDRESS QUESTA MIDDLE SCHOOL
SUPPORT AGENCY [redacted] NEW MEXICO ENVIRONMENT DEPARTMENT
SITE COMMENTS
MONITOR COMMENTS
MONITOR TYPE (3) OTHER
UNITS (001) UG/CU METER (25 C)
COLLECTION AND ANALYSIS METHOD (081) INSTRUMENTAL BETA-GAUGE-AUTOMATIC BETA-RAY ATTENUATION

AQCR (157) UPPER RIO GRANDE VALLEY
URBAN-AREA (00000) NOT [redacted]AN URBAN AREA
LAND USE (2) INDUSTRIAL
LOCATION SETTING (3) RURAL

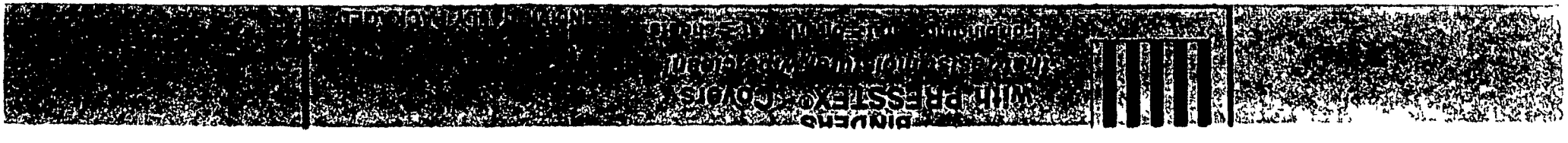
MONITOR DETECTABLE
REPORTING ORGANIZATION (001) NEW ME ICO ENVIRONMENT DEPARTM

LATITUDE [redacted] 3 18 N
LONGITUDE 1[redacted]5 3[redacted] 07 W
UTM ZONE 13
UTM-NORTHING [redacted]
UTM-EASTING 446234
ELEVATION-MSL 2320 ft
PROBE HEIGHT [redacted] M
INTERVAL 1

DAY/HOUR

	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MEAN
1	13	9	4	6	17	21	31	27	36	[illegible]	40	41	[illegible]	10	1	10	12	18	22	21	9		14	15	[illegible]	20
2	4	17	9	11	2	4	10	7	13	4				14	14	5		13	9	25	17	17	8	15	20	11
3	5	[illegible]	12	10	[illegible]	8	6	6	33	20	30		28	36		13	12	0	18	16	17	1	11	8	22	14
4	22	30	34	25	24	14	5	9	11	8	18	32	28	7	22	23	24	[illegible]0	20	21	11	26	10	10	24	19
5	10	10	10	16	10	19	6	[illegible]5	63	[illegible]7	14	20	17	8	[illegible]5	23	30	13	5	20	7	15	16	13	[illegible]4	20
6	11	5	7	9	6	9	6	8	9	10	9	17	21	10	10	12	2	8	7	7	10	7	8	8	[illegible]	9
7	9	5	8	10	10	4	1	0	9	7	13	33	41	45	27	30	[illegible]0	[illegible]7	27	18	11	7	13	6	24	16
8	10	9	6	7	14		17	9	8	59		89			[illegible]5	67		10	17	9	8	8	13	10	19	24
9	15	4	8	11	5	7	9	10	7	9	12	12		[illegible]7	23	44	23	14	17	8	9	5	9	14	[illegible]3	14
10	6	10	4	13	13	9	8	7	11	[illegible]2	2		8	2[illegible]		28		2[illegible]	22	[illegible]5	15	19	5	5	21	14
11	6	10	[illegible]	9	1[illegible]	10		15	[illegible]1	[illegible]0	3	5				18	14	1	19		8	8	18	3	19	11
12	14	11	1		10	1	10	6	3	0	15	8	7		[illegible]7		10	18	10	8	1	1[illegible]	5	8	1	1[illegible]
13	4	11	2	3	7	14	13	10	[illegible]4	[illegible]0	19	10	0	18	[illegible]	1[illegible]	21	16	4	10	7	10		4	3	1
14	[illegible]5	8	0	5	12	9	7	9	14	15	6	3	14	22	10	10	15	15	11	11	4	10	8	9	[illegible]4	10
15	8	10	12	4	7	7	3	3	5	4	7	[illegible]0	10	10	12	3	10	3	11	10	5		1		22	10
16	10	0	10	9			3							6	4		1								8	
17	9[illegible]80	99[illegible]0	9980	9930	9980	9980	9980	9980	9980	9980	[illegible]980	9970	[illegible]80	[illegible]960	9[illegible]30	9930	9980	9930	9[illegible]60	9980	9[illegible]80	9980	9980	9980	9[illegible]60	
18	9980	9980	9980	9960	9980	9980	9980	9980	9980	9980	9980	9980	99[illegible]0	9980	9980	9980	9980	9960	9930	9980	9980	9980	9980	9980	[illegible]80	
19															8	8	12	10	9	8	7	10	10	9	10	
20	9	8	10	10	9	10	8	9	10	9	8	9	9	8	10	8	8	8	9	8	8	11	8	9	24	9
21	11	11	11	9	9	10	8	8	8		[illegible]		11	11	25	19	18	17	11	10	10	10	10	11	21	12
22	10	10	9	9	10	9	10	9	11	10	10	7	9	9	9	10	10	10	10	9	9	10	10	11	[illegible]	10
23	10	10	10	10	10	10	10	10	10	9	9	10	10	9	10	10	10	9	9	11	10	10	10	10	[illegible]	10
24													9		9	10	29	22	18	[illegible]1	18	10	10	9	11	
25	9	10	10	9	9	9	10	10	10	10	10	9	9	10	31	25	25	20	9	9	10	9	9	10	[illegible]4	12
26	10	9	10	10	9	10	10	9	10	9	9	9	10			44	52	46	25	16	11	10	10	10	22	16
27	10	10	10	10	10	10	10	10	20	22	[illegible]0	17	12	9	9	9	9	21	25	[illegible]2	19	14	11	10	24	14
28	10	10	10	10	10	10	10	9	10	10	9	9	9	9	9	22	23	103	10[illegible]	75	[illegible]3	[illegible]5	10	10	24	24
29	10	10	10	10	10	10	10	10	10	9	33	34	2[illegible]	22	12	10	10	10	10	10	10	10	10	10	24	13
30	10	10	10	10	10	10	10	10	10	11	12	11	10	9	9	10	18	19	16	11	10	10	10	10	[illegible]4	11
31	10	10	10	10	10	10	10	10	10	9	10	10	10	9	10	10	10	10	10	10	10	10	10	10	24	10
NO	27	27	27	2[illegible]	2[illegible]	25	2[illegible]	26	2[illegible]	25	23	22	23	23	25	27	2[illegible]	28	28	[illegible]7	28	2[illegible]	27	27		
MAX	22	30	34	25	24	21	31	27	63	59	40	89	41	[illegible]5	[illegible]95	[illegible]7	52	103	10[illegible]	75	63	2[illegible]	25	15		
MEAN	10	10	9	10	10	10	9	10	16	15	14	22	17	16	19	19	17	18	17	17	1[illegible]	12	11	9		

MONTHLY OBSERVATIONS 621 MONTHLY MEAN 14 MONTHLY MAXIMUM 10[illegible]



(81102) PM10 TOTAL 0-100U

CAS NUMBER

STATE (35) NEW MEXICO
SEP 1994

SITE-ID 35-055-0006 POC 1
COUNTY (055) TAOS CO
CITY (00000) NOT IN A CITY
SITE ADDRESS QUESTA MIDDLE SCHOOL
SUPPORT AGENC[redacted] NEW MEXICO ENVIRONMENT DEPARTMENT
SITE COMMENTS
MONITOR COMMENTS
MONITOR TYPE (3) OTHER
UNITS (001) UG/CU METER (25 C)
COLLECTION AND ANALYSIS METHOD (081) INSTRUMENTAL-REDDING AUTOMATIC BETA-RAY ATTENUATION

AQCR (157) UPPER RIO GRANDE VALLEY
URBAN AREA (0000) NOT IN AN URBAN AREA
LAND USE (2) INDUSTRIAL
LOCATION SETTING (3) RURAL
[redacted]
REPORTING ORGANIZATION (081) NEW MEXICO ENVIRONMENT DEPARTM

LATITUDE 36 [illegible] 18 N
LONGITUDE 105 36 07 W
UTM ZONE 13
UTM-NORTHING 4006340
UTM EASTING 446254
ELEVATION-MSL 2320 M
PROBE HEIGHT M
INTERVAL 1

DAY/HOUR

DAY	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
1	2	20	1		7	12	1	8	7	11	4	25	10	17	5	8	2	18	9	16	13	8	5	[illegible]
2	7	2	13	8	15	9	9	3	4	5	2	28	17	26	1	15	3	2	13	25	16	10	7	9
3	10	12	26	31	37	18	15	14	21	2	14	17	12	20	47	11	5	12	13	20	11	16	16	10
4	18	26	22	29	4	4	5	3	4	22	6	4	5	5	11	13	21	10	20	3	30	40	21	8
5	20	9	3	2	6	17	16	14	17	15	16	8		11	106	61	75	58	13	24	7	20	5	5
6	2	2	19	24	27	22	4	18	8	30	45	23	25	6				15	1	21	1	16	6	3
7		60	40	30	20		4	6	13	5	4	16	4	6	7	10	10	16	3	8	17	14	47	63
8	55	35	18	19	14	16	12	19	18	9	1	8	8	18		10								15
9	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
10	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
11	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
12														15	4	5	7	19		4	11	2		5
13	2		22	15	6	11	12				6	21	7	13	23	21	6	3	1	20	4	2	5	7
14	9	17	2	13	6	16	19	17	23	6	7	55	30	46	8	22	7	33	21	25	13	4	3	1
15	3	12	13	6	14	12	4	3	3	21	21	7	14	23	18	19	18	2	6	2	18	8	26	6
16	1	11	17	2	4	2	7	3	3	10	7	2	10	6		5	8	24	2	11	29	33	2	7
17		9	1	6	7	4	4	1	17	11	1	9	12	17	19	3	12	10	9	16	19		18	13
18	20	13	2	15	12	7	15	8	29	24	51	53	22	24	3	22	5	2	16	7	5	25	10	6
19	2	22	16	11	7		5	1	11	6	14	18	34	12	16	32			22	12		7		
20	13	11			8	11	10	4	1	10			23	17	57			11	18	35	23	38	27	
21	14	2			8	10	2	14	2	14	14	16	12	45	19	35								
22	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
23	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
24	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
25	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
26	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
27	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988	9988
28					5	9							9											
29	17	6					12			25	1				32	6				12				
30	18				16	22	7	4	16	24	14	12	2					8	22	17	8	20	11	18
31																								
NO	17	17	15	15	19	17	19	17	17	19	18	17	18	18	16	17	13	16	16	18	16	16	15	15
MAX	55	60	40	31	37	22	19	19	82	30	45	55	34	46	106	61	75	58	22	35	30	40	49	68
MEAN	13	16	14	14	11	12	9	8	16	13	13	19	15	18	23	18	13	15	13	15	14	17	15	11

MONTHLY OBSERVATIONS 401 MONTHLY MEAN 14 MONTHLY MAXIMUM 106

(81102) PM10 TOTAL 0-10UM CAS NUMBER

STATE (35) NEW MEXICO

SITE ID 35 055 0006 POC 1 AQCR (017) UPPER RIO GRANDE VALLEY LATITUDE 36 43 18 N
COUNTY (055) TAOS CO URBAN-AREA (00000) NOT IN AN URBAN AREA LONGITUDE 105 36 07 W
CITY (00000) NOT IN A CITY LAND USE (2) INDUSTRIAL UTM ZONE 13
SITE ADDRESS QUESTA MIDDLE SCHOOL LOCATION SETTING (3) RURAL UTM NORTHING 4066240
SUPPORT AGENCY [redacted] ENVIRONMENT DEPARTMENT UTM EASTING 446254
SITE COMMENT ELEVATION MSL 8320 FT
MONITOR COMMENT PROBE HEIGHT M
MONITOR TYPE (3) OTHER MINIMUM DETECTABLE INTERVAL 1
UNITS (001) UG/CU METER (25 C) REPORTING ORGANIZATION (001) NEW MEXICO ENVIRONMENT DEPARTM
COLLECTION AND ANALYSIS METHOD (063) INSTRUMENTAL READING-AUTOMATIC BETA-RAY ATTENUATION

DAY/HOUR

DAY/HOUR	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	OBS	MEAN
1	10	10	10	10	10	10	10	10	10	10	10	[illegible]	9	[illegible]	9	9	9	12	12	10	10	10	10	10	[illegible]	10
2	10	10	10	10	10	10	10	10	10	[illegible]	37	55	[illegible]	5	[illegible]	16	10	10	1	[illegible]	[illegible]	17	13	12	[illegible]	20
3	12	10	9	10	10	10	10	10	12	12	10	[illegible]	[illegible]	9	[illegible]	9	9	10	10	10	10	10	10	10	[illegible]	10
4	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	15	50	39	32	16	10	10	10	10	24	15
5	10	10	10	10	10	10	10	10	10	10	10	10	18	19	15	14	11	10	10	10	10	10	10	10	24	11
6	10	10	10	10	10	10	10	10	10	9	9	9	9	9	9	9	9	10	13	14	13	11	10	10	24	10
7	10	10	10	9	9	9	9	10	10	9	9	9	9	9	9	9	9	9	27	29	24	21	15	9	24	12
8	10	10	10	16	16	14	13	11	10	9	9	9	33	47	48	48	30	13	9	9	10	10	10	10	24	17
9	10	10	9	10	10	10	10	10	10	9	10	9	9	9	9	9	10	10	10	10	10	10	10	10	[illegible]	10
10	10	10	10	10	10	10	10	10	10	9	10	9	9	9	9	10	10	10	10	22	24	20	17	12	[illegible]	12
11	10	10	10	10	10	10	10	10	8	10	9	12	12	23	21	14	11	10	10	10	9	9	10	9	24	11
12	9	9	9	10	9	9	10	9	10	9	9	9	9	8	18	20	18	17	13	10	10	9	10	10	24	11
13	10	10	9	9	10	10	9	9	9	9	9	9	9	9	9	9	9	10	10	10	10	10	10	10	[illegible]	9
14	10	10	10	10	10	10	10	10	10	9	9	10	9	9	9	10	10	10	10	10	10	10	10	9	24	10
15	11	9	10	9	9	10	10	10	10	10	10	10	9	10	10	17	18	31	32	23	19	13	9	10	24	13
16	10	10	9	10	10	10	10	10	9	9	9	17	21	18	17	15	15	12	10	9	9	9	9	9	24	12
17	9	9	9	9	9	10	9	10	9	9	9	9	9	9	10	10	10	9	9	10	9	10	10	9	24	9
18	8	10	10	10	9	10	9	11	10	9	9	9	9	9	9	9	9	9	10	9	10	10	9	9	[illegible]	9
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MONTHLY OBSERVATIONS 720 MONTHLY MEAN 11 MONTHLY MAXIMUM 55

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SITE ADDRESS QUESTA MIDDLE SCHOOL
SUPPORT AGENCY [redacted] NEW MEXICO ENVIRONMENT DEPARTMENT
SITE COMMENTS
MONITOR COMMENTS
MONITOR TYPE (3) OTHER
UNITS (001) UG/CU METER (25 C)
COLLECTION AND ANALYSIS METHOD (081) INSTRUMENTAL-BEDDING-AUTOMATIC BETA RAY-ATTENUATION

AQCR (157) UPPER RIO GRANDE VALLEY
URBAN-AREA (0000) NOT IN AN URBAN AREA
LAND USE (2) INDUSTRIAL
LOCATION SETTING (R) RURAL

Dec. '14

MINIMUM DETECTABLE 4
REPORTING ORGANIZATION (001) NEW MEXICO ENVIRONMENT DEPARTM

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LONGITUDE 105 36 07 N
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UTM NORTHING [illegible]
UTM-EASTING 446234
ELEVATION MSL 2320 M
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INTERVAL 1

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MONTHLY OBSERVATIONS 744 MONTHLY MEAN 10 MONTHLY MAXIMUM 38

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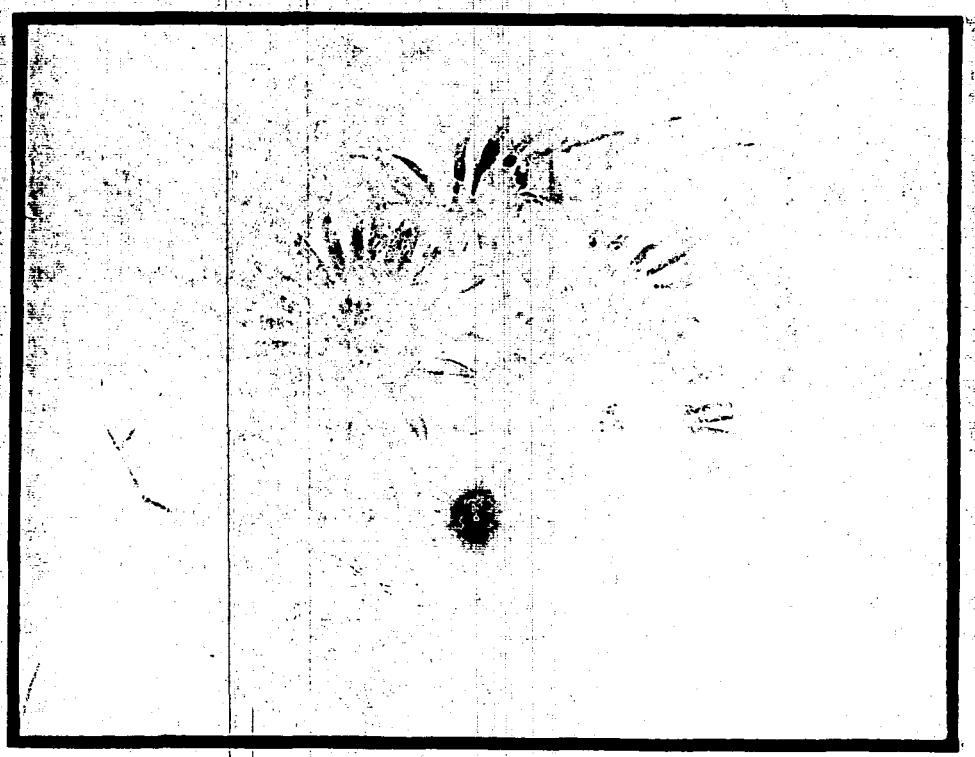
A HANDBOOK OF

Rare and Endemic Plants of New Mexico



New Mexico Native Plants
Protection Advisory Committee

A HANDBOOK OF

Rare and Endemic Plants of New Mexico

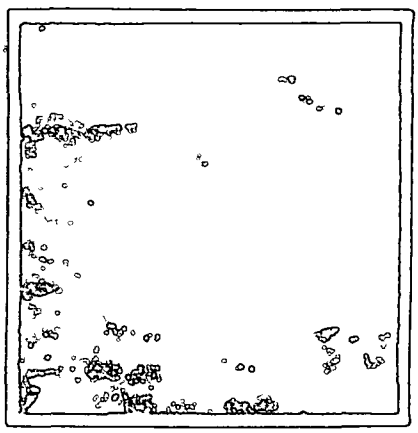
New Mexico Native Plants Protection Advisory Committee

Written for the amateur or professional botanist, as well as for those who have a general interest in the native flora of the state, *A Handbook of Rare and Endemic Plants of New Mexico* is the most complete guide to the rare New Mexico flora ever prepared. It includes plants that occur only in the state, as well as those that have a more regional distribution but require special management attention. All plants nominated for protection under the Endangered Species Act are also included.

Within, 137 species of plants representing 32 families are described and illustrated by a drawing. The New Mexico Native Plant Protection Advisory Committee has spent four years collecting information, presenting here the most up-to-date data available about each plant's habitat, known distribution, and the possible threats to it. Important literature is listed to enable further research. A glossary defines all the botanical terms used, and the appendix includes a list of the botanists who first named the plants. This book is essential for anyone interested in learning about, identifying, and preserving the flora of New Mexico.

The New Mexico Native Plant Protection Advisory Committee is a group of professionals in the field of botany representing the academic community, land managers, and private industry. This book represents the first major gathering of the Committee's collective knowledge and expertise.

The New Mexico Natural History Series
Barry S. Kues, General Editor
University of New Mexico Press
ISBN 0-8263-1123-1



Family ASTERACEAE (Compositae)
Scientific Name *Haplopappus microcephalus* Cronq
Common Name Small headed goldenweed
Classification Biologically endangered
Federal Action None
Common Synonyms None

Description Mat forming perennial with spreading st
(2 in) long, leaves numerous broader above the midd
base 2–4 cm (0 8–1 5 in) long to 3 5 mm (0 1 in) wi
teeth or sometimes with an occasional minute tooth
mm (0 25 in) high several to many in a rather flat-t
outer flowers of each head with inconspicuous yello
(0 12 in) long, involucral bracts firm translucent, u
outermost bracts gradually tapering to a point Flow
Known Distribution Taos County, New Mexico
Habitat Crevices on granite rocks usually in ponde
2 450–2 600 (8 000–8 500 ft)
Ownership Forest Service
Threats to Taxon None known
Similar Species No species of *Asteraceae* in the reg
matted habit with the clustered heads
Remarks This species is known only from one coll
Mexico additional surveys of the Sangre de Cristo M
uncover new populations

Important Literature
Cronquist A A new *Haplopappus* from New Mexico
57 1951

: (Compositae)
opappus microcephalus Cronq
headed goldenweed
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crous broader above the middle
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Taos County New Mexico
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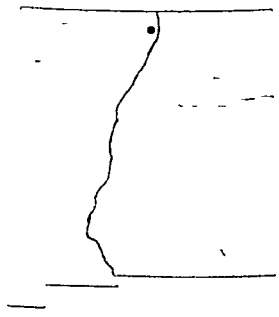

Note: single specimen seen in Taos County West of Rio Grande River

EPA-600/2-76-298
December 1976

WATER POLLUTION CAUSED BY INACTIVE ORE AND MINERAL MINES
A National Assessment

by

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William R. Mills, Jr.
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Santa Ana, California 92711

Contract 68-03-2212

Project Officer

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OFFICE OF RESEARCH AND DEVELOPMENT
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CONTENTS

FOREWORD iii

ABSTRACT iv

FIGURES. viii

TABLES ix

ACKNOWLEDGEMENTS x

SECTION 1 INTRODUCTION 1

PURPOSE. 2

SCOPE 2
- Conduct of Study 3
- Limitations of the Study. 3
- Abandoned Versus Inactive Mines 3

IDENTIFICATION OF MINE POLLUTION AREAS 4

SECTION 2 SUMMARY OF CONCLUSIONS 5

SECTION 3 SUMMARY OF RECOMMENDATIONS 7

SECTION 4 THE MINERAL INDUSTRY 8

SCOPE OF THE MINERAL INDUSTRY 8

ECONOMIC GEOLOGY 8
- Classification of Minerals, Rocks, and Mineral Deposits 8

PRODUCTION METHODS 9
- Mining 9
- Mineral Processing. 9
- Processing Technology for Major Commodities 18
- Waste Disposal 26
- Historical Mineral and Waste Production 27

CONTENTS (continued)

SECTION 5 POLLUTANTS ASSOCIATED WITH MINING. . . 29

FORMATION OF POLLUTANTS 29
Acid Mine Drainage (AMD) . . . 30
Heavy Metals . 34
Sedimentation . 37

ACID AND METALS IN RECEIVING WATERS 41
Natural Buffering Systems in Stream Systems . . 41
Sulfate as an Indication of AMD 43
Transportation and Removal of Pollutants in Streams 44

TOXICITIES AND BIOLOGICAL EFFECTS OF POLLUTANTS . 56
Aquatic Life . 57
Municipal and Agricultural Uses 63

SECTION 6 ASSESSMENT OF MINE RELATED WATER POLLUTION . 69

DATA COLLECTION PROCEDURE 69

NATIONAL SUMMARY 69
Regions Exhibiting Major Impact 71
Methodology of Assessment . . . 73
Causal Factors Affecting Pollution. . . . 84

SECTION 7 ASSESSMENT OF CONTROL TECHNOLOGY FOR INACTIVE MINES 89

EXISTING TECHNOLOGY 89
Infiltration Control. 89
Retention and Regulation of Mine Drainage . 91
Treatment of AMD. 92
Erosion Prevention. . 93
Sedimentation Basins. . . 94

DIFFICULTIES IN IMPLEMENTING CONTROL PROGRAMS . . 94

SECTION 8 RECOMMENDED RESEARCH AND DEVELOPMENT . . . 96

SPECIFIC PROBLEMS NOT SUFFICIENTLY DOCUMENTED 96
Effects of Mine Drainage on Groundwater Quality . . 96
Assessment of Mercury in Surface Waters from Gold Milling. 97

IMPROVEMENT OF POLLUTION MONITORING TECHNIQUES 97
Monitoring Manual 98

CHEMISTRY RELATED TO MINE DRAINAGE . . . 98

CONTENTS (continued)

PREVENTION TECHNOLOGY. 99
Air Control 99
Erosion Prevention. 101

TREATMENT. 102
Natural Mineral Formations as Traps for Dissolved Ions. 102
Botanical Treatment 103
Physical Chemical Treatment 103

EFFECTS OF MINING TECHNIQUES ON POLLUTION CONTROL. 105

SECTION 9. BIBLIOGRAPHY 106

SECTION 10. APPENDICIES 117

APPENDIX A METRIC CONVERSION. 117

APPENDIX B ILLUSTRATION OF VARIOUS MINING TECHNIQUES. 118

APPENDIX C HISTORICAL MINERAL PRODUCTION. 128

APPENDIX D STATE ASSESSMENT OF PROBLEM AREAS AND POLLUTANT LOADING. 144

SECTION I
INTRODUCTION

Regardless of the influence of man, mineral deposits are continuously undergoing the natural weathering process of oxidation and erosion. The materials released by weathering slowly find their way into streams, lakes, or groundwaters. This weathering produces acids and metals which result from the oxidation of metallic sulfide ores, principally pyrite. The acid produced accelerates the weathering of many other metallic ores which release heavy metals. This process is a continuing source of non-point pollution to the environment.

Mining operations expose vast quantities of previously undisturbed material in the search for valuable minerals. The exposure of these materials in underground workings and tailings provides many potential sources of pollution. Excavation of mine workings frequently intercept groundwater which transports the minerals dissolved by weathering. The groundwater must be either pumped or allowed to freely drain from the workings.

During active mining operations the quantity and quality of flow from an adit may be regulated and the discharge of pollutants controlled. Also water may be diverted around tailings making them less susceptible to erosion and accelerated weathering. When active operations cease, maintenance of control structures may also cease, increasing the possibility of failure and ultimately increased pollution.

Tailings offer another potential source of pollution. Material that is extracted from the ground is crushed and finely ground, greatly increasing the exposed surface area susceptible to weathering. Once a mineral is extracted from the gangue, the non-economic fine material is placed in a tailings pile. Historically, mills were often located near rivers and waste products were either discharged directly into the river or placed in tailings piles. Often these piles were carelessly constructed causing streams to flow through or around them. The exposure of the highly mineralized gangue to water and oxygen causes accelerated weathering and a manifold increase in the discharge in pollutants.

On a national basis, the potential for pollution from these mines is tremendous considering the multitude of abandoned mines and the many potential sources of pollution at each mine. Estimates of the number of abandoned mines in the country vary by orders of magnitude. In an unpublished draft report, the U.S. Bureau of Mines reported 19,000 abandoned and inactive ore and mineral mines and a total of 90,000 mines of all

ACID MINE DRAINAGE (AMD)

The results of this study indicate that AMD has contributed to water quality degradation at approximately 60 percent of the sites where inactive mines are a source of pollution Acid mine drainage is the result of the oxidation of many base metal sulfide compounds The most abundant of these compounds are iron sulfides of which pyrite (FeS_2), marcasite (FeS_2) and pyrrhotite (Fe_5S_6 to $Fe_{16}S_{17}$) are the most common Hereafter, for simplicity, the term "pyrite" will refer to all iron sulfides Investigators generally agree that the oxidation of pyrites is the predominant source of AMD [Hill 1975a, Colorado Water Conservation Board 1974]

This oxidation process would not manifest itself if the pyrite were left in its naturally reducing environment During mining operations, pyrites may be exposed to air in underground workings or above ground in open pits, over-burden piles, and tailing piles Regardless of the location, acid is formed if the pyrite comes in contact with oxygen and water

Pyrite Oxidation Model

Acid is formed as a result of a series of interrelated reactions which are given below for the pyrite system

$$FeS_2(s) + \frac{7}{2}O_2 + H_2O \longrightarrow Fe^{+2} + 2SO_4^{=} + 2H^+ \qquad (1)$$

Pyrite Ferrous Ion

$$Fe^{+2} + \frac{1}{4}O_2 + H^+ \longrightarrow Fe^{+3} + \frac{1}{2}H_2O \qquad (2)$$

Ferrous ion Ferric ion

$$Fe^{+3} + 3H_2O \longrightarrow Fe(OH)_3 + 3H^+ \qquad (3a)$$

Ferric ion — Ferric Hydroxide

$$2Fe^{+3} + XH_2O \longrightarrow Fe_2O_3 \quad XH_2O + \quad 6H^+ \qquad (3b)$$

Ferric ion — Hydrous Ferric Oxide

$$FeS_2(s) + 14Fe^{+3} + 8H_2O \longrightarrow 15Fe^{+2} + 2SO_4^{-2} + 16H^+ \qquad (4)$$

Pyrite + Ferric Iron — Ferrous Iron

When pyrite is exposed to oxygen and water, the sulfide is initially oxidized to sulfate releasing acid, sulfate, and ferrous iron (Reaction 1) The ferrous iron, which is many times more soluble than ferric iron, is ultimately oxidized to ferric iron (Reaction 2) At normal pH ranges (6-8) ferric iron hydrolyzes forming acid and an insoluble, hydrated ferric oxide (Reaction 3b) which occurs as a gelatinous floc (yellow boy) and precipitates or adsorbs onto surfaces over which it flows Frequently, the precipitate is shown as ferric hydroxide (Reaction 3a)

An alternate pathway for the oxidation of pyrite is shown by Reaction 4 Ferric iron, dissolved due to the depressed pH of the solution from the initial formation of acid, oxidizes the sulfide to sulfate and is itself reduced to the ferrous form. Regardless of the pathway taken, the net result is the same. By summing Reactions 1 through 3, shown by Reaction 5, the oxidation of one mole of pyrite produces four equivalents of acidity

$$FeS_2(s) + \frac{15}{4} O_2 + \frac{7}{2}H_2O \longrightarrow Fe(OH)_3(s) + 2H_2SO_4 \qquad (5)$$

Mechanisms and Rates of Oxidation

Stumn and Morgan have presented a model describing the oxidation of pyrite shown by Figure 3 [Stumm 1970].

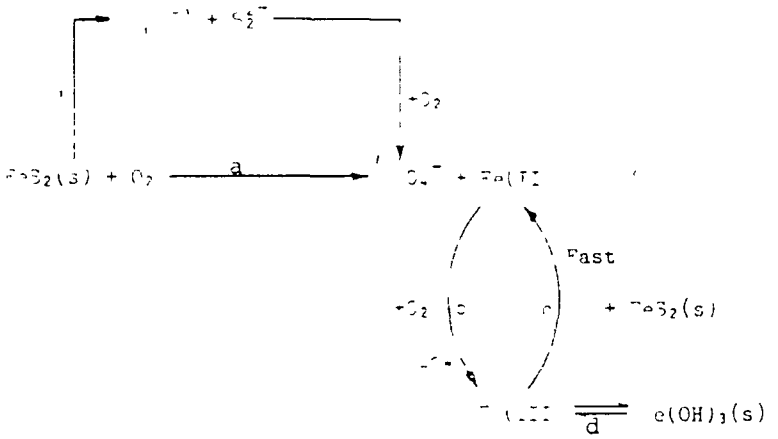

Figure 3. Pyrite oxidation model
[Stumm and Morgan 1970].

The initial step in the sequence is the oxidation of pyrite (a) or pyrite may be dissolved and then oxidized (a') In either case the principal oxidant is molecular oxygen The ferrous iron is then slowly oxidized to ferric iron (b) which may then rapidly oxidize pyrite (c) Once this sequence is initiated, oxygen is utilized only to oxidize ferrous iron. This reaction is schematic and is not intended to specify the exact mechanistic steps involved. The rate determining step in this scheme is the oxidation of ferrous iron (Reaction b) Singer and Stumm determined Reaction (b) to be much slower than (a). This conclusion is supported by others who discovered that a biological system, catalyzed by anaerobic microorganisms, produced only acid and ferrous iron [EPA 1970a]

The importance of molecular O_2 versus ferric iron as the principal oxidant of pyrite is not fully known. Wentz reported that the rate of O_2 oxidation increases with O_2 concentration and with pH's higher than 3 [CWCB 1974]. On the other hand oxidation by ferric iron increases

with the ratio of Fe^{+3}/Fe^{-2} and with the total dissolved iron concentration This ratio and the dissolved iron concentration both decrease with increasing pH [CWC 1974]

Singer and Stumm, as reported by Wentz, indicated that the rate of oxidation of pyrite is the same in the presence of Fe^{+3} regardless of the presence of oxygen It was also shown that this oxidation does not occur at detectable rates in the absence of Fe^{+3} A strong case is presented for the theory that the principal oxidant of pyrite is dissolved ferric iron. Although it appears that O_2 plays a minor role, it should not be forgotten that without the initial oxidation of sulfide and ferrous iron by O_2, no ferric iron could be formed [CWC 1974]

If the ferric iron oxidation of pyrite is to remain predominant over O_2 oxidation, the rate of conversion of ferrous to ferric must be accelerated Stumm and Lee reported that dissolved divalent copper and manganese increase the rate of ferrous iron oxidation [Stumm 1961] They also determined that micro-organisms appear to play a significant role in catalyzing the oxidation of ferrous iron Ferrobacillus ferrooxidans, F sulfoxidans, and Thiobacillus thiooxidans are the micro-organisms involved [EPA 1970a]. These aerobic acidophilic chemo-autrophic bacteria are active at pH ranges of 2 to 4 5, obtain energy from the oxidation of ferrous iron, and their carbon source is CO_2.

Law and others concluded that there is sound evidence that bacterial catalysis of pyrite oxidation may only occur in significant amounts in surface environments such as spoil and tailings piles [Third Symposium Coal Mining Drainage 1970]. It was also concluded that bacterial catalysis is less likely to occur in underground environments.

In summary it can be concluded that

a The principal oxidant of pyrite is ferric iron

b The apparent rate limiting step is the oxidation of ferrous iron by oxygen This reaction is catalyzed by dissolved copper and manganese, both of which are usually present in metal mines.

c Oxidation of ferrous iron is also catalyzed by microbial action which is most significant at or near a surface environment at pH ranges between 2 and 4 5

Frequently the overall reaction will not occur at a specific location but will occur as the water flows through the pyrite and on downstream. For example, the initial reaction will occur wherever the pyrite exists in the tailings pile or in the mine workings After Reaction 1, the ferrous iron is in a soluble form in the low pH water and is free to move with the water Therefore, Reaction 2 is free to occur away from the actual site of the sulfide oxidation Reaction 3 does not occur sufficiently until the low pH of its transport water is neutralized This buffering may occur as a result of stream alkalinity or the acid water flowing over natural calcareous formations

HEAVY METALS

In approximately 50 percent of the cases of pollution reported in this study, metallic ions were reported in sufficiently high concentrations to be harmful to aquatic life, either independently or synergistically The most commonly noted metals are copper, iron, manganese, and zinc. However, local mineralogic and lithologic conditions may result in the solution of other metals

The weathering process of other base metal sulfides is similar to the process described for pyrite but may not produce acid

Mining activities accelerate the weathering process by removing material from a naturally reducing environmemt, increasing its surface area by fracturing, and exposing it to elements needed for oxidation (i e , water and oxygen) In addition, tailings often have a high concentration of other minerals which were not recovered in the mining operation During active mining the operator will extract only those minerals from the gangue which are economically feasible Historically many ores such as pyrite, copper, lead, and zinc were overlooked in the search for gold

The Penn Mine slag dump (CA-6) is an example of high metals concentrations in the tailings The area was mined for copper from the 1860's to 1919 when the smelter was closed. Wiebelt and Ricker have analyzed the tailings and found the average copper and zinc content to be 0 37 and 6 -7 percent respectively [U S Bureau of Mines 1948] Zinc concentrations of present mining operations may be expected to range between 2 and 10 percent Thus if the mine were being worked in today's economic market, the zinc would undoubtedly be recovered

The dissolution of heavy metals is greatly accelerated when the pH of the solution passing over the mineral is lowered The relationship between pH and solubility of several metals, in distilled water, is shown in Figure 4 The linearity of many of the solubilities may only be expected in the pH ranges shown and should not be extrapolated further The solubilities increase by orders of magnitude for each unit the pH is lowered assuming theoretical complete ionization

63

Wetlands Identification (ref 73)

Number	Wetlands Label	Description	Length (mi)	Distance below PPE-1 (mi)
1	PFO1A	Palustrine,forested, broad-leaf deciduous trees, temporarily flooded	0 2	1 4
2	P EM/FO1A	Palustrine, emergent to forested, Broad-leafed deciduous trees, temporarily flooded	0 1	3 5
3	P EM/FO1A	Palustrine, emergent to forested, Broad-leafed deciduous trees, temporarily flooded	0 1	4 2
4	PFO1A	Palustrine,forested, broad-leaf deciduous trees, temporarily flooded	0 25	4 2
5	PSS1A	Palustrine, scrub shrub which are broad leaved deciduous, temporarily flooded	0 1	4 8
6	POWHK	Palustrine, open water, permanently an artificially flooded	0 1	5 3
7	PEM1A	Palustrine, emergent hydrophyte, persistent and temporarily flooded	0 2	5 6
8	PFO1A	Palustrine,forested, broad-leaf deciduous trees, temporarily flooded	0 1	6
9	POWHx	Palustrine, open water, permanently flooded, excavated	0 2	10
10	PSS1C	Palustrine, scrub shrub which are broad leaved deciduous, seasonally flooded	0 5	11 5
		Total Wetlands Length (miles)	1 85	

2

FWS/OBS 79/31
December 1979

CLASSIFICATION OF WETLANDS AND DEEPWATER HABITATS OF THE UNITED STATES

By

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Performed for

U S Department of the Interior
Fish and Wildlife Service
Office of Biological Services
Washington D C 20240

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Washington D C 20402

Contents

	Page
Abstract	1
Wetlands and Deepwater Habitats	3
Concepts and Definitions	3
Wetlands	3
Deepwater Habitats	3
Limits	3
The Classification System	4
Hierarchical Structure	4
Systems and Subsystems	4
Marine System	4
Estuarine System	4
Riverine System	7
Lacustrine System	9
Palustrine System	10
Classes Subclasses and Dominance Types	10
Rock Bottom	13
Unconsolidated Bottom	14
Aquatic Bed	15
Reef	16
Streambed	16
Rocky Shore	17
Unconsolidated Shore	18
Moss-Lichen Wetland	19
Emergent Wetland	19
Scrub-Shrub Wetland	20
Forested Wetland	20
Modifiers	21
Water Regime Modifiers	21
Water Chemistry Modifiers	22
Salinity Modifiers	22
pH Modifiers	23
Soil Modifiers	23
Special Modifiers	24
Regionalization for the Classification System	24
Use of the Classification System	26
Hierarchical Levels and Modifiers	27
Relationship to Other Wetland Classifications	27
Acknowledgments	31
References	31
Appendix A Scientific and common names of plants	35
Appendix B Scientific and common names of animals	38
Appendix C Glossary of terms	40
Appendix D Criteria for distinguishing organic soils from mineral soils	42
Appendix E Artificial key to the Systems	44
Artificial key to the Classes	44

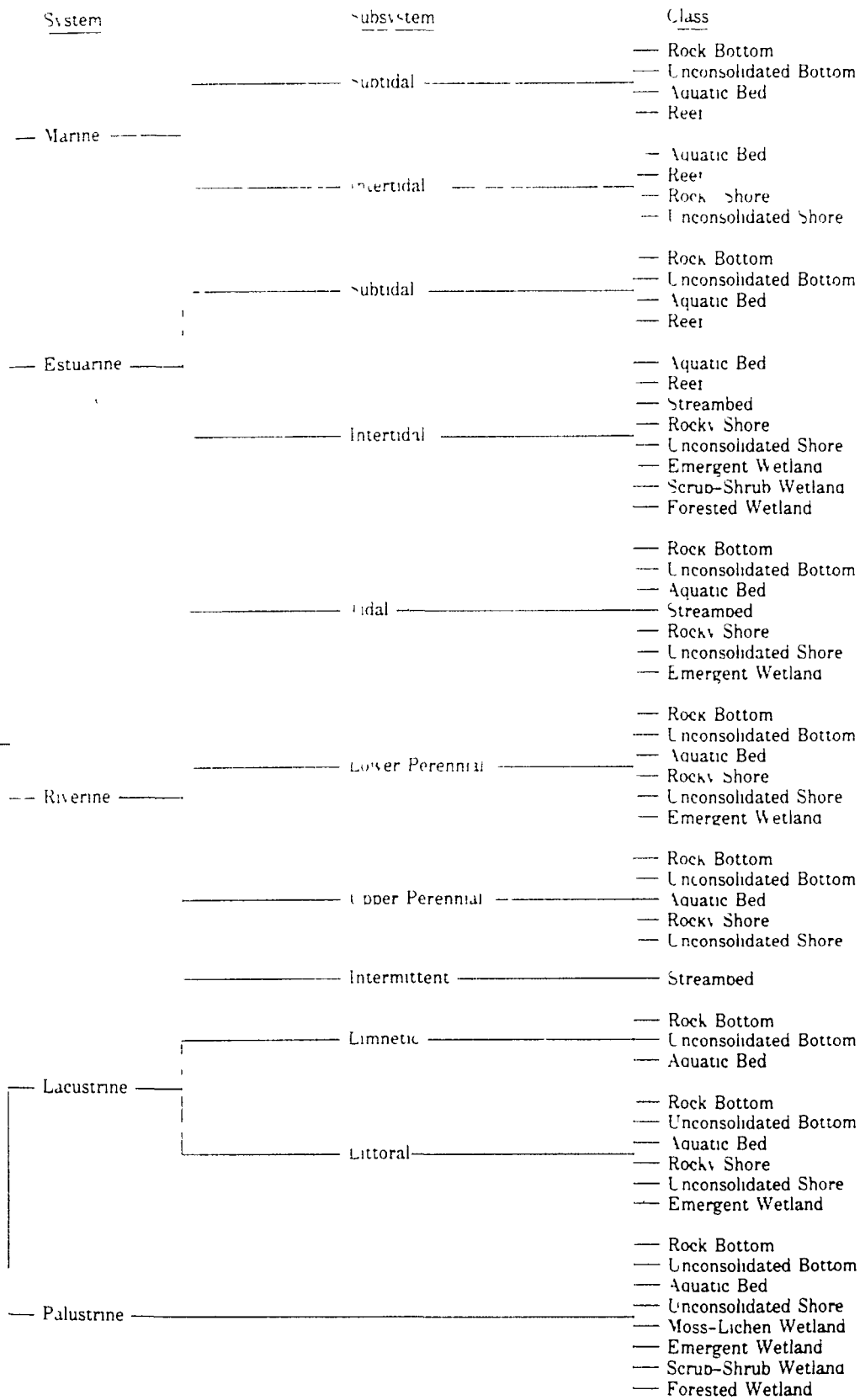
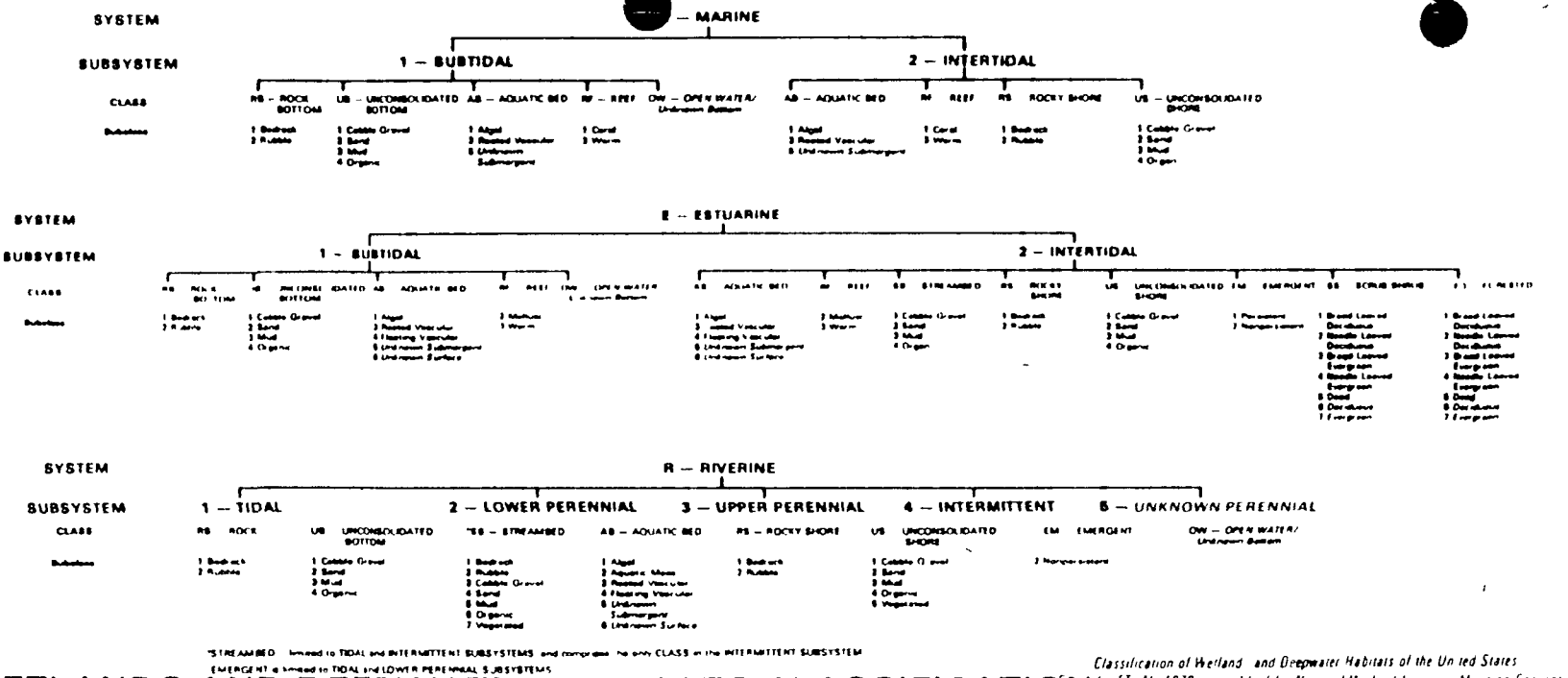


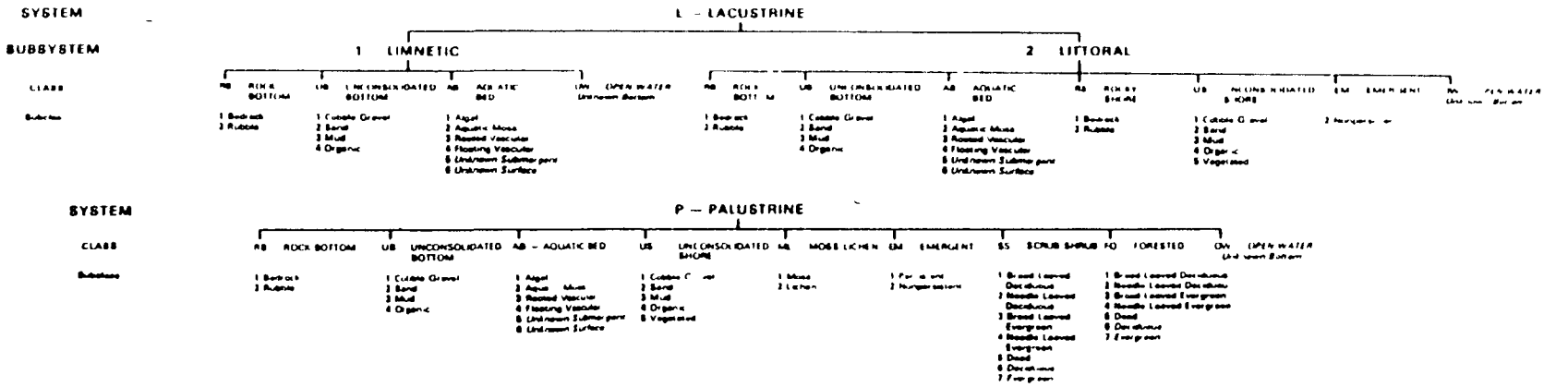
Fig. 1. Classification hierarchy of wetlands and deepwater habitats showing Systems, Subsystems and Classes. The Palustrine System does not include deepwater habitats.

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



Classification of Wetland and Deepwater Habitats of the United States (Cowardin ET AL 1979 as modified for National Wetland Inventory Mapping Convention

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



MODIFIERS

In order to more adequately describe wetlands and deepwater habitats one or more of the water regime water chemistry soil or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied at the ecological system

WATER REGIME

Non Tidal

- A Temporarily Flooded
- B Saturated
- C Seasonally Flooded
- D Seasonally Flooded Well Drained
- E Seasonally Flooded Saturated
- F Semipermanently Flooded
- G Intermittently Exposed
- H Permanently Flooded
- J Intermittently Flooded
- K Artificially Flooded
- Ws Intermittently Flooded/Temporary
- Y Saturated Semipermanent or Seasonal
- Z Intermittently Exposed Permanent
- U Unknown

Tidal

- L Artificially Flooded
- M Subtidal
- N Irregularly Exposed
- P Regularly Flooded
- R Irregularly Flooded
- S Temporary Tidal
- T Seasonal Tidal
- V Permanent Tidal
- U Unknown

WATER CHEMISTRY

Coastal Salinity

- 1 Hyperhaline
- 2 Euhaline
- 3 Mesohaline (Brackish)
- 4 Polyhaline
- 5 Mesohaline
- 6 Oligohaline
- 0 Fresh

Inland Salinity

- 7 Hyperhaline
- 8 Euhaline
- 9 Mesohaline
- 0 Fresh

pH Modifiers for all Fresh Water

- Acid
- Circumneutral or Alkaline

SOIL

- s Organic
- Mineral

SPECIAL MODIFIERS

- b Beaver
- d Partially Drained/Ditched
- f Farmed
- h Diked/Impounded
- n Artificial Substrate
- s Spoil
- Excavated

10-04-1995 08:41 FROM USFWS FLE TO 9150582?2965 P.01

6

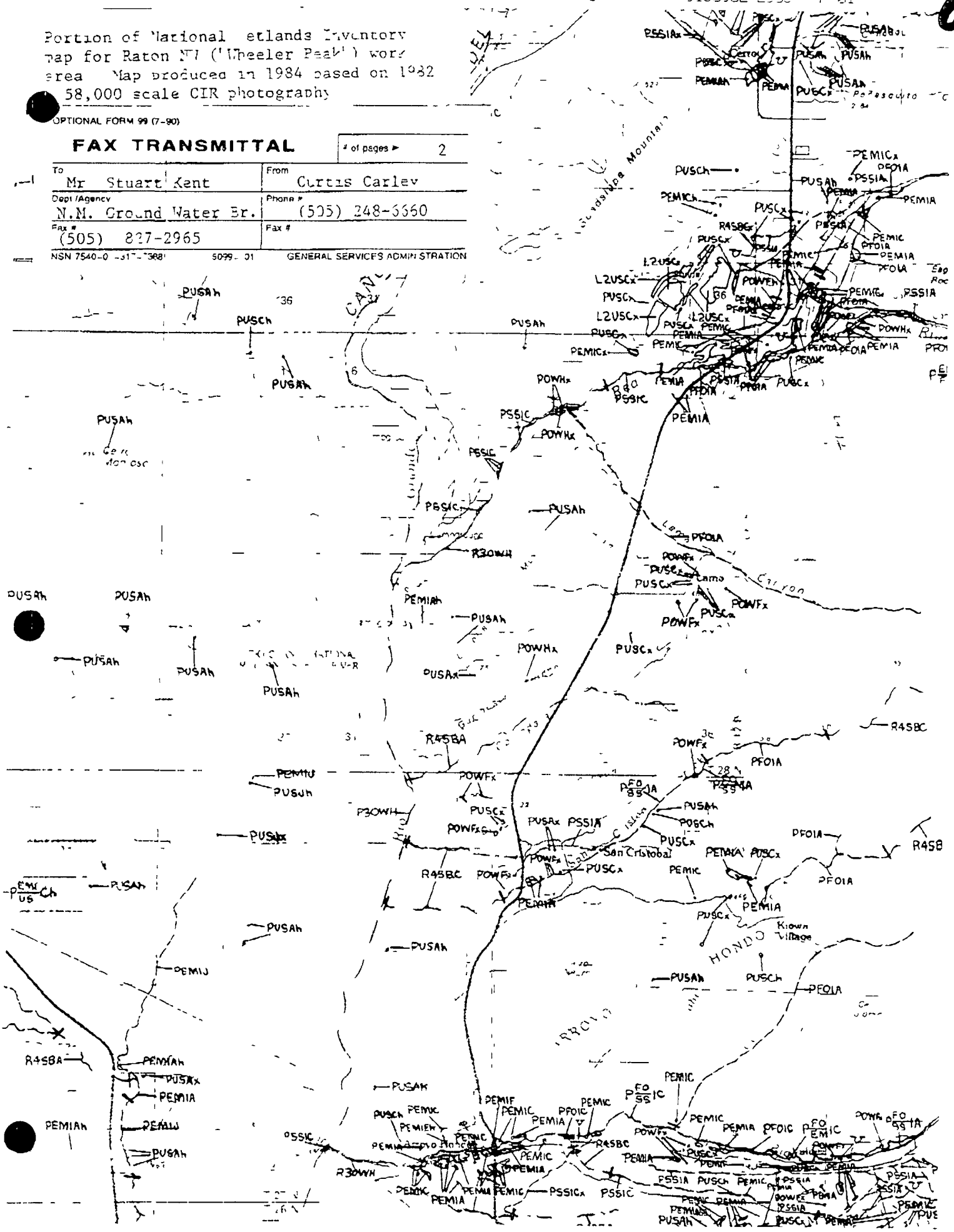
Portion of National Wetlands Inventory map for Raton NW ('Wheeler Peak') work area. Map produced in 1984 based on 1982 58,000 scale CIR photography

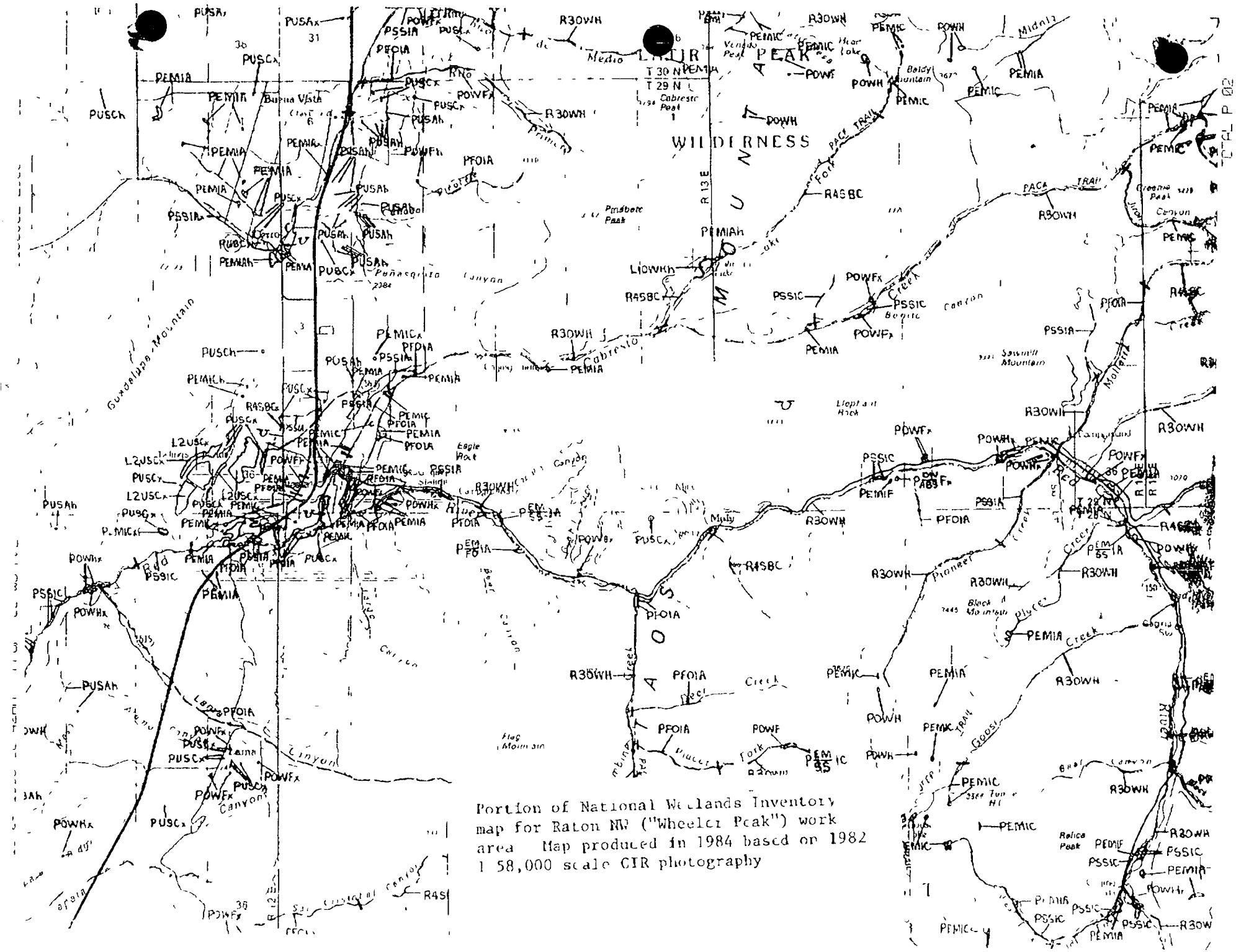
OPTIONAL FORM 99 (7-90)

FAX TRANSMITTAL

# of pages ► 2	
To: Mr Stuart Kent	From: Curtis Carley
Dept./Agency: N.M. Ground Water Br.	Phone #: (505) 248-6660
Fax #: (505) 827-2965	Fax #:

NSN 7540-01-317-7368 5099-01 GENERAL SERVICES ADMINISTRATION





Portion of National Wetlands Inventory map for Raton NW ("Wheeler Peak") work area. Map produced in 1984 based on 1982 1:58,000 scale CIR photography

Analysis Set	CLP#	Sample Location	Field ID#	Page #
SF 1368	SF 1368	B	W 2	19
Tailings	SF1369	X	W 13	20
Ponds	SF1370	Y	W 14	21
(FIG 4)	SF 1371	U	W 17	22
	SF1372	V	W 18	23
	SF1373	W	W 15	24
	SF1374	Q	W 20	25
	SF1375	O	W 16	26
	SF1376	P	W 19	27
	SF1377	R	W 21	28
	SF1378	S	W 22	29
	SF1379	T	W 23	30
	SF1380	G	W-8	31
	SF1381	H	W-9	32
	SF1382	L	W 7	33
	SF1383	M	W 7 5	34
	SF1384	K	W-6	35
	SF1385	N	W-8 5	36
	SF1386	A	W 1	37
	SF1387	E	W-5	38
SF 1388	SF1388	J	W 12	53
Tailings	SF1389	C	W-5	54
Ponds	SF1390	D	W-5 5	55
(FIG 4)	SF1391	I	W 11	56
	SF1392	F	W-4	57
	SF1393	BLANK		58
MFT-923	MFT923	6	S 12	77
Tailings	MFT924	7	S 13	78
Ponds	MFT925	8	S 14	79
(FIG 4)	MFT926	4	S-10	80
	MFT927	5	S-10A	81
	MFT928	3	S-11	82
	MFT929	1	S-8	83
	MFT930	2	S-9	84
	MFT931	22	S-26	85
	MFT932	20	S-27	86
	MFT934	17	S-23	87
	MFT935	18	S-23a	88
	MFT936	19	S-24	89
	MFT937	15	S-21	90
	MFT938	14	S-20a	91
	MFT939	16	S-22	92
	MFT940	11	S-15	93
	MFT941	10	S-16	94
	MFT942	9	S-17	95
MFT-933	MFT933	21	S-27 5	113
Tailings	MFT943	12	S-18	114
Ponds	MFT944	13	S-19	115
(FIG 4)	MFT945	23	S-20	116
	MFT946	X	W 13	117
	MFT947	X	W 13	118
	MFT948	Y	W 14	119
	MFT949	Y	W 14	120
	MFT950	U	W 17	121
	MFT951	U	W 17	122
	MFT952	V	W 16	123
	MFT953	V	W 16	124
	MFT954	W	W 15	125
	MFT955	W	W 15	126
	MFT958	O	W 16	127
	MFT959	O	W 18	128

Analysis Set	CLP#	Sample Location	Field ID#	Page #
MFT-965	MFT965	S	W 22	146
Tailings	MFT969	B	W 2	147
Ponds	MFT970	B	W 2	148
(FIG 4)	MFT979	K	W-6	149
	MFT980	K	W-8	150
	MFT981	N	W-6 5	151
	MFT982	N	W-8 5	152
	MFT995	A	W 1	153
	MFT996	A	W 1	154
	MFT997	E	W-5	155
	MFT998	E	W-5	156
MFT-956	MFT956	Q	W 20	170
Tailings	MFT957	Q	W 20	171
Ponds	MFT960	P	W 19	172
(FIG 4)	MFT961	P	W 19	173
	MFT962	R	W 21	174
	MFT963	R	W 21	175
	MFT964	S	W 22	176
	MFT966	T	W 23	177
	MFT967	T	W 23	178
	MFT971	G	W-6	179
	MFT972	G	W-8	180
	MFT973	H	W-9	181
	MFT974	H	W-9	182
	MFT975	L	W 7	183
	MFT976	L	W 7	184
	MFT977	M	W 7 5	185
	MFT978	M	W 7 5	186
	MFT984	BLANK		187
MFQ-069	MFQ069	J	W 12	199
Tailings	MFQ071	C	W-5	200
Ponds	MFQ073	D	W-5 5	201
(FIG 4)	MFQ074	I	W 11	202
	MFQ076	F	W-4	203
MFQ-070	MFQ070	J	W 12	215
Tailings	MFQ072	C	W-5	216
Ponds	MFQ075	I	W 11	217
(FIG 4)	MFQ077	F	W-4	218
	MFQ078	BLANK		219
SF-5823	SF5823	S 2	SP 2	235
Mine	SF5824	S-3	SP-3	236
Area	SF5825	S-3	SP-4	237
(FIG 3)	SF5826	S-4	SP-5	238
	SF5827	S-2	SP 2	239
	SF5828	S-3	SP-3	240
	SF5829	S-3	SP-4	241
	SF5830	S-4	SP-5	242
	SF5831	S 1	SP-0	243
	SF5832	S-1	SP-0	244
	SF5833	EQUIP BLK		245
	SF5839	S-5	SP-6	246
	SF5840	S-7	SP 7	247
	SF5841	9'	RR 2	248
	SF5842	S-6	SP-6	249
	SF5843	S-7	SP 7	250
	SF5850	18	RR 1	251
	SF5851	19	SP 11	252
	SF5852	18	RR 1	253
	SF5856	S-11	SP 12	254

Analysis Set	CLP#	Sample Location	Field ID#	Page #
SF-5813	SF5813	S-6	SP-9	274
Mine	SF5814	S-9	SP 10	275
Area	SF5815	S-10	SP-6	276
(FIG 3)	SF5834	S-2	SP 2	277
	SF5835	S-1	SP-0	278
	SF5836	S-3	SP-3	279
	SF5837	S-3	SP-4	280
	SF5838	S-4	SP-5	281
	SF5846	S-5	SP-6	282
	SF5847	S-7	SP 7	283
	SF5848	9	RR 2	284
	SF5849	FLD BLK		285
	SF5854	18	RR 1	286
	SF5855	19	SP 11	287
	SF5858	S 11	SP 12	288
	SF5863	1	RR-3	289
SF-5802	SF5802	T 1	TCLP-3	302
Mine	SF5803	T 2	TCLP-4	303
Area	SF5822	T-3	TCLP 10	304
(FIG 3)	SF5859	T-4	TCLP 12	305
	SF5898	T-5	TCLP 1	306
SF-5844	SF5807	S-9	SP 10	324
Mine	SF5808	S-9	SP 10	325
Area	SF5809	S-8	SP-9	326
(FIG 3)	SF5810	S-8	SP-9	327
	SF5811	S 10	SP-8	328
	SF5812	S-10	SP-8	329
	SF5844	9	RR 2	330
	SF5845	FLD BLK		331
	SF5853	19	SP 11	332
	SF5861	1	RR-3	333
	SF5862	1	RR-3	334
SF-5801	SF5897	M	SS 1	351
Mine	SF5899	N	SS-2	352
Area	SF5801	O	SS-3	353
(FIG 3)	SF5804	P	SS-4	354
	SF5805	Q	SS-5	355
	SF5806	R	SS-6	356
	SF5816	S	SS-7	357
	SF5817	T	SS-9	358
	SF5818	U	SS-10	359
	SF5819	V	SS-8	360
	SF5860	W	SS-12	361
MFQ-183	MFQ183	8	GW 2	380
Mine	MFQ192	2	RR 1	381
Area	MFQ193	3	RR 2	382
(FIG 3)	MFQ194	3	RR-3	383
	MFQ195	5	RR-4	384
	MFQ196	6	RR-4a	385
	MFQ197	7	RR-5	386
	MFQ198	9	RR-6	387
	MFQ199	10	RR 7	388
	MFQ243	11	RR-8	389
	MFQ244	4	GW 1	390
	MFQ245	13	GW-4	391
	MFQ246	14	GW-5	392
	MFQ272	16	RR 10	393
	MFQ392	17	RR 11	394
	MFQ393	18	RR 12	395
	MFQ394	12	RR-9	396
	MFQ395	16	RR 10	397
	MFQ396	17	RR 11	398
	MFQ397	18	RR 12	399

Analysis Set	CLP#	Sample Location	Field ID#	Page #
MFQ-248	MFQ248	14	GW-6	419
Mine	MFQ249	14	GW-5	420
Area	MFQ250	13	GW-4	421
	MFQ251	8	GW 2	422
	MFQ252	4	GW 1	423
	MFQ253	11	RR-8	424
	MFQ254	10	RR 7	425
	MFQ255	9	RR-6	426
	MFQ256	7	RR-5	427
	MFQ257	6	RR-4a	428
	MFQ258	5	RR-4	429
	MFQ259	3	RR-3	430
	MFQ260	3	RR 2	431
	MFQ261	2	RR 1	432
	MFQ262	21	GW 10	433
	MFQ263	20	GW-9	434
	MFQ264	22	GW-8	435
	MFQ265	15	GW 7	436
	MFQ267	21	SP 1	437
	MFQ268	20	GW-9	438
MFQ 182	MFQ182	A	SS 1	457
Mine	MFQ184	B	SS 2	458
Area	MFQ185	B	SS-3	459
	MFQ186	C	S-4	460
	MFQ187	E	S-5	461
	MFQ188	D	S-4a	462
	MFQ189	F	S-6	463
	MFQ190	G	S 7	464
	MFQ191	H	S-8	465
	MFQ247	14	GW-6	466
	MFQ266	S-8	SP 1	467
	MFQ269	22	GW-8	468
	MFQ270	15	GW 7	469
	MFQ271	12	RR-9	470
	MFQ398	I	SS-9	471
	MFQ399	J	SS 10	472
	MFT895	K	SS 11	473
	MFT696	L	SS 12	474
MFQ-082	MFQ082	24	SchBk1	486
	MFQ083	25	SchBk3	487
	MFQ084	26	SchBk3	488
NM State Lab	12900	2	RR-1	489
Mine	12902	3	RR 2	490
Area	12901	4	RR-3	491
	12913	5	GW 1	492
	12903	6	RR-4	493
	12904	7	RR-4a	494
	12905	8	RR-5	495
	12914	9	GW 2	496
	12906	10	RR-6	497
	12907	11	RR 7	498
	12908	12	RR-8	499
	12909	13	RR 9	500
	12915	14	GW-4	501
	12916	15	GW-5	502
	12917	16	GW-6	503
	12918	17	GW 7	504
	12910	18	RR 10	505
	12911	19	RR 11	506
	12912	20	RR 12	507
	10490	21	GW 9	508
	10491	22	GW10	509
	12919	23	GW-8	510
	10492	S-8	SP 1	511

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

02

MEMORANDUM

Date: 5-31-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP.

Case#: SAS 7943Q/21950

SDG#: SF-1368

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ir

USEPA REGION VI

REGIONAL ACCEPTANCE FORM
FOR SPECIAL ANALYTICAL SERVICES

33

Lab Code PBSJ SAS No 07943Q-01 Case No 21950 SDG No SF1368 Data Receipt Date 05/10/94
Site Name MOLY CORP QUESTA MINE Est Liquidated Damages. $360 00
SMO Complete Date: 05/19/94

ease provide a copy of this completed form to the Sample Management Office's SAS IPS Section Leader no later than 07/03/94
-dicate below, by checking the appropriate box, whether the data for this SDG are accepted or of reduced value or rejected
- the Region is requesting a reduced value or a rejection, please attach all appropriate documentation

heck appropriate box below

DATA ACCEPTANCE

☐ Data appear acceptable (i e data that is not rejected or recommended for reduced value) according to the Region's inspection process Applicable liquidated damages as outlined in the laboratory's subcontract are applied as approrpiate

REDUCED VALUE

☐ Data are recommended for a reduced value The Region recommends that the value of the data package be reduced by __% Attached are a signed memo from the Regional official describing the contractual reasons for reduced value and all related documents (data review, telephone logs, etc)

ECTION

☐ Data are recommended for rejection Attached are a signed memo from the Regional Official describing the contractual reasons for rejection, all related documents (data review, telephone logs, etc), and all rejected data

COMMENTS

Name of data reviewer: [illegible]

Organization: ESAT REGION

Date review complete: 5-27-[illegible]

Name of Regional Official [illegible] ELFERY

Signature: [illegible] Date: 5-31-94

MANTECH ENVIRONMENTAL TECHNOLOGY, INC.
ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: May 27, 1994

To: Melvin Ritter, ESAT RPO, Region VI

From: Bill Blanton
Bill Blanton, ESAT ETM, Region VI

Subject: CLP Data Review

WUD #: 6-4462

Attached is the data review summary for Case# SAS7943Q/21950
SDG # SF1368
Site MOLY CORP

COMMENTS:

1. The data package is technically provisional.

2. The matrix spike recoveries were outside the QC limits for alkalinity.

3. The CRDL standards for TOC were outside the contract-required limit (SAS 7943Q, page E-19).

4. The difference between field duplicate results was significant for total organic carbon.

5. The data reviewer found ten reporting errors and the data package had no custody seal.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. SAS7943Q/21950 SITE MOLY CORP
LABORATORY PBSJ NO. OF SAMPLES/
CONTRACT # SAS7943Q MATRIX 20/WATER
SDG # SF1368 REVIEWER (IF NOT ESD) ESAT
SOW # WQP 6/93 & SAS7943Q REVIEWER'S NAME Mervin Doucet
ACCT # 4TFAJNA1 SF # TFAUZZ COMPLETION DATE 5/27/94

SAMPLE NO.: SF1368, SF1369, SF1370, SF1371, SF1372, SF1373, SF1374, SF1375, SF1376, SF1377, SF1378, SF1379, SF1380, SF1381, SF1382, SF1383, SF1384, SF1385, SF1386, SF1387

DATA ASSESSMENT SUMMARY

	COLORI-[1] METRIC	GRAVI-[2] METRIC	REDUCTION/[3] OXIDATION	NH3	SO4	ALK
1. HOLDING TIMES	O	O	O	O	O	O
2. CALIBRATIONS	O	O	X	O	O	O
3. BLANKS	O	O	O	O	O	O
4. LCS	O	O	O	O	O	O
5. DUPLICATE ANALYSIS	O	O	O	O	O	O
6. MATRIX SPIKE	O	N/A	O	O	O	X
7. SAMPLE VERIFICATION	X	O	X	X	X	X
8. OTHER QC	O	O	X	O	O	O
9. OVERALL ASSESSMENT	X	O	X	X	X	X

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A = Not applicable

ACTION ITEMS: The data package was received without a custody seal.

AREAS OF CONCERN: CRA recoveries were below the lower contract-required quality control limit; matrix spike recoveries were outside the quality control limits, and the difference between field duplicate results was significant.

NOTES: [1]Colorimetric: chloride, total phosphate, chemical oxygen demand (COD)
[2]Gravimetric: total dissolved solids (TDS), total suspended solids (TSS)
[3]Reduction/Oxidation: nitrate (NOX), total organic carbon (TOC)

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS79430/21950 SDG SF1368 Site MOLY CORP Lab PBSJ

COMMENTS: Twenty water samples were analyzed at low concentrations for water quality parameters. According to the Packing List/Chain of Custody, sample SF1381 was identified as the QC sample, and samples SF1382 and SF1383 are field duplicates. The data package was one day late for the required 14-day turnaround time.

The data package is provisional due to problems with CRA recoveries, missing custody seal, matrix spike recoveries, and field duplicate results. The effects of these deficiencies on the sample results are discussed below. All other QC requirements were met.

An Evidence Audit was conducted for the Complete Sample Delivery File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. Holding Times

All holding time requirements were met.

2. Calibrations

All TOC results are estimated due to low CRA recoveries.

3. Blanks

All blank results were acceptable.

4. LCS

Laboratory control sample results were acceptable.

5. Duplicate Analysis

All duplicate results met quality control criteria.

6. Matrix Spike

All alkalinity results are estimated because both matrix spike recoveries were below the lower QC limit.

One of the two nitrate matrix spike recoveries exceeded the QC limits. The data reviewer did not qualify the nitrate results because one matrix spike recovery was acceptable and the other matrix spike recovery only marginally exceeded the upper QC limit.

Case SAS7943Q/21950 SDG SF1368 Site MOLY CORP Lab PBSJ

7. Sample Verification

The data reviewer noted the following problems.

The data package was sent to the EPA without a custody.

The receipt date on Airbill #9207028224 does not agree with the Traffic Report/Chain of Custody and Form DC-1 receipt date.

The laboratory did not report the alkalinity preparation blank on Form 3A.

The laboratory incorrectly reported sample spike recoveries for alkalinity, ammonia, and chloride on Form 5A.

The laboratory incorrectly reported the COD result for sample SF1381 on Form 1A.

The laboratory reported one extra ammonia CCB on Form 3A.

The laboratory did not report some nitrate CCVs on Form 2A.

The laboratory incorrectly reported the nitrate spike-added concentrations on Form 5A.

The nitrate result for sample SF1385 should be 1040 ug/L, not 10400 ug/L on Form 1A.

The laboratory incorrectly reported a total organic carbon CCV on Form 2A.

The laboratory incorrectly reported a sulfate spike result for sample SF1374 on Form 5A.

8. Other QC

The sampler identified samples SF1382 and SF1383 as field duplicates. All TOC results are estimated due to significant differences between the field duplicate results.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SA879430/21950 SDG SF1368 Site MOLY CORP Lab PBSJ

9. Overall Assessment

The data package is provisional for the following reasons.

All alkalinity results were estimated because the matrix spike recoveries were outside the QC limits.

All TOC results were estimated due to low CRA recoveries and because the difference between field duplicate results was significant.

In Reference to Case
Case SAS7943Q/21950 SDG SF1368
Page 1 of 2 pages

Contract Laboratory Program
REGIONAL/LABORATORY COMMUNICATION SYSTEM

FAX Record Log

Date of FAX: May 27, 1994

Laboratory Name: PBS & J ENVIRONMENTAL LABS

Lab Contact: BRIAN BRIGHT

Region: 6

Regional Contact: Mervin Doucet (ESAT)

Fax Initiated by: Region

In reference to data for the following sample numbers:

SF1368, SF1369, SF1370, SF1371, SF1372, SF1373, SF1374, SF1375, SF1376, SF1377, SF1378, SF1379, SF1380, SF1381, SF1382, SF1383, SF1384, SF1385, SF1386, SF1387

Summary of Questions/Issues Discussed:

1. The recovery of the TOC CRDL standards exceeded the contract limit of ± 20% (page 25) (SAS 7943Q, page E-19). Please explain why the analysis was not terminated, the problem corrected, and the analytical samples reanalyzed.

2. The data package was sent to the EPA without a custody seal. Please explain this contract violation.

3. The receipt date on Airbill #9207028224 does not agree with the Traffic Report/Chain of Custody and Form DC-1 receipt date. Please resubmit the airbill with the corrected receipt date.

4. The alkalinity preparation blank was not reported on Form 3A. Please report the alkalinity preparation blank on Form 3A and resubmit.

5. The COD result for sample SF1381 was incorrectly reported on Form 1A. Please correct the COD result for sample SF1381 on Form 1A and resubmit.

6. Alkalinity, ammonia, and chloride sample spike recoveries were incorrectly reported on Form 5A. Please calculate these recoveries according to the SOW (WQP 6/93, 7.6, p. E-21) and resubmit the Form 5A.

7. One extra ammonia CCB was reported on Form 3A. Please remove this extra CCB and resubmit Form 3A.

8. According to the raw data (page 117), some nitrate CCVs were not reported on Form 2A. Please report these CCVs on Form 2A and resubmit.

9. The nitrate spike-added concentrations were incorrectly reported on Form 5A. Please correct these concentrations and resubmit Form 5A.

10. The nitrite result for sample SF1385 should be 1040 ug/L, not 10400 ug/L (page 19). Please resubmit the Form 1A with the correct result from the raw data (page 120).

11. The final TOC CCV result was incorrectly reported on Form 2A. Please resubmit the Form 2A with the correct CCV result.

12. A sulfate spike result for sample SF1374 was incorrectly reported on Form 5A. Please correct the spike result and resubmit Form 5A.

The EPA expects the laboratory to look into items and submit data within 14 days to: Christy Macdowell ESAT, U.S. EPA, 10625 Fallstone Road, Houston TX 77099.

Signature 5/27/94 Date

Distribution: (1) Lab Copy, (2) Region Copy, (3) SMO Copy

Mantech Environmental Technology
ESD Region 6

c/o US EPA 10625 Fallstone Rd, Houston, TX 77099 EL: (713) 983-2135

FACSIMILE COVER SHEET

Please deliver the following pages to:

Name BRIAN BRIGHT

Firm PBS & J ENVIRONMENTAL LABS

City ORLANDO **State** FL

Telephone (407) 277-4443 **Ext.**

Fax Telephone No. (407) 382-8794 **Ext.**

Sender:

Name Mervin Doucet

Date 5/27/94 **Time** _____

Total Number of pages including this Cover Sheet 3

If you do not receive all the pages or if any pages are unclear, please call: (713) 983-2135

Messages: _____

Fax Model No. Panafax UF-620 Fax No. (713) 983-2248

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

Positive bias.

Negative bias.

DATA SUMMARY

Case No.: SAS79430/21950 SDG. No.: SF1368 Reviewer: M. DOUCET
Laboratory: PBSJ Matrix: WATER Units: UG/L

13

EPA ==> LAB	SF1368	FLAG	SF1369	FLAG	SF1370	FLAG	SF1371	FLAG	SF1372	FLAG	COMMENTS
ALK	188000	J	84400	J	158000	J	80200	J	80200	J	
COD	5000	U	5000	U	5000	U	5000	U	5000	U	
TDS	928000		199000		266000		281000		287000		
TSS	4000	U	4000	U	4000	U	4000	U	4000	U	
NH3	1000	U	1000	U	1000	U	1000	U	1000	U	
CL	8340		8880		6080		9610		10300		
NOX	320		350		630		390		300		
TOC	7370	J	1000	UJ	1660	J	1000	UJ	1090	J	
TP	120		160		100		170		170		
SO4	521000		54000		67000		105000		68000		

DATA SUMMARY

Case No.: SAS79439/21950 SDG. No.: SF1368 Reviewer: M. DOUCET
Laboratory: PBSJ Matrix: WATER Units: UG/L

EPA #=>		FLAG		FLAG		FLAG		FLAG		FLAG	COMMENTS
LAB ID	SF1373		SF1374		SF1375		SF1376		SF1377		
ALK	92900	J	71800	J	160000	J	71800	J	158000	J	
COD	5000	U	6840		5000	U	8410		5000	U	
TDS	320000		304000		1633000		273000		1580000		
TSS	4000	U	4000	U	4000	U	4000	U	4000	U	
NH3	1000	U	1000	U	1000	U	1000	U	1000	U	
CL	12000		3860		16000		3630		15600		
NOX	210		130		100	U	130		100	U	
TOC	1780	J	2890	J	3430	J	3000	J	2590	J	
TP	170		110		130		100	U	160		
SO4	127000		127000		1005000		121000		973000		

DATA SUMMARY

Case No.: SAS79430/21950 SDG. No.. SF1368 Reviewer: M. DOUCET
Laboratory: PBSJ Matrix: WATER Units: UG/L

EP[redacted] #=> LA[redacted]	SF1378	FLAG	SF1379	FLAG	SF1380	FLAG	SF1381	FLAG	SF1382	FLAG	COMMENTS
ALK	167000	J	184000	J	67500	J	179000	J	152000	J	
COD	5000	U	5000	U	5000	U	5860		5000	U	
TDS	679000		563000		1314000		1690000		1162000		
TSS	4000	U	4000	U	4000	U	4000	U	4000	U	
NH3	1000	U	1000	U	1000	U	1000	U	1000	U	
CL	12300		9530		15600		17900		18300		
NOX	100	U	370		100	U	100	U	710		
TOC	2840	J	2780	J	1990	J	5310	J	3030	J	
TP	100		100	U	100	U	120		150		
SO4	290000		254000		825000		1013000		701000		

DATA SUMMARY

Case No.: SAS7943Q/21950 SDG. No. SF1368 Reviewer: M. DOUCET
Laboratory: PBSJ Matrix. WATER Units: UG/L

EPA #=> / LAB ID	SF1383	FLAG	SF1384	FLAG	SF1385	FLAG	SF1386	FLAG	SF1387	FLAG	COMMENTS
ALK	150000	J	179000	J	154000	J	190000	J	112000	J	
COD	7200		5000	U	5000	U	5000	U	5000	U	
TDS	1313000		1340000		1290000		292000		454000		
TSS	4000	U	4000	U	4000	U	4000	U	4000	U	
NH3	1000	U	1000	U	1000	U	1000	U	1000	U	
CL	18300		18400		18300		2000	U	8420		
NOX	710		370		1040		400		400		
TOC	4770	J	5970	J	5820	J	5340	J	2460	J	
TP	160		120		170		120		120		
SO4	749000		779000		752000		58000		209000		

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case 21950 SDG No. SF1368 SDG Nos. To Follow SAS No. 79430 Date Rec 5/10/94

EPA Lab ID. P9SJ

Lab Location: ORLANDO, FL

Region: 6 Audit No. 21950/SF1368

Re_Submitted CSF? Yes _____ No X

Box No(s): 1

COMMENTS:

The data package had no custody seal

Over for additional comments.

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?		X	
2 Intact upon receipt?		X	
FORM DC-2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6 Present?	X		
7 Complete?	X		
8 Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10 Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS	X		
18 Complete?	X		
19 Legible?	X		
20 Original?	X		
20a. If "No", does the copy indicate where original documents are located?			

Audited by: Mervin L. Doucet ESAT MERVIN DOUCET/DATA REVIEWER Date 5/24/94

Audited by: _____ _____ Date _____

Audited by: _____ _____ Date _____

Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: _____ Date Entered: _____ Date Reviewed: _____

Entered by: _____ _____

Reviewed by: _____ _____

Signature Printed Name/Title

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COVER PAGE - SAS DATA PACKAGE

Lab Name PBS&J Environmental Laboratories Contract PBSJ-0135 Date 5/5/94

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

EPA SAMPLE NUMBER	LAB SAMPLE NUMBER
SF1368	940434306
SF1369	940433007
SF1370	940433008
SF1371	940433009
SF1372	940433010
SF1373	940433011
SF1374	940433002
SF1375	940433001
SF1376	940433003
SF1377	940433004
SF1378	940433005
SF1379	940433006
SF1380	940434303
SF1381	940434304
SF1382	940434301
SF1383	940434302
SF1384	940434308
SF1385	940434309
SF1386	940434305
SF1387	940434307

I certify that this data package is in compliance with the terms and conditions of the SAS contract, both technically and for completeness, for other than the conditions detailed above under Comments Release of the data contained in this data package and in the computer-readable data submitted on floppy diskette (if applicable) has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature

Signature _____ Name Brian Bright

Date 5/8/94 Title SAS Project Mgr

TP Well - 4

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1A

SAS DATA SHEET

(3)

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1368

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434306

Level Low Date Received 4/25/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	188000	ug/l
COD	5000u	ug/l
TDS	928000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	8340	ug/l
NOX	320	ug/l
TOC	7370	ug/l
TP	120	ug/l
SO4	521000	ug/l

Notes

' Indicates that result was below detection limit of test
Detection limits may vary between samples for the same analyte due to sample size limitations and or matrix problems

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SAS DATA SHEET

Warm Spr

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1369 (X)

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433007

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	84400	ug/l
COD	5000u	ug/l
TDS	199000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	8880	ug/l
NOX	350	ug/l
TOC	1000u	ug/l
TP	160	ug/l
SO4	54000	ug/l

Notes

' Indicates that result was below detection limit of test
Detection limits may vary between samples for the same analyte due to sample size limitations and or matrix problems

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SAS DATA SHEET

Cold springs

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1370 (Y)

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433008

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	158000	ug/l
COD	5000u	ug/l
TDS	266000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	6080	ug/l
NOX	630	ug/l
TOC	1660	ug/l
TP	100	ug/l
SO4	67000	ug/l

Notes

U Indicates that result was below detection limit of test.
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and or matrix problems

U S EPA - CLP

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SAS DATA SHEET

Red River @ Pt E
Seep

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1371

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433009

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	80200	ug/l
COD	5000u	ug/l
TDS	281000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	9610	ug/l
NOX	390	ug/l
TOC	1000u	ug/l
TP	170	ug/l
SO4	105000	ug/l

Notes

u Indicates that result was below detection limit of test.
Detection limits may vary between samples for the same analyte due to [illegible] and or matrix problems

U S EPA - CLP

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SAS DATA SHEET

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1372

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433010

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	80200	ug/l
COD	5000u	ug/l
TDS	287000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	10300	ug/l
NOX	300	ug/l
TOC	1090	ug/l
TP	170	ug/l
SO4	68000	ug/l

Notes

Indicates that result was below detection limit of test.
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

FORM 1A

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SAS DATA SHEET

Rad R... 3 ft A
seep

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1373

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433011

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	92900	ug/l
COD	5000u	ug/l
TDS	320000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	12000	ug/l
NOX	210	ug/l
TOC	1780	ug/l
TP	170	ug/l
SO4	127000	ug/l

Notes

1 Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample si... imitations and or matrix problems

U S EPA - CLP

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SAS DATA SHEET

Inc quot on Dtch b/w Embarco Rd sea

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1374

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433002

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	71800	ug/l
COD	6840	ug/l
TDS	304000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	3860	ug/l
NOX	130	ug/l
TOC	2890	ug/l
TP	110	ug/l
SO4	127000	ug/l

Notes

1 Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

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SAS DATA SHEET

Enlarge Rd soup

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1375

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433001

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	160000	ug/l
COD	5000u	ug/l
TDS	1633000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	16000	ug/l
NOX	100u	ug/l
TOC	3430	ug/l
TP	130	ug/l
SO4	1005000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary between samples for the same analyte due to sample size limitations and or matrix problems

U S EPA - CLP

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SAS DATA SHEET

Ir gal - Dlch ubr
Embargo Rd Seep

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1376 (P)

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433003

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	71800	ug/l
COD	8410	ug/l
TDS	273000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	3630	ug/l
NOX	130	ug/l
TOC	3000	ug/l
TP	100u	ug/l
SO4	121000	ug/l

Notes

1 Indicates that result was below detection limit of test.
Detection limits may vary bvetween samples for the same analyte due t[illegible] and or matrix problems

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SAS DATA SHEET

002 aifall

(R)

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1377

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433004

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	158000	ug/l
COD	5000u	ug/l
TDS	1580000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	15600	ug/l
NOX	100u	ug/l
TOC	2590	ug/l
TP	160	ug/l
SO4	973000	ug/l

Notes

U Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample limitations and or matrix problems

50 ft b/w #002 out fall

(5)

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SAS DATA SHEET

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1378

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433005

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	167000	ug/l
COD	5000u	ug/l
TDS	679000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	12300	ug/l
NOX	100u	ug/l
TOC	2840	ug/l
TP	100	ug/l
SO4	290000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and or matrix problems

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SAS DATA SHEET

old cold spring collection

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1379 (T)

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Surface Lab Sample I D 940433006

Level Low Date Received 4/22/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	184000	ug/l
COD	5000u	ug/l
TDS	563000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	9530	ug/l
NOX	370	ug/l
TOC	2780	ug/l
TP	100u	ug/l
SO4	254000	ug/l

Notes

1 Indicates that result was below detection limit of test
Detection limits may vary between samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

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SAS DATA SHEET

Tidell 2

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1380 (G)

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434303

Level Low Date Received 4/25/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	67500	ug/l
COD	5000u	ug/l
TDS	1314000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	15600	ug/l
NOX	100u	ug/l
TOC	1990	ug/l
TP	100u	ug/l
SO4	825000	ug/l

Notes

(indicates that result was below detection limit of test.
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and or matrix problems

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U S EPA - CLP

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SAS DATA SHEET

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1381

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434304

Level Low Date Received 4/25/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	179000	ug/l
COD	5900	ug/l
TDS	1690000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	17900	ug/l
NOX	100u	ug/l
TOC	5310	ug/l
TP	120	ug/l
SO4	1013000	ug/l

Notes

u Indicates that result was below detection limit of test

Detection limits may vary between samples for the same analyte due to sample [illegible] dilutions and or matrix problems

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SAS DATA SHEET

TP well = 1

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1382 (L)

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434301

Level Low Date Received 4/25/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	152000	ug/l
COD	5000u	ug/l
TDS	1162000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	18300	ug/l
NOX	710	ug/l
TOC	3030	ug/l
TP	150	ug/l
SO4	701000	ug l

Notes

u Indicates that result was below detection limit of test

Detection limits may vary between samples for the same analyte due to sample size limitations and or matrix problems

U S EPA - CLP

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SAS DATA SHEET

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1383

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434302

Level Low Date Received 4/25/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	150000	ug/l
COD	7200	ug/l
TDS	1313000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	18300	ug/l
NOX	710	ug/l
TOC	4770	ug/l
TP	160	ug/l
SO4	749000	ug/l

Notes

ndicates that result was below detection limit of test.

Detection limits may vary between samples for the same analyte due to sample size limitations and or matrix problems

U S EPA - CLP

1A
SAS DATA SHEET

TF well = 3

(K)

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1384

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434308

Level Low Date Received Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	179000	ug/l
COD	5000u	ug/l
TDS	1340000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	18400	ug/l
NOX	370	ug/l
TOC	5970	ug/l
TP	120	ug/l
SO4	779000	ug/l

Notes

U Indicates that result was below detection limit of test
Detection limits may vary between samples for the same analyte due to s[illegible] and or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1385

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434309

Level Low Date Received 4/25/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	154000	ug/l
COD	5000u	ug/l
TDS	1290000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	18300	ug/l
NOX	10400	ug/l
TOC	5820	ug/l
TP	170	ug/l
SO4	752000	ug/l

Notes

u Indicates that result was below detection limit of test

Detection limits may vary between samples for the same analyte due to sample size limitations and or matrix problems

U S EPA - CLP

IA

SAS DATA SHEET

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1386

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434305

Level Low Date Received 4/25/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	190000	ug/l
COD	5000u	ug/l
TDS	292000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	2000u	ug/l
NOX	400	ug/l
TOC	5340	ug/l
TP	120	ug/l
SO4	58000	ug/l

Notes

u Indicates that result was below detection limit of test.

Detection limits may vary between samples for the same analyte due to [illegible] and or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF1387(E)

Lab Code PBSJ SAS No 7943-21950 SDG No SF1368

Matrix Ground Lab Sample I D 940434307

Level Low Date Received 4/25/94 Date 5/5/94

TEST PERFORMED	RESULT	UNITS
ALK	112000	ug/l
COD	5000u	ug/l
TDS	454000	ug/l
TSS	4000u	ug/l
NH3	1000u	ug/l
CL	8420	ug/l
NOX	400	ug/l
TOC	2460	ug/l
TP	120	ug/l
SO4	209000	ug/l

Notes

1 Indicates that result was below detection limit of test.
Detection limits may vary between samples for the same analyte due to sample size limitations and or matrix problems

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON TEXAS 77099

MEMORANDUM

Date: 6-2-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: SAS 7943Q22010

SDG#: SF-1388

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

USEPA REGION VI

REGIONAL ACCEPTANCE FORM
FOR SPECIAL ANALYTICAL SERVICES

40

Lab [redacted] SILVER SAS No 07943Q-02 Case No 22010 SDG No SF1388 Data Receipt Date 05/11/94
Site Name MOLYCORP INC Est Liquidated Damages $0 00
SMO Complete Date 05/11/94

Please provide a copy of this completed form to the Sample Management Office's SAS IPS Section Leader no later than 06/25/94
Indicate below, by checking the appropriate box, whether the data for this SDG are accepted or of reduced value or rejected
If the Region is requesting a reduced value or a rejection, please attach all appropriate documentation

Check appropriate box below

I DATA ACCEPTANCE

☑ Data appear acceptable (i e data that is not rejected or recommended for reduced value) according to the Region's inspection process Applicable liquidated damages as outlined in the laboratory's subcontract are applied as appropriate

II REDUCED VALUE

☐ Data are recommended for a reduced value The Region recommends that the value of the data package be reduced by __% Attached are a signed memo from the Regional official describing the contractual reasons for reduced value and all related documents (data review, telephone logs, etc)

III REJECTION

☐ Data are recommended for rejection Attached are a signed memo from the Regional Official describing the contractual reasons for rejection, all related documents (data review, telephone logs, etc), and all rejected data

COMMENTS

Name of data reviewer MERVIN JOUET

Organization ESAT, REGION 6

Date review complete 6-1-94

Name of Regional Official HAMMAD ELFEKY

Signature [signature] Date 6-2-94

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. SAS7943Q/22010
LABORATORY SILVER
CONTRACT # SAS7943Q
SDG # SF1388
SOW # WQP 6/93 & SAS7943Q
ACCT # 4TFAJNA2 SF # TFAUZZ

SITE MOLY CORP
NO. OF SAMPLES/
MATRIX 6/WATER
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Mervin Doucet
COMPLETION DATE 6/1/94

SAMPLE NO.: SF1388, SF1389, SF1390, SF1391, SF1392, SF1393

DATA ASSESSMENT SUMMARY

	COLORI-[1] METRIC	GRAVI-[2] METRIC	TITRI-[3] METRIC	NH3	SO4	AC[4]
1. HOLDING TIMES	O	O	O	O	O	O
2. CALIBRATIONS	X	O	X	X	X	O
3. BLANKS	X	X	X	X	X	O
4. LCS	O	O	O	O	O	O
5. DUPLICATE ANALYSIS	O	O	O	O	O	O
6. MATRIX SPIKE	O	N/A	O	O	O	O
7. SAMPLE VERIFICATION	X	X	X	X	X	X
8. OTHER QC	O	O	O	O	O	O
9. OVERALL ASSESSMENT	X	X	X	X	X	X

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A = Not applicable

ACTION ITEMS: The laboratory did not analyze CRDL standards and did not perform ICVs, ICBs, CCVs, and CCBs prior to the sample analysis run for COD, chloride, total phosphorus, ammonia, sulfate, and alkalinity.

AREAS OF CONCERN: A field blank was above the detection limit.

NOTES: [1]Colorimetric: total phosphorus, chemical oxygen demand
[2]Gravimetric: total dissolved solids, total suspended solids
[3]Titrimetric: alkalinity, chloride
[4]AC (Automated Spectrophotometric): total organic carbon, nitrate + nitrite

MANTECH ENVIRONMENTAL TECHNOLOGY, INC.
ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: June 1, 1994

To: Melvin Ritter, ESAT RPO, Region VI

From: Bill Blanton, ESAT ETM, Region VI

Subject: CLP Data Review

WUD #: 6-4470

Attached is the data review summary for Case# SAS7943Q/22010
SDG # SF1388
Site MOLY CORP

COMMENTS:

1. The data package is technically provisional.

2. The laboratory did not perform ICVs, ICBs, CCVs, and CCBs prior to the sample analysis run for five parameters (SAS 7943Q, page E-18 to E-20)

3. The laboratory did not analyze CRDL standards for six parameters (SAS 7943Q, page E-19).

4. Three total suspended solids results were qualified as undetected due to the field blank TSS result.

5. The reviewer found 13 reporting errors.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SA879430/22010 SDG SF1388 Site MOLY CORP Lab SILVER

COMMENTS: Six water samples were analyzed at low concentrations for water quality parameters. According to the Packing List/Chain of Custody, sample SF1388 was identified as the QC sample, and samples SF1389 and SF1390 are field duplicates. Sample SF1393 was identified as the field blank. The laboratory met the contractual 14-day turnaround time requirement. The laboratory did not analyze CRDL standards and did not perform ICVs, ICBs, CCVs, and CCBs prior to the sample analysis run for COD, chloride, total phosphorus, ammonia, sulfate, and alkalinity.

The data package is provisional due to problems with the field blank. The effect of this deficiency on the sample results is discussed below. All other QC requirements were met.

An Evidence Audit was conducted for the Complete Sample Delivery File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. Holding Times

All holding time requirements were met.

2. Calibrations

The laboratory did not analyze CRDL standards and did not perform ICVs, CCBs, CCVs, and CCBs prior to the sample analysis run for COD, chloride, total phosphorus, ammonia, sulfate, and alkalinity. The laboratory obtained acceptable recoveries with the laboratory control sample after standardization. In the opinion of the reviewer, the data was not significantly affected by these contract violations because all other QC criteria were met.

3. Blanks

Field Blank

The sampler identified sample SF1393 as the field blank. Total suspended solids (TSS) results for sample SF1393

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS7943Q/22010 SDG SF1388 Site MOLY CORP Lab SILVER

5. Duplicate Analysis

All duplicate results met quality control criteria.

6. Matrix Spike

All matrix spike recoveries were acceptable.

7. Sample Verification

The laboratory did not perform the ammonia analytical spike.

The laboratory performed a sulfate CCB before the CCV.

The chloride result for sample SF1388 on Form 1 should be 16,200 ug/L, not 16,000 ug/L.

The total dissolved solids result for sample SF1391 on Form 1 should be 1,330,000 ug/L, not 13,300 ug/L.

The laboratory did not report the following items.

The alkalinity sample and spiked sample results on Form 5.

The IDL analysis date on Form 9.

One preparation and two continuing calibration blanks for chloride on Form 4.

The ICB and CCBs for nitrate on Form 4.

The total organic carbon CRDL standard result on Form 3.

The total phosphorus CCVs on Forms 2 and CCBs on Forms 4.

The chemical oxygen demand CCV on Form 2.

The total dissolved solids and total suspended solids duplicate results on Form 7.

The ammonia CCBs on Form 4.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS79430/22010 SDG SF1388 Site MOLY CORP Lab SILVER

8. Other QC

Field Duplicates

The sampler identified samples SF1389 and SF1390 as field duplicates. In the opinion of the data reviewer, there was no significant difference between field duplicate results.

9. Overall Assessment

The data package is provisional for the following reasons.

Three TSS sample results were undetected because the reported results were less than five times the amount in the field blank.

MEMORANDUM

W E. Blanton

To: M. Ritter **From:** W. E. Blanton

Subject: SAS7943Q SDG SF1388 Laboratory Resubmissions **Date:** June 1, 1994

Copies: M. El Feky, ICF File, File **Ref:** MEM981, WUD No. 6-4470, I-1307

Attached is a resubmission request of issues needing clarification for SAS case SAS7943Q SDG SF1388. The samples in this case were analyzed by:

SVL Analytical, Inc.
One Government Gulch
Kellogg, ID 83837

Attention: Melba Bencich

The laboratory resubmissions should be submitted to:

Ms. Christy Macdowell
ManTech Environmental Technology, Inc.
c/o US EPA
10625 Fallstone Rd.
Houston, TX 77099

Ms. Macdowell will then distribute the laboratory resubmission to the appropriate data reviewer who will prepare the resubmission report for this case.

In Reference to Case
SAS No.: SAS7943Q
SDG No.: SF1388
Laboratory: SILVER

In reference to data for the following sample numbers:

SF1388, SF1389, SF1390, SF1391, SF1392, SF1393

Summary of Questions/Issues Discussed:

1. ICVs, ICBs, CCVs, and CCBs were not performed prior to the sample analysis run for COD, chloride, total phosphorus, ammonia, and sulfate (SAS 7943Q, page E-18 to E-20). Please explain this contract violation.

2. CRDL standards were not analyzed for ammonia, alkalinity, chloride, sulfate, COD, and total phosphorus (SAS 7943Q, page E-19). Please explain this contract violation.

3. The analytical spike was not performed for ammonia. Please explain why the analytical spike was not performed.

4. The first sulfate CCB was performed before the CCV (SAS 7943Q, page E-20). Please explain the reason that the CCB was performed before the CCV.

5. The alkalinity sample and spiked sample results were not reported on Form 5. Please report these results on Form 5 and resubmit.

6. The IDL analysis date was not reported on Form 9. Please report the IDL analysis date on Form 9 and resubmit.

7. One preparation and two continuing calibration blank concentrations were not reported for chloride on Form 4. Please report these concentrations on Form 4 and resubmit.

8. The chloride result for sample SF1388 should be 16,200 ug/L, not 16,000 ug/L (page 42). Please correct Form 1 (page 2) and resubmit.

9. The nitrate ICB and CCBs were not reported on Form 4. Please report the nitrate ICB and CCBs on Form 4 and resubmit.

10. The TOC CRDL standard result was not reported on a Form 3. Please report the TOC CRDL and submit the Form 3 with a proper page number.

In Reference to Case
SAS No.: SAS7943Q
SDG No.: SF1388
Laboratory: SILVER

11. The total phosphorus CCVs and CCBs were not reported on Forms 2 and 4. Please report the total phosphorus CCVs and CCBs on Forms 2 and 4, and resubmit.

12. The COD CCV was not reported on Form 2. Please report the COD CCV on Form 2 and resubmit.

13. The TSS and TDS duplicate results were not reported on Form 7. Please report the TSS and TDS duplicate results on Form 7 and resubmit.

14. The total dissolved solids result for sample SF1391 should be 1,330,000 ug/L, not 13,300 ug/L (page 34). Please correct Form 1 (page 5) and resubmit.

15. The ammonia CCBs were not reported on Form 4. Please report the ammonia CCBs on Form 4 and resubmit.

DATA SUMMARY

Case No. SAS79430/22010 SDG. No . SF1388 Reviewer: M. DOUCET
Laboratory: SILVER Matrix: WATER Units: UG/L

EPA TR #=>	SF1388	FLAG	SF1389	FLAG	SF1390	FLAG	SF1391	FLAG	SF1392	FLAG	COMMENTS
LAB											
ALK	131000		103000		104000		134000		162000		
NH3	1000	U	1000	U	1000	U	1000	U	1000	U	
TOC	1390		1000	U	1000	U	2280		2150		
COD	5000	U	5000	U	5000	U	6600		5000	U	
CL	16200		6140		6140		15200		23500		
NOX	340		260		280		330		360		
TP	100	U	100	U	100	U	100	U	100	U	
TDS	1280000		288000		277000		1330000		81400		
TSS	3800	UC	100	U	100	U	3400	UC	600	UC	
SO4	740000		72000		84000		818000		384000		

DATA SUMMARY

Case No . SAS79430/22010 SDG. No.. SF1388 Reviewer: M. DOUCET

Laboratory SILVER Matrix WATER Units: UG/L

		FLAG	FLAG	FLAG	FLAG	FLAG	COMMENTS
EPA [redacted] =>	SF1393						
LAB							
ALK	2000 U						
NH3	1000 U						
TOC	1000 U						
COD	5000 U						
CL	2000 U						
NOX	100 U						
TP	100 U						
TDS	10000 U						
TSS	800						
SO4	3400						

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case 22010 SDG No. SF1388 SDG Nos. To Follow SAS No. Date Rec 5/11/94

EPA Lab ID: SILVER

Lab Location: KELLOGG, ID

Region: 6 Audit No: 22010/SF1388

Re_Submitted CSF? Yes _____ No X

Box No(s). 1

COMMENTS.

The Blank (Form 4) pages and Solids raw data pages were incorrectly numbered on Form DC-2 The data reviewer corrected these page numbers on Form DC-2

Ammonia raw data pages were not listed on Form DC-2 The data reviewer corrected the Form DC-2

Over for additional comments

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2. Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?		X	
4 Are enclosed documents listed?		X	
5 Are listed documents enclosed?	X		
FORM DC-1			
6. Present?	X		
7 Complete?	X		
8 Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10 Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18. Complete?	X		
19 Legible?	X		
20 Original?	X		
20a. If "No", does the copy indicate where original documents are located?			X

Audited by: Mervin L Doucet ESAT MERVIN DOUCET/DATA REVIEWER Date 5/28/94

Audited by: _____ Date _____

Audited by: _____ Date _____

Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: _____ Date Entered _____ Date Reviewed: _____

Entered by: _____

Reviewed by: _____

Signature Printed Name/Title

U S ENVIRONMENTAL PROTECTION AGENCY

CONTRACT LABORATORY PROGRAM

Water Quality Parameters

COVER PAGE - WATER QUALITY ANALYSES DATA PACKAGE

Lab Name: SVL ANALYTICAL, INC Contract: 68-D9-0135

Lab Code: SILVER SAS No: 7943Q-02

Case No: 22010 SDG No: SF1388

SOW No: NA

EPA Sample No	Lab Sample ID
SF1388	W60550
SF1388D	W60550D
SF1388S	W60550S
SF1389	W60551
SF1390	W60552
SF1391	W60553
SF1392	W60554
SF1393	W60555

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, excluding the conditions detailed above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: [signature] Name: MELBA BENCICH

Title: DOCUMENT CONTROL OFFICER

U S ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
Water Quality Parameters

EPA SAMPLE NO
SF1388

WATER QUALITY ANALYSES DATA SHEET

Lab Name SVL ANALYTICAL, INC
Lab Code SILVER
Case No 22010
SAS No 79430-02
SDC No SF1388

Contract 68-D9-0135
Lab Sample ID W60550
Date Received 04/27/94
pH 7.3

PARAMETER	CONCENTRATION (µg/L)	C	Q	M
Alkalinity	131000			T
Ammonia, Nitrogen	1000	U		P
Carbon, Total Organic	1390			AC
Chemical Oxygen Demand	5000	U		C
Chloride	16000			T
Nitrate + Nitrite	340.			AC
Phosphorus, All Forms	100	U		C
Solids, Total Dissolved	1280000			G
Solids, Total Suspended	3800.			G
Sulfate	740000.			

Comments

U S ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
Water Quality Parameters

EPA SAMPLE NO
SF1389

WATER QUALITY ANALYSES DATA SHEET

Lab Name: SVL ANALYTICAL, INC
Contract: 68-D9-0135
Lab Code: SILVER
Lab Sample ID: W60551
Case No: 22010
Date Received: 04/27/94
SAS No: 79430-02
pH: 7.6
SDG No: SF1388

PARAMETER	CONCENTRATION (µg/L)	C	Q	M
Alkalinity	103000.			T
Ammonia, Nitrogen	1000	U		P
Carbon, Total Organic	1000.	U		AC
Chemical Oxygen Demand	5000	U		C
Chloride	6140.			T
Nitrate + Nitrite	260			AC
Phosphorus, All Forms	100.	U		C
Solids, Total Dissolved	288000.			G
Solids, Total Suspended	100.	U		G
Sulfate	72000.			

Comments:

U S ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
Water Quality Parameters

EPA SAMPLE NO
SF1390

WATER QUALITY ANALYSES DATA SHEET

Lab Name SVL ANALYTICAL, INC.
Contract 68-D9-0135
Lab Code SILVER
Lab Sample ID W60552
Case No 22010
Date Received 04/27/94
SAS No 7943Q-02
pH 7.6
SDG No SF1388

PARAMETER	CONCENTRATION (µg/L)	C	Q	M
Alkalinity	104000.			T
Ammonia, Nitrogen	1000.	U		P
Carbon, Total Organic	1000.	U		AC
Chemical Oxygen Demand	5000.	U		C
Chloride	6140.			T
Nitrate + Nitrite	280			AC
Phosphorus, All Forms	100.	U		C
Solids, Total Dissolved	277000.			G
Solids, Total Suspended	100.			G
Sulfate	84000			

Comments

U S ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
Water Quality Parameters

EPA SAMPLE NO
SF1391

WATER QUALITY ANALYSES DATA SHEET

Lab Name: SVL ANALYTICAL, INC
Lab Code: SILVER
Case No: 22010
SAS No: 79430-02
SDG No: SF1388

Contract: 68-D9-0135
Lab Sample ID: W60553
Date Received: 04/27/94
pH: 7.6

PARAMETER	CONCENTRATION (µg/L)	C	Q	M
Alkalinity	134000.			T
Ammonia, Nitrogen	1000.	U		P
Carbon, Total Organic	2280			AC
Chemical Oxygen Demand	6600.			C
Chloride	15200.			T
Nitrate + Nitrite	330.			AC
Phosphorus, All Forms	100.	U		C
Solids, Total Dissolved	13300.			G
Solids, Total Suspended	3400			G
Sulfate	818000.			

Comments:

U S ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
Water Quality Parameters

EPA SAMPLE NO
SF1392

WATER QUALITY ANALYSES DATA SHEET

Lab Name: SVL ANALYTICAL, INC.
Contract: 68-D9-0135
Lab Code: SILVER
Lab Sample ID: W60554
Case No: 22010
Date Received: 04/27/94
SAS No: 79430-02
pH: 7.7
SDG No: SF1388

PARAMETER	CONCENTRATION (µg/L)	C	Q	M
Alkalinity	162000.			T
Ammonia, Nitrogen	1000.	U		P
Carbon, Total Organic	2150			AC
Chemical Oxygen Demand	5000.	U		C
Chloride	23500.			T
Nitrate + Nitrite	360			AC
Phosphorus, All Forms	100.	U		C
Solids, Total Dissolved	814000			G
Solids, Total Suspended	600			G
Sulfate	384000			

Comments: _____

U S ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
Water Quality Parameters

EPA SAMPLE NO
SF1393

WATER QUALITY ANALYSES DATA SHEET

Lab Name SVL ANALYTICAL, INC. Contract 68-D9-0135
Lab Code SILVER Lab Sample ID W60555
Case No 22010 Date Received 04/27/94
SAS No 79430-02 pH 5.5
SDG No SF1388

PARAMETER	CONCENTRATION (µg/L)	C	Q	M
Alkalinity	2000.	U		T
Ammonia, Nitrogen	1000.	U		P
Carbon, Total Organic	1000.	U		AC
Chemical Oxygen Demand	5000.	U		C
Chloride	2000.	U		T
Nitrate + Nitrite	100.	U		AC
Phosphorus, All Forms	100.	U		C
Solids, Total Dissolved	10000	U		G
Solids, Total Suspended	800			G
Sulfate	3400.			

Comments

U S ENVIRONMENTAL PROTECTION AGENCY
CONTRACT LABORATORY PROGRAM
Water Quality Parameters

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Lab Name SVL ANALYTICAL, INC. Contract. 68-D9-0135

Lab Code SILVER SAS No 79430-02

Case No 22010 SDG No SF1388

Concentration Units = µg/L

PARAMETER	WAVE	INITIAL CALIBRATION				CONTINUING CALIBRATION						M
		SOURCE USED	TRUE	FOUND	%R (1)	SOURCE USED	TRUE	FOUND	%R (1)	FOUND	%R (1)	
Alkalinity												NR
Ammonia, Nitrogen							2000.	1930.	96	1960.	98	P
Carbon, Total Organic		ERA	44100.	37600.	85	~~10000~~	10000.	10120.	101	10180	102	AC
Chemical Oxygen Demand												NR
Chloride												NR
Nitrate + Nitrite			1500.	1530.	102		2000.	2020.	101	2040.	102	AC
Phosphorus, All Forms												NR
Sulfate							5000.	4930.	99	4957.	99	

OC 05/09/94

(1) Control Limits: 85-115%

Comments _____

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

AUG 1994
RECEIVED

MEMORANDUM

Date: 7-21-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: 21950

SDG#: MFT-923

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION VI

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

LAB CODE ETS	CASE NO 21950	SDG NO MFT923
SITE NAME MOLYCORP	NUMBER OF SAMPLES 22	

FORM DUE DATE: 06/27/94

SDG MAILDATE: 06/02/94

PART I DATA ACCEPTANCE OR REJECTION

INSTRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM MUST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR REJECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC), 2) ALL REJECTED DATA

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

✓ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG

REJECT ALL ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

PART II REDUCED VALUE

INSTRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA FOR A REDUCED VALUE TO BE PROCESSED THIS FORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE THE DOLLAR AMOUNT FOR REDUCED VALUE, AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS DETERMINED FOR EACH AFFECTED SAMPLE ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS ETC)

CHECK ONE OF THE FOLLOWING

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

IDENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM

THIS FORM CANNOT BE PROCEESSED WITHOUT A SIGNATURE

NAME OF REGIONAL OFFICIAL RICHARD ELFELT

SIGNATURE [signature] DATE 7-21-94

SEND THIS FORM TO SAMPLE MANAGEMENT OFFICE
SAMPLE SCHEDULING & REPORTING SECTION
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

SEE LIST OF SAMPLES ON REVERSE SIDE

| LAB CODE ETS | CASE NO 21950 | SDG NO . MFT923 |

PART III PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER A "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE

SAMPLE	FRACTIONS ANALYZED		
	METALS	CYANIDE	
LCSS	Y		
MFT923	Y		
MFT924	Y		
MFT925	Y		
MFT926	Y		
MFT927	Y		
MFT927D	Y		
MFT927S	Y		
MFT928	Y		
MFT929	Y		
MFT930	Y		
MFT931	Y		
MFT932	Y		
MFT934	Y		
MFT935	Y		
MFT936	Y		
MFT937	Y		
MFT938	Y		
MFT939	Y		
MFT940	Y		
MFT941	Y		
MFT942	Y		

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: July 20, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD # 6-4566

Attached is the data review summary for Case #21950
SDG #MFT923
Site MOLY CORP

COMMENTS:

1. The data package is technically provisional.
2. There were no contractual violations noted by CCS or the hardcopy data review.
3. The matrix spike recoveries for selenium and zinc were outside the QC limits.
4. Some FAA analytical spike recoveries failed to meet QC criteria.
5. The laboratory made one reporting error.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. 21950
LABORATORY ETS
CONTRACT # 68-D2-0048
SDG # MFT923
SOW# ILM02.0
ACCT # 4TFAJNA1 SF # TFAUZZ

SITE MOLY CORP
NO. OF SAMPLES/
MATRIX 19 soil
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Linda Hoffman
COMPLETION DATE July 20, 1994

SAMPLE NO.: MF-T923, MF-T924, MF-T925, MF-T926, MF-T927, MF-T928, MF-T929, MF-T930, MF-T931, MF-T932, MF-T934, MF-T935, MF-T936, MF-T937, MF-T938, MF-T939, MF-T940, MF-T941, MF-T942

DATA ASSESSMENT SUMMARY

	ICP	AA	HG
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	O	O
4. MATRIX SPIKES	X	X	O
5. DUPLICATE ANALYSIS	O	O	O
6. ICP QC	O		
7. FAA QC		X	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	O	X	O
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	X	X	O

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Matrix spike recoveries and FAA analytical spike recoveries were outside the QC criteria.

NOTABLE PERFORMANCE:

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 21950 SDG MFT923 Site MOLY CORP Lab ETS

COMMENTS: Nineteen soil samples were analyzed at low concentrations for total metals. Samples MF-T926 and MF-T927 were indicated as field duplicates, and sample MF-T927 was designated as the QC sample. The laboratory met the required data package turnaround time.

The data package is technically provisional due to problems with matrix spike recoveries and FAA QC. This report documents only the QC requirements that weren't met and those factors affecting the technical usability of the results.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. Holding Times

All holding time criteria were met.

2. Calibrations

All calibrations were acceptable.

3. Blanks

Arsenic and selenium were reported in the calibration blanks. The samples that were affected by blank concentrations were below the CRDL, and the qualifications are listed in the Data Summary Table.

4. Pre-digestion/Pre-distillation Matrix Spike Recovery

The samples listed below are estimated because matrix spike recoveries were outside QC criteria. Physical or chemical interferences are suspected in the sample matrix.

All selenium results because of a low matrix spike recovery.

All zinc results because of a high matrix spike recovery.

5. Duplicate Analysis

All duplicate results met QC criteria.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 21950 SDG MFT923 Site MOLY CORP Lab ETS

6. ICP Quality Control

The serial dilution differences and the ICS results had acceptable results.

7. Furnace Atomic Absorption Quality Control

FAA Analytical Spike Recovery

Selenium results except samples MF-T930, MF-T931, MF-T937, and MF-T940, and the thallium results for samples MF-T934 and MF-T938 are estimated because analytical spike recoveries were outside the QC limits. Physical or chemical interference is possible.

Method of Standard Addition

MSA results were acceptable.

8. Laboratory Control Sample

The LCS results were acceptable.

9. Sample Verification

On Form 14 (page 75), the laboratory X'd sample MF-T942A twice, instead of putting an X only for the rerun result.

10. Other QC

Field Duplicates

Field duplicate results were acceptable.

11. Overall Assessment

The data package is provisional for the following reasons.

All selenium and zinc results were estimated because matrix spike recoveries were outside QC limits.

Fifteen selenium and two thallium results were estimated because FAA analytical spike recoveries failed to meet QC criteria.

In Reference to
Case 21950/SDG MFT923
Page 1 of 1 page

Contract Laboratory Program
REGIONAL/LABORATORY COMMUNICATION SYSTEM

FAX Record Log

Date of FAX: July 20, 1994

Laboratory Name: ETS

Lab Contact: Susanne Deegan

Region: 6

Regional Contact: Linda Hoffman (ESAT)

FAX Initiated by: Region

In reference to data for the following sample number:

MF-T942

Summary of Questions/Issues:

On Form 14 (page 75), sample MF-T942A was X'd for the initial and the rerun result, although the rerun result was reported. Please correct Form 14 and resubmit.

The EPA expects the laboratory to look into items and submit data within fourteen days to Christy Macdowell, U.S. EPA, 10625 Fallstone Road, Houston TX 77099.

Linda Hoffman
Signature

7-20-94
Date

I1399

Distribution: (1) Lab Copy, (2) Region Copy, (3) SMO Copy

Ma[redacted]ech Environmental Technology
ES[redacted] Region 6

c/o US EPA 10625 Fallstone Rd, Houston, TX 77099 TEL:(713) 983-2125

FACSIMILE COVER SHEET

Please deliver the following pages to:

Name Susanne Deegan

Firm ETS

City Roanoke **State** VA

Telephone 703-265-0004 **Ext.** _____

Fax Telephone No. 703-563-4866 **Ext.** _____

Sender:

N[redacted] Linda Hoffman ESAT

Date 7-20-94 **Time** _____

Total Number of pages including this Cover Sheet 2

If you do not receive all the pages or if any pages are unclear, please call: (713) 983-2125

MESSAGES: _____

Fax Model No. Panafax UF-620 Fax No. (713) 983-2248

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

v Negative bias.

DATA SUMMARY

Case No.: 21950 SDG. No MFT923 Reviewer: A. CANTU
Laboratory: EIS Matrix: SOIL Units: MG/KG

EPA [illegible]=>	MF-T923	FLAG	MF-T924	FLAG	MF-T925	FLAG	MF-T926	FLAG	MF-T927	FLAG	COMMENTS
ALUMINUM	6190		16300		3850		5620		6220		
ANTIMONY	7.5	U	9 3	U	8.2	U	8.7	U	9 3	U	
ARSENIC	0.84	UC	0.47	UC	1.2	^J	1.1	UC	1 4	^J	
BARIUM	70.4		153		29 9		73.9		90.6		
BERYLLIUM	0.59		2.4		0 46		0 47		0.56		
CADMIUM	0.75	U	0.93	U	0.82	U	0.87	U	1 2		
CALCIUM	14500		17900		10200		18800		19700		
CHROMIUM	32.9		77.1		19 4		28.5		31		
COBALT	8.1		7.9		3 6		14.7		16.2		
COPPER	136		169		37 7		262		274		
IRON	13100		19700		8640		19400		20800		
LEAD	31.3		51.8		33.2		82 2		82.8		
MAGNESIUM	6300		14300		3870		5730		6180		
MANGANESE	352		692		515		386		413		
MERCURY	0.1	U	0.11	U	0.11	U	0 12	U	0.12	U	
NICKEL	24.6		42		10 5		30 5		34.9		
PO[illegible]UM	4010		8490		1910		3680		3970		
SELENIUM	0.18	UJ	0.18	UJ	0 18	UJ	0 3	UCJ	0.24	UCJ	
SILVER	0.75	U	0.93	U	0 82	U	0 87	U	0.93	U	
SODIUM	118		222		78 6		119		117		
THALLIUM	0 42		0 82		0.35	U	0.42		0.53		
VANADIUM	30.2		61 8		13 6		26 5		30 4		
ZINC	85.1	J	115	J	111	J	156	J	148	J	
% SOLIDS	92.7		83.8		89 2		84.9		83		

DATA SUMMARY

Case No.: 21950 SDG. No. MFT923 Reviewer: A. CANTU
Laboratory: ETS Matrix: SOIL Units: MG/KG

EPA TR #=>	MF-T928	FLAG	MF-T929	FLAG	MF-T930	FLAG	MF-T931	FLAG	MF-T932	FLAG	COMMENTS
ALUMINUM	11000		8150		7070		12300		8000		
ANTIMONY	9.8 U		8.7 U		7 5 U		8 U		7 8 U		
ARSENIC	0.74 UC		1.1 ^J		0 86 UC		2 3		2		
BARIUM	125		78.1		74 8		218		196		
BERYLLIUM	1.3		0.79		0 72		0 88		0 67		
CADMIUM	0.98 U		0.87 U		0 75 U		0 8 U		0 78 U		
CALCIUM	17700		15700		15500		9970		7680		
CHROMIUM	55.8		40.5		36.3		11.8		8.2		
COBALT	7.4		12.9		12 4		8 7		7.7		
COPPER	324		196		109		19 5		16.9		
IRON	16600		18500		16800		15000		10700		
LEAD	67.8		71.4		40.7		18.7		15.8		
MAGNESIUM	10100		8330		7130		4100		3100		
MANGANESE	546		461		406		589		504		
MERCURY	0.12 U		0.11 U		0 11 U		0 1 U		0.1 U		
NICKEL	35.4		31.2		29 8		12 6		9.2		
POTASSIUM	6230		5340		4460		3040		1700		
SELENIUM	0 18 UJ		0 16 UJ		0 78 UJ		0 17 UJ		0.15 UJ		
SILVER	0.98 U		0 87 U		0 75 U		0 8 U		0.78 U		
SODIUM	173		130		140		104		61.6		
THALLIUM	0 64		0.58		0 42		0 34 U		0.29 U		
VANADIUM	46.2		37 9		33 8		19 8		19 9		
ZINC	140 J		158 J		104 J		60.7 J		42.1 J		
% SOLIDS	77.6		90.6		92 6		91		96.7		

DATA SUMMARY

Case No.: 21950 SDG. No.. MFT923 Reviewer: A. CANTU
Laboratory: ETS Matrix: SOIL Units: MG/KG

EPA TR #=>	MF-T939	FLAG	MF-T940	FLAG	MF-T941	FLAG	MF-T942	FLAG		FLAG		COMMENTS
ALUMINUM	8300		3180		2980		2500					
ANTIMONY	7.8 U		8 U		8 5 U		7.3					
ARSENIC	1 4		0.84		0.72		0.77					
BARIUM	121		54.1		47 8		44.1					
BERYLLIUM	0.49		0 21		0.17		0.17					
CADMIUM	0.78 U		0.8 U		0.85 U		0.72 U					
CALCIUM	3060		1230		1200		903					
CHROMIUM	17.5		4.2		3 9		2 4					
COBALT	8.7		2.8		3 3		3					
COPPER	22.7		7		6 6		5.3					
IRON	15400		7780		7190		6560					
LEAD	15.7		13.5		12.7		11.5					
MAGNESIUM	3830		1120		1060		974					
MANGANESE	469		317		276		302					
MERCURY	0.1 U		0.11 U		0 1 U		0.1 U					
NICKEL	15 6		3 6		3.7		4					
POTASSIUM	1650		1100		1080		967					
SELENIUM	0.14 UJ		0 16 UJ		0.17 UJ		0 15 UJ					
SILVER	0 78 U		0.8 U		0.85 U		0.72 U					
SODIUM	89.9		45.8		40.9		28.7					
THALLIUM	0.28 U		0.32 U		0 34 U		0.29 U					
VANADIUM	21.9		8.7		7.5		7 4					
ZINC	52.4 J		38.4 J		32.7 J		29.3 J					
% SOLIDS	98.3		91.1		96.2		98					

DATA SUMMARY

Case No.: 21950 SDG. No. MFT923 Reviewer: A. CANTU
Laboratory: ETS Matrix: SOIL Units: MG/KG

EPA [illegible]=>	MF-T934	FLAG	MF-T935	FLAG	MF-T936	FLAG	MF-T937	FLAG	MF-T938	FLAG	COMMENTS
ALUMINUM	8290		8710		8650		7140		7070		
ANTIMONY	7.8 U		7.9 U		8 1 U		7 6 U		7.9 U		
ARSENIC	1 9		2 5		1 5		1 5		1.3		
BARIUM	157		167		192		108		156		
BERYLLIUM	0.63		0.62		0 62		0 56		0.58		
CADMIUM	0.78 U		0 79 U		0 81 U		0 76 U		0 79 U		
CALCIUM	5360		13700		14000		2490		8670		
CHROMIUM	12 8		9		14 5		16 4		14		
COBALT	7.3		6.6		7 8		9 1		7.1		
COPPER	31.7		16.4		30.2		20.1		20.3		
IRON	11700		13200		12500		14200		11300		
LEAD	33.7		16.4		48 4		17.3		21.7		
MAGNESIUM	3520		3980		4280		3350		3710		
MANGANESE	527		457		542		541		548		
MERCURY	0.1 U		0.11 U		0 11 U		0.1 U		0.1 U		
NIC[illegible]	13 6		11.5		14 3		15.5		15.4		
POTASSIUM	1650		2090		2630		1650		2960		
SELENIUM	0.15 UJ		0.17 UJ		0 18 UJ		0 14 UJ		0.15 UJ		
SILVER	0 78 U		0.79 U		0 81		0 76 U		0.79 U		
SODIUM	56.7		93.7		85.6		49 4		97.8		
THALLIUM	0 3 UJ		0 35 U		0 37 U		0 28 U		0.3 UJ		
VANADIUM	18.6		24.5		21		19 3		14.8		
ZINC	63.7 J		52.6 J		202 J		57.8 J		80.8 J		
% SOLIDS	97		93.3		84.1		99.1		97		

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. 21950 SDG No. MFT923 SDG Nos. To Follow SAS No. Date Rec 5-27-94

EPA Lab ID: ETS
Lab Location: Roanoke, VA
Region: 6 Audit No.: 21950/MFT923
Re_Submitted CSF? Yes ____ No X
Box No(s): ONE
COMMENTS:

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2 Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6 Present?	X		
7 Complete?	X		
8. Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10. Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11. Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18 Complete?	X		
19 Legible?	X		
20 Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Over for additional comments.

Audited by: [signature] Adam Cantu/ESAT Data Reviewer Date 7-11-94
Audited by: ____ ____ Date ____
Audited by: ____ ____ Date ____
Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: ____ Date Entered: ____ Date Reviewed: ____
Entered by: ____ ____
Reviewed by: ____ ____
Signature Printed Name/Title

ENVIROFORMS/INORGANIC CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

SOW No.: ILM02.0

Sample No.	Lab Sample ID.
MFT923	156408
MFT924	156409
MFT925	156410
MFT926	156411
MFT927	156412
MFT927D	156412D
MFT927S	156412S
MFT928	156413
MFT929	156414
MFT930	156415
MFT931	156416
MFT932	156417
MFT934	156419
MFT935	156420
MFT936	156421
MFT937	156422
MFT938	156423
MFT939	156424
MFT940	156425
MFT941	156426

Were ICP interelement corrections applied? Yes/No NO

Were ICP background corrections applied? Yes/No YES
If yes, were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Susanne H Deegan Name: SUSANNE H. DEEGAN

Date: 05/26/94 Title: PROJECT MANAGER

ENVIROFORMS/INORGANIC CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

SOW No.: ILM02.0

Sample No.	Lab Sample ID.
MFT942	156427

Were ICP interelement corrections applied? Yes/No NO

Were ICP background corrections applied? Yes/No YES
If yes, were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Susanne A Deegan Name: SUSANNE A. DEEGAN

Date: 05/26/94 Title: PROJECT MANAGER

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
Tailings P. #1 S?
MFT923

1
INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.. MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156408

Level (low/med): LOW Date Received: 04/22/94

% Solids: 92.7

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6190			P
7440-36-0	Antimony	7.5	U		P
7440-38-2	Arsenic	0.84	B		F
7440-39-3	Barium	70.4			P
7440-41-7	Beryllium	0.59	B		P
7440-43-9	Cadmium	0.75	U		P
7440-70-2	Calcium	14500			P
7440-47-3	Chromium	32.9			P
7440-48-4	Cobalt	8.1			P
7440-50-8	Copper	136			P
7439-89-6	Iron	13100			P
7439-92-1	Lead	31.3			F
7439-95-4	Magnesium	6300			P
7439-96-5	Manganese	352			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	24.6			P
7440-09-7	Potassium	4010			P
7782-49-2	Selenium	0.18	U	NW	F
7440-22-4	Silver	0.75	U		P
7440-23-5	Sodium	118	B		P
7440-28-0	Thallium	0.42	B		F
7440-62-2	Vanadium	30.2			P
7440-66-6	Zinc	85.1		N	P
	Cyanide				NR

Color Before: GRAY Clarity Before: Texture: FINE

Color After: COLORLESS Clarity After: Artifacts:

Comments:

SAMPLE NO.
MFT924

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.. MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156409

Level (low/med): LOW Date Received: 04/22/94

% Solids: 83.8

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	16300			P
7440-36-0	Antimony	9.3	U		P
7440-38-2	Arsenic	0.47	B		F
7440-39-3	Barium	153			P
7440-41-7	Beryllium	2.4			P
7440-43-9	Cadmium	0.93	U		P
7440-70-2	Calcium	17900			P
7440-47-3	Chromium	77.1			P
7440-48-4	Cobalt	7.9	B		P
7440-50-8	Copper	169			P
7439-89-6	Iron	19700			P
7439-92-1	Lead	51.8			F
7439-95-4	Magnesium	14300			P
7439-96-5	Manganese	692			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	42.0			P
7440-09-7	Potassium	8490			P
7782-49-2	Selenium	0.18	U	NW	F
7440-22-4	Silver	0.93	U		P
7440-23-5	Sodium	222	B		P
7440-28-0	Thallium	0.82	B		F
7440-62-2	Vanadium	61.8			P
7440-66-6	Zinc	115		N	P
	Cyanide				NR

Color Before: GRAY Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP12
MFT925

1
INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.. MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156410

Level (low/med): LOW Date Received: 04/22/94

% Solids: 89.2

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3850			P
7440-36-0	Antimony	8.2	U		P
7440-38-2	Arsenic	1.2	B		F
7440-39-3	Barium	29.9	B		P
7440-41-7	Beryllium	0.46	B		P
7440-43-9	Cadmium	0.82	U		P
7440-70-2	Calcium	10200			P
7440-47-3	Chromium	19.4			P
7440-48-4	Cobalt	3.6	B		P
7440-50-8	Copper	37.7			P
7439-89-6	Iron	8640			P
7439-92-1	Lead	33.2			F
7439-95-4	Magnesium	3870			P
7439-96-5	Manganese	515			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	10.5			P
7440-09-7	Potassium	1910			P
7782-49-2	Selenium	0.18	U	NW	F
7440-22-4	Silver	0.82	U		P
7440-23-5	Sodium	8.6	B		P
7440-28-0	Thallium	0.35	U		F
7440-62-2	Vanadium	13.6			P
7440-66-6	Zinc	111		N	P
	Cyanide				NR

Color Before: GRAY Clarity Before Texture: FINE

Color After: COLORLESS Clarity After Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TD # 5A
MFT926

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No. MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156411

Level (low/med): LOW Date Received: 04/22/94

% Solids: 84.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5620			P
7440-36-0	Antimony	8.7	U		P
7440-38-2	Arsenic	1.1	B		F
7440-39-3	Barium	73.9			P
7440-41-7	Beryllium	0.47	B		P
7440-43-9	Cadmium	0.87	U		P
7440-70-2	Calcium	18800			P
7440-47-3	Chromium	28.5			P
7440-48-4	Cobalt	14.7			P
7440-50-8	Copper	262			P
7439-89-6	Iron	19400			P
7439-92-1	Lead	82.2			F
7439-95-4	Magnesium	5730			P
7439-96-5	Manganese	386			P
7439-97-6	Mercury	0.12	U		CV
7440-02-0	Nickel	30.5			P
7440-09-7	Potassium	3680			P
7782-49-2	Selenium	0.30	B	NW	F
7440-22-4	Silver	0.87	U		P
7440-23-5	Sodium	119	B		P
7440-28-0	Thallium	0.42	B		F
7440-62-2	Vanadium	26.5			P
7440-66-6	Zinc	156		N	P
	Cyanide				NR

Color Before: GRAY Clarity Before: Texture FINE

Color After: COLORLESS Clarity After: Artifacts

Comments:

81

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP #5A (Dupl)

1
INORGANIC ANALYSIS DATA SHEET

MFT927

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156412

Level (low/med): LOW Date Received: 04/22/94

% Solids: 83.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	6220			P
7440-36-0	Antimony	9.3	U		P
7440-38-2	Arsenic	1.4	B		F
7440-39-3	Barium	90.6			P
7440-41-7	Beryllium	0.56	B		P
7440-43-9	Cadmium	1.2			P
7440-70-2	Calcium	19700			P
7440-47-3	Chromium	31.0			P
7440-48-4	Cobalt	16.2			P
7440-50-8	Copper	274			P
7439-89-6	Iron	20800			P
7439-92-1	Lead	82.8			F
7439-95-4	Magnesium	6180			P
7439-96-5	Manganese	413			P
7439-97-6	Mercury	0.12	U		CV
7440-02-0	Nickel	34.9			P
7440-09-7	Potassium	3970			P
7782-49-2	Selenium	0.24	B	NW	F
7440-22-4	Silver	0.93	U		P
7440-23-5	Sodium	117	B		P
7440-28-0	Thallium	0.53	B		F
7440-62-2	Vanadium	30.4			P
7440-66-6	Zinc	148		N	P
	Cyanide				NR

Color Before: GRAY Clarity Before: Texture: FINE

Color After: COLORLESS Clarity After: Artifacts:

Comments:

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
TP#4
MFT928

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156413

Level (low/med): LOW Date Received: 04/22/94

% Solids: 77.6

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	11000			P
7440-36-0	Antimony	9.8	U		P
7440-38-2	Arsenic	0.74	B		F
7440-39-3	Barium	125			P
7440-41-7	Beryllium	1.3			P
7440-43-9	Cadmium	0.98	U		P
7440-70-2	Calcium	17700			P
7440-47-3	Chromium	55.8			P
7440-48-4	Cobalt	7.4	B		P
7440-50-8	Copper	324			P
7439-89-6	Iron	16600			P
7439-92-1	Lead	67.8			F
7439-95-4	Magnesium	10100			P
7439-96-5	Manganese	546			P
7439-97-6	Mercury	0.12	U		CV
7440-02-0	Nickel	35.4			P
7440-09-7	Potassium	6230			P
7782-49-2	Selenium	0.18	U	NW	F
7440-22-4	Silver	0.98	U		P
7440-23-5	Sodium	173	B		P
7440-28-0	Thallium	0.64	B		F
7440-62-2	Vanadium	46.2			P
7440-66-6	Zinc	140		N	P
	Cyanide				NR

Color Before: GRAY Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts:

Comments:

1
INORGANIC ANALYSIS DATA SHEET

MFT929

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.. MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156414

Level (low/med): LOW Date Received: 04/22/94

% Solids: 90.6

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8150			P
7440-36-0	Antimony	8.7	U		P
7440-38-2	Arsenic	1.1	B		F
7440-39-3	Barium	78.1			P
7440-41-7	Beryllium	0.79	B		P
7440-43-9	Cadmium	0.87	U		P
7440-70-2	Calcium	15700			P
7440-47-3	Chromium	40.5			P
7440-48-4	Cobalt	12.9			P
7440-50-8	Copper	196			P
7439-89-6	Iron	18500			P
7439-92-1	Lead	71.4			F
7439-95-4	Magnesium	8330			P
7439-96-5	Manganese	461			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	31.2			P
7440-09-7	Potassium	5340			P
7782-49-2	Selenium	0.16	U	NW	F
7440-22-4	Silver	0.87	U		P
7440-23-5	Sodium	130	B		P
7440-28-0	Thallium	0.58	B		F
7440-62-2	Vanadium	37.9			P
7440-66-6	Zinc	158		N	P
	Cyanide				NR

Color Before: GRAY Clarity Before: Texture: FINE

Color After: COLORLESS Clarity After: Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP# 4

1

INORGANIC ANALYSIS DATA SHEET

MFT930

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156415

Level (low/med): LOW Date Received: 04/22/94

% Solids: 92.6

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7070			P
7440-36-0	Antimony	7.5	U		P
7440-38-2	Arsenic	0.86	B		F
7440-39-3	Barium	74.8			P
7440-41-7	Beryllium	0.72	B		P
7440-43-9	Cadmium	0.75	U		P
7440-70-2	Calcium	15500			P
7440-47-3	Chromium	36.3			P
7440-48-4	Cobalt	12.4			P
7440-50-8	Copper	109			P
7439-89-6	Iron	16800			P
7439-92-1	Lead	40.7			F
7439-95-4	Magnesium	7130			P
7439-96-5	Manganese	406			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	29.8			P
7440-09-7	Potassium	4460			P
7782-49-2	Selenium	0.78	U	N	F
7440-22-4	Silver	0.75	U		P
7440-23-5	Sodium	140	B		P
7440-28-0	Thallium	0.42	B		F
7440-62-2	Vanadium	33.8			P
7440-66-6	Zinc	104		N	P
	Cyanide				NR

Color Before: GRAY Clarity Before: Texture: FINE

Color After: COLORLESS Clarity After: Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
School - 2
MFT931

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156416

Level (low/med): LOW Date Received: 04/22/94

% Solids: 91.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	12300			P
7440-36-0	Antimony	8.0	U		P
7440-38-2	Arsenic	2.3			F
7440-39-3	Barium	218			P
7440-41-7	Beryllium	0.88			P
7440-43-9	Cadmium	0.80	U		P
7440-70-2	Calcium	9970			P
7440-47-3	Chromium	11.8			P
7440-48-4	Cobalt	8.7			P
7440-50-8	Copper	19.5			P
7439-89-6	Iron	15000			P
7439-92-1	Lead	18.7			F
7439-95-4	Magnesium	4100			P
7439-96-5	Manganese	589			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	12.6			P
7440-09-7	Potassium	3040			P
7782-49-2	Selenium	0.17	U	N	F
7440-22-4	Silver	0.80	U		P
7440-23-5	Sodium	104	B		P
7440-28-0	Thallium	0.34	U		F
7440-62-2	Vanadium	19.8			P
7440-66-6	Zinc	60.7		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts: YES

Comments:
Sample contains sticks.

ENVIROFORMS/INORGANIC CLP

SC

SAMPLE NO.
school -3

1

INORGANIC ANALYSIS DATA SHEET

MFT932

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156417

Level (low/med): LOW Date Received: 04/22/94

% Solids: 96.7

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8000			P
7440-36-0	Antimony	7.8	U		P
7440-38-2	Arsenic	2.0			F
7440-39-3	Barium	196			P
7440-41-7	Beryllium	0.67	B		P
7440-43-9	Cadmium	0.78	U		P
7440-70-2	Calcium	7680			P
7440-47-3	Chromium	8.2			P
7440-48-4	Cobalt	7.7	B		P
7440-50-8	Copper	16.9			P
7439-89-6	Iron	10700			P
7439-92-1	Lead	15.8			F
7439-95-4	Magnesium	3100			P
7439-96-5	Manganese	504			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	9.2			P
7440-09-7	Potassium	1700			P
7782-49-2	Selenium	0.15	U	NW	F
7440-22-4	Silver	0.78	U		P
7440-23-5	Sodium	61.6	B		P
7440-28-0	Thallium	0.29	U		F
7440-62-2	Vanadium	19.9			P
7440-66-6	Zinc	42.1		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts: YES

Comments:
Sample contains sticks.

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
Chg Hso
MFT934

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156419

Level (low/med): LOW Date Received: 04/22/94

% Solids: 97.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8290			P
7440-36-0	Antimony	7.8	U		P
7440-38-2	Arsenic	1.9			F
7440-39-3	Barium	157			P
7440-41-7	Beryllium	0.63	B		P
7440-43-9	Cadmium	0.78	U		P
7440-70-2	Calcium	5360			P
7440-47-3	Chromium	12.8			P
7440-48-4	Cobalt	7.3	B		P
7440-50-8	Copper	31.7			P
7439-89-6	Iron	11700			P
7439-92-1	Lead	33.7			F
7439-95-4	Magnesium	3520			P
7439-96-5	Manganese	527			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	13.6			P
7440-09-7	Potassium	1650			P
7782-49-2	Selenium	0.15	U	NW	F
7440-22-4	Silver	0.78	U		P
7440-23-5	Sodium	56.7	B		P
7440-28-0	Thallium	0.30	U	W	F
7440-62-2	Vanadium	18.6			P
7440-66-6	Zinc	63.7		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO.
Arch Trujillo
MFT935

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156420

Level (low/med): LOW Date Received: 04/22/94

% Solids: 93.3

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8710			P
7440-36-0	Antimony	7.9	U		P
7440-38-2	Arsenic	2.5		S	F
7440-39-3	Barium	167			P
7440-41-7	Beryllium	0.62	B		P
7440-43-9	Cadmium	0.79	U		P
7440-70-2	Calcium	13700			P
7440-47-3	Chromium	9.0			P
7440-48-4	Cobalt	6.6	B		P
7440-50-8	Copper	16.4			P
7439-89-6	Iron	13200			P
7439-92-1	Lead	16.4			F
7439-95-4	Magnesium	3980			P
7439-96-5	Manganese	457			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	11.5			P
7440-09-7	Potassium	2090			P
7782-49-2	Selenium	0.17	U	NW	F
7440-22-4	Silver	0.79	U		P
7440-23-5	Sodium	93.7	B		P
7440-28-0	Thallium	0.35	U		F
7440-62-2	Vanadium	24.5			P
7440-66-6	Zinc	52.6		N	P
	Cyanide				NR

Color Before: BROWN Clarit. Before: Texture: MEDIUM

Color After: COLORLESS Clarit. After: Artifacts: YES

Comments:
Sample contains grass.

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
Romolo Martinez
MFT936

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156421

Level (low/med): LOW Date Received: 04/22/94

% Solids: 84.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8650			P
7440-36-0	Antimony	8.1	U		P
7440-38-2	Arsenic	1.5	B		F
7440-39-3	Barium	192			P
7440-41-7	Beryllium	0.62	B		P
7440-43-9	Cadmium	0.81	U		P
7440-70-2	Calcium	14000			P
7440-47-3	Chromium	14.5			P
7440-48-4	Cobalt	7.8	B		P
7440-50-8	Copper	30.2			P
7439-89-6	Iron	12500			P
7439-92-1	Lead	48.4			F
7439-95-4	Magnesium	4280			P
7439-96-5	Manganese	542			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	14.3			P
7440-09-7	Potassium	2630			P
7782-49-2	Selenium	0.18	U	NW	F
7440-22-4	Silver	0.81	U		P
7440-23-5	Sodium	85.6	B		P
7440-28-0	Thallium	0.37	U		F
7440-62-2	Vanadium	21.0			P
7440-66-6	Zinc	202		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts ES

Comments:
Sample contains grass.

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
Rael
MFT937

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156422

Level (low/med): LOW Date Received: 04/22/94

% Solids: 99.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7140			P
7440-36-0	Antimony	7.6	U		P
7440-38-2	Arsenic	1.5			F
7440-39-3	Barium	108			P
7440-41-7	Beryllium	0.56	B		P
7440-43-9	Cadmium	0.76	U		P
7440-70-2	Calcium	2490			P
7440-47-3	Chromium	16.4			P
7440-48-4	Cobalt	9.1			P
7440-50-8	Copper	20.1			P
7439-89-6	Iron	14200			P
7439-92-1	Lead	17.3			F
7439-95-4	Magnesium	3350			P
7439-96-5	Manganese	541			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	15.5			P
7440-09-7	Potassium	1650			P
7782-49-2	Selenium	0.14	U	N	F
7440-22-4	Silver	0.76	U		P
7440-23-5	Sodium	49.4	B		P
7440-28-0	Thallium	0.28	U		F
7440-62-2	Vanadium	19.3			P
7440-66-6	Zinc	57.8		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts: YES

Comments:
Sample contains rocks.

ENVIROFORMS/INORGANIC CLP

91

SAMPLE NO.

Kennera

MFT938

(14)

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156423

Level (low/med): LOW Date Received: 04/22/94

% Solids: 97.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	7070			P
7440-36-0	Antimony	7.9	U		P
7440-38-2	Arsenic	1.3	B	S	F
7440-39-3	Barium	156			P
7440-41-7	Beryllium	0.58	B		P
7440-43-9	Cadmium	0.79	U		P
7440-70-2	Calcium	8670			P
7440-47-3	Chromium	14.0			P
7440-48-4	Cobalt	7.1	B		P
7440-50-8	Copper	20.3			P
7439-89-6	Iron	11300			P
7439-92-1	Lead	21.7			F
7439-95-4	Magnesium	3710			P
7439-96-5	Manganese	548			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	15.4			P
7440-09-7	Potassium	2960			P
7782-49-2	Selenium	0.15	U	NW	F
7440-22-4	Silver	0.79	U		P
7440-23-5	Sodium	97.8	B		P
7440-28-0	Thallium	0.30	U	W	F
7440-62-2	Vanadium	14.8			P
7440-66-6	Zinc	80.8		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts [illegible]S

Comments:

Sample contains rocks.

ENVIROFORMS/INORGANIC CLP

92

SAMPLE NO.
Clines

1

INORGANIC ANALYSIS DATA SHEET

MFT939

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156424

Level (low/med): LOW Date Received: 04/22/94

% Solids: 98.3

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8300			P
7440-36-0	Antimony	7.8	U		P
7440-38-2	Arsenic	1.4			F
7440-39-3	Barium	121			P
7440-41-7	Beryllium	0.49	B		P
7440-43-9	Cadmium	0.78	U		P
7440-70-2	Calcium	3060			P
7440-47-3	Chromium	17.5			P
7440-48-4	Cobalt	8.7			P
7440-50-8	Copper	22.7			P
7439-89-6	Iron	15400			P
7439-92-1	Lead	15.7			F
7439-95-4	Magnesium	3830			P
7439-96-5	Manganese	469			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	15.6			P
7440-09-7	Potassium	1650			P
7782-49-2	Selenium	0.14	U	NW	F
7440-22-4	Silver	0.78	U		P
7440-23-5	Sodium	89.9	B		P
7440-28-0	Thallium	0.28	U		F
7440-62-2	Vanadium	21.9			P
7440-66-6	Zinc	52.4		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts: YES

Comments:
Sample contains grass.

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
Bkgr
MFT940

1
INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.. MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156425

Level (low/med): LOW Date Received: 04/22/94

% Solids: 91.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3180			P
7440-36-0	Antimony	8.0	U		P
7440-38-2	Arsenic	0.84	B		F
7440-39-3	Barium	54.1			P
7440-41-7	Beryllium	0.21	B		P
7440-43-9	Cadmium	0.80	U		P
7440-70-2	Calcium	1230			P
7440-47-3	Chromium	4.2			P
7440-48-4	Cobalt	2.8	B		P
7440-50-8	Copper	7.0			P
7439-89-6	Iron	7780			P
7439-92-1	Lead	13.5			F
7439-95-4	Magnesium	1120			P
7439-96-5	Manganese	317			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	3.6	B		P
7440-09-7	Potassium	1100			P
7782-49-2	Selenium	0.16	U	N	F
7440-22-4	Silver	0.80	U		P
7440-23-5	Sodium	45.8	B		P
7440-28-0	Thallium	0.32	U		F
7440-62-2	Vanadium	8.7			P
7440-66-6	Zinc	38.4		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts. YES

Comments:
Sample contains rocks.

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
Bkgr
MFT941

1
INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156426

Level (low/med): LOW Date Received: 04/22/94

% Solids: 96.2

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2980			P
7440-36-0	Antimony	8.5	U		P
7440-38-2	Arsenic	0.72	B		F
7440-39-3	Barium	47.8			P
7440-41-7	Beryllium	0.17	B		P
7440-43-9	Cadmium	0.85	U		P
7440-70-2	Calcium	1200			P
7440-47-3	Chromium	3.9			P
7440-48-4	Cobalt	3.3	B		P
7440-50-8	Copper	6.6			P
7439-89-6	Iron	7190			P
7439-92-1	Lead	12.7			F
7439-95-4	Magnesium	1060			P
7439-96-5	Manganese	276			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	3.7	B		P
7440-09-7	Potassium	1080			P
7782-49-2	Selenium	0.17	U	NW	F
7440-22-4	Silver	0.85	U		P
7440-23-5	Sodium	40.9	B		P
7440-28-0	Thallium	0.34	U		F
7440-62-2	Vanadium	7.5	B		P
7440-66-6	Zinc	32.7		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts: YES

Comments:
Sample contains rocks.

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
Blgr
MFT942

1
INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT923

Matrix (soil/water): SOIL Lab Sample ID: 156427

Level (low/med): LOW Date Received: 04/22/94

% Solids: 98.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2500			P
7440-36-0	Antimony	7.3	B		P
7440-38-2	Arsenic	0.77	B		F
7440-39-3	Barium	44.1			P
7440-41-7	Beryllium	0.17	B		P
7440-43-9	Cadmium	0.72	U		P
7440-70-2	Calcium	903			P
7440-47-3	Chromium	2.4			P
7440-48-4	Cobalt	3.0	B		P
7440-50-8	Copper	5.3			P
7439-89-6	Iron	6560			P
7439-92-1	Lead	11.5			F
7439-95-4	Magnesium	974			P
7439-96-5	Manganese	302			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	4.0	B		P
7440-09-7	Potassium	967			P
7782-49-2	Selenium	0.15	U	NW	F
7440-22-4	Silver	0.72	U		P
7440-23-5	Sodium	28.7	B		P
7440-28-0	Thallium	0.29	U		F
7440-62-2	Vanadium	7.4			P
7440-66-6	Zinc	29.3		N	P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts ES

Comments:
Sample contains rocks.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: 7-21-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: 21950

SDG#: MFT-933

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION VI

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

LAB CODE ETS	CASE NO 21950 SDG NO MFT933
SITE NAME MOLYCORP	NUMBER OF SAMPLES 22

FORM DUE DATE 06/27/94

SDG MAILDATE 06/02/94

PART I DATA ACCEPTANCE OR REJECTION

INSTRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM MUST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR REJECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC), 2) ALL REJECTED DATA

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

✓ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG

REJECT ALL ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

PART II REDUCED VALUE

INSTRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA FOR A REDUCED VALUE TO BE PROCESSED THIS FORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE THE DOLLAR AMOUNT FOR REDUCED VALUE AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS DETERMINED FOR EACH AFFECTED SAMPLE ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS ETC)

CHECK ONE OF THE FOLLOWING

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

IDENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM

THIS FORM CANNOT BE PROCEESSED WITHOUT A SIGNATURE

NAME OF REGIONAL OFFICIAL HAROLD ELFERY

SIGNATURE Harold Elfery DATE 1-21-94

SEND THIS FORM TO SAMPLE MANAGEMENT OFFICE
SAMPLE SCHEDULING & REPORTING SECTION
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

SEE LIST OF SAMPLES ON REVERSE SIDE

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: July 20, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton
Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD #6-4567

Attached is the data review summary for Case #21950
SDG #MFT933
Site Moly Corp Mines

Comments:

1. The data package is technically provisional.

2. The selenium matrix spike recovery for the water samples and the antimony, lead, and selenium matrix spike recoveries for the soil samples were outside the QC limits.

3. No contractual violations were noted by the CCS or the hard copy data review.

4. FAA QC failed for three arsenic, eleven selenium, and seven thallium samples.

LAB CODE ETS	CASE NO 21950	SDG NO MFT933

PART III. PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER A "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE

SAMPLE	FRACTIONS ANALYZED METALS	CYANIDE
LCSS	Y	
LCSW	Y	
MFT933	Y	
MFT933D	Y	
MFT933S	Y	
MFT943	Y	
MFT944	Y	
MFT945	Y	
MFT946	Y	
MFT947	Y	
MFT948	Y	
MFT949	Y	
MFT950	Y	
MFT951	Y	
MFT951D	Y	
MFT951S	Y	
MFT952	Y	
MFT953	Y	
MFT954	Y	
MFT955	Y	
MFT958	Y	
MFT959	Y	

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

CASE NO. 21950
LABORATORY ETS
CONTRACT # 68-D2-0048
SDG # MFT933
SOW# ILM02.0
ACCT # 4TFAJNA1 SF # TFAUZZ

SITE MOLY CORP
NO. OF SAMPLES/
MATRIX 12 Water/4 Soil
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Nhan Tran
COMPLETION DATE July 20, 1994

SAMPLE Nos.: MF-T933, MF-T943, MF-T944, MF-T945, MF-T946, MF-T947, MF-T948, MF-T949, MF-T950, MF-T951, MF-T952, MF-T953, MF-T954, MF-T955, MF-T958, MF-T959

INORGANIC REGIONAL DATA ASSESSMENT
DATA ASSESSMENT SUMMARY

	ICP	AA	Hg	CYANIDE
1. HOLDING TIMES	O	O	O	NA
2. CALIBRATIONS	O	O	O	NA
3. BLANKS	O	O	O	NA
4. MATRIX SPIKE	X	X	O	NA
5. DUPLICATE ANALYSIS	O	O	O	NA
6. ICP QC	O			
7. FAA QC		X		
8. LCS	O	O	O	
9. SAMPLE VERIFICATION	O	O	O	NA
10. OTHER QC	O	O	O	NA
11. OVERALL ASSESSMENT	X	X	O	NA

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Matrix spike recoveries were outside the QC limits and FAA QC failed.

NOTABLE PERFORMANCE:

In Reference to
Case 21950/SDG MFT923
Page 1 of 1 page

Contract Laboratory Program
REGIONAL/LABORATORY COMMUNICATION SYSTEM

FAX Record Log

Date of FAX: July 20, 1994

Laboratory Name: ETS

Lab Contact: Susanne Deegan

Region: 6

Regional Contact: Linda Hoffman (ESAT)

FAX Initiated by: Region

In reference to data for the following sample number:

MF-T942

Summary of Questions/Issues:

On Form 14 (page 75), sample MF-T942A was X'd for the initial and the rerun result, although the rerun result was reported. Please correct Form 14 and resubmit.

The EPA expects the laboratory to look into items and submit data within fourteen days to Christy Macdowell, U.S. EPA, 10625 Fallstone Road, Houston TX 77099.

Linda Hoffman
Signature

7-20-94
Date

I1399

Distribution: (1) Lab Copy, (2) Region Copy, (3) SMO Copy

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case 21950 SDG MFT933 Site Moly Corp Lab ETS

COMMENTS: Twelve water and four soil samples were analyzed at low concentrations for total metals. The laboratory met the contractual data package turnaround time requirement. The sampler designated samples MF-T932/MF-T933 as field duplicates, and MF-T933 as the QC sample for the soil matrix.

The data package is provisional due to problems with matrix spike recoveries and FAA quality control. The effects of these deficiencies on the sample results are discussed below. All other QC requirements were met.

An Evident Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. **Holding Times**

   All holding time criteria were met.

2. **Calibrations**

   All calibrations were acceptable.

3. **Blanks**

   Arsenic and iron were reported in the calibration and/or preparation blanks. The reviewer has qualified the sample results below the CRDL that are affected and reported them in the Data Summary Table.

4. **Pre-digestion Matrix Spike Recovery**

   All lead results for the soil samples are estimated and are the lowest at which they are present due to a pre-digestion matrix spike recovery below 30%. All antimony and selenium soil sample results and all selenium water sample results are estimated because the matrix spike recoveries were below the QC limits. Physical or chemical interference due to the sample matrix may be present in the above samples.

5. **Duplicate Analysis**

   All duplicate results were acceptable.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case 21950 SDG MFT933 Site Moly Corp Lab ETS

6. ICP Quality Control

All serial dilution differences and ICS results were acceptable.

7. Furnace Atomic Absorption Quality Control

FAA Analytical Spike Recovery

The samples listed below are estimated due to FAA analytical spike recovery outside the QC limits. Physical or chemical interferences may be present in the sample matrix.

Arsenic results for MF-T947 and MF-T951.

Selenium results for all water samples except MF-T949.

Thallium results for samples MF-T947, MF-T952, MF-T953, MF-T955, MF-T958, and MF-T959.

Arsenic sample MF-T948 and thallium sample MF-T933 had FAA analytical spike recoveries above the QC limit, but no results were qualified because this wasn't significant in the reviewer's opinion.

Method of Standard Addition

No MSA analysis was performed.

8. Laboratory Control Sample

All laboratory control sample results were acceptable.

9. Sample Verification

All samples were reported correctly.

10. Other QC

There were no Section 10 problems.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case 21950 SDG MFT933 Site Moly Corp Lab ETS

11. Overall Assessment

The data package is provisional due to the following deficiencies.

All antimony, lead, and selenium soil sample results and all selenium water sample results were estimated due to matrix spike recoveries below the QC limits.

Three arsenic, eleven selenium, and seven thallium results were estimated due to FAA analytical spike recoveries outside the quality control limits.

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. 21950 SDG No. MFT933 SDG Nos. To Follow SAS No. Date Rec 5/27/94

EPA Lab ID. ETS

Lab Location: Roanoke, VA

Region: 5 Audit No . 21950/MFT933

Re_Submitted CSF? Yes No X

Box No(s). CNE

COMMENTS

Over for additional comments.

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2. Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?	X		
4. Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6 Present?	X		
7 Complete?	X		
8. Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10 Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16. Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18. Complete?	X		
19 Legible?	X		
20. Original?		X	
20a. If "NO", does the copy indicate where original documents are located?		X	

Audited by: [signature] L Lowe/Scientist Associate Date 7/20/94

Audited by: Date

Audited by: Date

Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: Date Entered: Date Reviewed:

Tech Environmental Technology
ESAT Region 6

c/o US EPA 10625 Fallstone Rd, Houston, TX 77099 TEL:(713) 983-2125

FACSIMILE COVER SHEET

Please deliver the following pages to:

Name Susanne Deegan

Firm ETS

City Roanoke **State** VA

Telephone 703-265-0004 **Ext.** _____

Fax Telephone No. 703-563-4866 **Ext.** _____

Sender:

Name Linda Hoffman ESAT

Date 7-20-94 **Time** _____

Total Number of pages including this Cover Sheet 2

If you do not receive all the pages or if any pages are unclear, please call: (713) 983-2125

MESSAGES: _____

Fax Model No. Panafax UF-620 Fax No. (713) 983-2248

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

Positive bias.

Negative bias.

DATA SUMMARY

Case No.: 21950 SDG. No.: MFT933 Reviewer: NHAN TRAN
Laboratory: ETS Matrix: Soil Units: mg/Kg

EPA IR #=>	MF-T933	FLAG	MF-T943	FLAG	MF-T944	FLAG	MF-T945	FLAG	FLAG	COMMENTS
ALUMINUM	10900		3280		3320		13600			
ANTIMONY	7.8	UJ	7.1	UJ	7.5	UJ	7.3	UJ		
ARSENIC	2.2	UC	1.1	UC	1.3	UC	2 2	UC		
BARIUM	195		48.3		42		187			
BERYLLIUM	0.69		0.25		0 27		0.75			
CADMIUM	1.2		0.86		0.75	U	0.98			
CALCIUM	7010		1200		1160		4670			
CHROMIUM	11.5		5.7		6.3		13.2			
COBALT	6.7		2.2		1.9		7.1			
COPPER	16		7.5		6.1		14.4			
IRON	14300		7970		7730		17200			
LEAD	3.3	Jv	10.7	Jv	13.2	Jv	16.2	Jv		
MAGNESIUM	3700		1080		1070		4100			
MANGANESE	518		279		230		493			
MERCURY	0.1	U	0.1	U	0.1	U	0 09	U		
[illegible]	11.2		4.5		4.1		12.4			
POTASSIUM	2070		1000		1040		2650			
SELENIUM	0 14	UJ	0.16	UJ	0.16	UJ	0 21	J		
SILVER	0 78	U	0.71	U	0.75	U	0 73	U		
SODIUM	73.5		34.3		33		86.9			
THALLIUM	0.28	U	0.32	U	0.32	U	0 31	U		
VANADIUM	22.4		10		9 5		24 8			
ZINC	44.1		37.8		31.7		49.3			
% SOLID	96.4		96.4		95.1		96.6			

DATA SUMMARY

Case No : 21950 SDG. No.: MFT933 Reviewer: NHAN TRAN
Laboratory: ETS Matrix: Water Units: ug/L

EPA [illegible] =>	MF-T946	FLAG	MF-T947	FLAG	MF-T948	FLAG	MF-T949	FLAG	MF-T950	FLAG	COMMENTS
ALUMINUM	34	U	35.5		34	U	34	U	66.9		
ANTIMONY	50	U	50	U	50	U	50	U	50	U	
ARSENIC	2.9	Jv	3	Jv	1	U	1.6	Jv	2.7	Jv	
BARIUM	18 3		20.1		44.8		45.1		27.6		
BERYLLIUM	1	U	1	U	1	U	1	U	1	U	
CADMIUM	5	U	5	U	5	U	5	U	5	U	
CALCIUM	21600		22200		50400		50900		31200		
CHROMIUM	9	U	9	U	9	U	9	U	9	U	
COBALT	9	U	9	U	9	U	9	U	9	U	
COPPER	6	U	6	U	6	U	6	U	6	U	
IRON	13.8	UC	8.2	UC	7.4	UC	6	U	62.4	UC	
LEAD	1	U	1	U	1	U	1	U	1	U	
MAGNESIUM	6730		6830		9120		8790		9850		
MANGANESE	1	U	1	Jv	1	U	1	U	4.8	Jv	
MERCURY	0 2	U	0.2	U	0 2	U	0.2	U	0.2	U	
NICKEL	11	U	11	U	11	U	11	U	11	U	
POTASSIUM	2280		2390		1210		1120		2690		
SELENIUM	1	UJ	5	UJ	1	UJ	1	UJ	1	UJ	
SILVER	5	U	5	U	5	U	5	U	5	U	
SODIUM	24300		24900		24700		25100		31700		
THALLIUM	2	U	10	UJ	2	U	2	U	2	U	
VANADIUM	7	U	7	U	7	U	7	U	7	U	
ZINC	8	U	8	U	8	U	8	U	8	U	

DATA SUMMARY

Case No.: 21950 SDG. No.: MFT933 Reviewer: NHAN TRAN
Laboratory: ETS Matrix: Water Units: ug/L

EPA TR #=>	MF-T951	FLAG	MF-T952	FLAG	MF-T953	FLAG	MF-T954	FLAG	MF-T955	FLAG	COMMENTS
ALUMINUM	50.3		658		34	U	480		34	U	
ANTIMONY	50	U	50	U	50	U	50	U	50	U	
ARSENIC	2.1	Jv	2.1	Jv	1.3	Jv	2.2	Jv	1.2	Jv	
BARIUM	28.1		41.8		27.7		73.8		66.4		
BERYLLIUM	1	U	1	U	1	U	1	U	1	U	
CADMIUM	5	U	5	U	5	U	5	U	5	U	
CALCIUM	31200		30800		30800		33100		33600		
CHROMIUM	9	U	9	U	9	U	9	U	9	U	
COBALT	9	U	9	U	9	U	9	U	9	U	
COPPER	6	U	6	U	6	U	6	U	6	U	
IRON	29	UC	900		6	U	494		11.1	UC	
LEAD	1	U	2.7		1	U	5		1	U	
MAGNESIUM	9960		10000		9770		10700		10800		
MANGANESE	2.8	Jv	56.8		1	U	8.6		3.7	Jv	
MERCURY	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	
NICKEL	11	U	11	U	11	U	11	U	11	U	
POTASSIUM	2960		3140		2740		3490		3670		
SELENIUM	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	
SILVER	5	U	5	U	5	U	5	U	5	U	
SODIUM	31800		33800		33000		41100		41200		
THALLIUM	2	U	2	UJ	2	UJ	2	U	2	UJ	
VANADIUM	7	U	7	U	7	U	7	U	7	U	
ZINC	8	U	11.8		8	U	8	U	8	U	

DATA SUMMARY

Case No.: 21950 SDG. No.: MFT933 Reviewer: NHAN TRAN
Laboratory: ETS Matrix: Water Units: ug/L

EPA Sample No.=>	MF-T958	FLAG	MF-T959	FLAG		FLAG		FLAG		FLAG		FLAG		COMMENTS
ALUMINUM	248		119											
ANTIMONY	50	U	50	U										
ARSENIC	1	U	1	U										
BARIUM	16.2		13.5											
BERYLLIUM	1	U	1	U										
CADMIUM	5	U	5	U										
CALCIUM	269000		265000											
CHROMIUM	9	U	9	U										
COBALT	9	U	9	U										
COPPER	6	U	6	U										
IRON	84.7	UC	6.9	UC										
LEAD	1.7		1											
MAGNESIUM	47200		45400											
MANGANESE	650		569											
MERCURY	0.2	U	0.2	U										
NICKEL	11	U	11	U										
POTASSIUM	4350		4140											
SELENIUM	1	UJ	1	UJ										
SILVER	5	U	5	U										
SODIUM	92000		90100											
THALLIUM	2	UJ	2	UJ										
VANADIUM	7	U	7	U										
ZINC	8.3		8	U										

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

SOW No.: ILM02.0

Sample No.	Lab Sample ID.
MFT933	156418
MFT933D	156418D
MFT933S	156418S
MFT943	156428
MFT944	156429
MFT945	156430
MFT946	156431
MFT947	156432
MFT948	156433
MFT949	156434
MFT950	156435
MFT951	156436
MFT951D	156436D
MFT951S	156436S
MFT952	156437
MFT953	156438
MFT954	156439
MFT955	156440
MFT958	156441
MFT959	156442

Were ICP interelement corrections applied? Yes/No NO

Were ICP background corrections applied? Yes/No YES
If yes, were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Susanne H. Deegan Name: SUSANNE H DEEGAN

Date: 05/26/94 Title: PROJECT MANAGER

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
School 3 Dupl
MFT933

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): SOIL Lab Sample ID: 156418

Level (low/med): LOW Date Received: 04/22/94

% Solids: 96.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10900			P
7440-36-0	Antimony	7.8	U	N	P
7440-38-2	Arsenic	2.2			F
7440-39-3	Barium	195			P
7440-41-7	Beryllium	0.69	B		P
7440-43-9	Cadmium	1.2			P
7440-70-2	Calcium	7010			P
7440-47-3	Chromium	11.5			P
7440-48-4	Cobalt	6.7	B		P
7440-50-8	Copper	16.0			P
7439-89-6	Iron	14300			P
7439-92-1	Lead	3.3		N	F
7439-95-4	Magnesium	3700			P
7439-96-5	Manganese	518			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	11.2			P
7440-09-7	Potassium	2070			P
7782-49-2	Selenium	0.14	U	N	F
7440-22-4	Silver	0.78	U		P
7440-23-5	Sodium	73.5	B		P
7440-28-0	Thallium	0.28	U	W	F
7440-62-2	Vanadium	22.4			P
7440-66-6	Zinc	44.1			P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: YELLOW Clarity After: Artifacts.

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
Bkgr
MFT943

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.. 21950 SAS No.. SDG No.: MFT933

Matrix (soil/water): SOIL Lab Sample ID: 156428

Level (low/med): LOW Date Received: 04/22/94

% Solids: 96.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3280			P
7440-36-0	Antimony	7.1	U	N	P
7440-38-2	Arsenic	1.1	B		F
7440-39-3	Barium	48.3			P
7440-41-7	Beryllium	0.25	B		P
7440-43-9	Cadmium	0.86			P
7440-70-2	Calcium	1200			P
7440-47-3	Chromium	5.7			P
7440-48-4	Cobalt	2.2	B		P
7440-50-8	Copper	7.5			P
7439-89-6	Iron	7970			P
7439-92-1	Lead	10.7		N	F
7439-95-4	Magnesium	1080			P
7439-96-5	Manganese	279			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	4.5	B		P
7440-09-7	Potassium	1000			P
7782-49-2	Selenium	0.16	U	N	F
7440-22-4	Silver	0.71	U		P
7440-23-5	Sodium	34.3	B		P
7440-28-0	Thallium	0.32	U		F
7440-62-2	Vanadium	10.0			P
7440-66-6	Zinc	37.8			P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: YELLOW Clarity After: Artifacts: YES

Comments:
Sample contains rocks.

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

Bkgr

MFT944

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT930

Matrix (soil/water): SOIL Lab Sample ID. 156429

Level (low/med): LOW Date Received: 04/22/94

% Solids: 95.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3320			P
7440-36-0	Antimony	7.5	U	N	P
7440-38-2	Arsenic	1.3	B		F
7440-39-3	Barium	42.0			P
7440-41-7	Beryllium	0.27	B		P
7440-43-9	Cadmium	0.75	U		P
7440-70-2	Calcium	1160			P
7440-47-3	Chromium	6.3			P
7440-48-4	Cobalt	1.9	B		P
7440-50-8	Copper	6.1			P
7439-89-6	Iron	7730			P
7439-92-1	Lead	13.2		N	F
7439-95-4	Magnesium	1070			P
7439-96-5	Manganese	230			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	4.1	B		P
7440-09-7	Potassium	1040			P
7782-49-2	Selenium	0.16	U	N	F
7440-22-4	Silver	0.75	U		P
7440-23-5	Sodium	33.0	B		P
7440-28-0	Thallium	0.32	U		F
7440-62-2	Vanadium	9.5			P
7440-66-6	Zinc	31.7			P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: YELLOW Clarity After: Artifacts: YES

Comments:

Sample contains rocks.

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
1/4 mi No of school
MFT945

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): SOIL Lab Sample ID: 156430

Level (low/med): LOW Date Received: 04/22/94

% Solids: 96.6

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	13600			P
7440-36-0	Antimony	7.3	U	N	P
7440-38-2	Arsenic	2.2			F
7440-39-3	Barium	187			P
7440-41-7	Beryllium	0.75			P
7440-43-9	Cadmium	0.98			P
7440-70-2	Calcium	4670			P
7440-47-3	Chromium	13.2			P
7440-48-4	Cobalt	7.1	B		P
7440-50-8	Copper	14.4			P
7439-89-6	Iron	17200			P
7439-92-1	Lead	16.2		N	F
7439-95-4	Magnesium	4100			P
7439-96-5	Manganese	493			P
7439-97-6	Mercury	0.09	U		CV
7440-02-0	Nickel	12.4			P
7440-09-7	Potassium	2650			P
7782-49-2	Selenium	0.21	B	N	F
7440-22-4	Silver	0.73	U		P
7440-23-5	Sodium	86.9	B		P
7440-28-0	Thallium	0.31	U		F
7440-62-2	Vanadium	24.8			P
7440-66-6	Zinc	49.3			P
	Cyanide				NR

Color Before: ORANGE Clarity Before: Texture: MEDIUM

Color After: YELLOW Clarity After: Artifacts: YES

Comments:
Sample contains rocks.

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.

MFT946

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT930

Matrix (soil/water): WATER Lab Sample ID: 156431

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	2.9	B		F
7440-39-3	Barium	18.3	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	21600			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	13.8	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	6730			P
7439-96-5	Manganese	1.0	U		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2280	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	24300			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts.

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
Warm Spr - F
MFT947 R

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID: 156432

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	35.5	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	3.0	B	W	F
7440-39-3	Barium	20.1	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	22200			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	8.2	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	6830			P
7439-96-5	Manganese	1.0	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2390	B		P
7782-49-2	Selenium	5.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	24900			P
7440-28-0	Thallium	10.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After CLEAR Artifacts:

Comments:

119

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
Cold Spr - UF

1
INORGANIC ANALYSIS DATA SHEET

MFT948

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID: 156433

Level (low/med). LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U	W	F
7440-39-3	Barium	44.8	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	50400			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	7.4	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	9120			P
7439-96-5	Manganese	1.0	U		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	1210	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	24700			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture

Color After: COLORLESS Clarity After: CLEAR Artifacts

Comments:

120

SAMPLE NO.
Cold Spr - 1

MFT949

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID: 156434

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.6	B		F
7440-39-3	Barium	45.1	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	50900			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	6.0	U		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	8790			P
7439-96-5	Manganese	1.0	U		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	1120	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	25100			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

121

SAMPLE NO.

RR seep @ P-E

MFT950

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No. MFT933

Matrix (soil/water): WATER Lab Sample ID: 156435

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	66.9	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	2.7	B		F
7440-39-3	Barium	27.6	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	31200			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	62.4	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	9850			P
7439-96-5	Manganese	4.8	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2690	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	31700			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
RR seep @ pt E
MFT951

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.. MFT933

Matrix (soil/water): WATER Lab Sample ID: 156436

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	50.3	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	2.1	B	W	F
7440-39-3	Barium	28.1	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	31200			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	29.0	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	9960			P
7439-96-5	Manganese	2.8	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2960	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	31800			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

123

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.

RR e Rt #D -UF

MFT952

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID: 156437

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	658			P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	2.1	B		F
7440-39-3	Barium	41.8	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	30800			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	900			P
7439-92-1	Lead	2.7	B		F
7439-95-4	Magnesium	10000			P
7439-96-5	Manganese	56.8			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	3140	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	33800			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	11.8	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: OPAQUE Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

124

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.

RR @ Pt D - F

MFT953

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID: 156438

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.3	B		F
7440-39-3	Barium	27.7	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	30800			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	6.0	U		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	9770			P
7439-96-5	Manganese	1.0	U		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2740	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	33000			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
RR seed G pt A
MFT954

1
INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID. 156439

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	480			P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	2.2	B		F
7440-39-3	Barium	73.8	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	33100			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	494			P
7439-92-1	Lead	5.0			F
7439-95-4	Magnesium	10700			P
7439-96-5	Manganese	8.6	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	3490	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	41100			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: OPAQUE Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

126

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.

RR seep @ St A - 1

1

INORGANIC ANALYSIS DATA SHEET

MFT955

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID: 156440

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.2	B		F
7440-39-3	Barium	66.4	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	33600			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	11.1	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	10800			P
7439-96-5	Manganese	3.7	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	3670	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	41200			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
Embarrass Rd seep
MFT958

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID: 156441

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	248			P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	16.2	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	269000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	84.7	B		P
7439-92-1	Lead	1.7	B		F
7439-95-4	Magnesium	47200			P
7439-96-5	Manganese	650			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	4350	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	92000			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.3	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
Embargo Rel samp
MFT959

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT933

Matrix (soil/water): WATER Lab Sample ID: 156442

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	119	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	13.5	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	265000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	6.9	B		P
7439-92-1	Lead	1.0	B		F
7439-95-4	Magnesium	45400			P
7439-96-5	Manganese	569			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	4140	B		P
7782-49-2	Selenium	1.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	90100			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: 7-25-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: 21950

SDG#: MFT-965

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION VI

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

| LAB CODE ETS | CASE NO 21950 | SDG NO MFT965 |
| SITE NAME MOLYCORP | | NUMBER OF SAMPLES 14 |

* FORM DUE DATE * 06/28/94
* SDG MAILDATE * 06/02/94

PART I DATA ACCEPTANCE OR REJECTION

INSTRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM MUST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR REJECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC), 2) ALL REJECTED DATA

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

✓ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG

REJECT ALL ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

PART II REDUCED VALUE

INSTRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA FOR A REDUCED VALUE TO BE PROCESSED, THIS FORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE, THE DOLLAR AMOUNT FOR REDUCED VALUE, AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS DETERMINED FOR EACH AFFECTED SAMPLE ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS, ETC)

CHECK ONE OF THE FOLLOWING

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

IDENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM

THIS FORM CANNOT BE PROCESSED WITHOUT A SIGNATURE

NAME OF REGIONAL OFFICIAL MAHMOUD ELFEKY

SIGNATURE [signature] DATE 7-25-94

SEND THIS FORM TO SAMPLE MANAGEMENT OFFICE
SAMPLE SCHEDULING & REPORTING SECTION
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

* SEE LIST OF SAMPLES ON REVERSE SIDE *

LAB CODE ETS	CASE NO 21950	SDG NO MFT965

PART III PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER A "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE

	FRACTIONS ANALYZED			
SAMPLE	METALS		CYANIDE	
LCSW	Y			
MFT965	Y			
MFT965D	Y			
MFT965S	Y			
MFT969	Y			
MFT970	Y			
MFT979	Y			
MFT980	Y			
MFT981	Y			
MFT982	Y			
MFT995	Y			
MFT996	Y			
MFT997	Y			
MFT998	Y			

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: July 22, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD # 6-4581

Attached is the data review summary for Case #21950
SDG #MFT965
Site MOLY CORP

COMMENTS:

1. The data package is technically provisional.
2. Hardcopy data review didn't confirm the missing information on the Form 14's noted by CCS. There were no contractual violations noted by CCS or the hardcopy data review.
3. The duplicate results for copper and zinc were inconsistent.
4. FAA QC failed for selenium and thallium.
5. The laboratory made 6 reporting errors.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. 21950 — SITE MOLY CORP
LABORATORY ETS — NO. OF SAMPLES/
CONTRACT # 68-D2-0048 — MATRIX 11 water
SDG # MFT965 — REVIEWER (IF NOT ESD) ESAT
SOW# ILM02.0 — REVIEWER'S NAME Linda Hoffman
ACCT # 4TFAJNA1 SF # TAUZZ — COMPLETION DATE July 22, 1994

SAMPLE NO.: MF-T965, MF-T969, MF-T970, MF-T979, MF-T980, MF-T981, MF-T982, MF-T995, MF-T996, MF-T997, MF-T998

DATA ASSESSMENT SUMMARY

	ICP	AA	HG
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	X	O
4. MATRIX SPIKES	O	O	O
5. DUPLICATE ANALYSIS	X	O	O
6. ICP QC	O		
7. FAA QC		X	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	X	X	X
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	X	X	X

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Duplicate differences were high, blank concentrations were above the IDL, and FAA analytical spike recoveries were outside QC limits.

NOTABLE PERFORMANCE:

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 21950 SDG MFT965 Site MOLY CORP Lab ETS

COMMENTS: Eleven water samples were analyzed at low concentrations for total metals. No field duplicate or QC samples were indicated by the sampler. The data package the met required 35-day turnaround time.

The data package is technically provisional due to problems with blanks, duplicate differences, and FAA QC. This report documents only the QC requirements that weren't met and those factors affecting the technical usability of the results.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. Holding Times

All holding time criteria were met.

2. Calibrations

All calibrations were acceptable.

3. Blanks

Arsenic, lead, and selenium were reported in the calibration and/or preparation blanks. Lead concentrations in samples MF-T980 and MF-T982 were above the CRDL, and these results are biased low due to blank concentrations of lead. The reviewer has qualified the results below the CRDL that were affected by blank concentrations, and all qualifications are listed on the Data Summary Table.

4. Pre-digestion Matrix Spike Recovery

All matrix spike recoveries met QC criteria.

5. Duplicate Analysis

All copper and zinc results are estimated because duplicate differences failed to met QC criteria.

6. ICP Quality Control

The serial dilution and ICS results were acceptable.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 21950 SDG MFT965 Site MOLY CORP Lab ETS

7. Furnace Atomic Absorption Quality Control

FAA Analytical Spike Recovery

The samples listed below are estimated because FAA analytical spike recoveries were below the QC limits. Physical or chemical interference is possible.

Selenium results for samples MF-T969, MF-T979, MF-T981, MF-T982, and MF-T995.

Thallium results for samples MF-T965, MF-T969, MF-T979, MF-T980, MF-T982, and MF-7995.

Arsenic samples MF-T965, MF-T995, and MF-T996 had analytical spike recoveries above the QC limit, but the results weren't qualified because sample concentrations were below the IDL.

Thallium analytical spike recoveries for samples MF-T970 and MF-T996 were only marginally below the QC limits. Since these results were undetected no qualifications were made.

Method of Standard Addition

The MSA result was acceptable.

8. Laboratory Control Sample

The LCS results were acceptable.

9. Sample Verification

The data reviewer noted the following errors.

Airbill #9207028250 is missing from the data package.

The SDG number reported on Form DC-1, page 208, is incorrect.

From the raw data, it appears that the barium preparation blank reported on Form 3 is incorrectly reported.

In the raw data page 140, a sample concentration was changed, but wasn't initialed and dated.

On Form 1, the selenium result for sample MF-T995 was reported without the "W" flag.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 21950 SDG MFT965 Site MOLY CORP Lab ETS

9. Sample Verification, continued

On Form 14, the %R reported for sample MF-T995A is incorrect.

The laboratory responded to CCS, and the resubmitted information is included with the data package. However, the resubmitted Form 14's weren't missing from the original data package and aren't necessary.

10. Other QC

There were no Section 10 problems.

11. Overall Assessment

The data package is provisional for the following reasons.

All copper and zinc results were estimated due to inconsistent duplicate results.

Five selenium and six thallium samples were estimated because FAA analytical spike recoveries failed to meet QC criteria.

In Reference to
Case 21950/SDG MFT965
Page 1 of 2 pages

Contract Laboratory Program
REGIONAL/LABORATORY COMMUNICATION SYSTEM

FAX Record Log

Date of FAX: July 22, 1994

Laboratory Name: ETS

Lab Contact: Susanne Deegan

Region: 6

Regional Contact: Linda Hoffman (ESAT)

FAX Initiated by: Region

In reference to data for the following sample numbers:

MF-T965, MF-T969, MF-T970, MF-T979, MF-T980, MF-T981, MF-T982, MF-T995, MF-T996, MF-T997, MF-T998

Summary of Questions/Issues:

A. Airbill #9207028250 is missing from the data package. A duplicate Traffic Report was submitted in place of the above Airbill. Please resubmit the above Airbill and number as page 297A.

B. The SDG number reported on Form DC-1, page 208, is incorrect. Please correct the SDG number on Form DC-1 and resubmit.

C. From the raw data (page 82), it appears that the barium preparation blank reported on Form 3 (page 26) should be -1.0B µg/L, not 1.0B µg/L. Please correct Form 3 and resubmit.

D. In the raw data (page 140), a sample concentration was changed but wasn't initialed and dated. Please date and initial the correction and resubmit page 140.

E. On Form 1 (page 9), the selenium result for sample MF-T995 should have a "W" flag. Please correct Form 1 and resubmit.

F. From the raw data (page 140), the %R reported on Form 14 (page 57) for sample MF-T995A, should be 61.2%, not 57.5%. Please correct the Form 14 and resubmit.

G. Custody seals are required on all resubmissions.

The EPA expects the laboratory to look into items and submit data within fourteen days to Christy Macdowell, U.S. EPA, 10625 Fallstone Road, Houston TX 77099.

Signature

7-22-94
Date

I1411

Distribution: (1) Lab Copy, (2) Region Copy, (3) SMO Copy

ManTech Environmental Technology
ESAT Region 6

c/o US EPA 10625 Fallstone Rd, Houston, TX 77099 TEL:(713) 983-2125

FACSIMILE COVER SHEET

Please deliver the following pages to:

Name Susanne Deegan

Firm ETS

City Roaroke **State** VA

Telephone 703-265-0004 **Ext.** _____

Fax Telephone No. 703-563-4866 **Ext.** _____

Sender:

Name Linda Hoffman ESAT

Date July 22, 1994 **Time** _____

Total Number of pages including this Cover Sheet 3

If you do not receive all the pages or if any pages are unclear, please call: (713) 983-2125

MESSAGES: _____

Fax Model No. Panafax UF-620 Fax No. (713) 983-2248

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

v Negative bias.

DATA SUMMARY

Case No.: 21950 SDG. No.: MFT965 Reviewer: A. CANTU
Laboratory: ETS Matrix: WATER Units: UG/L

EPA [redacted] => LAB [redacted]	MF-T965	FLAG	MF-T969	FLAG	MF-T970	FLAG	MF-T979	FLAG	MF-T980	FLAG	COMMENTS
ALUMINUM	40		36		55.7		115		34 U		
ANTIMONY	50 U		50 U		50 U		50 U		50 U		
ARSENIC	1 U		1 U		1 U		1 U		1 U		
BARIUM	57.5		36.1		36		35 8		31.4		
BERYLLIUM	1 U		1 U		1 U		1 U		1 U		
CADMIUM	5 U		5 U		5 U		5 U		5 U		
CALCIUM	123000		157000		158000		255000		243000		
CHROMIUM	9 U		9 U		9 U		13.1		9 U		
COBALT	9 U		9 U		9 U		9 U		9 U		
COPPER	6 UJ		6 UJ		6 UJ		6 UJ		6 UJ		
IRON	33.4		643		31.3		455		40.1		
LEAD	1 U		2.4		4.2		1.5		8.3 ^J		
MAGNESIUM	20700		31800		30900		46500		45000		
MANGANESE	11		43.5		1 7		14.9		1.9		
MERCURY	0.2 U		0.2 U		0 2 U		0.2 U		0.2 U		
NI[redacted]	11 U		11 U		11 U		11 U		11 U		
POTASSIUM	1060		667 U		945		1240		973		
SELENIUM	2 U		2 UJ		2 U		2 UJ		2 U		
SILVER	5 U		5 U		5 U		5 U		5 U		
SODIUM	48000		65700		66600		67600		65900		
THALLIUM	2 UJ		2 UJ		2 U		2 UJ		2 UJ		
VANADIUM	7 U		7 U		7 U		7 U		7 U		
ZINC	8 UJ		8 UJ		8 UJ		8 UJ		8 UJ		

DATA SUMMARY

Case No.. 21950 SDG. No.. MFT965 Reviewer: A. CANTU
Laboratory: ETS Matrix. WATER Units: UG/L

EPA [redacted] => LAB ID	MF-T981	FLAG	MF-T982	FLAG	MF-T995	FLAG	MF-T996	FLAG	MF-T997	FLAG	COMMENTS
ALUMINUM	3210		34	U	108		34	U	55.8		
ANTIMONY	50	U	50	U	50	U	50	U	50	U	
ARSENIC	1 4	vJ	1	U	1	U	1	U	1	U	
BARIUM	295		34.5		44 7		41 1		70		
BERYLLIUM	1	U	1	U	1	U	1	U	1	U	
CADMIUM	5	U	5	U	5	U	5	U	5	U	
CALCIUM	232000		231000		28000		28200		84000		
CHROMIUM	16.6		9	U	9	U	9	U	9	U	
COBALT	9	U	9	U	9	U	9	U	9	U	
COPPER	7.2	J	6	UJ	6	UJ	6	UJ	6	UJ	
IRON	17900		184		360		19		849		
LEAD	2.6	UC	8.5	^J	2.5	UC	1	U	1.2	UC	
MAGNESIUM	44400		44300		5180		5260		15600		
MANGANESE	215		22		6.8		3.1		4.1		
MERCURY	0.2	U	0.2	U	0 2	U	0 2	U	0 2	U	
[redacted]	11	U	11	U	11	U	11	U	11	U	
POTASSIUM	2940		2840		667	U	667	U	766		
SELENIUM	2	UJ	2	UJ	2 6	vJ	2	U	2	UJ	
SILVER	5	U	5	U	5	U	5	U	5	U	
SODIUM	69900		71400		66400		66300		26900		
THALLIUM	2	U	2	UJ	2	UJ	2	U	2	U	
VANADIUM	7.2		7	U	7	U	7	U	7	U	
ZINC	8.5	J	8	UJ	75.1	J	75.4	J	260	J	

DATA SUMMARY

Case No : 21950 SDG. No.. MFT965 Reviewer: A. CANTU
Laboratory: ETS Matrix. WATER Units: UG/L

		FLAG	FLAG	FLAG	FLAG	FLAG	COMMENTS
EPA [illegible]=>	MF-T998						
LAB [illegible]							
ALUMINUM	34	U					
ANTIMONY	50	U					
ARSENIC	1	U					
BARIUM	65.7						
BERYLLIUM	1	U					
CADMIUM	5	U					
CALCIUM	80800						
CHROMIUM	9	U					
COBALT	9	U					
COPPER	6	UJ					
IRON	13 5						
LEAD	1	U					
MAGNESIUM	14600						
MANGANESE	3.3						
MERCURY	0.2	U					
NI[illegible]	11	U					
POTASSIUM	667	U					
SELENIUM	2	U					
SILVER	5	U					
SODIUM	26100						
THALLIUM	2	U					
VANADIUM	7	U					
ZINC	206	J					

Rad

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. 21950 SDG No. MFT965 SDG Nos. To Follow SAS No. Date Rec 5-31-94

EPA Lab ID: ETS

Lab Location: Roanoke, VA

Region: 6 Audit No.: 21950/MFT965

Re_Submitted CSF? Yes ____ No X

Box No(s): CNE

COMMENTS:

5 and 13. On the Form DC-2 page 297A is listed as Airbill #9207028250. Page 297A is a copy of the Traffic Report, and the above Airbill wasn't submitted with the data package.

8. The SDG number on Form DC-1, page 208 is incorrect.

Over for additional comments.

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2 Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?		X	
FORM DC-1			
6. Present?	X		
7 Complete?	X		
8 Accurate?		X	
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10. Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12. Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?		X	
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16. Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18 Complete?	X		
19 Legible?	X		
20. Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Audited by: [signature] David Spencer/Scientist Associate Date 7-13-94

Audited by: ____ ____ Date ____

Audited by: ____ ____ Date ____

Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: ____ Date Entered ____ Date Reviewed: ____

Entered by: ____ ____

Reviewed by: ____ ____

Signature Printed Name/Title

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

SOW No.: ILM02.0

Sample No.	Lab Sample ID.
MFT965	156389
MFT965D	156389D
MFT965S	156389S
MFT969	156461
MFT970	156462
MFT979	156463
MFT980	156464
MFT981	156465
MFT982	156466
MFT995	156467
MFT996	156468
MFT997	156469
MFT998	156470

Were ICP interelement corrections applied? Yes/No NO

Were ICP background corrections applied? Yes/No YES
If yes, were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Susanne H Deegan Name: SUSANNE H. DEEGAN

Date: 05/27/94 Title: PROJECT MANAGER

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
50' west of coz outfall
MFT965 F

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156389

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	40.0	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U	W	F
7440-39-3	Barium	57.5	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	123000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	33.4	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	20700			P
7439-96-5	Manganese	11.0	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	1060	B		P
7782-49-2	Selenium	2.0	U		F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	48000			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U	*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP well 4 - UF
MFT969

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156461

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	36.0	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	36.1	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	157000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	643			P
7439-92-1	Lead	2.4	B		F
7439-95-4	Magnesium	31800			P
7439-96-5	Manganese	43.5			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	667	U		P
7782-49-2	Selenium	2.0	U	W	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	65700			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U	*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO.
TD well 4 - F
MFT970 B

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156462

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	55.7	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	36.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	158000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	31.3	B		P
7439-92-1	Lead	4.2			F
7439-95-4	Magnesium	30900			P
7439-96-5	Manganese	1.7	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	945	B		P
7782-49-2	Selenium	2.0	U		F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	66600			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U	*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
TP well 3
MFT979

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156463

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	115	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	35.8	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	255000			P
7440-47-3	Chromium	13.1			P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	455			P
7439-92-1	Lead	1.5	B		F
7439-95-4	Magnesium	46500			P
7439-96-5	Manganese	14.9	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	1240	B		P
7782-49-2	Selenium	2.0	U	W	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	67600			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U	*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP well 3-r

1

INORGANIC ANALYSIS DATA SHEET

MFT980

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156464

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	31.4	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	243000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	40.1	B		P
7439-92-1	Lead	8.3			F
7439-95-4	Magnesium	45000			P
7439-96-5	Manganese	1.9	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	973	B		P
7782-49-2	Selenium	2.0	U		F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	65900			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U	*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.

Hermera - UF

MFT981 (N)

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156465

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3210			P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.4	B		F
7440-39-3	Barium	295			P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	232000			P
7440-47-3	Chromium	16.6			P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	7.2	B	*	P
7439-89-6	Iron	17900			P
7439-92-1	Lead	2.6	B		F
7439-95-4	Magnesium	44400			P
7439-96-5	Manganese	215			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2940	B		P
7782-49-2	Selenium	2.0	U	W	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	69900			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.2	B		P
7440-66-6	Zinc	8.5	B	*	P
	Cyanide				NR

Color Before: BEIGE Clarity Before: OPAQUE Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO. Herrera - F

INORGANIC ANALYSIS DATA SHEET

MFT982 (2)

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156466

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	34.5	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	231000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	184			P
7439-92-1	Lead	8.5			F
7439-95-4	Magnesium	44300			P
7439-96-5	Manganese	22.0			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2840	B		P
7782-49-2	Selenium	2.0	U	W	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	71400			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U	*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
Change Hse Well - UF

MFT995

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156467

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	108	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U	W	F
7440-39-3	Barium	44.7	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	28000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	360			P
7439-92-1	Lead	2.5	B		F
7439-95-4	Magnesium	5180			P
7439-96-5	Manganese	6.8	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	667	U		P
7782-49-2	Selenium	2.6	B		F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	66400			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	75.1		*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
Chevy Hse Well
MFT996

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156468

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U	W	F
7440-39-3	Barium	41.1	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	28200			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	19.0	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	5260			P
7439-96-5	Manganese	3.1	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	667	U		P
7782-49-2	Selenium	2.0	U		F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	66300			P
7440-28-0	Thallium	2.0	U	W	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	75.4		*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO.
Reel - UF
MFT997 E

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 1564690

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	55.8	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	70.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	84000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	849			P
7439-92-1	Lead	1.2	B		F
7439-95-4	Magnesium	15600			P
7439-96-5	Manganese	4.1	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	766	B		P
7782-49-2	Selenium	2.0	U	S	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	26900			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	260		*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
Rae - F
MFT998

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT965

Matrix (soil/water): WATER Lab Sample ID: 156470

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	65.7	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U		P
7440-70-2	Calcium	80800			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U	*	P
7439-89-6	Iron	13.5	B		P
7439-92-1	Lead	1.0	U		F
7439-95-4	Magnesium	14600			P
7439-96-5	Manganese	3.3	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	667	U		P
7782-49-2	Selenium	2.0	U		F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	26100			P
7440-28-0	Thallium	2.0	U		F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	206		*	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

RECEIVED
AUG 1994

MEMORANDUM

Date: 7-25-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: 21950

SDG#: MFT-956

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION VI

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

LAB CODE ETS	CASE NO 21950
SITE NAME MOLYCORP	SDG NO MFT956
	NUMBER OF SAMPLES 21

FORM DUE DATE
06/28/94

SDG MAILDATE
06/03/94

PART I DATA ACCEPTANCE OR REJECTION

INSTRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM MUST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR REJECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC), 2) ALL REJECTED DATA

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

✓ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG

REJECT ALL ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

PART II REDUCED VALUE

INSTRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA FOR A REDUCED VALUE TO BE PROCESSED, THIS FORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE, THE DOLLAR AMOUNT FOR REDUCED VALUE, AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS DETERMINED FOR EACH AFFECTED SAMPLE ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS, ETC)

CHECK ONE OF THE FOLLOWING

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

IDENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM

THIS FORM CANNOT BE PROCEESSED WITHOUT A SIGNATURE

NAME OF REGIONAL OFFICIAL MAHMOUD ELFEKY

SIGNATURE M. Elfeky DATE 7-22-94

SEND THIS FORM TO SAMPLE MANAGEMENT OFFICE
SAMPLE SCHEDULING & REPORTING SECTION
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

SEE LIST OF SAMPLES ON REVERSE SIDE

LAB CODE ETS	CASE NO 21950	SDG NO MFT956

PART III PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER A "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE

	FRACTIONS ANALYZED			
SAMPLE	METALS		CYANIDE	
LCSW	Y			
MFT956	Y			
MFT957	Y			
MFT960	Y			
MFT961	Y			
MFT962	Y			
MFT963	Y			
MFT964	Y			
MFT966	Y			
MFT967	Y			
MFT971	Y			
MFT972	Y			
MFT973	Y			
MFT973D	Y			
MFT973S	Y			
MFT974	Y			
MFT975	Y			
MFT976	Y			
MFT977	Y			
MFT978	Y			
MFT984	Y			

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: July 22, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD # 6-4580

Attached is the data review summary for Case #21950
SDG #MFT956
Site MOLY CORP

COMMENTS:

1. The data package is technically provisional.
2. No contractual errors were detected by CCS or the hardcopy data review.
3. The lead, selenium, and thallium matrix spike recoveries were below the QC limits.
4. FAA QC was outside QC limits for lead, selenium, and thallium.
5. The laboratory exceeded the 35-day turnaround time by three days.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. 21950 SITE MOLY CORP
LABORATORY ETS NO. OF SAMPLES/
CONTRACT # 68-D2-0048 MATRIX 18 water
SDG # MFT956 REVIEWER (IF NOT ESD) ESAT
SOW# ILM02.0 REVIEWER'S NAME Linda Hoffman
ACCT # 4TFAJNA1 SF # TFAUZZ COMPLETION DATE July 22, 1994

SAMPLE NO.: MF-T956, MF-T957, MF-T960, MF-T961, MF-T962, MF-T963, MF-T964, MF-T966, MF-T967, MF-T971, MF-T972, MF-T973, MF-T974, MF-T975, MF-T976, MF-T977, MF-T978, MF-T984

DATA ASSESSMENT SUMMARY

	ICP	AA	HG
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	X	O
4. MATRIX SPIKES	O	X	O
5. DUPLICATE ANALYSIS	O	O	O
6. ICP QC	O		
7. FAA QC		X	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	O	O	O
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	O	X	O

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Matrix spike recoveries were below the QC limits and blank concentrations were above the IDL's.

NOTABLE PERFORMANCE:

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 21950 SDG MFT956 Site MOLY CORP Lab ETS

COMMENTS: Eighteen water samples were analyzed at low concentrations for total metals. Samples MF-T975/MF-T977 and MF-T976/MF-T978 were field duplicate pairs, sample MF-T984 was a field blank, and sample MF-T973 was designated as the QC sample. The data package was received at the Region three days past the 35-day turnaround time.

The data package is technically provisional due to problems with blanks and matrix spike recoveries. This report documents only the QC requirements that weren't met and those factors affecting the technical usability of the results.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. Holding Times

All holding time criteria were met.

2. Calibrations

All calibrations were acceptable.

3. Blanks

Calibration/Preparation Blanks

Arsenic, iron, lead, and manganese were reported in the calibration and/or preparation blanks. The lead concentration in sample MF-T971 was above the CRDL, and is biased low due to calibration blank concentrations.

Field Blank

Sodium and zinc were reported in the field blank. Sodium concentrations in samples MF-T956, MF-T957, MF-T960, and MF-T961, and zinc concentrations in MF-T963 and MF-T971 were above the CRDL and should be considered undetected due to the field blank concentrations.

The reviewer has qualified the results below the CRDL that were affected by the blanks, and listed all qualifications in the Data Summary Table.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 21950 SDG MFT956 Site MOLY CORP Lab ETS

4. Pre-digestion Matrix Spike Recovery

All lead, selenium, and thallium results are qualified because matrix spike recoveries were below the lower QC limits. Physical or chemical interference is possible in the sample matrix.

5. Duplicate Analysis

All duplicate results were acceptable. In the data reviewer's opinion, since the cadmium result is at the CRDL/IDL and the duplicate results is just under the CRDL/IDL, the difference isn't significant, and no results were qualified.

6. ICP Quality Control

The serial dilution and ICS results were acceptable.

7. Furnace Atomic Absorption Quality Control

FAA Analytical Spike Recovery

The samples listed below are estimated because FAA analytical spike recoveries failed to meet QC criteria. Physical or chemical interference is possible.

Lead results for samples MF-T963, MF-T971, MF-T972, MF-T973, MF-T974, MF-T975, MF-T977, and MF-T978.

All selenium results except sample MF-T984.

Thallium results for samples MF-T962, MF-T963, MF-T971, MF-T972, MF-T973, MF-T974, and MF-T977.

The following undetected sample results had FAA analytical spike recoveries that were only marginally below the QC limits, and therefore aren't qualified.

Arsenic for samples MF-T973 and MF-T978.

Lead for samples MF-T962 and MF-T976.

Thallium for samples MF-T964, MF-T966, MF-T975, MF-T976, and MF-T978.

Method of Standard Addition

MSA wasn't required.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 21950 SDG MFT956 Site MOLY CORP Lab ETS

8. Laboratory Control Sample

The LCS results were acceptable.

9. Sample Verification

The data reviewer determined that all sample results are correctly reported.

10. Other QC

Field Duplicates

Field duplicate pairs had acceptable results.

11. Overall Assessment

The data package is provisional for the following reasons.

All lead, selenium, and thallium results were estimated due to low matrix spike recoveries.

Eight lead, 17 selenium, and 7 thallium results were estimated due to low FAA analytical spike recoveries.

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

v Negative bias.

Case No : 21950
Laboratory: ETS

DATA SUMMARY
SDG. No.: MFT956
Matrix: WATER

Reviewer: A. CANTU
Units: UG/L

EPA #=> / LAB	MF-T956	FLAG	MF-T957	FLAG	MF-T960	FLAG	MF-T961	FLAG	MF-T962	FLAG	COMMENTS
ALUMINUM	1050		136		971		111		135		
ANTIMONY	50	U	50	U	50	U	50	U	50	U	
ARSENIC	1	U	1 2		1	U	1	U	1	U	
BARIUM	37.7		26		32		27 4		27 3		
BERYLLIUM	1	U	1	U	1	U	1	U	1	U	
CADMIUM	5	U	5	U	5	U	5	U	5	U	
CALCIUM	52900		45700		46800		49100		291000		
CHROMIUM	9	U	9	U	9	U	9	U	9	U	
COBALT	9	U	9	U	9	U	9	U	9	U	
COPPER	6	U	6	U	6	U	6	U	6	U	
IRON	1160		116		963		109		19.9		
LEAD	1 4	vJ	1	UJ	1	UJ	1	UJ	1	UJ	
MAGNESIUM	9910		8500		8970		9190		47400		
MANGANESE	65		15.8		36 4		8 8	vJ	1860		
MERCURY	0 2	U	0.2	U	0.2	U	0.2	U	0.2	U	
NICKEL	11	U	11	U	11	U	11	U	11	U	
POTASSIUM	1390		791		1110		863		4010		
SELENIUM	2	UJ	2	UJ	2	UJ	2	UJ	10	UJ	
SILVER	5	U	5	U	5	U	5	U	5	U	
SODIUM	16200	UC	14700	UC	14300	UC	15400	UC	91600		
THALLIUM	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	
VANADIUM	7	U	7	U	7	U	7	U	7	U	
ZINC	9 8	UC	8	U	10.4	UC	12.3	UC	8	U	

DATA SUMMARY

Case No. 21950 SDG. No.. MFT956 Reviewer: A. CANTU
Laboratory: ETS Matrix: WATER Units: UG/L

EPA SAMPLE No.	MF-T963	FLAG	MF-T964	FLAG	MF-T966	FLAG	MF-T967	FLAG	MF-T971	FLAG	COMMENTS
LAB ID											
ALUMINUM	148		149		44.5		34	U	3690		
ANTIMONY	50	U	50	U	50	U	50	U	50	U	
ARSENIC	1	U	1	U	1	U	1	U	1	U	
BARIUM	27.1		60.4		54.3		52.6		152		
BERYLLIUM	1	U	1	U	1	U	1	U	1	U	
CADMIUM	5	U	5	U	5	U	5	U	5	U	
CALCIUM	77000		119000		105000		101000		222000		
CHROMIUM	9	U	9	U	9	U	9	U	22		
COBALT	9	U	9	U	9	U	9	U	9	U	
COPPER	6	U	6	U	6	U	6	U	6	U	
IRON	18.7	UC	251		19.6	UC	24.5	UC	25200		
LEAD	1	UJ	1	UJ	1	UJ	1	UJ	4.4	vJ	
MAGNESIUM	6400		20800		17400		16700		50000		
MANGANESE	1820		10.9	vJ	1	U	1	U	774		
MERCURY	0.2	U	0.2	U	0 2	U	0.2	U	0.2	U	
NICKEL	11	U	11	U	11	U	11	U	22.7		
POTASSIUM	3520		1370		2130		1860		3150		
SELENIUM	10	UJ	2	UJ	2	UJ	2	UJ	10	UJ	
SILVER	5	U	5	U	5	U	5	U	5	U	
SODIUM	1700		46700		48000		46000		92100		
THALLIUM	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	
VANADIUM	7	U	7	U	7	U	7	U	7	U	
ZINC	6.8	UC	8	U	8	U	8.1	UC	33.2	UC	

DATA SUMMARY
SDG. No.: MFT956
Matrix: WATER

Reviewer: A. CANTU
Units: UG/L

Case No.: / Laboratory:	FLAG MF-T977	FLAG MF-T978	FLAG MF-T984	FLAG	FLAG	FLAG	COMMENTS
EPA [illegible]=>	161	48	34 U				
LAB ID	50 U	50 U	50 U				
ALUMINUM	1 U	1 6 UC	1 U				
ANTIMONY	34 6	26.4	1 U				
ARSENIC	1 U	1 U	1 U				
BARIUM	5 U	5 U	5 U				
BERYLLIUM	195000	222000	554				
CADMIUM	9 U	9 U	9 U				
CALCIUM	9 U	9 U	9 U				
CHROMIUM	6 U	6 U	6 U				
COBALT	562	36.6 UC	21.1 UC				
COPPER	1 UJ	1 UJ	1 UJ				
IRON	.0500	45800	77.1				
LEAD	19	3 vJ	1 U				
MAGNESIUM	0 2 U	0.2 U	0.2 U				
MANGANESE	11 U	11 U	11 U				
MERCURY	470	2690	667 U				
NIC[illegible]	2 UJ	2 UJ	2 UJ				
POTASSIUM	5 U	5 U	5 U				
SELENIUM	300	59800	4370				
SILVER	1 UJ	1 UJ	1 UJ				
SODIUM	7 U	7 U	7 U				
THALLIUM	8 UC	8 U	13 2				
VANADIUM	[illegible]	[illegible]	Blnk				
ZINC							

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

SOW No.: ILM02.0

Sample No.	Lab Sample ID.
MFT956	156382
MFT957	156383
MFT960	156384
MFT961	156385
MFT962	156386
MFT963	156387
MFT964	156388
MFT966	156390
MFT967	156391
MFT971	156452
MFT972	156453
MFT973	156454
MFT973D	156454D
MFT973S	156454S
MFT974	156455
MFT975	156456
MFT976	156457
MFT977	156458
MFT978	156459
MFT984	156460

Were ICP interelement corrections applied? Yes/No NO

Were ICP background corrections applied? Yes/No YES
If yes, were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Susanne H Deegan Name: SUSANNE H. DEEGAN

Date: 05/27/94 Title: PROJECT MANAGER

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO. 170

Irrig. Dtch b/w Embar Sep

MFT956

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156382

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1050			P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	37.7	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	52900			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	1160			P
7439-92-1	Lead	1.4	B	N	F
7439-95-4	Magnesium	9910			P
7439-96-5	Manganese	65.0			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	1390	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	16200			P
7440-28-0	Thallium	1.0	U	N	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	9.8	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

171

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.

Irrig. Ditch d/w Embargos

1

INORGANIC ANALYSIS DATA SHEET

MFT957

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156383

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	136	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.2	B		F
7440-39-3	Barium	26.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	45700			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	116			P
7439-92-1	Lead	1.0	U	N	F
7439-95-4	Magnesium	8500			P
7439-96-5	Manganese	15.8			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	791	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	14700			P
7440-28-0	Thallium	1.0	U	N	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture.

Color After: COLORLESS Clarity After: CLEAR Artifacts.

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO.
Inv Ditch abv Embargo
MFT960

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156384

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	971			P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	32.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	46800			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	963			P
7439-92-1	Lead	1.0	U	N	F
7439-95-4	Magnesium	8970			P
7439-96-5	Manganese	36.4			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	1110	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	14300			P
7440-28-0	Thallium	1.0	U	N	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	10.4	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
In Ditch abv Embargo Seep

1
INORGANIC ANALYSIS DATA SHEET

MFT961

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156385

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	111	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	27.4	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	49100			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	109			P
7439-92-1	Lead	1.0	U	N	F
7439-95-4	Magnesium	9190			P
7439-96-5	Manganese	8.8	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	863	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	15400			P
7440-28-0	Thallium	1.0	U	N	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	12.3	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
002 and Spill - UF

1

INORGANIC ANALYSIS DATA SHEET

MFT962

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156386

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	135	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	27.3	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	291000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	19.9	B		P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	47400			P
7439-96-5	Manganese	1860			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	4010	B		P
7782-49-2	Selenium	10.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	91600			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
002 at Soil - F
MFT963 (2)

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156387

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	148	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	27.1	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	277000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	18.7	B		P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	46400			P
7439-96-5	Manganese	1820			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	3520	B		P
7782-49-2	Selenium	10.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	91700			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	46.8			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO.
50' blw ooz outfall-
MFT964

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156388

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	149	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	60.4	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	119000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	251			P
7439-92-1	Lead	1.0	U	N	F
7439-95-4	Magnesium	20800			P
7439-96-5	Manganese	10.9	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	1370	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	46700			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

Old Cold Spr collection

SAMPLE NO.

MFT966

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156390

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	44.5	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	54.3	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	105000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	19.6	B		P
7439-92-1	Lead	1.0	U	N	F
7439-95-4	Magnesium	17400			P
7439-96-5	Manganese	1.0	U		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2130	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	48000			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts.

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO.
Old Coldspr Collection
MFT967

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156391

Level (low/med): LOW Date Received: 04/22/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	52.6	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	101000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	24.5	B		P
7439-92-1	Lead	1.0	U	N	F
7439-95-4	Magnesium	16700			P
7439-96-5	Manganese	1.0	U		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	1860	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	46000			P
7440-28-0	Thallium	1.0	U	N	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.1	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP well 2-

1
INORGANIC ANALYSIS DATA SHEET

MFT971

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156452

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	3690			P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	152	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	222000			P
7440-47-3	Chromium	22.0			P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	25200			P
7439-92-1	Lead	4.4		NW	F
7439-95-4	Magnesium	50000			P
7439-96-5	Manganese	774			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	22.7	B		P
7440-09-7	Potassium	3150	B		P
7782-49-2	Selenium	10.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	92100			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	33.2			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: OPAQUE Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO.
TP Well 2
MFT972

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156453

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	128	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	22.4	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	204000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	290			P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	45200			P
7439-96-5	Manganese	550			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2900	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	89200			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	11.7	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP well C
MFT973

1
INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156454

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	94.3	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.4	B	W	F
7440-39-3	Barium	35.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.1		*	P
7440-70-2	Calcium	311000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	170			P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	53200			P
7439-96-5	Manganese	2420			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	3420	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	87900			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

INORGANIC ANALYSIS DATA SHEET

SAMPLE NO.
TP well C
MFT974

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156455

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	135	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	35.4	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	307000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	22.5	B		P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	53800			P
7439-96-5	Manganese	2400			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	3620	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	89300			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP well 1
MFT975

1
INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156456

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	179	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	40.0	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	224000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	612			P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	46000			P
7439-96-5	Manganese	24.2			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2770	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	61100			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

1

SAMPLE NO. TP well 1-1

MFT976

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156457

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	26.2	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	225000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	29.9	B		P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	46900			P
7439-96-5	Manganese	3.2	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2630	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	61300			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO. Comp TP well 1

1

INORGANIC ANALYSIS DATA SHEET

MFT977

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156458

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	161	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	34.6	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	195000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	562			P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	40500			P
7439-96-5	Manganese	19.0			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2470	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	52300			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.8	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

ENVIROFORMS/INORGANIC CLP

SAMPLE NO.
TP well 1 (Dup)
MFT978

1

INORGANIC ANALYSIS DATA SHEET

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156459

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	48.0	B		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.6	B	W	F
7440-39-3	Barium	26.4	B		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	222000			P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	36.6	B		P
7439-92-1	Lead	1.0	U	NW	F
7439-95-4	Magnesium	45800			P
7439-96-5	Manganese	3.0	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	2690	B		P
7782-49-2	Selenium	2.0	U	NW	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	59800			P
7440-28-0	Thallium	1.0	U	NW	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	8.0	U		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

INORGANIC ANALYSIS DATA SHEET

MFT984

Lab Name: ETS Analytical Services Contract: 68-D2-0048

Lab Code: ETS Case No.: 21950 SAS No.: SDG No.: MFT956

Matrix (soil/water): WATER Lab Sample ID: 156460

Level (low/med): LOW Date Received: 04/23/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	34.0	U		P
7440-36-0	Antimony	50.0	U		P
7440-38-2	Arsenic	1.0	U		F
7440-39-3	Barium	1.0	U		P
7440-41-7	Beryllium	1.0	U		P
7440-43-9	Cadmium	5.0	U	*	P
7440-70-2	Calcium	554	B		P
7440-47-3	Chromium	9.0	U		P
7440-48-4	Cobalt	9.0	U		P
7440-50-8	Copper	6.0	U		P
7439-89-6	Iron	21.1	B		P
7439-92-1	Lead	1.0	U	N	F
7439-95-4	Magnesium	77.1	B		P
7439-96-5	Manganese	1.0	U		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	11.0	U		P
7440-09-7	Potassium	667	U		P
7782-49-2	Selenium	2.0	U	N	F
7440-22-4	Silver	5.0	U		P
7440-23-5	Sodium	4370	B		P
7440-28-0	Thallium	1.0	U	N	F
7440-62-2	Vanadium	7.0	U		P
7440-66-6	Zinc	13.2	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

AUG 1994
RECEIVED

MEMORANDUM

Date: 7-26-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: 22010

SDG#: MFQ-069

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

AUG 1994
RECEIVED
Recycled/Recyclable

USEPA REGION VI

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

LAB CODE SKINER	CASE NO 22010
SITE NAME MOLYCORP, INC	SDG NO MFQ069
	NUMBER OF SAMPLES 8

FORM DUE DATE
07/02/94
SDG MAILDATE
06/03/94

PART I DATA ACCEPTANCE OR REJECTION

INSTRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM MUST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR REJECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC), 2) ALL REJECTED DATA

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

✓ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG

REJECT ALL ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

PART II REDUCED VALUE

INSTRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA FOR A REDUCED VALUE TO BE PROCESSED, THIS FORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE, THE DOLLAR AMOUNT FOR REDUCED VALUE, AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS DETERMINED FOR EACH AFFECTED SAMPLE ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS, ETC)

CHECK ONE OF THE FOLLOWING

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

IDENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM

THIS FORM CANNOT BE PROCEESSED WITHOUT A SIGNATURE

NAME OF REGIONAL OFFICIAL MAHMOUD ELFEKY

SIGNATURE M. Elfeky DATE 7-26-94

SEND THIS FORM TO SAMPLE MANAGEMENT OFFICE
SAMPLE SCHEDULING & REPORTING SECTION
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

SEE LIST OF SAMPLES ON REVERSE SIDE

LAB CODE SKINER	CASE NO. 22010	SDG NO MFQ069

PART III PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER A "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE

SAMPLE	FRACTIONS ANALYZED			
	METALS		CYANIDE	
LCSW	Y			
MFQ069	Y			
MFQ069D	Y			
MFQ069S	Y			
MFQ071	Y			
MFQ073	Y			
MFQ074	Y			
MFQ076	Y			

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: July 25, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton
Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD #6-4590

Attached is the data review summary for Case #22010
SDG #MFQ069
Site Moly Corp

Comments:

1. The data package is technically provisional.
2. The aluminum matrix spike recovery was outside the QC limit.
3. No contractual violations were noted by the CCS or the hard copy data review.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

CASE NO. 22010
LABORATORY SKINER
CONTRACT # 68-D2-0039
SDG # MFQ069
SOW# ILM02.1
ACCT # 4TFAJNA2 SF # TFAUZZ

SITE Moly Corp
NO. OF SAMPLES/
MATRIX 5/Water
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Nhan Tran
COMPLETION DATE July 25, 1994

SAMPLE Nos.: MF-Q069, MF-Q071, MF-Q073, MF-Q074, MF-Q076

INORGANIC REGIONAL DATA ASSESSMENT
DATA ASSESSMENT SUMMARY

	ICP	AA	Hg	CYANIDE
1. HOLDING TIMES	O	NA	O	NA
2. CALIBRATIONS	O	NA	O	NA
3. BLANKS	O	NA	O	NA
4. MATRIX SPIKE	X	NA	O	NA
5. DUPLICATE ANALYSIS	O	NA	O	NA
6. ICP QC	O			
7. FAA QC		NA		
8. LCS	O	NA	O	
9. SAMPLE VERIFICATION	O	NA	O	NA
10. OTHER QC	O	NA	O	NA
11. OVERALL ASSESSMENT	X	NA	O	NA

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Matrix spike recovery was outside the QC limit.

NOTABLE PERFORMANCE:

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case 22010 SDG MFQ069 Site Moly Corp Lab SKINER

COMMENTS: Five water samples were analyzed at low concentrations for total metals. The laboratory met the contractual data package turnaround time requirement. The sampler designated samples MF-Q071/MF-Q073 as the field duplicates and MF-Q069 as the QC sample.

The data package is provisional due to a problem with a matrix spike recovery. The effect of this deficiency on the sample results is discussed below. All other QC requirements were met.

An Evident Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attacned to this report.

1. **Holding Times**

   All holding time criteria were met.

2. **Calibrations**

   All calibrations were acceptable.

3. **Blanks**

   Aluminum, arsenic, and chromium were reported in the calibration and/or preparation blanks. The reviewer has qualified the sample results below the CRDL that are affected and reported them in the Data Summary Table.

4. **Pre-digestion Matrix Spike Recovery**

   All aluminum sample results are estimated because the pre-digestion matrix spike recovery was above the QC limit. Physical or chemical interference due to the sample matrix may be possible.

5. **Duplicate Analysis**

   All duplicate results were acceptable.

6. **ICP Quality Control**

   All serial dilution differences and ICS results were acceptable.

7. **Furnace Atomic Absorption Quality Control**

   No FAA analysis was performed.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case 22010 SDG MFQ069 Site Moly Corp Lab SKINER

8. Laboratory Control Sample

All laboratory control sample results were acceptable.

9. Sample Verification

All samples were reported correctly.

10. Other QC

There were no Section 10 problems.

11. Overall Assessment

The data package is technically provisional because the aluminum results were estimated due to the matrix spike recovery above the QC limit.

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

Positive bias.

Negative bias.

DATA SUMMARY

Case No.: 22010 SDG. No MFQ069 Reviewer: NHAN TRAN
Laboratory: SKINER Matrix: water Units: ug/L

EPA #=>	MF-Q069	FLAG	MF-Q071	FLAG	MF-Q073	FLAG	MF-Q074	FLAG	MF-Q076	FLAG	COMMENTS
ALUMINUM	2540	J	45.6	UCJ	59.4	UCJ	53200	J	78800	J	
ANTIMONY	10.8	U	10.8	U	10 8	U	10.8	U	10.8	U	
ARSENIC	6	UC	2.2	UC	3 6	UC	15 2		23.7		
BARIUM	53 7		54.9		54 9		514		570		
BERYLLIUM	0 8	U	0.8	U	0 8	U	4 6		4.7		
CADMIUM	1	U	1	U	1	U	1	U	1	U	
CALCIUM	248000		46100		46000		274000		197000		
CHROMIUM	8.1	UC	4.4	U	4 4	U	88.1		109		
COBALT	3.7		2.3	U	2.3	U	15.8		32.1		
COPPER	7 8		3.1	U	3 1	U	38.9		65.7		
IRON	1900		1220		1420		38600		69500		
LEAD	5 3		1.5	U	3 1		44.9		65.6		
MAGNESIUM	45700		10100		9970		60500		49900		
MANGANESE	37.3		158		157		743		1880		
MERCURY	0 2	U	0 2	U	0 2	U	0 2	U	0.2	U	
NICKEL	4.5	U	4 5	U	4 5	U	65.3		82.2		
POTASSIUM	3250		877		873		13800		11000		
SELENIUM	2.6		2.1	U	2 1	U	2.1	U	2.1	U	
SILVER	3	U	3	U	3	U	3	U	3	U	
SODIUM	39600		15100		14900		42300		41100		
THALLIUM	2 2	U	2 2	U	2 2	U	2.2	U	2.2	U	
VANADIUM	3 9		2 6	U	2 6	U	48 8		91.7		
ZINC	16 4		150		165		177		288		

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. 22010 SDG No MFQ069 SDG Nos To Follow SAS No. Date Rec 6/1/94

EPA ID: SKINER

Lab Location: Waltham, MA

Region: 6 Audit No.. 22010/MFQ069

Re_Submitted CSF? Yes ____ No X

Box No(s). ONE

COMMENTS:

Over for additional comments.

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2 Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6 Present?	X		
7 Complete?	X		
8 Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10 Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13. Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18 Complete?	X		
19 Legible?	X		
20 Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Audited by: David Spencer D Spencer/Scientist Associate Date 7/13/94

Audited by: ____ ____ Date ____

Audited by: ____ ____ Date ____

Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: ____ Date Entered: ____ Date Reviewed: ____

Entered by: ____ ____

Reviewed by: ____ ____

Signature Printed Name/Title

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: CHINNER & SHERMAN LABS. Contract 68-D2-0039

Lab Code: CHINEP Case No. 12010 SAS No.: SDG No.: MFQ06?

SOW No.: ILM02.1

EPA Sample No.	Lab Sample ID.
MFQ069	04229-01S
MFQ069D	04229-01S2
MFQ069S	04229-01DS
MFQ071	04229-02S
MFQ073	04229-03S
MFQ074	04229-04S
MFQ076	04229-05S

Were ICP interelement corrections applied? Yes/No YES

Were ICP background corrections applied? Yes/No YES

If yes-were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: Kirk D. Johnson

Date: 1/31/92 Title: USEPA Data Manager

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.
TP well 7c

Lab Name: SKINNER & SHERMAN LABS Contract: 68-02-0037

Lab Code: SKINER Case No: 12010 SAS No.: SDG No: MEQ0

Matrix (soil/water): WATER Lab Sample ID: 0422

Level (low/med): LOW Date Received: 04/27/

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2540		N	P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	6.0	B		P
7440-39-3	Barium	53.7	B		P
7440-41-7	Beryllium	0.80	U		P
7440-43-9	Cadmium	1.0	U		P
7440-70-2	Calcium	248000			P
7440-47-3	Chromium	3.1	B		P
7440-48-4	Cobalt	3.7	B		P
7440-50-8	Copper	7.3	B		P
7439-89-6	Iron	1900			P
7439-92-1	Lead	5.3			P
7439-95-4	Magnesium	45700			P
7439-96-5	Manganese	37.3			P
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel	4.5	U		P
7440-09-7	Potassium	3250	B		P
7782-49-2	Selenium	2.6	B		P
7440-22-4	Silver	3.0	U	N	P
7440-23-5	Sodium	39600			P
7440-28-0	Thallium	2.2	U		P
7440-62-2	Vanadium	3.9	B		P
7440-66-6	Zinc	15.4	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLOUDY Texture:

Color After: COLORLESS Clarity After: CLOUDY Artifacts:

Comments:

[illegible] ANAL [illegible] DAT [illegible] SHEET

Doran Well -UF

[illegible] KINNE[illegible] HERMA[illegible] [illegible] [illegible]

[illegible] LINE[illegible] [illegible] [illegible] [illegible]

Matrix (soil/water): WATER

Lab Sample [illegible]

Level (low/med) LOW

Date Received: [illegible]

% Solids 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	45.6	B	N	P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	2.2	B		P
7440-39-3	Barium	54.9	B		P
7440-41-7	Beryllium	0.80	U		P
7440-43-9	Cadmium	1.0	U		P
7440-70-2	Calcium	16100			P
7440-47-3	Chromium	4.4	U		P
7440-48-4	Cobalt	2.3	U		P
7440-50-8	Copper	[illegible].1	U		P
7439-89-6	Iron	1220			P
7439-92-1	Lead	1.5	U		P
7439-95-4	Magnesium	[illegible]0100			P
7439-96-5	Manganese	156			P
7439-97-6	Mercury	[illegible].20	U		Av
7440-02-0	Nickel	4.5	U		P
7440-09-7	Potassium	[illegible]77	B		P
77[illegible]-49-2	Selenium	2.1	U		P
7440-22-4	Silver	3.0	U	N	P
7440-23-5	Sodium	15100			P
7440-28-0	Thallium	2.2	U		P
7440-62-2	Vanadium	2.6	U		P
7440-66-6	Zinc	150			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture

Color After: COLORLESS Clarity After: CLEAR Artifac

Comments

FORM [illegible]

[illegible]ORGAN[illegible] [illegible]NALY[illegible] [illegible]HEET

Duran Well (Dupl)

UF

(D)

Name [illegible]INNER & SHER[illegible] [illegible] Contract [illegible]-D2 [illegible]039

[illegible] [illegible]KINER [illegible] [illegible] [illegible] [illegible] [illegible]

trix (soil/water): WATER Lab Sample ID [illegible]

Level (low/med) LOW Date Received [illegible]

Solids: [illegible]

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	59.4	B	N	P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	3.6	B		P
7440-39-3	Barium	54.9	B		P
7440-41-7	Beryllium	0.80	U		P
7440-43-9	Cadmium	1.0	U		P
7440-70-2	Calcium	46000			P
7440-47-3	Chromium	4.4	U		P
7440-48-4	Cobalt	2.3	U		P
7440-50-8	Copper	3.1	U		P
7439-89-6	Iron	1420			P
7439-92-1	Lead	3.1			P
7439-95-4	Magnesium	9970			P
7439-96-5	Manganese	157			P
7439-97-6	Mercury	0.[illegible]0	U		Av
7440-02-0	Nickel	4.5	U		P
7440-09-7	Potassium	873	B		P
7782-49-2	Selenium	2.1	U		P
7440-22-4	Silver	3.0	U	N	P
7440-23-5	Sodium	14900			P
7440-28-0	Thallium	2.2	U		P
7440-62-2	Vanadium	2.6	U		P
7440-66-6	Zinc	165			P
_____	Cyanide				NR

Color Before: COLORLESS Clarity Before CLEAR Texture

Color After COLORLESS Clarity After CLEAR Artifact

Comments.

FORM I IN

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.
TP Well 76 -OF

MFQ07-

Lab Name: SKINNER & SHERMAN LABS Contract: [illegible]-D2 0039

Lab Code: SKINER Case No.: 2010 SAS No.: SDG No.: [illegible]

Matrix (soil/water): WATER Lab Sample ID: 0422[illegible]

Level (low/med): LOW Date Received: 04/27/94

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	53200		N	P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	15.2			P
7440-39-3	Barium	514			P
7440-41-7	Beryllium	4.6	B		P
7440-43-9	Cadmium	1.0	U		P
7440-70-2	Calcium	274000			P
7440-47-3	Chromium	38.1			P
7440-48-4	Cobalt	15.8	B		P
7440-50-8	Copper	38.9			P
7439-89-6	Iron	38600			P
7439-92-1	Lead	44.9			P
7439-95-4	Magnesium	60500			P
7439-96-5	Manganese	743			P
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel	65.3			P
7440-09-7	Potassium	13800			P
7782-49-2	Selenium	2.1	U		P
7440-22-4	Silver	3.0	U	N	P
7440-23-5	Sodium	42300			P
7440-28-0	Thallium	2.2	U		P
7440-62-2	Vanadium	48.8	B		P
7440-66-6	Zinc	177			P
_____	Cyanide				NR

Color Before: BROWN Clarity Before: OPAQUE Texture:

Color After: BROWN Clarity After: OPAQUE Artifacts:

Comments:

5

FORM IN

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE
TP Well 9a - CF

Lab Name: [illegible] & [illegible] LABS. Contract: [illegible] D2-0039

Lab Code: [illegible] Case No.: [illegible] [illegible]

Matrix (soil/water): WATER Lab Sample ID: [illegible]

Level (low/med): LOW Date Received: [illegible]

% Solids: 0.0

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	78800		N	P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	23.7			P
7440-39-3	Barium	[illegible]70			P
7440-41-7	Beryllium	4.7	B		P
7440-43-9	Cadmium	[illegible]	U		P
7440-70-2	Calcium	197000			P
7440-47-3	Chromium	109			P
7440-48-4	Cobalt	32.1	B		P
7440-50-8	Copper	65.7			P
7439-89-6	Iron	[illegible]9500			P
7439-92-1	Lead	65.[illegible]			P
7439-95-4	Magnesium	49900			P
7439-96-5	Manganese	1880			P
7439-97-6	Mercury	[illegible].20	U		AV
7440-02-0	Nickel	32.2			P
7440-09-7	Potassium	11000			P
7782-49-2	Selenium	2.1	U		P
7440-22-4	Silver	3.0	U	N	P
7440-23-5	Sodium	41100			P
7440-28-0	Thallium	2.2	U		P
7440-62-2	Vanadium	[illegible]1.7			P
7440-66-6	Zinc	288			P
_____	Cyanide				NR

Color Before: BROWN Clarity Before: OPAQUE Texture:

Color After: BROWN Clarity After: OPAQUE Artifact:

Comments:

6

FORM [illegible] IN

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: 7-26-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: 22010

SDG#: MFQ-070

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION VI

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

LAB CODE SKINER	CASE NO 22010
SDG NO MFQ070	
SITE NAME MOLYCORP, INC	NUMBER OF SAMPLES 8

FORM DUE DATE
07/02/94
SDG MAILDATE
06/07/94

PART I DATA ACCEPTANCE OR REJECTION

INSTRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM MUST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR REJECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC), 2) ALL REJECTED DATA

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

✓ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG

REJECT ALL ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

PART II REDUCED VALUE

INSTRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA FOR A REDUCED VALUE TO BE PROCESSED, THIS FORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE, THE DOLLAR AMOUNT FOR REDUCED VALUE, AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS DETERMINED FOR EACH AFFECTED SAMPLE ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS, ETC)

CHECK ONE OF THE FOLLOWING

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

IDENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM

THIS FORM CANNOT BE PROCEESSED WITHOUT A SIGNATURE

NAME OF REGIONAL OFFICIAL MAHMOUD ELEEKY

SIGNATURE M. Eleeky DATE 7-26-94

SEND THIS FORM TO SAMPLE MANAGEMENT OFFICE
SAMPLE SCHEDULING & REPORTING SECTION
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

SEE LIST OF SAMPLES ON REVERSE SIDE

| LAB CODE SKINER | CASE NO. 22010 | SDG NO MFQ070 |

PART III PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER A "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE

SAMPLE	FRACTIONS ANALYZED			
	METALS		CYANIDE	
LCSW	Y			
MFQ070	Y			
MFQ070D	Y			
MFQ072	Y			
MFQ072S	Y			
MFQ075	Y			
MFQ077	Y			
MFQ078	Y			

ESAT REGION VI
U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: July 25, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton
Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD #6-4591

Attached is the data review summary for Case #22010
SDG #MFQ070
Site MOLY CORP

COMMENTS:

1. The data package is technically provisional.

2. No contractual violations were noted by CCS and none were found during the hardcopy data review.

3. The difference in selenium laboratory duplicate results exceeded the quality control limit.

4. The difference in zinc serial dilution results was above the quality control limit.

5. All sample results for samples MF-Q077 and MF-Q078 were qualified because the samples were not properly preserved.

6. The laboratory made no reporting errors.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

CASE NO. 22010
LABORATORY SKINER
CONTRACT # 68-D2-0039
SDG # MFQ070
SOW# ILM02.1
ACCT # 4TFAJNA2 SF # TFAUZZ

SITE MOLY CORP
NO. OF SAMPLES/
MATRIX 5/WATER
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Elizabeth Cox
COMPLETION DATE July 25, 1994

SAMPLE NO.: MF-Q070, MF-Q072, MF-Q075, MF-Q077, MF-Q078

INORGANIC REGIONAL DATA ASSESSMENT
DATA ASSESSMENT SUMMARY

	ICP	AA	Hg	CYANIDE
1. HOLDING TIMES	O	N/A	O	N/A
2. CALIBRATIONS	O	N/A	O	N/A
3. BLANKS	X	N/A	O	N/A
4. MATRIX SPIKE	O	N/A	O	N/A
5. DUPLICATE ANALYSIS	X	N/A	O	N/A
6. ICP QC	X			
7. FAA QC		N/A		
8. LCS	O	N/A	O	
9. SAMPLE VERIFICATION	O	N/A	O	N/A
10. OTHER QC	X	N/A	X	N/A
11. OVERALL ASSESSMENT	X	N/A	X	N/A

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Blank concentrations were above instrument detection limits, a difference in laboratory duplicate results exceeded the quality control limit, a difference in serial dilution results exceeded the quality control limit, and two samples were not properly preserved.

NOTABLE PERFORMANCE:

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22010 **SDG** MFQ070 **Site** MOLY CORP **Lab** SKINER

COMMENTS:

Five low concentration water samples were analyzed for total metals. The sampler did not specify a lab QC sample. Sample MF-Q078 was a field blank. Samples MF-Q077 and MF-Q078 were not preserved below pH 2.0. The data package met the 35-day contractual data package turnaround requirement.

The data package is technically provisional due to QC deficiencies including blank contamination, a significant difference in duplicate results, and a significant difference in serial dilution results. This report documents only the QC requirements that weren't met and those factors affecting the technical usability of the results.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF) and the Evidence Inventory Checklist is attached to this report.

1. **Holding Times**

   All holding time criteria were met.

2. **Calibrations**

   All calibrations were acceptable.

3. **Blanks**

   Aluminum, iron, manganese, and sodium were reported in the calibration, preparation, and/or field blanks. The iron result for sample MF-Q075 was above the CRDL and should be considered undetected due to blank contamination. Sample results below the CRDL that were affected by the blank concentrations have been qualified. All qualifications are listed on the Data Summary Table.

4. **Pre-digestion/Pre-distillation Matrix Spike**

   All matrix spike recoveries were acceptable.

5. **Duplicate Analysis**

   The selenium results are estimated because the difference in laboratory duplicate results exceeded the quality control limit.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22010 SDG MFQ070 Site MOLY CORP Lab SKINER

6. ICP Quality Control

Serial Dilution

The zinc results are estimated because the difference in serial dilution results exceeded the quality control limit.

Interference Check Sample

All interference check sample criteria were met.

7. Furnace Atomic Absorption Quality Control

FAA was not used.

8. Laboratory Control Sample

All laboratory control sample results were acceptable.

9. Sample Verification

All results were correctly reported.

10. Other QC

Sample Preservation

All results for samples MF-Q077 and MF-Q078 are estimated because the pH of the samples was 2.5 and 3.0, respectively.

11. Overall Assessment

The data package is provisional for the following reasons.

All selenium results were estimated due to a significant difference in duplicate results.

All zinc results were estimated because the difference in serial dilution results exceeded the quality control limit.

All results for samples MF-Q077 and MF-Q078 were estimated because the samples were not properly preserved.

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

Positive bias.

Negative bias.

DATA SUMMARY

Case No.: 22010 SDG. No.: MFQ070 Reviewer: E. COX
Laboratory: SKINER Matrix: WATER Units: UG/L

[illegible]R #=>	MF-Q070	FLAG	MF-Q072	FLAG	MF-Q075	FLAG	MF-Q077	FLAG	MF-Q078	FLAG	COMMENTS
ALUMINUM	19	UC	31.4	UC	61.6	UC	78.3	UC	16.5	UJ	
ANTIMONY	10.8	U	10.8	U	10.8	U	10.8	UJ	10.8	UJ	
ARSENIC	3.6		4.7		1.5	U	1.5	UJ	1.5	UJ	
BARIUM	34		54		57.5		92.7	J	3.1	UJ	
BERYLLIUM	0.8	U	0.8	U	0.8	U	0.8	UJ	0.8	UJ	
CADMIUM	1	U	1	U	1	U	1	UJ	1	UJ	
CALCIUM	237000		47400		231000		144000	J	34.9	UJ	
CHROMIUM	4.4	U	4.4	U	4.4	U	4.4	UJ	4.4	UJ	
COBALT	2.3	U	2.3	U	2.3	U	2.3	UJ	2.3	UJ	
COPPER	3.1	U	3.1	U	3.5		3.1	UJ	3.1	UJ	
IRON	38.1	UC	24	UC	101	UC	59.7	UCJ	4.8	UJ	
LEAD	1.5	U	1.5	U	1.5	U	1.5	UJ	1.5	UJ	
MAGNESIUM	43400		10400		43600		28100	J	38.2	UJ	
MANGANESE	3.1	UC	146		12		573	J	0.94	UCJ	
MERCURY	0.2	U	0.2	U	0.2	U	0.2	UJ	0.2	UJ	
NICKEL	4.5	U	4.5	U	4.5	U	4.5	UJ	4.5	UJ	
[illegible]SSIUM	2670		867		5770		1420	J	103	UJ	
SELENIUM	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	2.1	UJ	
SILVER	3	U	3	U	3	U	3	UJ	3	UJ	
SODIUM	38200		15800		40600		40700	J	86.5	UCJ	
THALLIUM	2.2	U	2.2	U	2.2	U	2.2	UJ	2.2	UJ	
VANADIUM	2.6		2.6	U	2.6	U	2.6	UJ	2.6	UJ	
ZINC	7.8	J	101	J	26.1	J	37	J	2	UJ	

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. 22010 SDG No. MFQ070 SDG Nos. To Follow SAS No. Date Rec 06-01-94

EPA Lab ID: SKINER
Lab Location: Waltham, MA
Region: 6 Audit No.: 22010/MFQ070
Re_Submitted CSF? Yes ____ No X
Box No(s): ONE
COMMENTS:

Over for additional comments.

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1. Present on package?	X		
2. Intact upon receipt?	X		
FORM DC-2			
3. Numbering scheme accurate?	X		
4. Are enclosed documents listed?	X		
5. Are listed documents enclosed?	X		
FORM DC-1			
6. Present?	X		
7. Complete?	X		
8. Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9. Signed?	X		
10. Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11. Signed?	X		
12. Dated?	X		
AIRBILLS/AIRBILL STICKER			
13. Present?	X		
14. Signed?	X		
15. Dated?	X		
SAMPLE TAGS			
16. Does DC-1 list tags as being included?	X		
17. Present?	X		
OTHER DOCUMENTS			
18. Complete?	X		
19. Legible?	X		
20. Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Audited by: David Spencer — David Spencer - Scientist Associate — Date 07-14-94
Audited by: ____ — ____ — Date ____
Audited by: ____ — ____ — Date ____
Signature — Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: ____ Date Entered: ____ Date Reviewed: ____
Entered by: ____ ____
Reviewed by: ____ ____
Signature — Printed Name/Title

EPA CLP

COVER PAGE INORGANIC ANALYSES DATA PACKAGE

Lab Name: XYDNER SHERMAN LABS. Contract: 68-02-0039

Lab Code: XYDNER Case No.: 12010 SAS No. SDG No.: MFQ07

ON No. ILM02.1

EPA Sample No.	Lab Sample ID
MFQ070	04231-01S
MFQ070D	04231-01S2
MFQ072	04231-02S
MFQ072S	04231-02DS
MFQ075	04231-03S
MFQ077	04231-04S
MFQ078	04231-05S

Were ICP interelement corrections applied? Yes/No YES
Were ICP background corrections applied? Yes/No YES
If yes-were raw data generated before application of background corrections? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: Kirk D. Johnson

Date: 11/5/92 Title: USEPA Data Manager

[illegible] SHEET

TP Well 7c - F

Lab Name: [illegible] & CHERM[illegible] [illegible] (02 003)

Lab Code: [illegible] Case No.: [illegible] SDG No.: [illegible]

Matrix (soil/water): WATER Lab Sample ID: [illegible]

Level (low/med): LOW Date Received: 04/[illegible]

% Solids: [illegible]

Concentration Units (ug/L or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	19.0	B		P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	3.6	B		P
7440-39-3	Barium	34.0	B		P
7440-41-7	Beryllium	0.80	U		P
7440-43-9	Cadmium	1.0	U		P
7440-70-2	Calcium	[illegible]37000			P
7440-47-3	Chromium	[illegible].4	U		P
7440-48-4	Cobalt	[illegible] 3	U		P
7440-50-8	Copper	[illegible] 1	U		P
7439-89-6	Iron	[illegible] 1	B		P
7439-92-1	Lead	5	U		P
7439-95-4	Magnesium	[illegible]			P
7439-96-5	Manganese	1	B		P
7439-97-6	Mercury	20	U		AV
7440-02-0	Nickel	5	U		P
7440-09-7	Potassium		B		P
7782-49-2	Selenium	1	U	*	P
7440-22-4	Silver	[illegible] 0	U	N	P
7440-23-5	Sodium	[illegible]			P
7440-28-0	Thallium	2	U		P
7440-62-2	Vanadium	6	B		P
7440-66-6	Zinc	[illegible]	B	F	P
_____	Cyanide				NR

Color Before: COLORLESS Clarity: [illegible]AR Texture:

Color After: COLORLESS Clarity: [illegible]AR Artifact:

Comments:

Duran Well - F

Matrix (soil/water): WATER Lab Sample ID: [illegible]

Level (low/med): LOW Date Received: [illegible]

% Solids: [illegible]

Concentration units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	31.4	B		P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	4.7	B		P
7440-39-3	Barium	54.0	B		P
7440-41-7	Beryllium	[illegible]	U		P
7440-43-9	Cadmium	[illegible]	U		P
7440-70-2	Calcium	[illegible]			P
7440-47-3	Chromium	[illegible]	U		P
7440-48-4	Cobalt	[illegible]	U		P
7440-50-8	Copper	[illegible]	U		P
7439-89-6	Iron	[illegible]	B		P
7439-92-1	Lead	[illegible]	U		P
7439-95-4	Magnesium	[illegible]			P
7439-96-5	Manganese	[illegible]			P
7439-97-6	Mercury	[illegible]	U		AV
7440-02-0	Nickel	[illegible]	U		P
7440-09-7	Potassium	[illegible]	B		P
7782-49-2	Selenium	[illegible]	U	*	P
7440-22-4	Silver	[illegible]	U	N	P
7440-23-5	Sodium	[illegible]			P
7440-28-0	Thallium	[illegible]	U		P
7440-62-2	Vanadium	[illegible]	U		P
7440-66-6	Zinc			F	P
	Cyanide	[illegible]	[illegible]		NR

Color Before: COLORLESS Clarity: CLAR Texture:

Color After: COLORLESS Clarity: CLAR Artifact:

Comments:

TP Well 76 - F

Concentration Units (ug/l or mg/Kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	61.6	B		P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	1.5	U		P
7440-39-3	Barium	57.5	B		P
7440-41-7	Beryllium	0.80	U		P
7440-43-9	Cadmium	1.0	U		P
7440-70-2	Calcium	231000			P
7440-47-3	Chromium	1.4	U		P
7440-48-4	Cobalt	2.3	U		P
7440-50-8	Copper	1.5	B		P
7439-89-6	Iron	101			P
7439-92-1	Lead	1.5	U		P
7439-95-4	Magnesium	43600			P
7439-96-5	Manganese	12.0	B		P
7439-97-6	Mercury	0.20	U		AV
7440-02-0	Nickel	1.5	U		P
7440-09-7	Potassium	5770			P
7782-49-2	Selenium	2.1	U	*	P
7440-22-4	Silver	3.0	U	N	P
7440-23-5	Sodium	10600			P
7440-28-0	Thallium	2.2	U		P
7440-62-2	Vanadium	2.6	U		P
7440-66-6	Zinc	26.1		E	P
----------	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

TP Well 9a - F

E

[illegible]

[illegible] Wa[illegible] [illegible] Sample [illegible]

[illegible] [illegible] Rec[illegible]

[illegible]

Conc[illegible]tration [illegible] [illegible] weight). UG/L

[illegible]	[illegible]	[illegible]		Q	M
[illegible]-90-5	[illegible]	[illegible]	B		P
7440-[illegible]	[illegible]	[illegible]	U		P
[illegible]-38-2	[illegible]	[illegible]	U		P
[illegible]-39-3	[illegible]	[illegible]	B		P
7440-41-7	[illegible]	[illegible]	U		P
[illegible]-43-[illegible]	[illegible]	[illegible]	U		P
[illegible]-70-2	[illegible]	[illegible]			P
[illegible]	[illegible]		[illegible]		[illegible]
7440-48-4	[illegible]	[illegible]	U		P
[illegible]	[illegible]		[illegible]		P
[illegible]-6	[illegible]	[illegible]	[illegible]		P
[illegible]-1	[illegible]	[illegible]	[illegible]		P
[illegible]	[illegible]	[illegible]	[illegible]		P
[illegible]	[illegible]	[illegible]			P
[illegible]	[illegible]	[illegible]	[illegible]		AV
[illegible]	[illegible]		[illegible]		P
[illegible]	[illegible]	[illegible]	[illegible]		P
[illegible]-49-2	[illegible]		[illegible]	*	P
[illegible]-22-4	Silver	[illegible]	U	N	P
7440-23-5	Sodium	[illegible]			P
7440-28-0	Thallium		U		P
7440-62-2	Vanadium		U		P
7440-66-6	Zinc	[illegible]		[illegible]	P
	Cyanide				NR

[illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible]

[illegible]

Fld Blk - UF

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	[illegible].5	U		P
7440-36-0	Antimony	10.8	U		P
7440-38-2	Arsenic	[illegible]	U		P
7440-39-3	Barium	[illegible]	U		P
7440-41-7	Beryllium	[illegible].20	U		P
7440-43-9	Cadmium	[illegible]	U		P
7440-70-2	Calcium	[illegible]	U		P
7440-47-3	Chromium	[illegible]	U		P
7440-48-4	Cobalt	[illegible]	U		P
7440-50-8	Copper	[illegible]	U		P
7439-89-6	Iron	[illegible].8	U		P
7439-92-1	Lead	[illegible]	U		P
7439-95-4	Magnesium	[illegible]	U		P
7439-96-5	Manganese	[illegible]	B		P
7439-97-6	Mercury	[illegible].20	U		AV
7440-02-0	Nickel	[illegible]	U		P
7440-09-7	Potassium	[illegible]	U		P
7782-49-2	Selenium	[illegible].1	U	*	P
7440-22-4	Silver	[illegible]	U	N	P
7440-23-5	Sodium	[illegible]	B		P
7440-28-0	Thallium	[illegible]	U		P
7440-62-2	Vanadium	[illegible]	U		P
7440-66-6	Zinc	[illegible]	U	E	P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

2 of 20

MEMORANDUM

Date: 8-12-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLLY CORP

Case#: SAS 8450F-01

SDG#: SF-5823

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable

USEPA REGION VI

REGIONAL ACCEPTANCE FORM
FOR SPECIAL ANALYTICAL SERVICES

221

Lab Code SILVER SAS No 08450F-01 Case No . SDG No SF5823 Data Receipt Date: 07/13/94
Site Name MOLY CORP QUESTA MINE Est. Liquidated Damages. $0 00
SMO Complete Date: 07/14/94

Please provide a copy of this completed form to the Sample Management Office's SAS IPS Section Leader no later than 08/28/94 indicate below, by checking the appropriate box, whether the data for this SDG are accepted or of reduced value or rejected. If the Region is requesting a reduced value or a rejection, please attach all appropriate documentation.

Check appropriate box below

I DATA ACCEPTANCE

☑ Data appear acceptable (i e data that is not rejected or recommended for reduced value) according to the Region's inspection process. Applicable liquidated damages as outlined in the laboratory's subcontract are applied as approrpiate

II REDUCED VALUE

☐ Data are recommended for a reduced value The Region recommends that the value of the data package be reduced by __%. Attached are a signed memo from the Regional official describing the contractual reasons for reduced value and all related documents (data review, telephone logs, etc.)

III REJECTION

☐ Data are recommended for rejection Attached are a signed memo from the Regional Official describing the contractual reasons for rejection, all related documents (data review, telephone logs, etc), and all rejected data

COMMENTS

Name of data reviewer: YOUREE HOLLOWAY

Organization ESAT, REGION 3

Date review complete. 8-11-94

Name of Regional Official. MAHMOUD ELFEKY

Signature: M Elfeky Date: 8-12-94

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: August 11, 1994

To: Melvin Ritter, ESAT RPO, Region VI

From: Bill Blanton, ESAT ETM, Region VI

Subject: CLP Data Review

WUD #: 6-4712

Attached is the data review summary for Case # SAS8450F-01
SDG # SF-5823
Site MOLYCORP

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

There were no contractual violations identified by the hardcopy data review.

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

The data package is technically provisional. Significant technical problems are summarized below.

1. Most selenium results were unusable due to a matrix spike recovery below 30%.

2. The differences between duplicate results for cadmium and selenium exceeded the quality control (QC) limits.

3. Arsenic, cadmium, lead, selenium, and thallium had matrix spike recoveries outside of the QC limits.

4. Selenium had method of standard addition correlation coefficients below 0.995.

5. FAA analytical spike recoveries were outside of the QC limits for 49 of 80 determinations.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. SAS8450F-01
LABORATORY SILVER
CONTRACT # SAS8450F-01
SDG # SF5823
SOW # ILMO3.0 and ILMO2.0
ACCT # 4TFAJNG5 SF # TFAUZZ

SITE MOLYCORP
NO. OF SAMPLES/
MATRIX 20/water
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Youree Holloway
COMPLETION DATE August 11, 1994

SAMPLE NO.: SF-5823 SF-5824 SF-5825 SF-5826 SF-5827 SF-5828 SF-5829 SF-5830 SF-5831 SF-5832 SF-5833 SF-5839 SF-5840 SF-5841 SF-5842 SF-5843 SF-5850 SF-5851 SF-5852 SF-5856

DATA ASSESSMENT SUMMARY

	ICP	AA	Hg
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	O	O
4. MATRIX SPIKE	M	M	O
5. DUPLICATE ANALYSIS	M	M	O
6. ICP QC	O		
7. FAA QC		M	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	X	X	X
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	M	M	X

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A = Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Differences between duplicate results exceeded the quality control (QC) limits; matrix spike recoveries were outside of the QC limits; method of standard addition correlation coefficients were below 0.995, and FAA analytical spike recoveries exceeded the QC limits for 49 of 80 determinations.

NOTABLE PERFORMANCE:

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case SAS8450F-01 SDG SF5823 Site MOLYCORP Lab SILVER

Comments: Twenty water samples were analyzed at low concentrations for total metals and molybdenum. Samples SF-5824/SF-5825 and SF-5828/SF-5829 were field duplicate pairs, and sample SF-5827 was designated as the QC sample. The laboratory met the contractual data package turnaround time requirements.

Most selenium sample results were qualified as unusable due to a low matrix spike recovery. The data package is provisional due to problems with matrix spike recovery, inconsistent duplicate results, MSA correlation coefficients, and FAA analytical spike recoveries. This report documents the QC requirements that were not met or those factors affecting technical usability of the results.

An Evident Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. Holding Times

All holding time criteria were met.

2. Calibrations

All calibrations were acceptable.

3. Blanks

Sample results were affected by lead and thallium in the preparation and/or calibration blanks. Lead concentrations in samples SF-5824, SF-5825, SF-5826, SF-5827, SF-5828, SF-5829, SF-5830, SF-5839, and SF-5842 were above the contract required detection limit (CRDL), and these results are low-biased. The affected sample results below the CRDL are reported in the Data Summary Table.

4. Pre-digestion Matrix Spike Recovery

The following sample results are qualified because of possible physical or chemical interference in the samples.

The selenium results below the instrument detection limit (IDL) are unusable due to pre-digestion matrix spike recoveries below 30%. False negatives are possible.

The cadmium and lead results above the IDL are estimated due to high pre-digestion matrix spike recoveries.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case SAS8450F-01 SDG SF5823 Site MOLYCORP Lab SILVER

4. Pre-digestion Matrix Spike Recovery, continued

The selenium results above the IDL are estimated due to a low pre-digestion matrix spike recovery. The reported concentrations should be considered minimum concentrations and higher concentrations are possible.

All arsenic and thallium results are estimated due to low pre-digestion matrix spike recoveries.

5. Duplicate Analysis

The differences between duplicate cadmium and selenium results exceeded the technical limit of the CRDL. The selenium results above the IDL and all cadmium results are estimated.

6. ICP Quality Control

All serial dilution and interference check sample results were acceptable.

7. Furnace Atomic Absorption Quality Control

FAA Analytical Spike Recovery

The following sample results are estimated because of possible physical or chemical interference in the samples and FAA analytical spike recoveries outside of the QC limits.

The arsenic results for samples SF-5823, SF-5824, SF-5825, SF-5826, SF-5827, SF-5828, SF-5829, SF-5830, SF-5831, SF-5832, SF-5839, SF-5840, SF-5842, SF-5843, SF-5850, SF-5851, SF-5852, and SF-5856.

The lead results for samples SF-5823, SF-5824, SF-5825, SF-5826, SF-5827, SF-5828, SF-5829, SF-5830, SF-5831, SF-5832, SF-5839, SF-5840, SF-5842, SF-5843, SF-5851, and SF-5856.

The selenium results for samples SF-5839, SF-5840, and SF-5843.

The thallium results for samples SF-5823, SF-5824, SF-5825, SF-5826, SF-5827, SF-5828, SF-5829, SF-5830, SF-5839, SF-5841, SF-5851, and SF-5856.

Case SAS8450F-01 SDG SF5823 Site MOLYCORP Lab SILVER

7. Furnace Atomic Absorption Quality Control, continued

Method of Standard Addition (MSA)

The selenium result for sample SF-5827 is estimated due to correlation coefficients below 0.995. Matrix interference is suspected.

8. LCS

All laboratory control sample results were acceptable.

9. Sample Verification

The dilution factor, listed under "Comments", for selenium sample SF-5828 should be X10 on Form I, page 8.

Rinsate is incorrectly spelled on page 13 for sample SF-5833.

10. Other QC

Field Duplicates

In the opinion of the data reviewer, there was no significant difference between field duplicate results.

11. Overall Assessment

The data package is provisional for the following reasons:

Most selenium sample results were unusable due to a matrix spike recovery below 30%.

All cadmium and some selenium sample results were estimated because differences between duplicate results exceeded the QC limits.

Most cadmium and lead, and all arsenic and thallium sample results were estimated because matrix spike recoveries were outside of the QC limits.

A selenium sample result was estimated because MSA correlation coefficients were below 0.995.

Eighteen arsenic, sixteen lead, three selenium, and twelve thallium FAA analytical spike recoveries were outside of the QC limits and estimated.

All other technical requirements were met.

MEMORANDUM

W. E. Blanton

To: M. Ritter

From: W. E. Blanton

Subject: SAS8450F-01 SDG SF5823 Laboratory Resubmissions

Date: August 11, 1994

Copies: M. El Feky
ICF File
File

Ref: WUD # 6-4712
MEM1089
I1461

Attached is a list of issues needing clarification and items needing corrections and omissions for SAS case SAS8450F-01 SDG SF5823. The samples in this case were analyzed by:

Name of Laboratory	Silver Analytical Inc.
Address	One Government Gulch Kellogg, ID 83837
Attention:	Melba Bencich

These laboratory resubmissions are necessary to enable the Environmental Protection Agency to maximize the usability of the laboratory results in this data package. The user for this site is K. Hill 6H-MA. The laboratory resubmissions should be submitted to:

Ms. Christy Macdowell
ManTech Environmental Technology, Inc.
c/o US EPA
10625 Fallstone Rd.
Houston, TX 77099

Ms. Macdowell will then distribute the laboratory resubmission to the appropriate data reviewer who will prepare the resubmission report for this case.

In Reference to Case
SAS No.: SAS8450F-01
SDG No.: SF5823
Laboratory: SILVER

In reference to data for the following sample numbers:

SF-5823 SF-5824 SF-5825 SF-5826 SF-5827 SF-5828 SF-5829 SF-5830
SF-5831 SF-5832 SF-5833 SF-5839 SF-5840 SF-5841 SF-5842 SF-5843
SF-5850 SF-5851 SF-5852 SF-5856

Summary of Questions/Issues:

1. The dilution factor, under "Comments", for selenium sample SF-5828 should be X10 on Form I, page 8. Please correct and resubmit the corrected page.

2. Rinsate is incorrectly spelled on page 13 for sample SF-5833. Please correct and resubmit the corrected page.

DATA SUMMARY

Case No.. SAS8450F-01 SDG No.. SF5823 Reviewer Y HOLLOWAY
Laboratory: S.L.ER Matrix WATER Units: ug/L

EP[redacted] #=>	SF-5823	FLAG	SF-5824	FLAG	SF-5825	FLAG	SF-5826	FLAG	SF-5827	FLAG	COMMENTS
LA[redacted] #=>											
ALUMINUM	127000		104000		105000		113000		120000		
ANTIMONY	28 5 U		32 1		28 5 U		28 5 U		28 5 U		
ARSENIC	1 8 J		1 1 J		1 1 J		2 1 J		1 J		
BARIUM	8 1		9 8		13 6		8 2		7 9		
BERYLLIUM	25 6		19 6		20		17 6		21 3		
CADMIUM	3 9 UJ		9 2 J		13 1 J		6 8 J		5 7 J		
CALCIUM	224000		199000		201000		216000		218000		
CHROMIUM	3 3		4		3 8		5		3 8		
COBALT	216		179		183		195		202		
COPPER	1010		741		755		1130		916		
IRON	4730		7550		7430		14600		6010		
LEAD	4 J		4 4 vJ		5 vJ		3 6 vJ		4 9 vJ		
MAGNESIUM	63000		50800		51500		55500		58100		
MANGANESE	19200		14700		14800		15900		17000		
MERCURY	0 2 U		0 2 U		0 2 U		0 2 U		0 2 U		
NICKEL	430		357		367		393		409		
POTASSIUM	2770		3290		3210		2460		3000		
SELENIUM	7 UR		7 UR		7 UR		7 UR		15 7 vJ		
SILVER	2 6 U		3 9		2 6 U		2 6 U		2 6 U		
SODIUM	26500		22200		22500		27100		25500		
THALLIUM	1 3 UCJ		1 4 UCJ		1 7 UCJ		1 1 UCJ		1 3 UCJ		
VANADIUM	3 5 U		3 5 U		3.5 U		3 5 U		3 5 U		
ZINC	4890		3790		3840		4230		4370		
MOLYBDENUM	6 9 U		6 9 U		8 6		6 9 U		6 9 UJ		
% SOLIDS	N/A		N/A		N/A		N/A		N/A		
	SP-2F		SP-3F		SP-4F		SP-5F		SP-2UF		

DATA SUMMARY

Case No. SAS8450F 01 SDG No SF5823 Reviewer Y HOLLOWAY 2JU
Laboratory S LVER Matrix WATER Units ug/L

E[illegible] #=> LAB TR #=>	SF-5828	SF-5829	SF-5830	SF-5831	SF-5832	COMMENTS
ALUMINUM	108000	105000	4000	43100	43500	
ANTIMONY	28 5 U	28 5 U	28 5 U	28 5 U	28 5 U	
ARSENIC	0 9 UJ	1 3 J	1 J	0 9 UJ	0 9 UJ	
BARIUM	12 2	13 9	3	12 3	13 5	
BERYLLIUM	20 4	19 9	7 5	13 1	13 1	
CADMIUM	12 1 J	15 2 J	3 9 UJ	17 7 J	23 J	
CALCIUM	206000	202000	2 6000	79800	79500	
CHROMIUM	3 4	3 9	3 9	2 9	2 8 U	
COBALT	185	183	94	127	125	
COPPER	775	753	40	361	363	
IRON	7860	7900	7500	47	146	
LEAD	3 8 vJ	5 1 vJ	4 4 vJ	2 1 vJ	2 5 vJ	
MAGNESIUM	53000	51900	55900	44100	44000	
MANGANESE	15200	14900	6000	19000	18900	
MERCURY	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	
NICKEL	373	364	4 2	368	353	
POTASSIUM	3000	3220	3200	1650	1980	
SELENIUM	7 UR	7 UR	7 UR	0 7 UR	0 7 UR	
SILVER	3 6	3 2	5 4	2 6 U	2 6 U	
SODIUM	23000	22300	27100	0700	10500	
THALLIUM	1 5 UCJ	1 8 UCJ	7 UCJ	2 UCJ	2 3 UCJ	
VANADIUM	3 5 U	3 5 U	3 5 U	3 5 U	3 5 U	
ZINC	3940	3880	4290	4560	4570	
MOLYBDENUM	6 9 U	6 9 U	6 9 U	6 9 U	6 9 U	
% SOLIDS	N/A	N/A	N/A	N/A	N/A	
	SP-3UF	SP4UF	SP-5UF	SP-CF	SP-[illegible]F	

DATA SUMMARY

Case No SAS8-50F-01 | COG No SF5823 | Reviewer Y HOLLOWAY
Laboratory SILVER | Matrix WATER | Units ug/L

EPA #=> / LAB #=>	SF-5833	SF-5839	SF 5840	SF 5841	SF-5842	COMMENTS
ALUMINUM	24 9	28500	3700	34 1	28800	
ANTIMONY	28 5 U	28 5 U	28 5 U	31 7	28 5 U	
ARSENIC	0 9 UJ	0 9 UJ	0 9 UJ	0 9 UJ	0 9 UJ	
BARIUM	4 9	20 1	62 5	32 3	25	
BERYLLIUM	0 02 U	5 5	3 6	0 02 U	5 5	
CADMIUM	3 9 UJ	11 1 J	3 J	3 9 UJ	15 1 J	
CALCIUM	1290	275000	206000	21200	273000	
CHROMIUM	2 8 U	2 8 U	2 3 U	2 8 U	4 6	
COBALT	4 1 U	113	4 U	4 1 U	115	
COPPER	3 U	233	22	3 U	234	
IRON	10 1	29 7	3 4	15 3	602	
LEAD	1 U	3 4 vJ	1 7 vJ	1 U	6 8 vJ	
MAGNESIUM	281	104000	80300	2850	103000	
MANGANESE	3 9	4270	6350	33 3	4250	
MERCURY	0 2 U	0 2 U	0 2 U	0 2 U	0 2 U	
NICKEL	13 3 U	412	342	13 3 U	414	
POTASSIUM	503 U	3270	3150	503 U	3360	
SELENIUM	0 7 UR	1 3 vJ	4 vJ	0 7 UR	7 UR	
SILVER	2 6 U	2 6 U	2 6 U	2 6 U	2 6 U	
SODIUM	11000	32200	22200	1900	31600	
THALLIUM	2 2 UCJ	1 9 UCJ	2 UCJ	1 9 UCJ	1 1 UCJ	
VANADIUM	3 5 U	3 5 U	3 5 U	3 5 U	3 5 U	
ZINC	2 7	1650	2470	10 1	1650	
MOLYBDENUM	6 9 U	6 9 U	6 9 U	6 9 U	6 9 U	
% SOLIDS	N/A	N/A	N/A	N/A	N/A	
	[illegible]	SP-6F	[illegible]	RR-2F	SP 6UF	

DATA SUMMARY

Case No . SAS8450F-01 SDG No SF5823 Reviewer Y HOLLOWAY
Laboratory SILVER Matrix WATER Units ug/L

EPA #=> LAB TR #=>	SF-5843	SF-5850	SF-5851	SF-5852	SF-5856	COMMENTS
ALUMINUM	17500	73 3	97600	286	86700	
ANTIMONY	28 5 U	28 5 U	28 5 U	28 5 U	28 5 U	
ARSENIC	0 9 UJ	0 9 UJ	0 9 UJ	0 9 UJ	0 9 UJ	
BARIUM	58 1	25 6	5 7	29 4	5 9	
BERYLLIUM	4 2	0 02 U	8	0 02 U	17 6	
CADMIUM	51 4 J	3 9 UJ	3 9 UJ	3 9 UJ	5 J	
CALCIUM	210000	21500	336000	21200	299000	
CHROMIUM	2 8 U	2 8 U	3 3	2 8 U	6 2	
COBALT	4 1 U	4 1 U	79	4 1 U	167	
COPPER	37 9	3 U	20	3 U	109	
IRON	59 1	40 3	7330	331	6870	
LEAD	1 4 VJ	1 U	2 9 J	1 U	3 5 J	
MAGNESIUM	37000	3520	67000	3510	59800	
MANGANESE	9450	29 4	3870	37 1	8010	
MERCURY	0 2 U	0 2	0 2 U	0 2 U	0 2 U	
[illegible]L	413	13 3 U	431	13 3 U	413	
POTASSIUM	3000	796	7080	503 U	6280	
SELENIUM	1 5 VJ	0 7 UR	7 UR	0 7 UR	7 UR	
SILVER	2 6 U	2 6 U	2 6 U	2 6 U	2 6 U	
SODIUM	22400	2210	10200	2070	8960	
THALLIUM	1 2 UCJ	0 9 UJ	0 9 UJ	1 7 UCJ	1 4 UCJ	
VANADIUM	3 5 U	3 5 U	3 5 U	3 5 U	3 5 U	
ZINC	3100	18 3	2970	10 1	2670	
MOLYBDENUM	6 9 U	6 9 U	6 9 U	6 9 U	6 9 U	
% SOLIDS	N/A	N/A	N/A	N/A	N/A	
	SP 7UF	RR-1F	SP-11F	RR-1UF	SP12F	

INORGANIC DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

P A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

+ Positive bias.

- Negative bias.

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case ___ SDG No SF5823 SDG Nos To Follow SAS No 3450F1 Date Rec 7/ 3/94

EPA Lab ID SILVER

Lab [illegible]ation KELLOGG, D

Region 5 Audit No 3450F1/SF5823

Re_Submitted CSF? Yes ___ No X

Box No(s) One

COMMENTS

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2 Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6 Present?	X		
7 Complete?	X		
8 Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10 Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18 Complete?	X		
19 Legible?	X		
20 Original?	X		
20a If "No", does the copy indicate where original documents are located?			X

Over for additional comments

Audited by Youree L. Holloway ESAT YOUREE HOLLOWAY/DATA REVIEWER Date 8/10/94

Audited by* ___ ___ Date ___

Audited by* ___ ___ Date ___

Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Data Rcvd by CEAT ___ Date Entered ___ Date Reviewed ___

Entered by ___ ___

Reviewed by ___ ___

Signature Printed Name/Title

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO
Capulin Channel seep (F)
SF5823

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5823
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

(5-2)

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	127000			P
7440-36-0	Antimony	28.5	U		P
7440-38-2	Arsenic	1.8	B	WN	F
7440-39-3	Barium	8.1	B		P
7440-41-7	Beryllium	25.6			P
7440-43-9	Cadmium	3.9	U	N*	P
7440-70-2	Calcium	224000			P
7440-47-3	Chromium	3.3	B		P
7440-48-4	Cobalt	216			P
7440-50-8	Copper	1010			P
7439-89-6	Iron	4730			P
7439-92-1	Lead	4.0	B	WN	F
7439-95-4	Magnesium	63000			P
7439-96-5	Manganese	19200			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	430			P
7440-09-7	Potassium	2770	B		P
7782-49-2	Selenium	7.0	U	N*	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	26500			P
7440-28-0	Thallium	1.3	B	WN	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	4890			P
	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____
Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:
SE = 10X DILUTION

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Capulin Seep @ RR (F)

SF5824

Lab Name: SVL ANALYTICAL INC. Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823

Matrix (soil/water): WATER Lab Sample ID: SF5824

Level (low/med): LOW Date Received: 06/28/94

% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	104000			P
7440-36-0	Antimony	32.1	B		P
7440-38-2	Arsenic	1.1	B	WN	F
7440-39-3	Barium	9.8	B		P
7440-41-7	Beryllium	19.6			P
7440-43-9	Cadmium	9.2		N*	P
7440-70-2	Calcium	199000			P
7440-47-3	Chromium	4.0	B		P
7440-48-4	Cobalt	179			P
7440-50-8	Copper	741			P
7439-89-6	Iron	7550			P
7439-92-1	Lead	4.4	B	WN	F
7439-95-4	Magnesium	50800			P
7439-96-5	Manganese	14700			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	357			P
7440-09-7	Potassium	3290	B		P
7782-49-2	Selenium	7.0	U	N*	F
7440-22-4	Silver	3.9	B		P
7440-23-5	Sodium	22200			P
7440-28-0	Thallium	1.4	B	WN	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	3790			P
	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture:

Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:

SE = 10X DILUTION

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Capulin seep @ RR (dup) F

SF5825

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5825
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

5-3

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	105000			P
7440-36-0	Antimony	28.5	U		P
7440-38-2	Arsenic	1.1	B	WN	F
7440-39-3	Barium	13.6	B		P
7440-41-7	Beryllium	20.0			P
7440-43-9	Cadmium	13.1		N*	P
7440-70-2	Calcium	201000			P
7440-47-3	Chromium	3.8	B		P
7440-48-4	Cobalt	183			P
7440-50-8	Copper	755			P
7439-89-6	Iron	7430			P
7439-92-1	Lead	5.0	B	WN	F
7439-95-4	Magnesium	51500			P
7439-96-5	Manganese	14800			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	367			P
7440-09-7	Potassium	3210	B		P
7782-49-2	Selenium	7.0	U	N*	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	22500			P
7440-28-0	Thallium	1.7	B	WN	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	3840			P
	Molybdenu	8.6	B		P

MAP 07/11/94

Color Before: COLORLESS Clarity Before CLEAR Texture: _____
Color After: COLORLESS Clarity After CLEAR Artifacts: _____

Comments:
SE_=_10X_DILUTION

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Seep abv Cap Cyn

SF5826

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823

Matrix (soil/water): WATER Lab Sample ID: SF5826

Level (low/med): LOW__ Date Received: 06/28/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	113000			P
7440-36-0	Antimony	28.5	U		P
7440-38-2	Arsenic	2.1	B	WN	F
7440-39-3	Barium	8.2	B		P
7440-41-7	Beryllium	17.6			P
7440-43-9	Cadmium	6.8		N*	P
7440-70-2	Calcium	216000			P
7440-47-3	Chromium	5.0	B		P
7440-48-4	Cobalt	195			P
7440-50-8	Copper	1130			P
7439-89-6	Iron	14600			P
7439-92-1	Lead	3.6	B	WN	F
7439-95-4	Magnesium	55500			P
7439-96-5	Manganese	15900			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	393			P
7440-09-7	Potassium	2460	B		P
7782-49-2	Selenium	7.0	U	N*	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	27100			P
7440-28-0	Thallium	1.1	B	WN	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	4230			P
	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____

Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:

SE_=_10X_DILUTION

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Caplin Channel seep
SF5827

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5827
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	120000			P
7440-36-0	Antimony	28.5	U		P
7440-38-2	Arsenic	1.0	B	WN	F
7440-39-3	Barium	7.9	B		P
7440-41-7	Beryllium	21.3			P
7440-43-9	Cadmium	5.7		N*	P
7440-70-2	Calcium	218000			P
7440-47-3	Chromium	3.8	B		P
7440-48-4	Cobalt	202			P
7440-50-8	Copper	916			P
7439-89-6	Iron	6010			P
7439-92-1	Lead	4.9	B	WN	F
7439-95-4	Magnesium	58100			P
7439-96-5	Manganese	17000			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	409			P
7440-09-7	Potassium	3000	B		P
7782-49-2	Selenium	15.7		+N*	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	25500			P
7440-28-0	Thallium	1.3	B	WN	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	4370			P
	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____
Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Caput'n seep @ RR

SF5828

UF

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823

Matrix (soil/water): WATER Lab Sample ID: SF5828

Level (low/med): LOW__ Date Received: 06/28/94

% Solids: __0.0

S-3

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	108000	_		P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic__	0.90	U	WN	F_
7440-39-3	Barium___	12.2	B		P_
7440-41-7	Beryllium	20.4	_		P_
7440-43-9	Cadmium__	12.1	_	N*	P_
7440-70-2	Calcium__	206000	_		P_
7440-47-3	Chromium_	3.4	B		P_
7440-48-4	Cobalt___	185	_		P_
7440-50-8	Copper___	775	_		P_
7439-89-6	Iron_____	7860	_		P_
7439-92-1	Lead_____	3.8	B	WN	F_
7439-95-4	Magnesium	53000	_		P_
7439-96-5	Manganese	15200	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	373	_		P_
7440-09-7	Potassium	3000	B		P_
7782-49-2	Selenium_	7.0	U	N*	F_
7440-22-4	Silver___	3.6	B		P_
7440-23-5	Sodium___	23000	_		P_
7440-28-0	Thallium_	1.5	B	WN	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc_____	3940	_		P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

SE_=_110X_DILUTION_____

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

SF5829

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5829
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	105000			P
7440-36-0	Antimony_	28.5	U		P
7440-38-2	Arsenic__	1.3	B	WN	F
7440-39-3	Barium___	13.9	B		P
7440-41-7	Beryllium	19.9			P
7440-43-9	Cadmium__	15.2		N*	P
7440-70-2	Calcium__	202000			P
7440-47-3	Chromium_	3.9	B		P
7440-48-4	Cobalt___	183			P
7440-50-8	Copper___	753			P
7439-89-6	Iron_____	7900			P
7439-92-1	Lead_____	5.1		WN	F
7439-95-4	Magnesium	51900			P
7439-96-5	Manganese	14900			P
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	364			P
7440-09-7	Potassium	3220	B		P
7782-49-2	Selenium_	7.0	U	N*	F
7440-22-4	Silver___	3.2	B		P
7440-23-5	Sodium___	22300			P
7440-28-0	Thallium_	1.8	B	WN	F
7440-62-2	Vanadium_	3.5	U		P
7440-66-6	Zinc_____	3880			P
_____	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts. _____

Comments:
SE_=_10X_DILUTION

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Seep abv Cayuga Cyn UF
SF5830

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5830
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

S-4

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	114000			P
7440-36-0	Antimony_	28.5	U		P
7440-38-2	Arsenic__	1.0	B	WN	F
7440-39-3	Barium___	8.1	B		P
7440-41-7	Beryllium	17.6			P
7440-43-9	Cadmium__	3.9	U	N*	P
7440-70-2	Calcium__	216000			P
7440-47-3	Chromium_	3.9	B		P
7440-48-4	Cobalt___	194			P
7440-50-8	Copper___	1140			P
7439-89-6	Iron_____	17500			P
7439-92-1	Lead_____	4.4	B	WN	F
7439-95-4	Magnesium	55900			P
7439-96-5	Manganese	16000			P
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	412			P
7440-09-7	Potassium	3200	B		P
7782-49-2	Selenium_	7.0	U	N*	F
7440-22-4	Silver___	5.4	B		P
7440-23-5	Sodium___	27100			P
7440-28-0	Thallium_	1.7	B	WN	F
7440-62-2	Vanadium_	3.5	U		P
7440-66-6	Zinc_____	4290			P
_____	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:
SE_=_10X_DILUTION_____

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

SF5831

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823

Matrix (soil/water): WATER Lab Sample ID: SF5831

Level (low/med): LOW__ Date Received: 06/28/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	43100	_		P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic__	0.90	U	WN	F_
7440-39-3	Barium___	12.8	B		P_
7440-41-7	Beryllium	13.1	_		P_
7440-43-9	Cadmium__	17.7	_	N*	P_
7440-70-2	Calcium__	79800	_		P_
7440-47-3	Chromium_	2.9	B		P_
7440-48-4	Cobalt___	127	_		P_
7440-50-8	Copper___	361	_		P_
7439-89-6	Iron_____	47.0	B		P_
7439-92-1	Lead_____	2.1	B	WN	F_
7439-95-4	Magnesium	44100	_		P_
7439-96-5	Manganese	19000	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	368	_		P_
7440-09-7	Potassium	1650	B		P_
7782-49-2	Selenium_	0.70	U	N*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	10700	_		P_
7440-28-0	Thallium_	2.0	B	N	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc_____	4560	_		P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
CL-SS seep @ RB
SF5832
UF

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5832
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	43500			P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic__	0.90	U	WN	F_
7440-39-3	Barium___	13.5	B		P_
7440-41-7	Beryllium	13.1			P_
7440-43-9	Cadmium__	23.0		N*	P_
7440-70-2	Calcium__	79500			P_
7440-47-3	Chromium_	2.8	U		P_
7440-48-4	Cobalt___	125			P_
7440-50-8	Copper___	363			P_
7439-89-6	Iron_____	146			P_
7439-92-1	Lead_____	2.5	B	WN	F_
7439-95-4	Magnesium	44000			P_
7439-96-5	Manganese	18900			P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	353			P_
7440-09-7	Potassium	1980	B		P_
7782-49-2	Selenium_	0.70	U	WN*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	10500			P_
7440-28-0	Thallium_	2.3	B	N	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc_____	4570			P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Equip Blank
SF5833

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5833
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	24.9	B		P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic__	0.90	U	N	F_
7440-39-3	Barium___	4.9	B		P_
7440-41-7	Beryllium	0.02	U		P_
7440-43-9	Cadmium__	3.9	U	N*	P_
7440-70-2	Calcium__	1290	B		P_
7440-47-3	Chromium_	2.8	U		P_
7440-48-4	Cobalt___	4.1	U		P_
7440-50-8	Copper___	3.0	U		P_
7439-89-6	Iron____	10.1	B		P_
7439-92-1	Lead____	1.0	U	N	F_
7439-95-4	Magnesium	281	B		P_
7439-96-5	Manganese	3.9	B		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	13.3	U		P_
7440-09-7	Potassium	503	U		P_
7782-49-2	Selenium_	0.70	U	N*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	11000			P_
7440-28-0	Thallium_	2.2	B	N	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc____	2.7	B		P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:
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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Goathill seep @ ER
SF5839 (F)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5839
Level (low/med): LOW__ Date Received: 06/28/94 (5-5)
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	28500			P
7440-36-0	Antimony	28.5	U		P
7440-38-2	Arsenic	0.90	U	WN	F
7440-39-3	Barium	20.1	B		P
7440-41-7	Beryllium	5.5			P
7440-43-9	Cadmium	11.1		N*	P
7440-70-2	Calcium	275000			P
7440-47-3	Chromium	2.8	U		P
7440-48-4	Cobalt	113			P
7440-50-8	Copper	233			P
7439-89-6	Iron	29.7	B		P
7439-92-1	Lead	3.4	B	WN	F
7439-95-4	Magnesium	104000			P
7439-96-5	Manganese	4270			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	412			P
7440-09-7	Potassium	3270	B		P
7782-49-2	Selenium	1.3	B	WN*	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	32200			P
7440-28-0	Thallium	1.9	B	WN	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	1650			P
	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____
Color After: COLORLESS Clarity After: CLEAR Artifacts _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Adit seep -(F

SF5840

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823

Matrix (soil/water): WATER Lab Sample ID: SF5840

Level (low/med): LOW__ Date Received: 06/28/94

% Solids: __0.0

(S-7)

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	13700			P
7440-36-0	Antimony	28.5	U		P
7440-38-2	Arsenic	0.90	U	WN	F
7440-39-3	Barium	62.5	B		P
7440-41-7	Beryllium	3.6	B		P
7440-43-9	Cadmium	13.0		N*	P
7440-70-2	Calcium	206000			P
7440-47-3	Chromium	2.8	U		P
7440-48-4	Cobalt	4.1	U		P
7440-50-8	Copper	22.0	B		P
7439-89-6	Iron	18.4	B		P
7439-92-1	Lead	1.7	B	WN	F
7439-95-4	Magnesium	80300			P
7439-96-5	Manganese	6350			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	342			P
7440-09-7	Potassium	3150	B		P
7782-49-2	Selenium	1.4	B	WN*	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	22200			P
7440-28-0	Thallium	2.0	B	N	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	2470			P
	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
RE blw Columbine
SF5841 (5)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5841
Level (low/med): LOW__ Date Received: 06/28/94 (9)
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	84.1	B		P_
7440-36-0	Antimony_	31.7	B		P_
7440-38-2	Arsenic__	0.90	U	N	F_
7440-39-3	Barium___	32.3	B		P_
7440-41-7	Beryllium	0.02	U		P_
7440-43-9	Cadmium__	3.9	U	N*	P_
7440-70-2	Calcium__	21200			P_
7440-47-3	Chromium_	2.8	U		P_
7440-48-4	Cobalt___	4.1	U		P_
7440-50-8	Copper___	3.0	U		P_
7439-89-6	Iron____	15.3	B		P_
7439-92-1	Lead____	1.0	U	N	F_
7439-95-4	Magnesium	2850	B		P_
7439-96-5	Manganese	33.3			P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	13.3	U		P_
7440-09-7	Potassium	503	U		P_
7782-49-2	Selenium_	0.70	U	N*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	1900	B		P_
7440-28-0	Thallium_	1.9	B	WN	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc____	10.1	B		P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Goathill Seep - UF
SF5842

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5842
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	28800	_		P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic__	0.90	U	WN	F_
7440-39-3	Barium___	25.0	B		P_
7440-41-7	Beryllium	5.5	_		P_
7440-43-9	Cadmium__	15.1	_	N*	P_
7440-70-2	Calcium__	273000	_		P_
7440-47-3	Chromium_	4.6	B		P_
7440-48-4	Cobalt___	115	_		P_
7440-50-8	Copper___	234	_		P_
7439-89-6	Iron_____	602	_		P_
7439-92-1	Lead_____	6.8	_	WN	F_
7439-95-4	Magnesium	103000	_		P_
7439-96-5	Manganese	4250	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	414	_		P_
7440-09-7	Potassium	3360	B		P_
7782-49-2	Selenium_	7.0	U	N*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	31600	_		P_
7440-28-0	Thallium_	1.1	B	N	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc_____	1650	_		P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Adit seep — UF
SF5843

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5843
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	17500	_		P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic__	0.90	U	WN	F_
7440-39-3	Barium___	58.1	B		P_
7440-41-7	Beryllium	4.2	B		P_
7440-43-9	Cadmium__	51.4	_	N*	P_
7440-70-2	Calcium__	210000	_		P_
7440-47-3	Chromium_	2.8	U		P_
7440-48-4	Cobalt___	4.1	U		P_
7440-50-8	Copper___	37.9	_		P_
7439-89-6	Iron_____	59.1	B		P_
7439-92-1	Lead_____	1.4	B	WN	F_
7439-95-4	Magnesium	87000	_		P_
7439-96-5	Manganese	9450	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	413	_		P_
7440-09-7	Potassium	3000	B		P_
7782-49-2	Selenium_	1.5	B	WN*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	22400	_		P_
7440-28-0	Thallium_	1.2	B	N	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc_____	3100	_		P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts _____

Comments:

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U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

RR abv Hanson Crk

SF5850

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823

Matrix (soil/water): WATER Lab Sample ID: SF5850

Level (low/med): LOW__ Date Received: 06/28/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	73.3	B		P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic__	0.90	U	WN	F_
7440-39-3	Barium___	25.6	B		P_
7440-41-7	Beryllium	0.02	U		P_
7440-43-9	Cadmium__	3.9	U	N*	P_
7440-70-2	Calcium__	21500			P_
7440-47-3	Chromium_	2.8	U		P_
7440-48-4	Cobalt___	4.1	U		P_
7440-50-8	Copper___	3.0	U		P_
7439-89-6	Iron_____	40.3	B		P_
7439-92-1	Lead_____	1.0	U	WN	F_
7439-95-4	Magnesium	3520	B		P_
7439-96-5	Manganese	29.4			P_
7439-97-6	Mercury__	0.20			CV
7440-02-0	Nickel___	13.3	U		P_
7440-09-7	Potassium	796	B		P_
7782-49-2	Selenium_	0.70	U	N*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	2210	B		P_
7440-28-0	Thallium_	0.90	U	N	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc_____	18.3	B		P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Hanson Crk @ Hwy 3
SF5851

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5851
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	97600			P
7440-36-0	Antimony	28.5	U		P
7440-38-2	Arsenic	0.90	U	WN	F
7440-39-3	Barium	5.7	B		P
7440-41-7	Beryllium	18.0			P
7440-43-9	Cadmium	3.9	U	N*	P
7440-70-2	Calcium	336000			P
7440-47-3	Chromium	3.3	B		P
7440-48-4	Cobalt	179			P
7440-50-8	Copper	120			P
7439-89-6	Iron	7330			P
7439-92-1	Lead	2.9	B	WN	F
7439-95-4	Magnesium	67000			P
7439-96-5	Manganese	8870			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	431			P
7440-09-7	Potassium	7080			P
7782-49-2	Selenium	7.0	U	N*	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	10200			P
7440-28-0	Thallium	0.90	U	WN	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	2970			P
	Molybdenu	6.9	U		P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:
SE_=_10X_DILUTION

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
RR [illegible] Hanson Crk
SF5852

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5852
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

(18)

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	286			P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic__	0.90	U	WN	F_
7440-39-3	Barium___	29.4	B		P_
7440-41-7	Beryllium	0.02	U		P_
7440-43-9	Cadmium__	3.9	U	N*	P_
7440-70-2	Calcium__	21200			P_
7440-47-3	Chromium_	2.8	U		P_
7440-48-4	Cobalt___	4.1	U		P_
7440-50-8	Copper___	3.0	U		P_
7439-89-6	Iron_____	331			P_
7439-92-1	Lead_____	1.0	U	N	F_
7439-95-4	Magnesium	3510	B		P_
7439-96-5	Manganese	37.1			P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	13.3	U		P_
7440-09-7	Potassium	503	U		P_
7782-49-2	Selenium_	0.70	U	N*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	2070	B		P_
7440-28-0	Thallium_	1.7	B	N	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc_____	10.1	B		P_
	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Hanson Scar - (5)
SF5856

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450-F SDG No.: SF5823
Matrix (soil/water): WATER Lab Sample ID: SF5856
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

(5-11)

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	86700	_		P_
7440-36-0	Antimony_	28.5	U		P_
7440-38-2	Arsenic_	0.90	U	WN	F_
7440-39-3	Barium___	5.9	B		P_
7440-41-7	Beryllium	17.6	_		P_
7440-43-9	Cadmium__	5.0	B	N*	P_
7440-70-2	Calcium__	299000	_		P_
7440-47-3	Chromium_	6.2	B		P_
7440-48-4	Cobalt___	167	_		P_
7440-50-8	Copper___	109	_		P_
7439-89-6	Iron____	6870	_		P_
7439-92-1	Lead____	3.5	B	WN	F_
7439-95-4	Magnesium	59800	_		P_
7439-96-5	Manganese	8010	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	413	_		P_
7440-09-7	Potassium	6280	_		P_
7782-49-2	Selenium_	7.0	U	N*	F_
7440-22-4	Silver___	2.6	U		P_
7440-23-5	Sodium___	8960	_		P_
7440-28-0	Thallium_	1.4	B	WN	F_
7440-62-2	Vanadium_	3.5	U		P_
7440-66-6	Zinc____	2670	_		P_
_____	Molybdenu	6.9	U		P_

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:
SE_=_10X_DILUTION`_____

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: 8-16-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: 22394/SAS7943Q-02

SDG#: SF-5813

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable

USEPA REGION VI

REGIONAL ACCEPTANCE FORM
FOR SPECIAL ANALYTICAL SERVICES

Lab Code: PBSJ SAS No : 07943Q-01 Case No.. 22394 SDG No : 3F5813 Data Receipt Date: 07/14/94
Site Name: MOLY CORP QUESTA MINE Est. Liquidated Damages: $96.00
SMO Complete Date: 07/15/94

Please provide a copy of this completed form to the Sample Management Office's SAS IPS Section Leader no later than 08/29/94 Indicate below, by checking the appropriate box, whether the data for this SDG are accepted or of reduced value or rejected. If the Region is requesting a reduced value or a rejection, please attach all appropriate documentation.

Check appropriate box below.

DATA ACCEPTANCE

[X] Data appear acceptable (i.e. data that is not rejected or recommended for reduced value) according to the Region's inspection process. Applicable liquidated damages as outlined in the laboratory's subcontract are applied as approrpiate.

I REDUCED VALUE

[ ] Data are recommended for a reduced value. The Region recommends that the value of the data package be reduced by __% Attached are a signed memo from the Regional official describing the contractual reasons for reduced value and all related documents (data review, telephone logs, etc).

II REJECTION

[ ] Data are recommended for rejection Attached are a signed memo from the Regional Official describing the contractual reasons for rejection, all related documents (data review, telephone logs, etc), and all rejected data.

COMMENTS

Name of data reviewer [illegible]
Organization: [illegible]
Date review complete: [illegible]

Post-it Fax Note 7671	Date 8/16/94 # of pages ▶ 3
To M. EL-FEKY	From L. KARL
Co./Dept REG VI	Co DYNCORP V.AR
Phone #	Phone #
Fax #	Fax #

Name of Regional Official: [illegible] EL-FEKY

Signature: [illegible] Date: 8-16-94

MANTECH ENVIRONMENTAL TECHNOLOGY, INC.
ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

MEMORANDUM

Date August 15, 1994

To: Melvin Ritter, ESAT RPO, Region VI

From: Bill Blanton, ESAT ETM, Region VI

Subject: CLP Data Review

WUD #: 6-4717

Attached is the data review summary for Case# 22394/SAS7943Q-02
SDG # SF5813
Site MOLY CORP

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

Contractual problems identified in this review are listed below.

1. The following contractual violation was present in the hardcopy data:

   The laboratory did not perform analytical spikes for alkalinity, chloride, nitrate + nitrite, TOC, total phosphorus, and sulfate (WQP 6/93, 8.1, page E-22). No data was qualified.

2. The CCS report was not available at the time of the hardcopy data review.

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

The data package is technically provisional. The significant technical problem is summarized below.

1. The difference between TSS field duplicate results was significant.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO 22394/SAS7943Q-02
LABORATORY PBSJ
CONTRACT # SAS7943Q
SDG # SF5813
SOW # WQP 6/93
ACCT # 4TFAJNG7 SF # TFAUZZ

SITE MOLY CORP
NO OF SAMPLES/
MATRIX 16/WATER
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Mervin Doucet
COMPLETION DATE 8/15/94

SAMPLE NO SF-5813, SF-5814, SF-5815, SF-5834, SF-5835, SF-5836, SF-5837, SF-5838, SF-5846, SF-5847, SF-5848, SF-5849, SF-5854, SF-5855, SF-5858, SF-5863

DATA ASSESSMENT SUMMARY

	ALK	NH3	TOC	COD	CL	NOX	PO4	TDS	TSS	SO4
1. HOLDING TIMES	O	O	O	O	O	O	O	O	O	O
2. CALIBRATIONS	O	O	O	O	O	O	O			O
3. CRDL	O	O	O	O	O	O	O			O
4. BLANKS	O	O	O	O	O	O	O	O	O	O
5. MATRIX SPIKE	O	O	O	O	O	O	O			O
6. ANALYTICAL SPIKE	O	O	O	O	O	O	O			O
7 DUPLICATE ANALYSIS	O	O	O	O	O	O	O	O	O	O
8. LCS	O	O	O	O	O	O	O	O	O	O
9. SAMPLE VERIFICATION	X	X	X	O	O	X	X	O	O	X
10. OTHER QC	O	O	O	O	O	O	O	O	X	O
11 OVERALL ASSESSMENT	X	X	X	O	O	X	X	O	X	X

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems
Z = Data unacceptable
X = Problems, but do not affect data.
N/A = Not applicable

ACTION ITEMS: The laboratory did not perform analytical spikes for alkalinity, chloride, combined nitrate/nitrite, TOC, total phosphorus, and sulfate.

AREAS OF CONCERN: A difference between field duplicate results was significant.

NOTABLE PERFORMANCE:

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22394/SAS7943Q02 SDG SF5813 Site MOLY CORP Lab PBSJ

COMMENTS: Sixteen water samples were analyzed at low concentrations for water quality parameters by WQP 6/93 According to the Packing List/Chain of Custody, sample SF-5834 was specified as the QC sample, and samples SF-5836 and SF-5837 were identified as field duplicates Sample SF-5849 was identified as a field blank. Analytical spikes were not performed for alkalinity, chloride, combined nitrate/nitrite, TOC, total phosphorus, and sulfate The data package was one day late for the required 14-day turnaround time

The data package is provisional due to a problem with field duplicates The effect of this deficiency on the sample results is discussed below All other QC requirements were met.

An Evidence Audit was conducted for the Complete Sample Delivery File CSF), and the Evidence Inventory Checklist is attached to this report

1. Holding Times

All holding times were acceptable

2. Calibrations

All calibrations were acceptable

3. CRDL

The contract required detection limit (CRDL) results met QC criteria

4. Blanks

The sampler identified sample SF-5849 as a field blank. The following results were qualified due to field blank concentrations above the CRDL The effects of the field blank concentrations are listed in the Data Summary Table.

Alkalinity results for samples SF-5847, SF-5848, SF-5854, and SF-5863 are undetected

TDS results for samples SF-5848 and SF-5854 are undetected, and sample SF-5863 is high-biased.

TSS results for samples SF-5834, SF-5835, SF-5836, SF-5837, SF-5838, SF-5846, SF-5847, SF-5848, SF-5854, SF-5855, SF-5858, and SF-5863 are undetected

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22394/SAS7943Q02 SDG SF5813 Site MOLY CORP Lab PBSJ

4. Blanks, continued

Combined nitrate/nitrite results for samples SF-5813, SF-5814, SF-5815, SF-5848, SF-5854, and SF-5863 are undetected, and sample SF-5846 is high-biased.

TOC results for samples SF-5815, SF-5834, SF-5835, SF-5836, SF-5837, SF-5838, SF-5846, SF-5847, SF-5848, SF-5854, SF-5855, SF-5858, and SF-5863 are undetected.

Total phosphorus results for samples SF-5813, SF-5814, SF-5815, SF-5834, SF-5835, SF-5837, SF-5838, SF-5846, SF-5847, SF-5848, SF-5854, SF-5855, and SF-5858 are undetected

5. Matrix Spike

All matrix spike recoveries met QC criteria

6. Analytical Spike

The laboratory did not perform analytical spikes for alkalinity, chloride, combined nitrate/nitrite, TOC, total phosphorus, and sulfate The reviewer did not qualify results because the matrix spike results for these parameters met QC criteria

7. Duplicate Analysis

Laboratory duplicate results met QC criteria

8. LCS

Laboratory control sample results were acceptable.

9. Sample Verification

The reviewer noted the following problems

The laboratory did not submit the Telephone Communications Logs (pages 217 & 218) as reported on Form DC-2

The laboratory reported one extra TDS laboratory control sample on Form 6A

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22394/SAS7943Q02 SDG SF5813 Site MOLY CORP Lab PBSJ

9. Sample Verification, continued

On Form 4A, the relative percent difference for the ammonia duplicate results analyzed on 7/8/94 should be 7.4%, not <1%.

The true values for ammonia ICV/CCVS should be 600 ug/L for ICV and 500 ug/L for CCV.

The TOC and ammonia matrix spike recoveries were incorrectly calculated on Form 5A.

The ammonia result for sample SF-5834 is illegible in the raw data.

The date for the ammonia ICB/CCBs analyzed on 7/8/94 was incorrectly reported on Form 3A.

On Form 5A, the ammonia and sulfate spike results were reported in the spike added column and the spike added values were reported in the spike result column.

The last combined nitrate/nitrite CCV should be 38,000 ug/L, not 39,000 ug/L.

The final total phosphorus CRDL standard result should be 90 ug/L, not 900 ug/L.

The laboratory incorrectly reported the sulfate sample, duplicate, and matrix spike results on Forms 4A and 5A.

10. Other QC

Field Duplicate

The sampler identified samples SF-5836 and SF-5837 as field duplicates. All TSS results are estimated because the difference between field duplicate results was significant.

11. Overall Assessment

The data package is provisional for the following reason.

All TSS results were estimated because the difference between field duplicate results was significant.

MEMORANDUM

W E Blanton

To: M. Ritter
From: W. E. Blanton

Subject: 22394/SAS7943Q-02
SDG SF5813
Laboratory Resubmissions
Date: August 15, 1994

Copies: M. El Feky
ICF File
File
Ref: MEM1092
WUD No. 6-4717
I-1462

Attached is a resubmission request of issues needing clarification for SAS case 22394/SAS7943Q-02 SDG SF5813. The EPA user is K. Hill, 6H-MA. The samples in this case were analyzed by:

PBS & J ENVIRONMENTAL LABS
6635 EAST COLONIAL DRIVE
ORLANDO, FL 32807

Attention: BRIAN BRIGHT

The laboratory resubmissions should be submitted to:

Ms. Christy Macdowell
ManTech Environmental Technology, Inc.
c/o US EPA
10625 Fallstone Rd.
Houston, TX 77099

Ms. Macdowell will then distribute the laboratory resubmission to the appropriate data reviewer who will prepare the resubmission report for this case.

In Reference to Case
SAS No.: SAS7943Q-02
Case: 22394
SDG No.: SF5813
Laboratory: PBSJ

In reference to data for the following sample numbers:

SF-5813, SF-5814, SF-5815, SF-5834, SF-5835, SF-5836, SF-5837, SF-5838, SF-5846, SF-5847, SF-5848, SF-5849, SF-5854, SF-5855, SF-5858, SF-5863

Summary of Questions/Issues Discussed:

1. Analytical spikes were not performed for alkalinity, chloride, combined nitrate/nitrite, TOC, total phosphorus, and sulfate (WQP 6/93, 8.1, page E-22). There were samples containing measurable amounts of analytes for each of these parameters to perform analytical spike analyses. Please explain this contract deviation.

2. One extra TDS laboratory control sample was reported on Form 6A. Please correct Form 6A and resubmit.

3. On Form 4A, the relative percent difference for the ammonia duplicate results analyzed on 7/8/94 should be 7.4%, not <1%. Please correct Form 4A and resubmit.

4. On Form 2A, the true values for ammonia ICV/CCVS should be 600 ug/L for ICV and 500 ug/L for CCV. Please correct Form 2A and resubmit.

5. On Form 5A, the matrix spike recovery for ammonia should be 96%, not 95%. Please correct Form 5A and resubmit.

6. On Form 5A, the ammonia and sulfate spike results were reported in the spike added column and the spike added values were reported in the spike result column. Please report these results in the correct columns and resubmit Form 5A.

7. On Form 5A, the matrix spike recovery for ammonia (analyzed 7/8/94) should be 91.4%, not 94%. Please correct Form 5A and resubmit.

8. On Form 5A, the matrix spike recovery for TOC should be 109%, not 125%. Please correct Form 5A and resubmit.

In Reference to Case
SAS No.: SAS7943Q-02
Case: 22394
SDG No.: SF5813
Laboratory: PBSJ

9. The ammonia result for sample SF-5834 is illegible in the raw data (page 99). Please resubmit a copy of the raw data that includes sample SF-5834.

10. On Form 3A (page 23), the analysis date for the ammonia ICB/CCBs should be 7/8/94, not 78/94. Please correct Form 3A and resubmit.

11. On Form 2A (page 17), the last combined nitrate/nitrite CCV should be 38,000 ug/L, not 39,000 ug/L. Please correct Form 2A and resubmit.

12. On Form 7A (page 19), the final phosphorus CRDL standard result should be 90 ug/L, not 900 ug/L. Please correct and resubmit Form 7A.

13. The Telephone Communication Logs (pages 217 & 218) are listed on Form DC-2, but not included in the data package. Please submit these pages.

14. The sulfate sample, duplicate, and matrix spike results were incorrectly reported on Forms 4A and 5A Please correct and resubmit Forms 4A and 5A.

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

Positive bias.

Negative bias.

DATA SUMMARY

Case No 22394/SAS7943Q-02 SDG No SF5813 Reviewer M DOUCET
Laboratory PBSJ Matrix WATER Units UG/L

EPA #=> / LAB	SF-5813	FLAG	SF-5814	FLAG	SF-5815	FLAG	SF-5834	FLAG	SF-5835	FLAG	COMMENTS
ALK	2000	U	2000	U	2000	U	2000	U	2000	U	
COD	10000	U	10000	U	10000	U	5000	U	5000	U	
TDS	19300000		18800000		6660000		2248000		1010000		
TSS	353000	J	320000	J	110000	J	26000	UCJ	15000	UCJ	
NH3	1000	U	1000	U	1000	U	1000	U	1000	U	
CL	12800		17600		5590		29200		9990		
NOX	270	UC	370	UC	340	UC	100	U	100	U	
TOC	13700		15500		2950	UC	1810	UC	2560	UC	
TP	280	UC	180	UC	140	UC	210	UC	170	UC	
SO4	14490000		13807000		3981000		1298000		551000		
	SP-9		SP-10		SP-8		SP-2		SP-0		

DATA SUMMARY

Case No 22394/SAS7943Q-02 SDG No SF5813 Reviewer M DOUCET
Laboratory PBSJ Matrix WATER Units UG/L

EPA SR #=>		FLAG		FLAG		FLAG		FLAG		FLAG	COMMENTS
LAB ID	SF-5836		SF-5837		SF-5838		SF-5846		SF-5847		
ALK	2000	U	2000	U	2000	U	2000	U	3200	UC	
COD	5000	U	5000	U	5000	U	5000	U	5000	U	
TDS	2100000		2140000		2230000		1940000		1410000		
TSS	14000	UCJ	26000	UCJ	22000	UCJ	10000	UCJ	20000	UCJ	
NH3	1000	U	1000	U	1000	U	1000	U	1000	U	
CL	25800		26000		29800		25600		20700		
NOX	100	U	100	U	100	U	1900	J^	2960		
TOC	2230	UC	1890	UC	1250	UC	3200	UC	3060	UC	
TP	210	UC	180	UC	110	UC	130	UC	400	UC	
SO4	1190000		1383000		1517000		1222000		837000		
	SP-3		SP-4		SP-5		SP-6		SP-7		

DATA SUMMARY

Case No 22394/SAS7943Q-02 SDG No SF5813 Reviewer: M DOUCET
Laboratory: PBSJ Matrix WATER Units UG/L

EPA #=>		FLAG		FLAG		FLAG		FLAG		FLAG	COMMENTS
LAB ID	SF-5848		SF-5849		SF-5854		SF-5855		SF-5858		
ALK	63300	UC	31700		57000	UC	2000	U	2000	U	
COD	5000	U	5000	U	5000	U	5000	U	5000	U	
TDS	92000	UC	26000		102000	UC	2670000		2450000		
TSS	12000	UCJ	12000	J	10000	UCJ	34000	UCJ	30000	UCJ	
NH3	1000	U	1000	U	1000	U	1000	U	1000	U	
CL	2000	U	2000	U	2000	U	2000	U	2000	U	
NOX	100	UC	340		150	UC	100	U	100	U	
TOC	2550	UC	1910		2650	UC	1000	U	1000	U	
TP	140	UC	160		240	UC	110	UC	110	UC	
SO4	12600		2000	U	21000		1871000		1620000		
	RB-2		FBL		RB-1		SP-11		SP-12		

DATA SUMMARY

Case No 22394/SAS7943Q-02 SDG No SF5813 Reviewer M DOUCET
Laboratory PBSJ Matrix WATER Units UG/L

EPA #=>	SF-5863	FLAG	FLAG	FLAG	FLAG	FLAG	COMMENTS
LAB ID							
ALK	45400 UC						
COD	5000 U						
TDS	156000 J^						
TSS	14000 UCJ						
NH3	1000 U						
CL	2000 U						
NOX	160 UC						
TOC	2700 UC						
TP	100 U						
SO4	53700						

RR-3

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case 22394 SDG No SF5813 SDG Nos To Follow SAS No 7943002 Date Rec 7/14/94

EPA ID PBSJ

Lab Location: ORLANDO, FL

Region: 6 Audit No 22394/SF5813

Re_Submitted CSF? Yes _____ No X

Box No(s): 1

COMMENTS.

5 The Telephone Communication Logs (pages 217 & 218) are listed on Form DC-2, but not included in the data package

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2 Intact upon receipt?	X		
FORM DC 2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?		X	
FORM DC 1			
6 Present?	X		
7 Complete?	X		
8 Accurate?	X		
CHAIN OF-CUSTODY RECORD(s)			
9 Signed?	X		
10 Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18 Complete?	X		
19 Legible?	X		
20 Original?		X	
20a If "No", does the copy indicate where original documents are located?	X		

Over for additional comments

Audited by: David Spencer ESAT DAVID SPENCER/SCIENTIST ASSOC Date 7/19/94

Audited by: _____ _____ Date _____

Audited by: _____ _____ Date _____

Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: _____ Date Entered: _____ Date Reviewed. _____

Entered by: _____ _____

Reviewed by: _____ _____

WATER QUALITY PARAMETERS
COMPLETE SDG FILE (CSF)
INVENTORY SHEET

Lab Name PBS&J Environmental Labs City/State Orlando FL

Case No 22394 SDG No SF5813 SDG Nos to Follow ____ ____ ____

SAS No 7943 Contract N PBSJ-0135 SOW No ____ IFB No ____

All documents delivered in the complete SDG file must be original documents where possible (Reference Exhibit B Section III)

		Page Nos			(Please Chec
		From	To	Lab	Region
1	Inventory Sheet (WQPDC-2) (Do not number)				✓
2	Cover Page	0	0		✓
3	Water Quality Analyses Data Sheet (FORM I)	1	16		✓
4	Initial & Continuing Calibration Verification (FORM II)	17	18		✓
5	CRDL Standards (FORM III)	19	20		✓
6	Blanks (FORM IV)	21	23		✓
7	Spike Sample Recovery (FORM V)	24	24		✓
8	Analytical Spike Sample Recovery (FORM VI)	N\A	N/A		✓
9	Duplicates (FORM VII)	25	25		✓
10	Laboratory Control Sample (FORM VIII)	26	26		✓
11	Instrument Detection Limit (FORM IX)	N/A			✓
12	Analysis Run Log (FORM X)	N/A			✓
13	Ion Chromatography Raw Data	N/A	N/A		✓
14	Alkalinity Raw Data	27	56		✓
15	Chemical Oxygen Demand Raw Data	57	71		✓
16	Solids Raw Data	72	92		✓
17	Ammonia, Nitrogen Raw Data	93	115		✓
18	Chloride Raw Data	116	130		✓
19	Nitrate + Nitrite Raw Data	131	146		✓
20	Total Organic Carbon Raw Data	147	157		✓
21	Total Phosphorus Raw Data	158	173		✓
22	Sulfate Raw Data	174	185		✓
23	EPA Shipping/Receiving Documents				
	Airbill (No of Shipments _3____)	186	188		✓
	Chain-of-custody Records	189	191		✓
	Custody Seals	N/A	N/A		
	Sample Log-In Sheet (Lab & WQPDC-1)	192	194		✓
	Sample Tags	in bag			✓

WATER QUALITY PARAMETERS
COMPLETE SDG FILE (CSF)
INVENTORY SHEET

SDG Cover Sheet

	Page Nos		(Please Chec	
	From	To	Lab	Region
24 Misc Shipping/Receiving Records (list all individual records)				
Telephone Logs				
_____				
_____				
25 Internal Lab Sample Transfer Records & Tracking Sheets (describe or list)				
26 Internal Original Sample Preparation & Analysis Records (describe or list)				
Preparation Records _____				
Analysis Records _____				
Description _____				
27 Other Records (describe or list)				
Telephone Communication Log	217	218		
_____				

Comments _____

Completed By (CLP Lab)

(Signature)	(Print Name & Title)	(Date)
Marvin L. Doucet	Marvin Doucet / Data Reviewer	8/10/94

U. S. EPA - CLP

COVER PAGE - SAS DATA PACKAGE

Lab Name PBS&J Environmental Laboratories Contract PBSJ-0135 Date 7/13/94

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

EPA SAMPLE NUMBER	LAB SAMPLE NUMBER
SF5813	940634702
SF5814	940634703
SF5815	940634701
SF5834	940632902
SF5835	940632901
SF5836	940632903
SF5837	940632904
SF5838	940632905
SF5846	940632906
SF5847	940632907
SF5848	940632909
SF5849	940632911
SF5854	940632908
SF5855	940634710
SF5858	940634712
SF5863	940634713

I certify that this data package is in compliance with the terms and conditions of the SAS contract, both technically and for completeness, for other than the conditions detailed above under Comments Release of the data contained in this data package and in the computer-readable data submitted on floppy diskette (if applicable) has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature

Signature _____ Name Brian Bright

Date 7/13/94 Title SAS Project Mgr.

U S EPA - CLP

1A

SAS DATA SHEET

Capulin Collection - NW cutoff

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5813 (58)

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

Matrix Ground Lab Sample I D 940634702

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	10000u	ug/l
TDS	19300000	ug/l
TSS	353000	ug/l
NH3	1000u	ug/l
CL	12800	ug/l
NOX	270	ug/l
TOC	13700	ug/l
TP	280	ug/l
SO4	14490000	ug/l

Notes

U - Indicates that result was below detection limit of test

Detection limits may vary bvetween samples for the same analyte du ations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Capulin collection - eastern sump

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5814

S-9

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

Matrix Ground Lab Sample I D 940634703

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	10000u	ug/l
TDS	18800000	ug/l
TSS	320000	ug/l
NH3	1000u	ug/l
CL	17600	ug/l
NOX	370	ug/l
TOC	15500	ug/l
TP	180	ug/l
SO4	13807000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Goathill Scar wtr

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5815 5-10

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

Matrix Ground Lab Sample I D 940634701

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	10000u	ug/l
TDS	6660000	ug/l
TSS	110000	ug/l
NH3	1000u	ug/l
CL	5590	ug/l
NOX	340	ug/l
TOC	2950	ug/l
TP	140	ug/l
SO4	3981000	ug/l

Notes

U - Indicates that result was below detection limit of test.
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Caparlin Channel Seep (S-2)

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5834

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

Matrix Ground Lab Sample I D 940632902

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	5000u	ug/l
TDS	2248000	ug/l
TSS	26000	ug/l
NH3	1000u	ug/l
CL	29200	ug/l
NOX	100u	ug/l
TOC	1810	ug/l
TP	210	ug/l
SO4	1298000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Cliff seep

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5835

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813 S-1

Matrix Ground Lab Sample I D 940632901

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	5000u	ug/l
TDS	1010000	ug/l
TSS	15000	ug/l
NH3	1000u	ug/l
CL	9990	ug/l
NOX	100u	ug/l
TOC	2560	ug/l
TP	170	ug/l
SO4	551000	ug/l

Notes

U - Indicates that result was below detection limit of test

Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Capulin seep @ RR

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5836

(S-3)

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

Matrix Ground Lab Sample I D 940632903

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	5000u	ug/l
TDS	2100000	ug/l
TSS	14000	ug/l
NH3	1000u	ug/l
CL	25800	ug/l
NOX	100u	ug/l
TOC	2230	ug/l
TP	210	ug/l
SO4	1190000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Capulin seep @ RR/dup

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5837

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813 5-3

Matrix Ground Lab Sample I D 940632904

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	5000u	ug/l
TDS	2140000	ug/l
TSS	26000	ug/l
NH3	1000u	ug/l
CL	26000	ug/l
NOX	100u	ug/l
TOC	1890	ug/l
TP	180	ug/l
SO4	1383000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

RR seep abv Capulin c

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5838

S-4

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

Matrix Ground Lab Sample I D 940632905

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	5000u	ug/l
TDS	2280000	ug/l
TSS	22000	ug/l
NH3	1000u	ug/l
CL	29800	ug/l
NOX	100u	ug/l
TOC	1250	ug/l
TP	110	ug/l
SO4	1517000	ug/l

Notes

U Indicates that result was below detection limit of test

Detection limits may vary bvetween samples for the same analyte du tions and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Gauthill Seep @ RR

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5846

(S-5)

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

Matrix Ground Lab Sample I D 940632906

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	5000u	ug/l
TDS	1940000	ug/l
TSS	10000	ug/l
NH3	1000u	ug/l
CL	25600	ug/l
NOX	1900	ug/l
TOC	3200	ug/l
TP	130	ug/l
SO4	1222000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Alt seep @ RB

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5847

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

S-7

Matrix Ground Lab Sample I D 940632907

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	3200	ug/l
COD	5000u	ug/l
TDS	1410000	ug/l
TSS	20000	ug/l
NH3	1000u	ug/l
CL	20700	ug/l
NOX	2960	ug/l
TOC	3060	ug/l
TP	400	ug/l
SO4	837000	ug/l

Notes

U - Indicates that result was below detection limit of test

Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

RR blw Columbine Co.

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5848

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813 (9)

Matrix Ground Lab Sample I D 940632909

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	63300	ug/l
COD	5000u	ug/l
TDS	92000	ug/l
TSS	12000	ug/l
NH3	1000u	ug/l
CL	2000u	ug/l
NOX	100	ug/l
TOC	2550	ug/l
TP	140	ug/l
SO4	12600	ug/l

Notes

U - Indicates that result was below detection limit of test

Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Fld Blk

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5849

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

Matrix Ground Lab Sample I D 940632911

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	31700	ug/l
COD	5000u	ug/l
TDS	26000	ug/l
TSS	12000	ug/l
NH3	1000u	ug/l
CL	2000u	ug/l
NOX	340	ug/l
TOC	1910	ug/l
TP	160	ug/l
SO4	2000u	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A
SAS DATA SHEET

RR abv Hanson Crk

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5854

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813 18

Matrix Ground Lab Sample I D 940632908

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	57000	ug/l
COD	5000u	ug/l
TDS	102000	ug/l
TSS	10000	ug/l
NH3	1000u	ug/l
CL	2000u	ug/l
NOX	150	ug/l
TOC	2650	ug/l
TP	240	ug/l
SO4	21000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analvte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Hanson Crk @ Hwy 38

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5855

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813 (19)

Matrix Ground Lab Sample I D 940632910

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	5000u	ug/l
TDS	2670000	ug/l
TSS	34000	ug/l
NH3	1000u	ug/l
CL	2000u	ug/l
NOX	100u	ug/l
TOC	1000u	ug/l
TP	110	ug/l
SO4	1871000	ug/l

Notes

U - Indicates that result was below detection limit of test

Detection limits may vary bvetween samples for the same analyte due to dilutions and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

Harrison Crk Scar Wtr

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5858

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813 S-11

Matrix Ground Lab Sample I D 940632912

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	2000u	ug/l
COD	5000u	ug/l
TDS	2450000	ug/l
TSS	30000	ug/l
NH3	1000u	ug/l
CL	2000u	ug/l
NOX	100u	ug/l
TOC	1000u	ug/l
TP	110	ug/l
SO4	1620000	ug/l

Notes

U - Indicates that result was below detection limit of test
Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

U S EPA - CLP

1A

SAS DATA SHEET

RR @ Ranger Station

Lab Name PBS&J Environmental Labs Contract PBSJ-0135 Client ID No SF5863

Lab Code PBSJ SAS No 7943-22394 SDG No SF5813

(1)

Matrix Ground Lab Sample I D 940632913

Level Low Date Received 6/28/94-6/29/94 Date 7/12/94

TEST PERFORMED	RESULT	UNITS
ALK	45400	ug/l
COD	5000u	ug/l
TDS	156000	ug/l
TSS	14000	ug/l
NH3	1000u	ug/l
CL	2000u	ug/l
NOX	160	ug/l
TOC	2700	ug/l
TP	100u	ug/l
SO4	53700	ug/l

Notes

U - Indicates that result was below detection limit of test

Detection limits may vary bvetween samples for the same analyte due to sample size limitations and/or matrix problems

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: 8-17-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: SAS 8450F-02

SDG#: SF-5802

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable

USEPA REGION VI

REGIONAL ACCEPTANCE FORM
FOR SPECIAL ANALYTICAL SERVICES

Lab Code: SILVER SAS No.: 08450F-02 Case No. SDG No SF5802 Data Receipt Date: 07/13/94
Site Name: MOLY CORP QUESTA MINE Est. Liquidated Damages: $0.00
SMO Complete Date: 07/14/94

Please provide a copy of this completed form to the Sample Management Office's SAS IPS Section Leader no later than 08/28/94 Indicate below, by checking the appropriate box, whether the data for this SDG are accepted or of reduced value or rejected. If the Region is requesting a reduced value or a rejection, please attach all appropriate documentation.

Check appropriate box below

I DATA ACCEPTANCE

☑ Data appear acceptable (i.e. data that is not rejected or recommended for reduced value) according to the Region's inspection process Applicable liquidated damages as outlined in the laboratory's subcontract are applied as approrpiate.

II. REDUCED VALUE

☐ Data are recommended for a reduced value. The Region recommends that the value of the data package be reduced by __%. Attached are a signed memo from the Regional official describing the contractual reasons for reduced value and all related documents (data review, telephone logs, etc.).

III. [redacted]ECTION

☐ Data are recommended for rejection. Attached are a signed memo from the Regional Official describing the contractual reasons for rejection, all related documents (data review, telephone logs, etc.), and all rejected data.

COMMENTS

Name of data reviewer: JIN ZHAO
Organization: ESAT, REGION 6
Date review complete: 8-16-94

Name of Regional Official: MAHMOUD EL-FEKY
Signature: M. El-Feky Date: 8-17-94

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: August 16, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD # 6-4713

Attached is the data review summary for Case #SAS8450F02
SDG #SF5802
Site MOLYCORP

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

Contractual problems identified in this review are listed below. NONE

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

The data package is technically provisional. Significant technical problems are summarized below.

1. Lead matrix spike recoveries were outside QC limits.
2. Selenium and FAA lead had inconsistent duplicate results.
3. FAA QC failed for lead, selenium, and thallium.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. SAS8450F02
LABORATORY SILVER
CONTRACT # SILVER0135
SDG # SF5802
SOW# ILM03.0 & SAS8450F02
ACCT # 4TFAJNG5 SF # TFAUZZ

SITE MOLYCORP
NO. OF SAMPLES/
MATRIX 5/TCLP EXTRACTS
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Linda Hoffman
COMPLETION DATE August 16, 1994

SAMPLE NO.: SF-5802, SF-5803, SF-5822, SF-5859, SF-5898

DATA ASSESSMENT SUMMARY

	ICP	AA	HG
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	O	O
4. MATRIX SPIKE	M	M	O
5. DUPLICATE ANALYSIS	O	M	O
6. ICP QC	O		
7. FAA QC		M	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	X	X	O
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	M	M	O

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Matrix spike recoveries, duplicate differences, and FAA QC.

NOTABLE PERFORMANCE:

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS8450F02 SDG SF5802 Site MOLYCORP Lab SILVER

COMMENTS: Five soil samples were extracted and the TCLP leachate was analyzed for TAL metals and molybdenum. No field or laboratory QC samples were specified by the sampler. The laboratory met the 14-day turnaround time requirement.

The data package is technically provisional due to problems with matrix spike recoveries, duplicate differences, FAA analytical spike recoveries, MSA correlation coefficients, and FAA duplicate injection precision. This report documents only the QC requirements that weren't met and those affecting the technical usability of the results.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. Holding Times

All holding time criteria were met.

2. Calibrations

All calibrations were acceptable.

3. Blanks

Sample results below the CRDL were affected by barium, beryllium, iron, and thallium in the calibration and/or preparation blanks. Blank effects are noted in the Data Summary Table.

4. Pre-digestion Matrix Spike Recovery

All lead results are estimated due to matrix spike recoveries above the QC limit. Physical or chemical interference may be present in the sample matrix.

5. Duplicate Analysis

All selenium and FAA lead results are estimated because relative percent differences were above the QC limits.

6. ICP Quality Control

The serial dilution and the ICS results met QC criteria.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS8450F02 SDG SF5802 Site MOLYCORP Lab SILVER

7. Furnace Atomic Absorption Quality Control

FAA Analytical Spike Recovery

The lead result for sample SF-5859 and the thallium results for samples SF-5802, SF-5859, and SF-5898 are estimated because FAA analytical spike recoveries were outside the QC limits. Physical or chemical interference is possible in the sample matrix.

Duplicate Injection Coefficient of Variance

The lead result for sample SF-5859 is estimated because duplicate injection precision failed to meet QC criteria.

Method of Standard Addition

Selenium results for samples SF-5859 and SF-5898 are estimated due to MSA correlation coefficients below 0.995.

8. Laboratory Control Sample

All laboratory control sample results were acceptable.

9. Sample Verification

The data reviewer noted the following problems.

The laboratory reported the wrong lead CRDL on the Form 10's.

The laboratory incorrectly X'd the molybdenum ICV on Form 14.

On Form 1, the MSA selenium result for sample SF-5898 should be 0.02 mg/L, rather than the 0.049 mg/L reported by the laboratory. The correct result is reported on the Data Summary Table.

On Form 14, molybdenum is X'd for the ICSA and ICSAB results but no concentrations are reported on the Form 4.

10. Other QC

There were no Section 10 problems.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SA88450F02 SDG SF5802 Site MOLYCORP Lab SILVER

11. Overall Assessment

The data package is provisional for the following reasons:

All lead results were estimated due to high matrix spike recoveries.

The selenium results and FAA lead results were estimated because of significant duplicate differences.

One lead result and three thallium results were estimated because FAA QC failed to meet criteria.

MEMORANDUM

W. E. Blanton

To: M. Ritter **From:** W. E. Blanton

Subject: SAS8450F02 SDG SF5802 Laboratory Resubmissions **Date:** August 16, 1994

Copies: M. El Feky, ICF File, File **Ref:** WUD No. 6-4713, MEM1095, I-1463

Attached is a list of issues needing clarification and items needing corrections and omissions for SAS case 8450F02 SDG SF5802. The user is K. Hill 6H-MA. The samples in this case were analyzed by:

SILVER
One Government Gulch
Kellogg, ID 83837

Attention: Blake Johnson

These laboratory resubmissions are necessary to enable the Environmental Protection Agency to maximize the usability of the laboratory results in this data package. The laboratory resubmissions should be submitted to:

Ms. Christy Macdowell
ManTech Environmental Technology, Inc.
c/o US EPA
10625 Fallstone Rd.
Houston, TX 77099

Ms. Macdowell will then distribute the laboratory resubmission to the appropriate data reviewer who will prepare the resubmission report for this case.

In Reference to Case
SAS No.: 8450F02
SDG No.: SF5802
Laboratory: SILVER

In reference to data for the following sample numbers:

SF-5802, SF-5803, SF-5822, SF-5859, SF-5898

Summary of Questions/Issues:

A. The reported lead CRDL on the Form 10's (pages 34 - 39) should be 3.0 µg/L, not 5.0 µg/L. Please correct the Form 10's and resubmit.

B. The incorrect molybdenum ICV was X'd on Form 14 (page 49). Please correct Form 14 and resubmit.

C. On Form 1, the correct MSA selenium result for sample SF-589 wasn't reported. The correct result should be 0.02 mg/L, rather than the 0.049 mg/L reported. Please correct Form 1 and resubmit.

D. On Form 14, molybdenum is X'd for the ICSA and ICSAB results but no concentrations are reported on Form 4. Please add the molybdenum concentrations to Form 4 and resubmit.

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

v Negative bias.

DATA SUMMARY

Case No.: SAS8450F02 SDG. No.: SF5802 Reviewer: A. CANTU
Laboratory: SILVER Matrix: TCLP Leachate Units: MG/L

EPA ==> LAB	SF-5802	FLAG	SF-5803	FLAG	SF-5822	FLAG	SF-5859	FLAG	SF-5898	FLAG	COMMENTS
ALUMINUM	0.2		0.16		0.17		1.3		4		
ANTIMONY	0.028 U		0.028 U		0.028 U		0.028 U		0.028 U		
ARSENIC	0.00092		0.001		0 0034		0.00098		0 0012		
BARIUM	0 11		0.18		0.15		0.065 J^		0.068		
BERYLLIUM	0.00031 UC		0 00019 UC		0 0032		0.00085 UC		0 0014 UC		
CADMIUM	0.0039 U		0.0039 U		0.056		0.0039 U		0.0039 U		
CALCIUM	1.9		4.1		472		450		188		
CHROMIUM	0.0028 U		0.0028 U		0.0028 U		0.0028 U		0 011		
COBALT	0.0045		0.0041 U		0.0077		0.064		0.024		
COPPER	0.016		0.004		0.22		0.0057		0.071		
IRON	0.043 UC		0.047 UC		0.038 UC		0.072 J^		0.11		
LEAD	0.027 J		0 44 J		0.15 J		0.0034 J		0 033 J		
MAGNESIUM	1.2		0 25		1.5		14.2		9.3		
MANGANESE	0.45		0.29		30.6		2.1		0.51		
MERCURY	0.0002 U		0.0002 U		0 0002 U		0.0002 U		0.0002 U		
NICKEL	0.016		0.013 U		0.025		0 21		0.078		
POTASSIUM	2.7		1.6		3 9		1.7		1.4		
SELENIUM	0.0026 J		0.0011 J		0.0026 J		0.062 J		0.02 J		
SILVER	0 0026 U		0.0026 U		0.0073		0.0026 U		0 0026 U		
THALLIUM	0.0009 UJ		0 0009 U		0.00092 UC		0.0009 UJ		0 0011 UCJ		
VANADIUM	0.0035 U		0.0035 U		0.0035 U		0.0035 U		0 0035 U		
ZINC	0.13		0.23		3.9		0.22		0.13		
MOLYBDENUM	0.0069 U		0.0069 U		0.14		0.0069 U		0.0069 U		
	SS-3-TCLP		SS-4-TCLP		SS-10-TCLP		SS-12-TCLP		SS-1-TCLP		

Note. units in mg/L = PPM

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. [redacted] SDG No. SF5802 SDG Nos. To Follow SAS No. 8450F02 Date Rec 7-13-94

EPA Lab ID: SILVER
Lab Location: Kellogg, ID
Region: 6 Audit No.: SAS8450F02/SF5802
Re_Submitted CSF? Yes ____ No X
Box No(s): ONE
COMMENTS:

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1. Present on package?	X		
2. Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5. Are listed documents enclosed?	X		
FORM DC-1			
6. Present?	X		
7 Complete?	X		
8. Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10. Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11. Signed?	X		
12. Dated?	X		
AIRBILLS/AIRBILL STICKER			
13. Present?	X		
14. Signed?	X		
15. Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18. Complete?	X		
19. Legible?	X		
20. Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Over for additional comments.

Audited by: [signature] David Spencer/Scientist Associate Date 7-21-94
Audited by: ____ ____ Date ____
Audited by: ____ ____ Date ____
Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: ____ Date Entered: ____ Date Reviewed: ____
Entered by: ____ ____
Reviewed by: ____ ____
Signature Printed Name/Title

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22594 SAS No.: 8450F- SDG No.:SF5802

SOW No.: ILM02

EPA Sample No.	Lab Sample ID
SF5802	SF5802
SF5803	SF5803
SF5822	SF5822
SF5859	SF5859
SF5898	SF5898
SF5898D	SF5898D
SF5898S	SF5898S

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES

If yes - were raw data generated before application of background corrections ? Yes/No NO

Comments:

SAS_NO: 8450F-02

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: MELBA BENCICH

Date: JULY 12, 1994 Title: DOCUMENT CONTROL OFFICER

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Eagle Rock Scar TCLP
SF5898 (T-1)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5802
Matrix (soil/water): WATER Lab Sample ID: SF5898
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): MG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4.0			P
7440-36-0	Antimony	0.028	U		P
7440-38-2	Arsenic	0.0012	B		F
7440-39-3	Barium	0.068	B		P
7440-41-7	Beryllium	0.0014	B		P
7440-43-9	Cadmium	0.0039	U		P
7440-70-2	Calcium	188			P
7440-47-3	Chromium	0.011			P
7440-48-4	Cobalt	0.024	B		P
7440-50-8	Copper	0.071			P
7439-89-6	Iron	0.11			P
7439-92-1	Lead	0.033		SN*	F
7439-95-4	Magnesium	9.3			P
7439-96-5	Manganese	0.51			P
7439-97-6	Mercury	0.00020	U		CV
7440-02-0	Nickel	0.078			P
7440-09-7	Potassium	1.4	B		P
7782-49-2	Selenium	0.049		+*	F
7440-22-4	Silver	0.0026	U		P
7440-23-5	Sodium				NR
7440-28-0	Thallium	0.0011	B	W	F
7440-62-2	Vanadium	0.0035	U		P
7440-66-6	Zinc	0.13			P
	Molybdenu	0.0069	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____
Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:
[illegible]= 3X DILUTION
SE = 4X DILUTION
TCLP EXTRACTION

3 1 4

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Goathill Scar -TCLP

SF5802 (T-Z)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5802
Matrix (soil/water): WATER Lab Sample ID: SF5802
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): MG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	0.20			P
7440-36-0	Antimony	0.028	U		P
7440-38-2	Arsenic	0.00092	B		F
7440-39-3	Barium	0.11	B		P
7440-41-7	Beryllium	0.00031	B		P
7440-43-9	Cadmium	0.0039	U		P
7440-70-2	Calcium	1.9	B		P
7440-47-3	Chromium	0.0028	U		P
7440-48-4	Cobalt	0.0045	B		P
7440-50-8	Copper	0.016	B		P
7439-89-6	Iron	0.043	B		P
7439-92-1	Lead	0.027		SN*	F
7439-95-4	Magnesium	1.2	B		P
7439-96-5	Manganese	0.45			P
7439-97-6	Mercury	0.00020	U		CV
7440-02-0	Nickel	0.016	B		P
7440-09-7	Potassium	2.7	B		P
7782-49-2	Selenium	0.0026	B	*	F
7440-22-4	Silver	0.0026	U		P
7440-23-5	Sodium				NR
7440-28-0	Thallium	0.00090	U	W	F
7440-62-2	Vanadium	0.0035	U		P
7440-66-6	Zinc	0.13			P
	Molybdenu	0.0069	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____
Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:
[redacted]_= 2X DILUTION
TCLP EXTRACTION

U.S. EPA - CLP

3033

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Capulin Dump TCLP
SF5803
T-3

Lab Name: SVL ANALYTICAL INC. Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5802
Matrix (soil/water): WATER Lab Sample ID: SF5803
Level (low/med): LOW Date Received: 06/29/94
% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): MG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	0.16	B		P
7440-36-0	Antimony	0.028	U		P
7440-38-2	Arsenic	0.0010	B		F
7440-39-3	Barium	0.18	B		P
7440-41-7	Beryllium	0.00019	B		P
7440-43-9	Cadmium	0.0039	U		P
7440-70-2	Calcium	4.1	B		P
7440-47-3	Chromium	0.0028	U		P
7440-48-4	Cobalt	0.0041	U		P
7440-50-8	Copper	0.0040	B		P
7439-89-6	Iron	0.047	B		P
7439-92-1	Lead	0.44		SN*	F
7439-95-4	Magnesium	0.25	B		P
7439-96-5	Manganese	0.29			P
7439-97-6	Mercury	0.00020	U		CV
7440-02-0	Nickel	0.013	U		P
7440-09-7	Potassium	1.6	B		P
7782-49-2	Selenium	0.0011	B	*	F
7440-22-4	Silver	0.0026	U		P
7440-23-5	Sodium				NR
7440-28-0	Thallium	0.00090	U		F
7440-62-2	Vanadium	0.0035	U		P
7440-66-6	Zinc	0.23			P
	Molybdenu	0.0069	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture:
Color After: COLORLESS Clarity After: CLEAR Artifacts:

Comments:
PB = 20X DILUTION
TCLP EXTRACTION

3UC

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Lower Bench Dump - TCLP
SF5822 (T-4)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5802
Matrix (soil/water): WATER Lab Sample ID: SF5822
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): MG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	0.17	B		P
7440-36-0	Antimony	0.028	U		P
7440-38-2	Arsenic	0.0034	B		F
7440-39-3	Barium	0.15	B		P
7440-41-7	Beryllium	0.0032	B		P
7440-43-9	Cadmium	0.056			P
7440-70-2	Calcium	472			P
7440-47-3	Chromium	0.0028	U		P
7440-48-4	Cobalt	0.0077	B		P
7440-50-8	Copper	0.22			P
7439-89-6	Iron	0.038	B		P
7439-92-1	Lead	0.15		N*	F
7439-95-4	Magnesium	1.5	B		P
7439-96-5	Manganese	30.6			P
7439-97-6	Mercury	0.00020	U		CV
7440-02-0	Nickel	0.025	B		P
7440-09-7	Potassium	3.9	B		P
7782-49-2	Selenium	0.0026	B	*	F
7440-22-4	Silver	0.0073	B		P
7440-23-5	Sodium				NR
7440-28-0	Thallium	0.00092	B		F
7440-62-2	Vanadium	0.0035	U		P
7440-66-6	Zinc	3.9			P
	Molybdenu	0.14			P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:
PB_=_3X_DILUTION
TCLP_EXTRACTION

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Hanson Crk Scav TCLP

SF5859

T-5

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5802

Matrix (soil/water): WATER Lab Sample ID: SF5859

Level (low/med): LOW__ Date Received: 06/29/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): MG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1.3			P
7440-36-0	Antimony	0.028	U		P
7440-38-2	Arsenic	0.00098	B		F
7440-39-3	Barium	0.065	B		P
7440-41-7	Beryllium	0.00085	B		P
7440-43-9	Cadmium	0.0039	U		P
7440-70-2	Calcium	450			P
7440-47-3	Chromium	0.0028	U		P
7440-48-4	Cobalt	0.064			P
7440-50-8	Copper	0.0057	B		P
7439-89-6	Iron	0.072	B		P
7439-92-1	Lead	0.0034	B	WMN*	F
7439-95-4	Magnesium	14.2			P
7439-96-5	Manganese	2.1			P
7439-97-6	Mercury	0.00020	U		CV
7440-02-0	Nickel	0.21			P
7440-09-7	Potassium	1.7	B		P
7782-49-2	Selenium	0.062		+*	F
7440-22-4	Silver	0.0026	U		P
7440-23-5	Sodium				NR
7440-28-0	Thallium	0.00090	U	W	F
7440-62-2	Vanadium	0.0035	U		P
7440-66-6	Zinc	0.22			P
	Molybdenu	0.0069	U		P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____

Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:

*= 5X DILUTION

TCLP EXTRACTION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: 8-17-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: SAS 8450F-01

SDG#: SF-5844

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION VI

REGIONAL ACCEPTANCE FORM
FOR SPECIAL ANALYTICAL SERVICES

Lab Code SILVER SAS No · 08450F-01 Case No SDG No SF5844 Data Receipt Date: 07/13/94
Site Name MOLY CORP QUESTA MINE Est Liquidated Damages $0 00
SMO Complete Date· 07/14/94

Please provide a copy of this completed form to the Sample Management Office's SAS IPS Section Leader no later than 08/28/94
Indicate below, by checking the appropriate box, whether the data for this SDG are accepted or of reduced value or rejected
If the Region is requesting a reduced value or a rejection, please attach all appropriate documentation

Check appropriate box below

I DATA ACCEPTANCE

☑ Data appear acceptable (i.e. data that is not rejected or recommended for reduced value) according to the Region's inspection process. Applicable liquidated damages as outlined in the laboratory's subcontract are applied as approrpiate

II REDUCED VALUE

☐ Data are recommended for a reduced value. The Region recommends that the value of the data package be reduced by __% Attached are a signed memo from the Regional official describing the contractual reasons for reduced value and all related documents (data review, telephone logs, etc.)

III REJECTION

☐ Data are recommended for rejection Attached are a signed memo from the Regional Official describing the contractual reasons for rejection, all related documents (data review, telephone logs, etc), and all rejected data

COMMENTS

Name of data reviewer· Yolette Holloway
Organization: ESAT, Region 6
Date review complete: 8-16-94

Name of Regional Official. MAHMOUD ELFEKY
Signature: M. Elfeky Date: 8-17-94

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: August 16, 1994

To: Melvin Ritter, ESAT RPO, Region VI

From: Bill Blanton, ESAT ETM, Region VI

Subject: CLP Data Review

WUD #: 6-4711

Attached is the data review summary for Case # SAS8450F-01
SDG # SF5844
Site MOLYCORP

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

There where no contractual violations identified by the hard copy data review.

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

The data package is technically provisional. Significant technical problems are summarized below.

1. Some arsenic and lead results were unusable due to matrix spike recoveries below 30%.
2. Antimony, arsenic, barium, lead, and selenium matrix spike recoveries were outside of the quality control (QC) limits.
3. Lead, selenium, and thallium had method of standard addition correlation coefficients below 0.995.
4. Calcium, chromium, cobalt, copper, and nickel serial dilution differences exceeded the QC limits.
5. FAA analytical spike recoveries were outside of the QC limits for 24 of 48 determinations.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. SAS8450F-01
LABORATORY SILVER
CONTRACT # SILVER0135
SDG # SF5844
SOW # ILM03.0 & ILM02.0
ACCT # 4TFAJNG5 SF # TFAUZZ

SITE MOLYCORP
NO. OF SAMPLES/
MATRIX 12/water
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Youree Holloway
COMPLETION DATE August 16, 1994

SAMPLE NO.: SF-5807 SF-5808 SF-5809 SF-5810 SF-5811 SF-5812 SF-5844 SF-5845 SF-5853 SF-5857 SF-5861 SF-5862

DATA ASSESSMENT SUMMARY

	ICP	AA	Hg
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	O	O
4. MATRIX SPIKE	M	M	O
5. DUPLICATE ANALYSIS	O	O	O
6. ICP QC	M		
7. FAA QC		M	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	X	X	O
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	M	M	O

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A = Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Matrix spike recoveries were outside of the quality control (QC) limits; method of standard addition correlation coefficients were below 0.995; serial dilution differences exceeded the QC limit, and FAA analytical spike recoveries exceeded the QC limits for 24 of 48 determinations.

NOTABLE PERFORMANCE:

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case SAS8450F-01 SDG SF5844 Site MOLYCORP Lab SILVER

Comments: Twelve water samples were analyzed at low concentrations for total metals and molybdenum. Sample SF-5845 was a field blank, and samples SF-5807 and SF-5809 were used as QC samples. The laboratory met the contractual data package turnaround time requirements.

Some arsenic and lead sample results were unusable due to low matrix spike recoveries. The data package is provisional due to problems with matrix spike recoveries, serial dilution differences, MSA correlation coefficients, and FAA analytical spike recoveries. This report documents the QC requirements that were not met or those factors affecting technical usability of the results.

An Evident Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. Holding Times

All holding time criteria were met.

2. Calibrations

All calibrations were acceptable.

3. Blanks

Preparation and Calibration Blanks

Sample results were affected by aluminum, beryllium, copper, iron, manganese, silver, and thallium in the preparation and/or calibration blanks. The concentrations of aluminum in sample SF-5861 and silver in sample SF-5844 were above the contract required detection limit (CRDL) and should be considered undetected. The aluminum concentration in sample SF-5844 was above the CRDL and is high-biased. The affected sample results below the CRDL are listed in the Data Summary Table.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case SAS8450F-01 SDG SF5844 Site MOLYCORP Lab SILVER

3. **Blanks**, continued

Field Blank

Samples were affected by barium, chromium, iron, potassium, and sodium concentrations reported in the field blank. The sample results listed below were above the CRDL and should be considered undetected.

Chromium in samples SF-5811 and SF-5812.

Iron in samples SF-5844, SF-5853, SF-5857, and SF-5862.

Sodium in samples SF-5807, SF-5808, SF-5809, SF-5810, SF-5811, SF-5812, SF-5853, and SF-5857.

The affected sample results below the CRDL are listed in the Data Summary Table.

4. **Pre-digestion Matrix Spike Recovery**

The following sample results are qualified because of possible physical or chemical interference in the samples.

The arsenic and lead results below the instrument detection limit (IDL) are unusable due to pre-digestion matrix spike recoveries below 30%. False negatives are possible.

The arsenic and lead results above the IDL are estimated due to low pre-digestion matrix spike recoveries. The reported concentrations should be considered minimum concentrations, and higher concentrations are possible.

All antimony and selenium results above the IDL are estimated due to pre-digestion matrix spike recoveries outside of the QC limit.

Barium results for samples SF-5807, SF-5808, SF-5809, SF-5810, SF-5811, SF-5812, SF-5853, and SF-5857, which were previously qualified due to field blank contamination, are unusable due to matrix spike recoveries below 30%. False negatives are possible for these eight samples. All other barium results are biased low due to the matrix spike recovery.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case SAS8450F-01 SDG SF5844 Site MOLYCORP Lab SILVER

5. Duplicate Analysis

Antimony and zinc duplicate results were only marginally outside of QC limits, so samples were not qualified.

6. ICP Quality Control

Serial Dilution

All calcium, chromium, cobalt, copper, and nickel results are estimated due to serial dilution differences outside of the QC limits. Physical or chemical interference may exist in the samples.

Interference Check Sample

The concentrations of aluminum, calcium, iron, and magnesium in some samples are significant enough to cause interference. The silver results for samples SF-5807, SF-5808, SF-5809, SF-5810, SF-5811, and SF-5812 are biased high due to the concentration of interferant in the samples.

7. Furnace Atomic Absorption Quality Control

FAA Analytical Spike Recovery

The following sample results are qualified because of possible physical or chemical interference in the samples.

The arsenic results for samples SF-5808, SF-5811, SF-5812, SF-5844, SF-5845, SF-5853, SF-5857, SF-5861, and SF-5862 are estimated due to low FAA analytical spike recoveries.

The lead results for samples SF-5808, SF-5811, SF-5812, SF-5844, SF-5853, SF-5857, and SF-5862 are estimated due to FAA analytical spike recoveries outside of the QC limits.

The selenium results for samples SF-5810, SF-5811, and SF-5857 are estimated due to low FAA analytical spike recoveries.

The thallium results for samples SF-5811, SF-5812, SF-5845, SF-5853, and SF-5857 are estimated due to FAA analytical spike recoveries outside of the QC limits.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case SAS8450F-01 SDG SF5844 Site MOLYCORP Lab SILVER

7. Furnace Atomic Absorption Quality Control, continued

Method of Standard Addition

The results for lead in samples SF-5809 and SF-5810, selenium in samples SF-5809 and SF-5812, and thallium in samples SF-5807, SF-5808, and SF-5810 are estimated due to correlation coefficients below 0.995. Matrix interference is suspected.

8. LCS

All laboratory control sample results were acceptable.

9. Sample Verification

The thallium result for sample SF-5809 should have an "S" flag instead of a "+" flag on Form I (page 343).

The laboratory control sample result for molybdenum should be 968.4 ug/L, not 1946.84 ug/L (page 211).

The "E" flags for beryllium and magnesium should be removed. When rounded according to EPA rounding rules, their differences do not exceeded 10%.

The MSA for thallium sample SF-5810 is "X'd" twice on Form XIV.

The CRDL for lead on FORM X should be 3 ug/L.

10. Other QC

No other QC was required.

11. Overall Assessment

The data package is provisional for the following reasons:

Some arsenic and lead sample results were unusable due to matrix spike recoveries below 30%.

All antimony, all barium, and some arsenic, lead, and selenium sample results were estimated because matrix spike recoveries were outside of the QC limits.

Two lead, two selenium, and three thallium sample results were estimated because method of standard addition correlation coefficients were below 0.995.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case SAS8450F-01 SDG SF5844 Site MOLYCORP Lab SILVER

All calcium, chromium, cobalt, copper, and nickel sample results were estimated because serial dilution differences exceeded the QC limit.

Nine arsenic, seven lead, three selenium, and five thallium FAA analytical spike recoveries were outside of the QC limits and estimated.

All other technical requirements were met.

MEMORANDUM

To: M. Ritter

From: W. E. Blanton

Subject: SAS8450F-01 SDG SF5844
Laboratory Resubmissions

Date: August 16, 1994

Copies: M. El Feky
ICF File
File

Ref: WUD # 6-4711
MEM1094
I1466

Attached is a list of issues needing clarification and items needing corrections and omissions for SAS case SAS8450F-01 SDG SF5844. The samples in this case were analyzed by:

Name of Laboratory	Silver Analytical Inc.
Address	One Government Gulch Kellogg, ID 83837
Attention:	Melba Bencich

These laboratory resubmissions are necessary to enable the Environmental Protection Agency to maximize the usability of the laboratory results in this data package. The user for this site is K. Hill 6H-MA. The laboratory resubmissions should be submitted to:

Ms. Christy Macdowell
ManTech Environmental Technology, Inc.
c/o US EPA
10625 Fallstone Rd.
Houston, TX 77099

Ms. Macdowell will then distribute the laboratory resubmission to the appropriate data reviewer who will prepare the resubmission report for this case.

In Reference to Case
SAS No.: SAS8450F-01
SDG No.: SF5844
Laboratory: SILVER

In reference to data for the following sample numbers:

SF-5807 SF-5808 SF-5809 SF-5810 SF-5811 SF-5812 SF-5844 SF-5845 SF-5853 SF-5857 SF-5861 SF-5862

Summary of Questions/Issues:

1. The thallium result for sample SF-5809 should have an "S" flag instead of a "+" flag on Form I (see page 343). Please correct and resubmit the corrected page.

2. The laboratory control sample result for molybdenum should be 968.4 ug/L, not 1946.84 ug/L (see page 211). Please correct and resubmit the corrected page.

3. The "E" flags for beryllium and magnesium should be removed. When rounded according to EPA rounding rules, their differences do not exceeded 10%. Please remove the "E" flags and resubmit the corrected forms.

4. The MSA for thallium sample SF-5810 is "X'd" twice on Form XIV. Please correct and resubmit the corrected page.

5. The CRDL for lead on FORM X should be 3 ug/L. Please correct your Form X's.

Case No.: SAS8450F-01
Laboratory: SILVER

DATA SUMMARY
SDG. No. SF5844
Matrix: WATER

Reviewer: Y HOLLOWAY
Units: ug/L

EPA [redacted] #=> / LAB [redacted] #=>	SF-5807	FLAG	SF-5808	FLAG	SF-5809	FLAG	SF-5810	FLAG	SF-5811	FLAG	COMMENTS
ALUMINUM	*340000		1330000		1280000		1160000		237000		
ANTIMONY	103	J	28.5	UJ	133	J	28.5	UJ	79.4	J	
ARSENIC	54	vJ	35 5	vJ	75	vJ	67	vJ	25 8	vJ	
BARIUM	6	UCR	7 8	UCR	9 2	UCR	7 2	UCR	6.4	UCR	
BERYLLIUM	353		347		536		531		98 2		
CADMIUM	608		635		370		345		12.6		
CALCIUM	373000	J	381000	J	395000	J	386000	J	169000	J	
CHROMIUM	373	J	360	J	287	J	279	J	12.8	UCJ	
COBALT	3560	J	3500	J	2330	J	2320	J	407	J	
COPPER	11600	J	12200	J	12400	J	12100	J	4740	J	
IRON	498000		495000		920000		832000		968000		
LEAD	6	UR	7 9	vJ	19 2	vJ	11.2	vJ	3.5	vJ	
MAGNESIUM	938000		970000		961000		935000		55500		
MANGANESE	560000		544000		675000		663000		76800		
MERCURY	0.2	U	0.2	U	0.2	U	0 2	U	0.2		
[redacted]	8030	J	7900	J	5170	J	5200	J	663	J	
POTASSIUM	503	U	935	UC	503	U	503	U	1260	UC	
SELENIUM	8 2	J	10.5	U	7	U	9.2	J	7	U	
SILVER	79.7	^J	79 3	^J	89	^J	79 8	^J	69 2	^J	
SODIUM	23500	UC	24500	UC	26600	UC	25800	UC	8310	UC	
THALLIUM	4.2	J	3.2	J	3 3		5	UCJ	3 5	J	
VANADIUM	3.5	U	3.5	U	3 5	U	11.7		27.5		
ZINC	140000		139000		139000		127000		15000		
MOLYBDENUM	65.9		6.9	U	47.4		63.7		40.6		
% SOLIDS	N/A		N/A		N/A		N/A		N/A		
	SP-10 UF		SP-10 F		SP-9 UF		SP-9F		SP-8 UF		

DATA SUMMARY

Case No.. SAS8450F-01 SDG No SF5844 Reviewer: Y HOLLOWAY
Laboratory: SILVER Matrix WATER Units. ug/L

EPA SMO #=> / LAB TR #=>	SF-5812	FLAG	SF-5844	FLAG	SF-5845	FLAG	SF-5853	FLAG	SF-5857	FLAG	COMMENTS
ALUMINUM	239000		284	^J	25.1	UC	98800		90200		
ANTIMONY	34.5	J	28.5	UJ	28.5	UJ	28.5	UJ	28 5	UJ	
ARSENIC	21.2	vJ	0.9	UR	0 9	UR	1	vJ	1 4	vJ	
BARIUM	5 6	UCR	38	vJ	3 7	vJ	7 2	UCR	10 8	UCR	
BERYLLIUM	97		0.4	UC	0 61	UC	18.6		18 3		
CADMIUM	17.4		3.9	U	3 9	U	3.9	U	3.9	U	
CALCIUM	170000	J	21700	J	1300	J	332000	J	301000	J	
CHROMIUM	15.8	UCJ	2.8	UJ	5.3	J	3 5	UCJ	5 8	UCJ	
COBALT	405	J	4.1	UJ	4 1	UJ	180	J	171	J	
COPPER	4780	J	6	UCJ	5 5	UCJ	128	J	120	J	
IRON	962000		388	UC	1710		7770	UC	8230	UC	
LEAD	3.5	vJ	2.5	vJ	0 6	UR	2.5	vJ	4 4	vJ	
MAGNESIUM	56000		2960		322		66800		60300		
MANGANESE	75800		55.8		4 6	UC	8810		8110		
MERCURY	0.22		0.2	U	0 2	U	0 2	U	0 2	U	
[redacted]	704	J	13.3	UJ	13 3	UJ	436	J	408	J	
POTASSIUM	930	UC	873	UC	939		6990		6690		
SELENIUM	15	J	0.7	U	0.7	U	7	U	7	UJ	
SILVER	68 8	^J	11 8	UC	8 6	UC	2 6	U	2 6	U	
SODIUM	8870	UC	2000	UC	12300		11000	UC	9890	UC	
THALLIUM	3.9	J	0.9	U	1	UCJ	0 9	UJ	1 2	UCJ	
VANADIUM	30.3		3.5	U	3 5	U	3 5	U	3 5	U	
ZINC	15000		25.7		2.8		2900		2640		
MOLYBDENUM	31.6		6.9	U	6.9	U	6.9	U	6.9	U	
% SOLIDS	N/A		N/A		N/A		N/A		N/A		
	SP-8F		RR-2DF		Fld Blk DF		SP-11 DF		SP-12 DF		

DATA SUMMARY

Case No.: SAS8450F-01 SDG. No.: SF5844 Reviewer: Y. HOLLOWAY
Laboratory: SILVER Matrix: WATER Units: ug/L

EP[redacted] #=> / LAB ER #=>	SF-5861	FLAG	SF-5862	FLAG	FLAG	FLAG	FLAG	FLAG	COMMENTS
ALUMINUM	236	UC	1360						
ANTIMONY	28.5	UJ	28.5	UJ					
ARSENIC	0.9	UR	0.9	UR					
BARIUM	26.9	vJ	39 8	vJ					
BERYLLIUM	0.52	UC	0 84	UC					
CADMIUM	3.9	U	3.9	U					
CALCIUM	29000	J	29800	J					
CHROMIUM	3.3	UCJ	2.8	UJ					
COBALT	5.4	J	5.9	J					
COPPER	4 2	UCJ	14.9	UCJ					
IRON	46.4	UC	716	UC					
LEAD	0.6	UR	2	vJ					
MAGNESIUM	5890		6210						
MANGANESE	369		407						
MERCURY	0.2	U	0 22						
N[redacted]	13.3	UJ	13 3	UJ					
POTASSIUM	1070	UC	1150	UC					
SELENIUM	0 7	U	0 7	U					
SILVER	2.6	U	9 6	UC					
SODIUM	3160	UC	3230	UC					
THALLIUM	0.9	U	0.9	U					
VANADIUM	3 5	U	3.5	U					
ZINC	62.8		95.2						
MOLYBDENUM	6.9	U	6.9	U					
% SOLIDS	N/A		N/A						

12R-3F RR-3 UF

INORGANIC DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

? A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

Negative bias.

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case | SDG No SF5844 | SDG Nos To Follow | SAS No. 8450F1 | Date Rec 7/13/94

EPA Lab ID: SILVER

Location: KELLOGG, ID

Region: 6 Audit No.. 8450F1/SF5844

Re_Submitted CSF? Yes _____ No X

Box No(s): One

COMMENTS:

Over for additional comments.

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2. Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6 Present?	X		
7 Complete?	X		
8 Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10 Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18 Complete?	X		
19 Legible?	X		
20 Original?	X		
20a. If "No", does the copy indicate where original documents are located?			X

Audited by: Youree L. Holloway ESAT | YOUREE HOLLOWAY/DATA REVIEWER | Date 8/12/94

Audited by: _____ | _____ | Date _____

Audited by: _____ | _____ | Date _____

Signature | Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: _____ Date Entered: _____ Date Reviewed: _____

Entered by: _____ _____

Reviewed by: _____ _____

Signature | Printed Name/Title

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Capulin Collection - Low eastern UF
SF5807

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844
Matrix (soil/water): WATER Lab Sample ID: SF5807
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: __0.0

S-9

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1340000			P
7440-36-0	Antimony	103		N*	P
7440-38-2	Arsenic	54.0	B	SN	F
7440-39-3	Barium	6.0	B	N	P
7440-41-7	Beryllium	353		E	P
7440-43-9	Cadmium	608			P
7440-70-2	Calcium	373000		E	P
7440-47-3	Chromium	373		E	P
7440-48-4	Cobalt	3560		E	P
7440-50-8	Copper	11600		E	P
7439-89-6	Iron	498000			P
7439-92-1	Lead	6.0	U	WN	F
7439-95-4	Magnesium	938000		E	P
7439-96-5	Manganese	560000			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	8030		E	P
7440-09-7	Potassium	503	U		P
7782-49-2	Selenium	8.2	B	N	F
7440-22-4	Silver	79.7			P
7440-23-5	Sodium	23500			P
7440-28-0	Thallium	4.2	B	+	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	140000			P
	Molybdenu	65.9		*	P

Color Before: BROWN Clarity Before: CLEAR Texture: _____
Color After: BROWN Clarity After: CLEAR Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Capulin Collection - lower upper (eastern sump)

SF5808

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844 (F)
Matrix (soil/water): WATER Lab Sample ID: SF5808
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: __0.0

5-9

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1330000			P
7440-36-0	Antimony	28.5	U	N*	P
7440-38-2	Arsenic	35.5	B	WN	F
7440-39-3	Barium	7.8	B	N	P
7440-41-7	Beryllium	347		E	P
7440-43-9	Cadmium	635			P
7440-70-2	Calcium	381000		E	P
7440-47-3	Chromium	360		E	P
7440-48-4	Cobalt	3500		E	P
7440-50-8	Copper	12200		E	P
7439-89-6	Iron	495000			P
7439-92-1	Lead	7.9	B	WN	F
7439-95-4	Magnesium	970000		E	P
7439-96-5	Manganese	544000			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	7900		E	P
7440-09-7	Potassium	935	B		P
7782-49-2	Selenium	10.5	U	WN	F
7440-22-4	Silver	79.3			P
7440-23-5	Sodium	24500			P
7440-28-0	Thallium	3.2	B	+	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	139000			P
	Molybdenu	6.9	U	*	P

Color Before: BROWN____ Clarity Before: CLEAR_ Texture: _____
Color After: BROWN____ Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

INORGANIC ANALYSIS DATA SHEET

EPA SAMPLE NO.
Caplin Collection - upper (NW co
SF5809 (UF)

Lab Name: SVL_ANALYTICAL_INC. Contract: SILVER0135
Lab Code: SILVER Case No.: 12394 SAS No.: 8450F- SDG No.: SF5844
Matrix (soil/water): WATER Lab Sample ID: SF5809
Level (low/med): LOW Date Received: 06/29/94 (5-8)
% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1280000			P
7440-36-0	Antimony	133		N*	P
7440-38-2	Arsenic	75.0	B	SN	F
7440-39-3	Barium	9.2	B	N	P
7440-41-7	Beryllium	536		E	P
7440-43-9	Cadmium	370			P
7440-70-2	Calcium	395000		E	P
7440-47-3	Chromium	287		E	P
7440-48-4	Cobalt	2330		E	P
7440-50-8	Copper	12400		E	P
7439-89-6	Iron	920000			P
7439-92-1	Lead	19.2		+N	F
7439-95-4	Magnesium	961000		E	P
7439-96-5	Manganese	675000			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	5170		E	P
7440-09-7	Potassium	503	U		P
7782-49-2	Selenium	7.0	U	SN	F
7440-22-4	Silver	89.0			P
7440-23-5	Sodium	26600			P
7440-28-0	Thallium	3.3	B	+	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	139000			P
	Molybdenu	47.4		*	P

Color Before: BROWN Clarity Before: CLEAR Texture:
Color After: BROWN Clarity After: CLEAR Artifacts:

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Capulin Collection - upper (NW corner)
SF5810

Lab Name: SVL ANALYTICAL INC. Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844
Matrix (soil/water): WATER Lab Sample ID: SF5810
Level (low/med): LOW Date Received: 06/29/94
% Solids: 0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1160000			P
7440-36-0	Antimony	28.5	U	N*	P
7440-38-2	Arsenic	67.0	B	SN	F
7440-39-3	Barium	7.2	B	N	P
7440-41-7	Beryllium	531		E	P
7440-43-9	Cadmium	345			P
7440-70-2	Calcium	386000		E	P
7440-47-3	Chromium	279		E	P
7440-48-4	Cobalt	2320		E	P
7440-50-8	Copper	12100		E	P
7439-89-6	Iron	832000			P
7439-92-1	Lead	11.2		+N	F
7439-95-4	Magnesium	935000		E	P
7439-96-5	Manganese	663000			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	5200		E	P
7440-09-7	Potassium	503	U		P
7782-49-2	Selenium	9.2	B	WN	F
7440-22-4	Silver	79.8			P
7440-23-5	Sodium	25800			P
7440-28-0	Thallium	5.0	B	+	F
7440-62-2	Vanadium	11.7	B		P
7440-66-6	Zinc	127000			P
	Molybdenu	63.7		*	P

Color Before: BROWN Clarity Before: CLEAR Texture:
Color After: BROWN Clarity After: CLEAR Artifacts:

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Goathill Scar Water (UF)
SF5811

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844
Matrix (soil/water): WATER Lab Sample ID: SF5811
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: __0.0

5-10

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	237000	_		P_
7440-36-0	Antimony_	79.4	_	N*	P_
7440-38-2	Arsenic__	25.8	B	WN	F_
7440-39-3	Barium___	6.4	B	N	P_
7440-41-7	Beryllium	98.2	_	E	P_
7440-43-9	Cadmium__	12.6	_		P_
7440-70-2	Calcium__	169000	_	E	P_
7440-47-3	Chromium_	12.8	_	E	P_
7440-48-4	Cobalt___	407	_	E	P_
7440-50-8	Copper___	4740	_	E	P_
7439-89-6	Iron_____	968000	_		P_
7439-92-1	Lead_____	3.5	B	WN	F_
7439-95-4	Magnesium	55500	_	E	P_
7439-96-5	Manganese	76800	_		P_
7439-97-6	Mercury__	0.20	_		CV
7440-02-0	Nickel___	663	_	E	P_
7440-09-7	Potassium	1260	B		P_
7782-49-2	Selenium_	7.0	U	WN	F_
7440-22-4	Silver___	69.2	_		P_
7440-23-5	Sodium___	8310	_		P_
7440-28-0	Thallium_	3.5	B	W	F_
7440-62-2	Vanadium_	27.5	B		P_
7440-66-6	Zinc_____	15000	_		P_
_____	Molybdenu	40.6	_	*	P_

Color Before: BROWN____ Clarity Before: CLEAR_ Texture: _____
Color After: BROWN____ Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Goathill Scar wtr
SF5812

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844
Matrix (soil/water): WATER Lab Sample ID: SF5812
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	239000	_		P_
7440-36-0	Antimony_	34.5	B	N*	P_
7440-38-2	Arsenic__	21.2	B	WN	F_
7440-39-3	Barium___	5.6	B	N	P_
7440-41-7	Beryllium	97.0	_	E	P_
7440-43-9	Cadmium__	17.4	_		P_
7440-70-2	Calcium__	170000	_	E	P_
7440-47-3	Chromium_	15.8	_	E	P_
7440-48-4	Cobalt___	405	_	E	P_
7440-50-8	Copper___	4780	_	E	P_
7439-89-6	Iron____	962000	_		P_
7439-92-1	Lead____	3.5	B	WN	F_
7439-95-4	Magnesium	56000	_	E	P_
7439-96-5	Manganese	75800	_		P_
7439-97-6	Mercury__	0.22	_		CV
7440-02-0	Nickel___	704	_	E	P_
7440-09-7	Potassium	930	B		P_
7782-49-2	Selenium_	15.0	_	+N	F_
7440-22-4	Silver___	68.8	_		P_
7440-23-5	Sodium___	8870	_		P_
7440-28-0	Thallium_	3.9	B	W	F_
7440-62-2	Vanadium_	30.3	B		P_
7440-66-6	Zinc____	15000	_		P_
_____	Molybdenu	31.6	_	*	P_

Color Before: BROWN____ Clarity Before: CLEAR_ Texture: _____
Color After: BROWN____ Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
RB blw Columbine Cr
SF5844 (CUF)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844
Matrix (soil/water): WATER Lab Sample ID: SF5844
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

(9)

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	284			P
7440-36-0	Antimony	28.5	U	N*	P
7440-38-2	Arsenic	0.90	U	WN	F
7440-39-3	Barium	38.0	B	N	P
7440-41-7	Beryllium	0.40	B	E	P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	21700		E	P
7440-47-3	Chromium	2.8	U	E	P
7440-48-4	Cobalt	4.1	U	E	P
7440-50-8	Copper	6.0	B	E	P
7439-89-6	Iron	388			P
7439-92-1	Lead	2.5	B	WN	F
7439-95-4	Magnesium	2960	B	E	P
7439-96-5	Manganese	55.8			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	13.3	U	E	P
7440-09-7	Potassium	873	B		P
7782-49-2	Selenium	0.70	U	N	F
7440-22-4	Silver	11.8			P
7440-23-5	Sodium	2000	B		P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	25.7			P
	Molybdenu	6.9	U	*	P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____
Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:

U.S. FPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Field Blk
SF5845

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844
Matrix (soil/water): WATER Lab Sample ID: SF5845
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	25.1	B		P
7440-36-0	Antimony	28.5	U	N*	P
7440-38-2	Arsenic	0.90	U	WN	F
7440-39-3	Barium	3.7	B	N	P
7440-41-7	Beryllium	0.61	B	E	P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	1300	B	E	P
7440-47-3	Chromium	5.3	B	E	P
7440-48-4	Cobalt	4.1	U	E	P
7440-50-8	Copper	5.5	B	E	P
7439-89-6	Iron	1710			P
7439-92-1	Lead	0.60	U	N	F
7439-95-4	Magnesium	322	B	E	P
7439-96-5	Manganese	4.6	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	13.3	U	E	P
7440-09-7	Potassium	939	B		P
7782-49-2	Selenium	0.70	U	N	F
7440-22-4	Silver	8.6	B		P
7440-23-5	Sodium	12300			P
7440-28-0	Thallium	1.0	B	W	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	2.8	B		P
	Molybdenu	6.9	U	*	P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Hanson Crk @ Hwy 38

SF5853

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844

Matrix (soil/water): WATER Lab Sample ID: SF5853

Level (low/med): LOW__ Date Received: 06/28/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	98800			P
7440-36-0	Antimony	28.5	U	N*	P
7440-38-2	Arsenic	1.0	B	WN	F
7440-39-3	Barium	7.2	B	N	P
7440-41-7	Beryllium	18.6		E	P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	332000		E	P
7440-47-3	Chromium	3.5	B	E	P
7440-48-4	Cobalt	180		E	P
7440-50-8	Copper	128		E	P
7439-89-6	Iron	7770			P
7439-92-1	Lead	2.5	B	WN	F
7439-95-4	Magnesium	66800		E	P
7439-96-5	Manganese	8810			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	436		E	P
7440-09-7	Potassium	6990			P
7782-49-2	Selenium	7.0	U	N	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	11000			P
7440-28-0	Thallium	0.90	U	W	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	2900			P
	Molybdenu	6.9	U	*	P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____

Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
RR @ Ranger station
SF5861 (f)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844
Matrix (soil/water): WATER Lab Sample ID: SF5861
Level (low/med): LOW__ Date Received: 06/28/94 (1)
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	236			P
7440-36-0	Antimony	28.5	U	N*	P
7440-38-2	Arsenic	0.90	U	WN	F
7440-39-3	Barium	26.9	B	N	P
7440-41-7	Beryllium	0.52	B	E	P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	29000		E	P
7440-47-3	Chromium	3.3	B	E	P
7440-48-4	Cobalt	5.4	B	E	P
7440-50-8	Copper	4.2	B	E	P
7439-89-6	Iron	46.4	B		P
7439-92-1	Lead	0.60	U	WN	F
7439-95-4	Magnesium	5890		E	P
7439-96-5	Manganese	369			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	13.3	U	E	P
7440-09-7	Potassium	1070	B		P
7782-49-2	Selenium	0.70	U	N	F
7440-22-4	Silver	2.6	U		P
7440-23-5	Sodium	3160	B		P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	62.8			P
	Molybdenu	6.9	U	*	P

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____
Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

13

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
ER @ Ranger Station (UF)
SF5862

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F- SDG No.: SF5844 (1)
Matrix (soil/water): WATER Lab Sample ID: SF5862
Level (low/med): LOW__ Date Received: 06/28/94
% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1360			P
7440-36-0	Antimony	28.5	U	N*	P
7440-38-2	Arsenic	0.90	U	WN	F
7440-39-3	Barium	39.8	B	N	P
7440-41-7	Beryllium	0.84	B	E	P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	29800		E	P
7440-47-3	Chromium	2.8	U	E	P
7440-48-4	Cobalt	5.9	B	E	P
7440-50-8	Copper	14.9	B	E	P
7439-89-6	Iron	716			P
7439-92-1	Lead	2.0	B	WN	F
7439-95-4	Magnesium	6210		E	P
7439-96-5	Manganese	407			P
7439-97-6	Mercury	0.22			CV
7440-02-0	Nickel	13.3	U	E	P
7440-09-7	Potassium	1150	B		P
7782-49-2	Selenium	0.70	U	N	F
7440-22-4	Silver	9.6	B		P
7440-23-5	Sodium	3230	B		P
7440-28-0	Thallium	0.90	U	W	F
7440-62-2	Vanadium	3.5	U		P
7440-66-6	Zinc	95.2			P
	Molybdenu	6.9	U	*	P

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____
Color After: COLORLESS Clarity After. CLEAR Artifacts: _____

Comments:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: 8-18-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP

Case#: SAS 8450F-01

SDG#: SF-5801

The EPA Region 6 Houston Branch ESAT data review team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site.

The samples analyzed and reviewed are detailed in the attached Regional data assessment report for this case.

The data package was found to be:

( ) Acceptable. No major problems with data package.

(X) Provisional; use of data requires caution. Problems are noted in Review Summary. Data is acceptable for Regional use.

( ) Unacceptable; Some or all of data should not be used. Problems are noted in the Review Summary.

Questions regarding the data review can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. ElFeky, Region 6 Data Coordinator
Regional CLP/TPO (lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable

USEPA REGION VI

REGIONAL ACCEPTANCE FORM
FOR SPECIAL ANALYTICAL SERVICES

Lab Code: SILVER SAS No. 08450F-01 Case No SDG No. SF5801 Data Receipt Date: 07/13/94
Site Name: MOLY CORP QUESTA MINE Est. Liquidated Damages: $0 00
SMO Complete Date: 07/14/94

Please provide a copy of this completed form to the Sample Management Office's SAS IPS Section Leader no later than 08/28/94
ndicate below, by checking the appropriate box, whether the data for this SDG are accepted or of reduced value or rejected
'f the Region is requesting a reduced value or a rejection, please attach all appropriate documentation.

Check appropriate box below:

DATA ACCEPTANCE

☑ Data appear acceptable (i.e data that is not rejected or recommended for reduced value) according to the Region's inspection process Applicable liquidated damages as outlined in the laboratory's subcontract are applied as approrpiate.

I REDUCED VALUE

☐ Data are recommended for a reduced value. The Region recommends that the value of the data package be reduced by __% Attached are a signed memo from the Regional official describing the contractual reasons for reduced value and all related documents (data review, telephone logs, etc.).

II. JECTION

☐ Data are recommended for rejection. Attached are a signed memo from the Regional Official describing the contractual reasons for rejection, all related documents (data review, telephone logs, etc.), and all rejected data.

COMMENTS

Name of data reviewer: ELIZABETH COX
Organization: ESAT, REGION 6
Date review complete: 8-17-94

Name of Regional Official: MAHMOUD ELFEKY
Signature: M. Elfeky Date: 8-18-94

ESAT REGION VI
U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: August 17, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD #6-4714

Attached is the data review summary for Case #22394/SAS8450F-01
SDG #SF5801
Site MOLYCORP

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

No contractual problems were identified in this review.

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

The data package is technically provisional, and the significant technical problems are summarized below.

1. Three arsenic and eight thallium results were unusable due to matrix spike recoveries below 30%.

2. The antimony and selenium matrix spike recoveries were below the QC limits.

3. Arsenic, selenium, and thallium FAA analytical spike recoveries were outside QC limits.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

CASE NO. 22394/SAS8450F-01
LABORATORY SILVER
CONTRACT # SAS 8450F-01
SDG # SF5801
SOW# SAS8450F-01/ILM02.1
ACCT # 4TFAJNG5 SF # TFAUZZ

SITE MOLYCORP
NO. OF SAMPLES/
MATRIX 11/SOIL
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Elizabeth Cox
COMPLETION DATE Aug. 17, 1994

SAMPLE NO.: SF-5801, SF-5804, SF-5805, SF-5806, SF-5816, SF-5817, SF-5818, SF-5819, SF-5860, SF-5897, SF-5899

INORGANIC REGIONAL DATA ASSESSMENT
DATA ASSESSMENT SUMMARY

	ICP	AA	Hg
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	O	O
4. MATRIX SPIKE	M	M	O
5. DUPLICATE ANALYSIS	O	O	O
6. ICP QC	O		
7. FAA QC		M	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	X	X	O
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	M	M	O

O = Data had no problems/or qualified due to minor problems.
M = Data qualified due to major problems.
Z = Data unacceptable.
X = Problems, but do not affect data.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: Matrix spike recoveries were outside QC limits, and FAA analytical spikes were outside QC limits.

NOTABLE PERFORMANCE:

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS8450F-01 SDG SF5801 Site MOLYCORP Lab SILVER

COMMENTS:

The SAS request required the laboratory to prepare and analyze the samples by CLP SOW ILM02.1 and Method 200.7. The data review was based on the requirement in these methods.

Eleven low concentration soil samples were analyzed for total metals and molybdenum. The sampler specified sample SF-5801 as a lab QC sample. Samples SF-5897 and SF-5899 were field duplicates. The data package met the 15-day data package turnaround requirement specified in the SAS request.

Three arsenic and eight thallium results were unusable due to matrix spike recoveries below 30%. The data package is technically provisional due to QC deficiencies including outlying matrix spike recoveries and outlying FAA analytical spike recoveries. This report documents only the QC requirements that weren't met and those factors affecting the technical usability of the results.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF) and the Evidence Inventory Checklist is attached to this report.

1. **Holding Times**

   All holding time criteria were met.

2. **Calibrations**

   All calibrations were acceptable.

3. **Blanks**

   Sample results were affected by arsenic, beryllium, selenium, silver, and thallium in the calibration and/or preparation blanks. Sample results above the contract required detection limit (CRDL) that were affected by blank contamination are listed below.

   The silver results for samples SF-5804, SF-5805, SF-5817, and SF-5897 are biased high.

   The silver results for samples SF-5816 and SF-5818 should be considered undetected.

   The effects of blank contamination on sample results above and below the CRDL are noted in the Data Summary Table.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS8450F-01 SDG SF5801 Site MOLYCORP Lab SILVER

4. Pre-digestion Matrix Spike

The following results are qualified due to outlying matrix spike recoveries. Although some arsenic and thallium results were previously affected by blank contamination, it is the reviewer's opinion that the effect of the extremely low matrix spike recoveries outweighs the effect of blank contamination. Physical or chemical interference in the samples is possible.

The arsenic results for samples SF-5817, SF-5897, and SF-5899, and the thallium results for samples SF-5804, SF-5805, SF-5806, SF-5816, SF-5817, SF-5818, SF-5860, and SF-5899 are unusable due to matrix spike recoveries below 30%. False negatives for arsenic and thallium are possible in these samples.

The remaining arsenic and thallium results are estimated due to matrix spike recoveries below 30%. The results reported in the Data Summary Table for these samples are the lowest possible results and the actual results may be higher than reported.

The antimony and selenium results are estimated due to matrix spike recoveries below the QC limits.

5. Duplicate Analysis

The differences between all duplicate results were acceptable.

6. ICP Quality Control

All serial dilution differences were acceptable, and all interference check sample criteria were met.

7. Furnace Atomic Absorption Quality Control

FAA Analytical Spike

The following results are qualified due to outlying FAA analytical spike recoveries. Physical or chemical interference in the samples is possible.

The arsenic results for samples SF-5818 and SF-5819 are estimated.

The selenium result for sample SF-5805 is estimated.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS8450F-01 SDG SF5801 Site MOLYCORP Lab SILVER

7. Furnace Atomic Absorption Quality Control, continued:

The thallium result for sample SF-5801 is estimated.

Arsenic results for samples SF-5817, SF-5897, and SF-5899, and thallium results for samples SF-5806, SF-5817, and SF-5899 were previously qualified as unusable due to matrix spike recoveries and no further qualification was made.

Two other selenium results had FAA analytical spike recoveries above QC limits. However, since no selenium was reported in the samples, it is the reviewer's opinion that these results are not affected by the outlying FAA analytical spike recoveries.

Method of Standard Additions

All MSA results were acceptable.

8. Laboratory Control Sample

All laboratory control sample results were acceptable.

9. Sample Verification

The reviewer noted the following errors or omission. The laboratory was contacted for resubmission.

The value for the molybdenum ICV in the raw data (page 172) is 1966 µg/L. However, the value listed on Form 2A is 1980 µg/L.

The molybdenum results for the ICSA and ICSAB were not reported on Form 4, although they were "X'd" on the Form 14 (page 58).

The lead CRDL reported on Form 10 is 5 µg/L. According to ILM02.1, the lead CRDL is 3 µg/L.

10. Other QC

Field Duplicates

The sampler identified samples SF-5897 and SF-5899 as field duplicates. The differences between all field duplicate results were acceptable.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case SAS8450F-01 SDG SF5801 Site MOLYCORP Lab SILVER

11. Overall Assessment

The data package is provisional for the following reasons.

Three arsenic and eight thallium results were unusable, and the remaining arsenic and thallium results were estimated due to matrix spike recoveries below 30%.

All antimony and selenium results were estimated due to outlying matrix spike recoveries.

Five arsenic, one selenium, and four thallium results were estimated due to outlying FAA analytical spike recoveries.

In Reference to Case
SAS No.: 8450F-01
SDG No.: SF5801
Laboratory: SILVER

In reference to data for the following sample numbers:

SF-5801, SF-5804, SF-5805, SF-5806, SF-5816, SF-5817, SF-5818, SF-5819, SF-5860, SF-5897, SF-5899

Summary of Questions/Issues:

1. The value for the molybdenum ICV in the raw data (page 172) is 1966 µg/L. However, the value listed on Form 2A is 1980 µg/L. Please verify and, if necessary, correct and resubmit the Form 2A.

2. The molybdenum results for the ICSA and ICSAB were not reported on Form 4, although they were "X'd" on the Form 14 (page 58). Please resubmit the Form 4 listing the molybdenum results for the ICSA and ICSAB.

3. The lead CRDL reported on Form 10 is 5 µg/L. According to ILM02.1, the lead CRDL is 3 µg/L. Please correct and resubmit the Form 10 listing the lead CRDL as 3 µg/L.

MEMORANDUM

W. E. Blanton

To: M. Ritter
From: W. E. Blanton

Subject: SAS 8450F-01 SDG SF5801 Laboratory Resubmissions
Date: August 17, 1994

Copies: M. El Feky
ICF File
File

Ref: WUD No. 6-4714
MEM1097
I-1460

Attached is a list of issues needing clarification and items needing corrections and omissions for SAS case 8450F-01 SDG SF5801. The EPA user is K. Hill, 6H-MA. The samples in this case were analyzed by:

SVL Analytical, Inc.
One Government Gulch
Kellogg, ID 83837
Attention: Blake Johnson

These laboratory resubmissions are necessary to enable the Environmental Protection Agency to maximize the usability of the laboratory results in this data package. The laboratory resubmissions should be submitted to:

Ms. Christy Macdowell
ManTech Environmental Technology, Inc.
c/o US EPA
10625 Fallstone Rd.
Houston, TX 77099

Ms. Macdowell will then distribute the laboratory resubmission to the appropriate data reviewer who will prepare the resubmission report for this case.

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

, Negative bias.

DATA SUMMARY

Case No : SAS8450F01 SDG. No.. SF5801 Reviewer: A. CANTU
Laboratory: SILVER Matrix: SOIL Units: MG/KG

EPA TR #=>	SF-5801	FLAG	SF-5804	FLAG	SF-5805	FLAG	SF-5806	FLAG	SF-5816	FLAG	COMMENTS
LAB ID											
ALUMINUM	2220		1910		2730		5860		6190		
ANTIMONY	6.2	UJ	5.8	UJ	5 9	UJ	5 9	UJ	6.3	UJ	
ARSENIC	21.2	Jv	2.6	Jv	2.5	Jv	11 4	Jv	1 6	Jv	
BARIUM	106		45.2		171		46 2		27.5		
BERYLLIUM	0 12	J^	0 25		0.27		0 27		0.59		
CADMIUM	0.85	U	0.8	U	0.81	U	0.8	U	0.86	U	
CALCIUM	81.9		195		1350		2280		8860		
CHROMIUM	0.61	U	0.57	U	4 6		17 5		10 4		
COBALT	3.7		0.84	U	2.4		3 5		5.6		
COPPER	52.4		26.3		45.4		41.6		126		
IRON	156000		13800		16800		27700		22700		
LEAD	134		431		40.2		91		61		
MAGNESIUM	192		265		1800		3610		4300		
MANGANESE	17.7		64 5		155		473		432		
MERCURY	0 11	U	0 1	U	0.1	U	0.1	U	0.11	U	
NICKEL	2.9	U	2.7	U	5 5		12.7		12.2		
POTASSIUM	23700		1620		2180		2550		2540		
SELENIUM	3 4	J	0.14	UJ	1.5	J	0.43	J	0.35	J	
SILVER	12.5		3.2	J^	2.9	J^	4		2.4	UC	
SODIUM	1200		27.5		40.5		67		99.9		
THALLIUM	2.9	Jv	0.18	UR	0 19	UR	0.19	UR	0.2	UR	
VANADIUM	16.2		1.3		5.9		12.7		14.9		
ZINC	23.9		86.5		20.8		53.3		66.3		
MOLYBDENUM	35.6		9 3		6 1		24		10.8		
% SOLIDS	91 6		97.7		96.1		97 2		90.4		

SD # SS-3 SS-1 SS-5 SS-6 SS-7

Location Gauthier Capuchin Capwell Gauthier Inland Sh

Soil Soil Soil Soil West

DATA SUMMARY

Case No · SAS8450F01 SDG No.. SF5801 Reviewer: A. CANTU
Laboratory· SILVER Matrix: SOIL Units: MG/KG

EPA #=> LAB ID	SF-5817	FLAG	SF-5818	FLAG	SF-5819	FLAG	SF-5860	FLAG	SF-5897	FLAG	COMMENTS
ALUMINUM	9130		5810		18900		8210		10300		
ANTIMONY	6	UJ	5 8	UJ	5.9	UJ	6 4	UJ	6	UJ	
ARSENIC	0 7	UCR	1.1	Jv	0.96	Jv	11.5	Jv	0.7	UCR	
BARIUM	41.2		4		246		248		147		
BERYLLIUM	0 89		1.3		0.63		0 42		0 52		
CADMIUM	0.82	U	3.9		0.8	U	0.87	U	0 82	U	
CALCIUM	8670		15100		18400		8810		5590		
CHROMIUM	17		0.57	U	81.7		12.8		47		
COBALT	13 3		2.9		9		4.6		2.4		
COPPER	222		92.5		140		35.1		31.4		
IRON	25400		7830		46000		61500		40200		
LEAD	40.8		275		31.1		138		42.5		
MAGNESIUM	4700		1250		18700		7100		4140		
MANGANESE	293		1080		362		258		200		
MERCURY	0.1	U	0.1	U	0.1	U	0.11	U	0.1	U	
[illegible]EL	21.7		3.7		26.9		12.4		12.6		
POTASSIUM	2550		1020		12300		3300		6250		
SELENIUM	0.15	UJ	0.14	UJ	0 68	UCJ	2 2	J	3 6	J	
SILVER	3	J^	2.2	UC	4.6		6		3.8	J^	
SODIUM	56.1		43.8		183		689		908		
THALLIUM	0 32	UCR	0.18	UR	2.4	Jv	2	UR	2.1	Jv	
VANADIUM	16.2		3 4		83.3		18.6		43		
ZINC	43.3		569		35.4		55.9		31.4		
MOLYBDENUM	176		207		168		16.6		7.5		
% SOLIDS	95.6		99.1		97.2		89.4		95.5		
	[illegible]		[illegible]-10		[illegible]		[illegible]-12		[illegible]		
	Truck Shop Road		Lower Seven Rd		[illegible] South		Hanson Scar		Eagle Scar		

DATA SUMMARY

Case No.: SAS8450F01 SDG No.. SF5801 Reviewer: A. CANTU
Laboratory: SILVER Matrix SOIL Units. MG/KG

EPA [redacted] #=>	SF-5899	FLAG	FLAG	FLAG	FLAG	FLAG	COMMENTS
LAB ID							
ALUMINUM	7770						
ANTIMONY	6	UJ					
ARSENIC	0 63	UCR					
BARIUM	131						
BERYLLIUM	0 44						
CADMIUM	0.82	U					
CALCIUM	7680						
CHROMIUM	44.8						
COBALT	2.4						
COPPER	31.3						
IRON	43500						
LEAD	45.9						
MAGNESIUM	3370						
MANGANESE	173						
MERCURY	0.1	U					
[redacted]L	9 1						
POTASSIUM	5630						
SELENIUM	3.7	J					
SILVER	4 1						
SODIUM	1200						
THALLIUM	0 19	UR					
VANADIUM	37.7						
ZINC	27.5						
MOLYBDENUM	9.6						
% SOLIDS	95.6						

Eagle

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No 22394 SDG No. SF5801 SDG Nos. To Follow SAS No. 8450F-01 Date Rec 07-13-94

EPA [redacted] ID: SILVER

Lab Location: Kellogg, ID

Region: 6 Audit No.: SAS8450F/SF5801

Re_Submitted CSF? Yes ____ No X

Box No(s): ONE

COMMENTS:

3 Page 66 of the data package was listed as a Form 14 on the Form DC-2 but is actually a Form 7.

Over for additional comments.

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2. Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?		X	
4 Are enclosed documents listed?	X		
5. Are listed documents enclosed?	X		
FORM DC-1			
6. Present?	X		
7. Complete?	X		
8. Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10. Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11. Signed?	X		
12. Dated?	X		
AIRBILLS/AIRBILL STICKER			
13. Present?	X		
14. Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17. Present?	X		
OTHER DOCUMENTS			
18 Complete?	X		
19. Legible?	X		
20. Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Audited by: Elizabeth Cox for — David Spencer - Scientist Associate — Date 07-21-94

Audited by: ____ — ____ — Date ____

Audited by: ____ — ____ — Date ____

Signature — Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: ____ Date Entered: ____ Date Reviewed: ____

Entered by: ____ ____

Reviewed by: ____ ____

Signature — Printed Name/Title

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135

Lab Code: SILVER Case No.: 22394 SAS No.: 450F_ SDG No.:SF5801

SOW No.: ILM02

EPA Sample No.	Lab Sample ID
_SF5801_____	_SF5801_____
_SF5801D_____	_SF5801D_____
_SF5801S_____	_SF5801S_____
_SF5804_____	_SF5804_____
_SF5805_____	_SF5805_____
_SF5806_____	_SF5806_____
_SF5816_____	_SF5816_____
_SF5817_____	_SF5817_____
_SF5818_____	_SF5818_____
_SF5819_____	_SF5819_____
_SF5860_____	_SF5860_____
_SF5897_____	_SF5897_____
_SF5899_____	_SF5899_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:
____SAS_NO:__8450F-01_____

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Melba Bencich Name: MELBA BENCICH

Date: JULY 12, 1994 Title: DOCUMENT CONTROL OFFICER

U.S. EPA -

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Eagle Rock Scar

SF5897 (M)

E NO.

Dump

(R)

ANALYTICAL_INC._____ Contract: SILVER0135

ER Case No.: 22394 SAS No.: 8450F_ SDG No.: SF5801 SF5801

ater): SOIL_ Lab Sample ID: SF5897 06

): LOW__ Date Received: 06/29/94 9/94

_95.5

ncentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10300		*	P
7440-36-0	Antimony	6.0	U	N	P
7440-38-2	Arsenic	0.70	B	WN	F
7440-39-3	Barium	147			P
7440-41-7	Beryllium	0.52	B		P
7440-43-9	Cadmium	0.82	U		P
7440-70-2	Calcium	5590			P
7440-47-3	Chromium	47.0			P
7440-48-4	Cobalt	2.4	B		P
7440-50-8	Copper	31.4			P
7439-89-6	Iron	40200		*	P
7439-92-1	Lead	42.5			F
7439-95-4	Magnesium	4140			P
7439-96-5	Manganese	200			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	12.6			P
7440-09-7	Potassium	6250		*	P
7782-49-2	Selenium	3.6		N	F
7440-22-4	Silver	3.8		*	P
7440-23-5	Sodium	908	B		P
7440-28-0	Thallium	2.1	B	N	F
7440-62-2	Vanadium	43.0			P
7440-66-6	Zinc	31.4			P
	Molybdenu	7.5			P

BROWN Clarity Before: _____ Texture: MEDIUM MEDIUM

YELLOW Clarity After: _____ Artifacts: _____ _____

TION

UTIO

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Sugar Shack South
SF5819

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F_ SDG No.: SF5801
Matrix (soil/water): SOIL_ Lab Sample ID: SF5819
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: _97.2

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	18900		*	P
7440-36-0	Antimony	5.9	U	N	P
7440-38-2	Arsenic	0.96	B	WN	F
7440-39-3	Barium	246			P
7440-41-7	Beryllium	0.63	B		P
7440-43-9	Cadmium	0.80	U		P
7440-70-2	Calcium	18400			P
7440-47-3	Chromium	81.7			P
7440-48-4	Cobalt	9.0	B		P
7440-50-8	Copper	140			P
7439-89-6	Iron	46000		*	P
7439-92-1	Lead	31.1		S	F
7439-95-4	Magnesium	18700			P
7439-96-5	Manganese	362			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	26.9			P
7440-09-7	Potassium	12300		*	P
7782-49-2	Selenium	0.68	B	SN	F
7440-22-4	Silver	4.6		*	P
7440-23-5	Sodium	183	B		P
7440-28-0	Thallium	2.4	B	N	F
7440-62-2	Vanadium	83.3			P
7440-66-6	Zinc	35.4			P
	Molybdenu	168			P

Color Before: BROWN Clarity Before: _____ Texture: MEDIUM
Color After: YELLOW Clarity After: _____ Artifacts: _____

Comments:
PB_=_10X_DILUTION
TL_=_10X_DILUTION

U.S. E. . - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Along Truck Shop Rd.
SF5817

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F_ SDG No.: SF5801
Matrix (soil/water): SOIL_ Lab Sample ID: SF5817
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: _95.6

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	9130		*	P
7440-36-0	Antimony	6.0	U	N	P
7440-38-2	Arsenic	0.70	B	WN	F
7440-39-3	Barium	41.2	B		P
7440-41-7	Beryllium	0.89	B		P
7440-43-9	Cadmium	0.82	U		P
7440-70-2	Calcium	8670			P
7440-47-3	Chromium	17.0			P
7440-48-4	Cobalt	13.3			P
7440-50-8	Copper	222			P
7439-89-6	Iron	25400		*	P
7439-92-1	Lead	40.8			F
7439-95-4	Magnesium	4700			P
7439-96-5	Manganese	293			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	21.7			P
7440-09-7	Potassium	2550		*	P
7782-49-2	Selenium	0.15	U	WN	F
7440-22-4	Silver	3.0		*	P
7440-23-5	Sodium	56.1	B		P
7440-28-0	Thallium	0.32	B	WN	F
7440-62-2	Vanadium	16.2			P
7440-66-6	Zinc	43.3			P
	Molybdenu	176			P

Color Before: YELLOW Clarity Before: _____ Texture: MEDIUM
Color After: YELLOW Clarity After. _____ Artifacts: _____

Comments:
PB_=_3X_DILUTION

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Along Bench Road
SF5818

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F_ SDG No.: SF5801
Matrix (soil/water): SOIL_ Lab Sample ID: SF5818
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: _99.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5810		*	P
7440-36-0	Antimony	5.8	U	N	P
7440-38-2	Arsenic	1.1	B	WN	F
7440-39-3	Barium	4.0	B		P
7440-41-7	Beryllium	1.3			P
7440-43-9	Cadmium	3.9			P
7440-70-2	Calcium	15100			P
7440-47-3	Chromium	0.57	U		P
7440-48-4	Cobalt	2.9	B		P
7440-50-8	Copper	92.5			P
7439-89-6	Iron	7830		*	P
7439-92-1	Lead	275			P
7439-95-4	Magnesium	1250			P
7439-96-5	Manganese	1080			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	3.7	B		P
7440-09-7	Potassium	1020		*	P
7782-49-2	Selenium	0.14	U	N	F
7440-22-4	Silver	2.2		*	P
7440-23-5	Sodium	43.8	B		P
7440-28-0	Thallium	0.18	U	N	F
7440-62-2	Vanadium	3.4	B		P
7440-66-6	Zinc	569			P
	Molybdenu	207			P

Color Before: GREY_____ Clarity Before: _____ Texture: MEDIUM
Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Hanson Creek Sca
SF5860

Lab Name: SVL_ANALYTICAL_INC._____ Contract: SILVER0135
Lab Code: SILVER Case No.: 22394 SAS No.: 8450F_ SDG No.: SF5801
Matrix (soil/water): SOIL_ Lab Sample ID: SF5860
Level (low/med): LOW__ Date Received: 06/29/94
% Solids: _89.4

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	8210	_	*	P_
7440-36-0	Antimony_	6.4	U	N	P_
7440-38-2	Arsenic__	11.5	B	N	F_
7440-39-3	Barium___	248	_		P_
7440-41-7	Beryllium	0.42	B		P_
7440-43-9	Cadmium__	0.87	U		P_
7440-70-2	Calcium__	8810	_		P_
7440-47-3	Chromium_	12.8	_		P_
7440-48-4	Cobalt___	4.6	B		P_
7440-50-8	Copper___	35.1	_		P_
7439-89-6	Iron____	61500	_	*	P_
7439-92-1	Lead____	138	_		P_
7439-95-4	Magnesium	7100	_		P_
7439-96-5	Manganese	258	_		P_
7439-97-6	Mercury_	0.11	U		CV
7440-02-0	Nickel___	12.4	_		P_
7440-09-7	Potassium	3300	_	*	P_
7782-49-2	Selenium_	2.2	_	N	F_
7440-22-4	Silver___	6.0	_	*	P_
7440-23-5	Sodium___	689	B		P_
7440-28-0	Thallium_	2.0	U	N	F_
7440-62-2	Vanadium_	18.6	_		P_
7440-66-6	Zinc____	55.9	_		P_
_____	Molybdenu	16.6	_		P_

Color Before: YELLOW___ Clarity Before: _____ Texture: MEDIUM
Color After: YELLOW___ Clarity After: _____ Artifacts: _____

Comments:
AS_=_10X_DILUTION
TL_=_10X_DILUTION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

MEMORANDUM

Date: 12-22-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLY CORP QUESTA MINE

Case#: 22894

SDG#: MFQ-183

The EPA Region 6 Houston Branch ESAT data validation team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site. The samples analyzed and reviewed are detailed in the attached Regional data review and assessment report for this case.

The data package was found to be:

( ) Acceptable: No major problems with data package.

(X) Provisional: Use of data requires caution.
Data is acceptable for Regional use. Problems are noted in the review report.

( ) Unacceptable: Some or all of data should not be used.
Problems are noted in the review report.

Questions regarding the data review report can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. El-feky, Region 6 Data Coordinator
Regional CLP/TPO (if lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

LAB CODE: SILVER	CASE NO.: 22894	SDG NO.: MFQ183

RT III. PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER AN "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE.
ALL SAMPLES THAT ARE NOT MARKED WITH AN "X" OR A "D" ARE ACCEPTED

SAMPLE	FRACTIONS ANALYZED			
	METALS		CYANIDE	
LCSW	Y			
MFQ183	Y			
MFQ192	Y			
MFQ193	Y			
MFQ194	Y			
MFQ195	Y			
MFQ196	Y			
MFQ197	Y			
MFQ197D	Y			
MFQ197S	Y			
MFQ198	Y			
MFQ199	Y			
MFQ243	Y			
MFQ244	Y			
MFQ245	Y			
MFQ246	Y			
MFQ272	Y			
MFQ392	Y			
MFQ393	Y			
MFQ394	Y			
MFQ395	Y			
MFQ396	Y			
MFQ397	Y			

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: December 20, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD # 6-5198

Attached is the data review summary for Case #22894
SDG #MFQ183
Site Molycorp

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

The laboratory was contractually compliant as noted by CCS and the hardcopy data review.

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

A total of 460 results were reviewed for this data package. Six percent of the results reviewed were qualified due to technical problems. The data package is technically provisional due to the following significant problems.

Analytical spike recoveries for some arsenic, lead, and selenium were outside QC limits.

The ICSA indicates over-correction for cadmium by the interelement correction factors.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. 22894
LABORATORY Silver
CONTRACT # 68-D2-0042
SDG # MFQ183
SOW# ILM02.1
ACCT # 5TFAJN34 SF # TFAUZZ
SITE Molycorp
NO. OF SAMPLES/
MATRIX 20/Water
REVIEWER (IF NOT ESD) ESAT
REVIEWER'S NAME Sonya Meekins
COMPLETION DATE December 20, 1994

SAMPLE NO.:				
MFQ-183	MFQ-195	MFQ-199	MFQ-246	MFQ-394
MFQ-192	MFQ-196	MFQ-243	MFQ-272	MFQ-395
MFQ-193	MFQ-197	MFQ-244	MFQ-392	MFQ-396
MFQ-194	MFQ-198	MFQ-245	MFQ-393	MFQ-397

DATA ASSESSMENT SUMMARY

	ICP	AA	Hg
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	O	O
4. MATRIX SPIKES	O	O	O
5. DUPLICATE ANALYSIS	O	O	O
6. ICP QC	M		
7. FAA QC		M	O
8. LCS	O	O	O
9. SAMPLE VERIFICATION	O	O	O
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	M	M	O

O = Data had no problems.
M = Data qualified due to major or minor problems.
Z = Data unacceptable.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: FAA analytical spike recoveries for lead were above the upper QC limit and below the lower QC limit for arsenic and selenium. Interelement correction factors (IEC's) appear to be incorrect for cadmium.

NOTABLE PERFORMANCE: The data package was received two days early.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ183 Site Molycorp Lab Silver

COMMENTS:

Twenty water samples were analyzed at low concentration for total metals. The sampler specified sample MFQ-197 as a laboratory QC. The laboratory met the contractual 35-day turnaround time requirement. More than half of the target analytes were present at levels above the CRDL's in all samples. Reported concentrations were significant for half of the analytes in sample MFQ-183. Dilution of sample MFQ-183 was necessary to analyze the iron and magnesium. Other samples also contained high concentrations of manganese and zinc.

This data package is technically provisional due to a problem with a few FAA analytical spike recoveries and IEC's. The technical usability of all reported sample results is appropriately indicated by ESAT's final data qualifiers in the attached Data Summary Sheet.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. **Holding Times:** Acceptable. All holding time and sample preservation criteria were met.

2. **Calibrations:** Acceptable. All calibrations were acceptable. Analyses of CRDL standards indicated that the instrument performance near the CRDL's was acceptable.

3. **Blanks:** Acceptable. Preparation and calibration blanks met contractual requirements. Aluminum, antimony, beryllium, calcium, copper, iron, and magnesium were present in the calibration and/or preparation blanks. Only aluminum, copper, and iron concentrations in the preparation blank affected sample results below the CRDL, and these effects are noted on the Data Summary Sheet.

4. **Pre-digestion Matrix Spike Recovery:** Acceptable. All matrix spike recoveries were acceptable. The lead matrix spike recovery was marginally above the upper QC limit, but no results were qualified.

5. **Duplicate Analysis:** Acceptable. The differences between all laboratory duplicate results were within QC limits.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ183 Site Molycorp Lab Silver

6. **ICP Quality Control:**

Serial Dilution: Acceptable. All serial dilution differences met QC criteria.

Interference Check Sample: Provisional. All ICS results are acceptable. However, negative cadmium readings for the initial and final ICSA and some sample results indicate an over-correction by the IEC's. All cadmium results are estimated because a low bias is possible for these results.

The aluminum, iron, and magnesium concentrations in sample MFQ-183 and the calcium concentration in sample MFQ-244 were high enough to cause interference. After further consideration, the reviewer determined that samples MFQ-183 and MFQ-244 were not affected.

7. **Furnace Atomic Absorption Quality Control:**

FAA Analytical Spike Recovery: Provisional.

The arsenic result for sample MFQ-246 is estimated because the FAA analytical spike recovery was below the lower QC limit.

The lead results for samples MFQ-244 and MFQ-246 are estimated due to FAA analytical spike recoveries were above the upper QC limit. Although the lead analytical spike recoveries were high for samples MFQ-193, MFQ-194, MFQ-195, MFQ-198, MFQ-392, MFQ-393, MFQ-396, and MFQ-397, the reviewer did not qualify these lead results because they were undetected. The remaining lead results were not qualified because their FAA analytical spike recoveries were only marginally above the upper QC limit.

The selenium results for sample MFQ-244, MFQ-245, and MFQ-246 are estimated because the FAA analytical spike recoveries were below the lower QC limit.

All thallium FAA analytical spike recoveries were acceptable. Although analytical spike recoveries for samples MFQ-245 and MFQ-272 were high, the results were not qualified because they were undetected.

Method of Standard Addition: Acceptable. Lead results for samples MFQ-183 and MFQ-245 were determined by MSA. All MSA results met QC criteria.

8. **Laboratory Control Sample:** Acceptable. The LCS results were

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ183 Site Molycorp Lab Silver

9. **Sample Verification:** The data reviewer confirmed reporting errors found by CCS. A few reporting errors were noted by hardcopy review that were not detected by CCS. (See attached Fax Record Log).

10. **Other QC:** Not applicable.

11. **Overall Assessment:** The data package is technically provisional, and the following problems were noted:

    A few analytical spike recoveries for arsenic, lead, and selenium were outside QC limits for some samples.

    All cadmium results were estimated because of incorrect IEC's.

ManTech Environmental Technology
ESAT Region 6

c/o US EPA 10625 Fallstone Rd, Houston, TX 77099 TEL:(713) 983-2125

FACSIMILE COVER SHEET

Please deliver the following pages to:

Name Blake Johnson

Firm SVL Analytical Inc.

City Kellogg **State** ID

Telephone 208-784-1258 **Ext.** _____

Fax Telephone No. 208-783-0981 **Ext.** _____

Sender:

Name Sonya Meekins ESAT

Date December 20, 1994 **Time** _____

Total Number of pages including this Cover Sheet 2

If you do not receive all the pages or if any pages are unclear, please call: (713) 983-2122

MESSAGES: _____

Fax Model No. Panafax UF-620 Fax No. (713) 983-2248

Contract Laboratory Program
REGIONAL/LABORATORY COMMUNICATION SYSTEM

FAX Record Log

Date of FAX: December 20, 1994

Laboratory Name: SVL Analytical Inc.

Lab Contact: Blake Johnson

Region: 6

Regional Contact: Sonya Meekins (ESAT)

FAX Initiated by: Region

In reference to data for the following sample numbers:

MFQ-183	MFQ-195	MFQ-199	MFQ-246	MFQ-394
MFQ-192	MFQ-196	MFQ-243	MFQ-272	MFQ-395
MFQ-193	MFQ-197	MFQ-244	MFQ-392	MFQ-396
MFQ-194	MFQ-198	MFQ-245	MFQ-393	MFQ-397

Summary of Questions/Issues:

A. The lead analytical spike recoveries for samples MFQ-193, MFQ-198, MFQ-392, MFQ-393, MFQ-394, MFQ-396 and MFQ-397 were calculated incorrectly. According to the SOW (E-27,b), to calculate spike recoveries, anything less than the IDL should not be subtracted from the spiked result. Please correct Form 14 (p. 66-67) and resubmit.

B. Please explain why the cadmium ICSA's are negative and what action will be taken to correct this problem. Please explain.

The EPA expects the laboratory to look into items and submit data within fourteen days to Christy Macdowell, U.S. EPA, 10625 Fallstone Road, Houston TX 77099.

Sonya Meekins
Signature

12-20-94
Date

Distribution: (1) Lab Copy, (2) Region Copy, (3) SMO Copy

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

P A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

v Negative bias.

DATA SUMMARY

Case No.: 22894 SDG. No.: MFQ183 Reviewer: S. MEEKINS
Laboratory: SILVER Matrix: WATER Units: ug/L

EPA TR #=>	MFQ-183	FLAG	MFQ-192	FLAG	MFQ-193	FLAG	MFQ-194	FLAG	MFQ-195	FLAG	COMMENTS
ALUMINUM	770000		2590		2050		2050		1690		
ANTIMONY	25.6 U		25 6 U		25.6 U		25 6 U		25.6 U		
ARSENIC	114		1.2 U		1 2 U		1.2 U		1 2 U		
BARIUM	108		36.9		36.7		36.5		36.1		
BERYLLIUM	93		0 7		0 55		0 45		0.54		
CADMIUM	84.8 Jv		3.9 UJv		3.9 UJv		3 9 UJv		3.9 UJv		
CALCIUM	295000		47000		46600		46900		46100		
CHROMIUM	161		3.7 U		3 7 U		3 7 U		3.7 U		
COBALT	3810		7.4		7.9		4 6 U		4.6 U		
COPPER	4220		29 8		26.1		24.3		20.5		
IRON	322000		407		355		386		279		
LEAD	37.3		1 3		0.9 U		0 9 U		0.9 U		
MAGNESIUM	1060000		11000		10600		10700		10500		
MANGANESE	55000		851		603		607		553		
MERCURY	0.2 U		0 2 U		0 2 U		0.2 U		0.2 U		
NICKEL	7880		16.7 U		23		16.7 U		18.7		
POTASSIUM	10300		971		1130		668		1090		
SELENIUM	33 4 J		1 U		1 U		1 U		1 U		
SILVER	26		3.6 U		3 6 U		3 6 U		3.6 U		
SODIUM	177000		5490		5550		5660		5610		
THALLIUM	9 U		0.9 U		0.9 U		0.9 U		0.9 U		
VANADIUM	124		3.7 U		3.7 U		3.7 U		3.7 U		
ZINC	8860		205		149		153		136		

DATA SUMMARY

Case No.: 22894 SDG. No.: MFQ183 Reviewer: S. MEEKINS
Laboratory: SILVER Matrix: WATER Units: ug/L

EPA [redacted]#=>	MFQ-196	FLAG	MFQ-197	FLAG	MFQ-198	FLAG	MFQ-199	FLAG	MFQ-243	FLAG	COMMENTS
ALUMINUM	1540		1270		856		49.7	UC	1080		
ANTIMONY	25.6	U	25.6	U	25.6	U	25.6	U	25.6	U	
ARSENIC	1 2	U	1 2	U	1 2	U	1 2	U	1.2	U	
BARIUM	36 7		37.1		37 4		41 8		36 3		
BERYLLIUM	0 45		0 59		0.45		0.3	U	0 35		
CADMIUM	3 9	UJv	3.9	UJv	3.9	UJv	3.9	UJv	3.9	UJv	
CALCIUM	46000		44600		36600		23000		39800		
CHROMIUM	3 7	U	3.7	U	3.7	U	3.7	U	3.7	U	
COBALT	4 6	U	6.8		4 6	U	4.6	U	4.6	U	
COPPER	21 8		16.2		10	UC	2.8	U	15.6		
IRON	269		265		263		49.7	UC	320		
LEAD	1		1.1		0.9	U	0.9	U	0.93		
MAGNESIUM	10500		10100		7670		2290		9070		
MANGANESE	531		495		208		1 7	U	267		
MERCURY	0 2	U	0 2	U	0 2	U	0.2	U	0.2	U	
NI[redacted]	16.7	U	16.7	U	16.7	U	16 7	U	16.7	U	
POTASSIUM	873		1320		983		810		1210		
SELENIUM	1	U	1	UJ	1	U	1	U	1	U	
SILVER	3.6	U	3 6	U	3 6	U	3.6	U	3.6	U	
SODIUM	5620		5250		4830		2100		5530		
THALLIUM	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	
VANADIUM	3.7	U	3.7	U	3 7	U	3.7	U	3.7	U	
ZINC	132		123		56.5		3.3		75.3		

DATA SUMMARY

Case No.. 22894 SDG. No.: MFQ183 Reviewer: S. MEEKINS
Laboratory: SILVER Matrix: WATER Units: ug/L

EPA [illegible] #=>	MFQ-244	FLAG	MFQ-245	FLAG	MFQ-246	FLAG	MFQ-272	FLAG	MFQ-392	FLAG	COMMENTS
ALUMINUM	3790		9370		47900		1070		612		
ANTIMONY	25 6 U		25.6 U		25.6 U		25.6 U		25.6 U		
ARSENIC	2.1		1.2 U		1.3 J		1 2 U		1.2 U		
BARIUM	47.8		37.2		15		41 1		40.5		
BERYLLIUM	2.7		6.2		11.5		0 34		0.35		
CADMIUM	3.9 UJv		16.3 Jv		28.7 Jv		3.9 UJv		3.9 UJv		
CALCIUM	501000		321000		225000		36900		34200		
CHROMIUM	3.7 U		3 7 U		3.7 U		3 7 U		3.7 U		
COBALT	65 6		60		233		4.6 U		4.6 U		
COPPER	23		158		823		14.3 UC		11.2 UC		
IRON	426		1190		44 2 UC		394		376		
LEAD	1.5 J		65.4		12 J		1.1		0.9 U		
MAGNESIUM	91100		79600		108000		8220		7240		
MANGANESE	26200		7480		24800		208		138		
MERCURY	0.2 U		0.2 U		0 2 U		0.2 U		0.2 U		
[illegible]	188		164		494		16 7 U		16.7 U		
POTASSIUM	6130		3030		2690		1030		1140		
SELENIUM	1 UJ		1 UJ		2 J		1 U		1 U		
SILVER	5.5		3.6 U		3.6 U		3.6 U		3.6 U		
SODIUM	114000		28100		28200		5430		5120		
THALLIUM	0.9 U		0.9 U		0.9 U		0.9 U		0.9 U		
VANADIUM	3.7 U		3.7 U		3.7 U		3.7 U		3.7 U		
ZINC	1090		1170		4330		60.9		48.7		

DATA SUMMARY

C 22894 SDG N MFQ183 Rev ewe S MEEKINS
L bo ry SILVER M WATER U t g/L

EPA [redacted] #-	MFQ 393	FLAG	MFQ 394	FLAG	MFQ 395	FLAG	FQ 396	FLAG	MFQ 397	FLAG	COMMENTS
ALUMINUM	347		51 5	UC	115	UC	48 4	UC	115	UC	
ANTIMONY	25 6	U	25 6	U	25 6	U	25 6	U	25 6	U	
ARSENIC	1 2	U	1 2	U	1 2	U	1 2	U	1 2	U	
BARIUM	40 9		33 6		36 7		40 2		44 2		
BERYLLIUM	0 35		0 3		0 3	U	0 3		0 3	U	
CADMIUM	3 9	UJ	3 9	UJ	3 9	UJ	3 9	UJ	3 9	UJ	
CALCIUM	33300		38800		36900		34300		33400		
C ROMIUM	3 7	U	3 7	U	3 7	U	3 7	U	3 7	U	
COBALT	4 6	U	4 6	U	4 6	U	4 6	U	4 6	U	
COPPER	13 1	UC	4 4	UC	3 7	UC	3 7	UC	6 8	UC	
IRON	294		29	UC	19 3	UC	12 7	UC	29 5	UC	
LEAD	0 9	U	0 9	U	1 9		0 9	U	0 9	U	
MAGNESIUM	7090		8760		8140		7260		7050		
MANGANESE	109		250		195		130		106		
ERCURY	0 2	U	0 2	U	0 2	U	0 2	U	0 2	U	
NI [redacted]	16 7	U	16 7	U	16 7	U	16 7	U	16 7	U	
POTASSIUM	1200		1220		1320		775		868		
SELENIUM	1	U	1	U	1	U	1	U	1	U	
SILVER	3 6	U	3 6	U	3 6	U	3 6	U	3 6	U	
SODIUM	5260		5750		5640		5270		5400		
THALLIUM	0 9	U	0 9	U	0 9	U	0 9	U	0 9	U	
AD UM	3 7		3 7		3 7		3 7	U	3 7		
ZINC	32 1		62		29 9		28 8		22 1		

FULL INORGANICS
COMPLETE SDG FILE (CSF)
INVENTORY SHEET

3.6

Lab Name SVL ANALYTICAL, INC. City/State KELLOGG, IDAHO

Case No. 22894 SDG No MFQ183 SDG Nos. to Follow. MFQ183 _____ _____

SAS No. _____ Contract No 68-D20042 SOW No ILM02.1

All documents delivered in the Complete SDG File must be original documents where possible. (Reference Exhibit B, Section II D and Section III V)

		Page Nos.		(Please Check)	
		From	To	Lab	Region
1.	Inventory Sheet (DC-2) (Do not number)			X	✓
2.	Cover Page	1	2	X	✓
3.	Inorganic Analysis Data Sheet (Form I-IN)	3	22	X	✓
4.	Initial & Continuing Calibration Verification (Form IIA-IN)	23	27	X	✓
5.	CRDL Standards For AA and ICP (Form IIB-IN)	28	31	X	✓
6.	Blanks (Form III-IN)	32	35	X	✓
7.	ICP Interference Check Sample (Form IV-IN)	36	37	X	✓
8.	Spike Sample Recovery (Form VA-IN)	38	38	X	✓
9.	Post Digest Spike Sample Recovery (Form VB-IN)	NA			
10.	Duplicates (Form VI-IN)	39	39	X	✓
11.	Laboratory Control Sample (Form VII-IN)	40	41	X	✓
12.	Standard Addition Results (Form VIII-IN)	42	42	X	✓
13.	ICP Serial Dilutions (Form IX-IN)	43	43	X	✓
14.	Instrument Detection Limits (Form X-IN)	44	49	X	✓
15.	ICP Interelement Correction Factors (Form XIA-IN)	50	50	X	✓
16.	ICP Interelement Correction Factors (Form XIB-IN)	51	54	X	✓
17.	ICP Linear Ranges (Form XII-IN)	55	55	X	✓
18	Preparation Log (Form XIII-IN)	56	58	X	✓
19.	Analysis Run Log (Form XIV-IN)	59	78	X	✓
20.	ICP Raw Data	79	173	X	✓
21	Furnace AA Raw Data	174	197	X	✓
22	Mercury Raw Data	198	201	X	✓

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. 22894 SDG No. MFQ183 SDG Nos. To Follow SAS No. Date Rec 12/13/94

EPA Lab ID: SILVER
Lab Location: KELLOGG, ID
Region: 6 Audit No.: 22894/MFQ183
Re_Submitted CSF? Yes ____ No X
Box No(s): CNE
COMMENTS:

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2 Intact upon receipt?	X		
FORM DC-2			
3. Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6. Present?	X		
7 Complete?	X		
8 Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10. Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11. Signed?	X		
12. Dated?	X		
AIRBILLS/AIRBILL STICKER			
13. Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16. Does DC-1 list tags as being included?	X		
17. Present?	X		
OTHER DOCUMENTS			
18. Complete?	X		
19. Legible?	X		
20. Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Over for additional comments.

Audited by: Sonya Meekins — Sonya Meekins/ESAT Data Reviewer — Date 12-14-94
Audited by: ____ — ____ — Date ____
Audited by: ____ — ____ — Date ____
Signature — Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: ____ Date Entered: ____ Date Reviewed: ____
Entered by: ____ ____
Reviewed by: ____ ____
Signature — Printed Name/Title

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894 SAS No.: _____ SDG No.:MFQ183

SOW No.: ILM02.1

EPA Sample No.	Lab Sample ID
MFQ183	MFQ183
MFQ192	MFQ192
MFQ193	MFQ193
MFQ194	MFQ194
MFQ195	MFQ195
MFQ196	MFQ196
MFQ197	MFQ197
MFQ197D	MFQ197D
MFQ197S	MFQ197S
MFQ198	MFQ198
MFQ199	MFQ199
MFQ243	MFQ243
MFQ244	MFQ244
MFQ245	MFQ245
MFQ246	MFQ246
MFQ272	MFQ272
MFQ392	MFQ392
MFQ393	MFQ393
MFQ394	MFQ394
MFQ395	MFQ395

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: /Melba Bencich/ Name: MELBA BENCICH

Date: DECEMBER 09, 1994 Title: DOCUMENT CONTROL OFFICER

U.S. EPA - CLP

GE - INORGANIC ANALYSES DATA PACKAGE

C._____ Contract: 68-D20042_

.: 22894 SAS No.: _____ SDG No.:MFQ183

Lab

Lab

SOW

	Lab Sample ID
	_MFQ396
	_MFQ397

s applied ?

pplied ? Yes/No YES

ated before Yes/No YES
rections ?

Yes/No NO_

Wer

Wer

Com

In compliance with the terms and
hnically and for completeness, for
bove. Release of the data contained
the computer-readable data submitted
ed by the Laboratory Manager or the
e following signature.

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Man

Name: MELBA BENCICH

Title: DOCUMENT CONTROL OFFICER

Sig

Dat

OVER PAGE - IN

U.S. EPA - CLP

3

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
MFQ183

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ183

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	770000			P
7440-36-0	Antimony_	25.6	U		P
7440-38-2	Arsenic__	114			F
7440-39-3	Barium___	108	B		P
7440-41-7	Beryllium	93.0			P
7440-43-9	Cadmium__	84.8			P
7440-70-2	Calcium__	295000			P
7440-47-3	Chromium_	161			P
7440-48-4	Cobalt___	3810			P
7440-50-8	Copper___	4220			P
7439-89-6	Iron_____	322000			P
7439-92-1	Lead_____	37.3		SN	F
7439-95-4	Magnesium	1060000			P
7439-96-5	Manganese	55000			P
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	7880			P
7440-09-7	Potassium	10300			P
7782-49-2	Selenium_	33.4		EM	F
7440-22-4	Silver___	26.0			P
7440-23-5	Sodium___	177000			P
7440-28-0	Thallium_	9.0	U		F
7440-62-2	Vanadium_	124			P
7440-66-6	Zinc_____	8860			P
_____	Cyanide__	_____			NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ192

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ192

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2590			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	36.9	B		P
7440-41-7	Beryllium	0.70	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	47000			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	7.4	B		P
7440-50-8	Copper	29.8			P
7439-89-6	Iron	407			P
7439-92-1	Lead	1.3	B	WN	F
7439-95-4	Magnesium	11000			P
7439-96-5	Manganese	851			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	971	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5490			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	205			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ193

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ193

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	2050	_		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	36.7	B		P_
7440-41-7	Beryllium	0.55	B		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	46600	_		P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	7.9	B		P_
7440-50-8	Copper___	26.1	_		P_
7439-89-6	Iron_____	355	_		P_
7439-92-1	Lead_____	0.90	U	WN	F_
7439-95-4	Magnesium	10600	_		P_
7439-96-5	Manganese	603	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	23.0	B		P_
7440-09-7	Potassium	1130	B		P_
7782-49-2	Selenium_	1.0	U		F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	5550	_		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	149	_		P_
_____	Cyanide__	_____	_		NR
_____	_____	_____	_		__

Color Before: COLORLESS Clarity Before. CLEAR_ Texture: _____

Color After: COLORLESS Clarity After CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ194

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ194

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	2050			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	36.5	B		P
7440-41-7	Beryllium	0.45	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	46900			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	24.3	B		P
7439-89-6	Iron	386			P
7439-92-1	Lead	0.90	U	WN	F
7439-95-4	Magnesium	10700			P
7439-96-5	Manganese	607			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	668	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5660			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	153			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ195

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ195

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1690			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	36.1	B		P
7440-41-7	Beryllium	0.54	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	46100			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	20.5	B		P
7439-89-6	Iron	279			P
7439-92-1	Lead	0.90	U	WN	F
7439-95-4	Magnesium	10500			P
7439-96-5	Manganese	553			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	18.7	B		P
7440-09-7	Potassium	1090	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5610			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	136			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ196

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ196

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1540			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	36.7	B		P
7440-41-7	Beryllium	0.45	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	46000			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	21.8	B		P
7439-89-6	Iron	269			P
7439-92-1	Lead	1.0	B	WN	F
7439-95-4	Magnesium	10500			P
7439-96-5	Manganese	531			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	873	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5620			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	132			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ197

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ197

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1270			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	37.1	B		P
7440-41-7	Beryllium	0.59	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	44600			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	6.8	B		P
7440-50-8	Copper	16.2	B		P
7439-89-6	Iron	265			P
7439-92-1	Lead	1.1	B	WN	F
7439-95-4	Magnesium	10100			P
7439-96-5	Manganese	495			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	1320	B		P
7782-49-2	Selenium	1.0	U	W	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5250			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	123			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ198

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ198

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	856	_		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	37.4	B		P_
7440-41-7	Beryllium	0.45	B		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	36600			P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	4.6	U		P_
7440-50-8	Copper___	10	B		P_
7439-89-6	Iron_____	263			P_
7439-92-1	Lead_____	0.90	U	WN	F_
7439-95-4	Magnesium	7670	_		P_
7439-96-5	Manganese	208	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	16.7	U		P_
7440-09-7	Potassium	983	B		P_
7782-49-2	Selenium_	1.0	U		F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	4830	B		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	56.5	_		P_
_____	Cyanide__	_____	_		NR
_____	_____	_____	_		__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ199

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ199

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	49.7	B		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	41.8	B		P_
7440-41-7	Beryllium	0.30	U		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	23000			P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	4.6	U		P_
7440-50-8	Copper___	2.8	U		P_
7439-89-6	Iron_____	49.7	B		P_
7439-92-1	Lead_____	0.90	U	N	F_
7439-95-4	Magnesium	2290	B		P_
7439-96-5	Manganese	1.7	U		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	16.7	U		P_
7440-09-7	Potassium	810	B		P_
7782-49-2	Selenium_	1.0	U		F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	2100	B		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	3.3	B		P_
_____	Cyanide__	_____	_		NR
_____	_____	_____	_		__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ243

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ243

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1080			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	36.3	B		P
7440-41-7	Beryllium	0.35	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	39800			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	15.6	B		P
7439-89-6	Iron	320			P
7439-92-1	Lead	0.93	B	WN	F
7439-95-4	Magnesium	9070			P
7439-96-5	Manganese	267			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	1210	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5530			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	75.3			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ244

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ244

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	3790	_		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	2.1	B		F_
7440-39-3	Barium___	47.8	B		P_
7440-41-7	Beryllium	2.7	B		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	501000	_		P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	65.6	_		P_
7440-50-8	Copper___	23.0	B		P_
7439-89-6	Iron____	426	_		P_
7439-92-1	Lead____	1.5	B	WN	F_
7439-95-4	Magnesium	91100	_		P_
7439-96-5	Manganese	26200	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	188	_		P_
7440-09-7	Potassium	6130	_		P_
7782-49-2	Selenium_	1.0	U	W	F_
7440-22-4	Silver___	5.5	B		P_
7440-23-5	Sodium___	114000	_		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc____	1090	_		P_
_____	Cyanide__	_____	_		NR
_____	_____	_____	_		__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ245

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ245

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	9370			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	37.2	B		P
7440-41-7	Beryllium	6.2			P
7440-43-9	Cadmium	16.3			P
7440-70-2	Calcium	321000			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	60.0			P
7440-50-8	Copper	158			P
7439-89-6	Iron	1190			P
7439-92-1	Lead	65.4		SN	F
7439-95-4	Magnesium	79600			P
7439-96-5	Manganese	7480			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	164			P
7440-09-7	Potassium	3030	B		P
7782-49-2	Selenium	1.0	U	W	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	28100			P
7440-28-0	Thallium	0.90	U	W	F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	1170			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After. CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ246

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ246

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	47900			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.3	B	W	F
7440-39-3	Barium	15.0	B		P
7440-41-7	Beryllium	11.5			P
7440-43-9	Cadmium	28.7			P
7440-70-2	Calcium	225000			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	233			P
7440-50-8	Copper	823			P
7439-89-6	Iron	44.2	B		P
7439-92-1	Lead	12.0		WN	F
7439-95-4	Magnesium	108000			P
7439-96-5	Manganese	24800			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	494			P
7440-09-7	Potassium	2690	B		P
7782-49-2	Selenium	2.0	B	W	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	28200			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	4330			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ272

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ272

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1070			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	41.1	B		P
7440-41-7	Beryllium	0.34	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	36900			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	14.3	B		P
7439-89-6	Iron	394			P
7439-92-1	Lead	1.1	B	WN	F
7439-95-4	Magnesium	8220			P
7439-96-5	Manganese	208			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	1030	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5430			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	60.9			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
MFQ392

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ392

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	612			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	40.5	B		P
7440-41-7	Beryllium	0.35	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	34200			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	11.2	B		P
7439-89-6	Iron	376			P
7439-92-1	Lead	0.90	U	WN	F
7439-95-4	Magnesium	7240			P
7439-96-5	Manganese	138			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	1140	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5120			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	48.7			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ393

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ393

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	347			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	40.9	B		P
7440-41-7	Beryllium	0.35	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	33300			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	13.1	B		P
7439-89-6	Iron	294			P
7439-92-1	Lead	0.90	U	WN	F
7439-95-4	Magnesium	7090			P
7439-96-5	Manganese	109			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	1200	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5260			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	32.1			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ394

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ394

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	51.5	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	33.6	B		P
7440-41-7	Beryllium	0.30	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	38800			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	4.4	B		P
7439-89-6	Iron	29.0	B		P
7439-92-1	Lead	0.90	U	WN	F
7439-95-4	Magnesium	8760			P
7439-96-5	Manganese	250			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	1220	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5750			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	62.0			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ395

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ395

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	115	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	36.7	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	36900			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	3.7	B		P
7439-89-6	Iron	19.3	B		P
7439-92-1	Lead	1.9	B	WN	F
7439-95-4	Magnesium	8140			P
7439-96-5	Manganese	195			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	1320	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5640			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	29.9			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR Texture: _____

Color After: COLORLESS Clarity After: CLEAR Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ396

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ396

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	48.4	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	40.2	B		P
7440-41-7	Beryllium	0.30	B		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	34300			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	3.7	B		P
7439-89-6	Iron	12.7	B		P
7439-92-1	Lead	0.90	U	WN	F
7439-95-4	Magnesium	7260			P
7439-96-5	Manganese	130			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	775	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5270			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	28.8			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ397

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ183

Matrix (soil/water): WATER Lab Sample ID: MFQ397

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	115	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	44.2	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	33400			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	6.8	B		P
7439-89-6	Iron	29.5	B		P
7439-92-1	Lead	0.90	U	WN	F
7439-95-4	Magnesium	7050			P
7439-96-5	Manganese	106			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	868	B		P
7782-49-2	Selenium	1.0	U		F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5400			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	22.1			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

400

MEMORANDUM

Date: 12-27-1994

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: K. Hill , 6H-MA

Site: MOLYCORP

Case#: 22894

SDG#: MFQ-248

The EPA Region 6 Houston Branch ESAT data validation team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site. The samples analyzed and reviewed are detailed in the attached Regional data review and assessment report for this case.

The data package was found to be:

( ) Acceptable: No major problems with data package.

(X) Provisional: Use of data requires caution.
Data is acceptable for Regional use. Problems are noted in the review report.

( ) Unacceptable: Some or all of data should not be used.
Problems are noted in the review report.

Questions regarding the data review report can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. El-feky, Region 6 Data Coordinator
Regional CLP/TPO (if lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION: VI

401

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

LAB CODE: SILVER	CASE NO 22894
SITE NAME MOLY CORP QUESTA MINE	SDG NO . MFQ248
	NUMBER OF SAMPLES. 23

FORM DUE DATE
01/14/95

SDG MAILDATE
12/16/94

PART I DATA ACCEPTANCE OR REJECTION

INSTRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM MUST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR REJECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC), 2) ALL REJECTED DATA.

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

__✓__ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG
ALL FRACTIONS NOT MARKED AS REJECTED ARE ACCEPTED

REJECT ALL. ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

PART II REDUCED VALUE

INSTRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA. FOR A REDUCED VALUE TO BE PROCESSED, THIS FORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE; THE DOLLAR AMOUNT FOR REDUCED VALUE, AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS DETERMINED FOR EACH AFFECTED SAMPLE. ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS, ETC.)

CHECK ONE OF THE FOLLOWING:

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

IDENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM.

THIS FORM CANNOT BE PROCEESSED WITHOUT A SIGNATURE

NAME OF REGIONAL OFFICIAL: MAHMOUD EFFEKY

SIGNATURE: M. Effeky DATE: 12-27-94

SEND THIS FORM TO CLASS C/O DYNCORP
INVOICE PROCESSING & CALCULATION GROUP
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

SEE LIST OF SAMPLES ON REVERSE SIDE

| LAB CODE: SILVER | CASE NO.: 22894 | SDG NO.: MFQ248 |

III. PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER AN "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE.
ALL SAMPLES THAT ARE NOT MARKED WITH AN "X" OR A "D" ARE ACCEPTED.

SAMPLE	FRACTIONS ANALYZED METALS		CYANIDE	
LCSW	Y			
MFQ248	Y			
MFQ248D	Y			
MFQ248S	Y			
MFQ249	Y			
MFQ250	Y			
MFQ251	Y			
MFQ252	Y			
MFQ253	Y			
MFQ254	Y			
MFQ255	Y			
MFQ256	Y			
MFQ257	Y			
MFQ258	Y			
MFQ259	Y			
MFQ260	Y			
MFQ261	Y			
MFQ262	Y			
MFQ263	Y			
MFQ264	Y			
MFQ265	Y			
MFQ267	Y			
MFQ268	Y			

ESAT REGION VI
U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: December 27, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD #6-5200

Attached is the data review summary for Case #22894
SDG #MFQ248
Site MOLYCORP

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

The laboratory was contractually compliant, as noted by CCS and the hardcopy data review

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

A total of 460 results were reviewed for this data package. The data package is technically provisional for the following reasons.

1. The mercury CRDL standard recovery was high.

2. The lead and selenium matrix spike recoveries were outside the QC limits.

3. One arsenic, one lead, and one thallium result had low MSA correlation coefficients.

4. Four cadmium results had ICP coefficients of variance greater than 20 percent.

5. Three arsenic, three lead, and six selenium results had FAA analytical spike recoveries that failed to meet QC criteria.

6. Approximately nine percent of the results were qualified due to technical problems.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

CASE NO. 22894 SITE MOLYCORP
LABORATORY SILVER NO. OF SAMPLES/
CONTRACT # 68-D2-0042 MATRIX 20/WATER
SDG # MFQ248 REVIEWER (IF NOT ESD) ESAT
SOW # ILM02.1 REVIEWER'S NAME Elizabeth Cox
ACCT # 5TFAJN34 SF # TFAUZZ COMPLETION DATE December 27, 1994

SAMPLE NO'S :					
	MFQ-248	MFQ-252	MFQ-256	MFQ-260	MFQ-264
	MFQ-249	MFQ-253	MFQ-257	MFQ-261	MFQ-265
	MFQ-250	MFQ-254	MFQ-258	MFQ-262	MFQ-267
	MFQ-251	MFQ-255	MFQ-259	MFQ-263	MFQ-268

INORGANIC REGIONAL DATA ASSESSMENT
DATA ASSESSMENT SUMMARY

	ICP	FAA	Hg
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	M
3. BLANKS	O	O	O
4. MATRIX SPIKE	O	M	O
5. DUPLICATE ANALYSIS	O	O	O
6. ICP QC	M		
7. FAA QC		M	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	O	O	O
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	M	M	M

O = Data had no problems.
M = Data qualified due to major or minor problems.
Z = Data unacceptable.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: The mercury CRDL standard recovery was high. The lead and selenium matrix spike recoveries were outside the QC limits. One arsenic, one lead, and one thallium result had MSA correlation coefficients below 0.995. Four cadmium results had ICP coefficients of variance above 20 percent. Some arsenic, lead, and selenium results had outlying FAA analytical spike recoveries.

NOTABLE PERFORMANCE: The data package was received by the Region one day early for the contractual turnaround requirement.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ248 Site MOLYCORP Lab SILVER

COMMENTS:

Twenty low concentration water samples were analyzed for total metals. The sampler did not specify a sample to be used as laboratory QC, and samples MFQ-248 and MFQ-249 were field duplicates. The laboratory returned the data package to the Region within the 14-day contractual turnaround requirement. Sample MFQ-251 had an unusually high magnesium concentration. A 10X dilution was required for iron and magnesium in sample MFQ-251.

The data package is technically provisional due to QC problems including a high CRDL standard recovery, outlying matrix spike recoveries, high ICP coefficients of variance, and FAA QC. An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. **Holding Times:** Acceptable. Holding time criteria were met. Although, the temperature of both coolers was approximately 9°C when they were received at the laboratory, but no results were qualified.

2. **Calibrations:** Acceptable. All calibrations were acceptable. The ICV and CCV analyses met contractual frequency criteria, and all recoveries were within QC limits. The mercury CRDL standard recovery was high, indicating poor instrument performance near the CRDL. The mercury results for samples MFQ-253 and MFQ-254 are estimated and high biased.

3. **Blanks:** Acceptable. All blanks met contractual requirements. However, some results were affected by aluminum, iron, manganese, and thallium in the calibration and/or preparation blanks. The iron result for sample MFQ-252 is above the CRDL and is biased high due to blank contamination. No other affected results were above the CRDL's. The qualifications are listed in the Data Summary Table.

4. **Pre-digestion Matrix Spike:** Provisional. Lead results greater than the IDL were estimated and high biased because the matrix spike recovery was above the upper QC limit. All selenium results were estimated and low biased because the matrix spike recovery was below the lower QC limit.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ248 Site MOLYCORP Lab SILVER

5. **Duplicate Analysis:** Acceptable. The differences between all laboratory duplicate results met QC criteria.

6. **ICP Quality Control:**

Serial Dilution: Acceptable. All serial dilution differences were within the QC limit.

Interference Check Sample: Acceptable. All interference check sample results met criteria. Possible interference with zinc was indicated by the interference check sample. However, no zinc results were qualified because the effects of the interferences were insignificant compared to the reported zinc concentrations.

ICP Coefficient of Variance: Provisional. The cadmium concentrations in samples MFQ-249, MFQ-250, MFQ-262, and MFQ-267 were above the CRDL and are estimated because the coefficients of variance were above 20 percent.

7. **Furnace Atomic Absorption Quality Control:**

Method of Standard Additions: Provisional. The arsenic, lead, and thallium results for sample MFQ-251 are estimated because the MSA correlation coefficients failed to meet QC criteria.

FAA Analytical Spike: Provisional. The following results are estimated because of outlying FAA analytical spike recoveries.

The arsenic results for sample MFQ-252 is biased high and for samples MFQ-262 and MFQ-267 are biased low.

The lead results for samples MFQ-252, MFQ-262, and MFQ-267 are biased high.

The selenium results for samples MFQ-248, MFQ-249, MFQ-250, MFQ-252, and MFQ-258 are biased low.

The lead FAA analytical spike recoveries for MFQ-255, MFQ-257, MFQ-258, MFQ-259, and MFQ-260 were above the upper QC limit. However, no results were qualified because the lead results for the above five samples were below the IDL's.

Coefficient of Variance: Acceptable. All coefficients of variance met contractual QC limits.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ248 Site MOLYCORP Lab SILVER

8. **Laboratory Control Sample:** Acceptable. All laboratory control sample results met QC criteria.

9. **Sample Verification:** CCS noted one minor reporting error, and the reviewer noted other minor reporting errors during the hardcopy data review. The laboratory was contacted for resubmission. (See attached Fax Record Log).

   For selenium in sample MFQ-251, the laboratory reported a result from an incorrect sample dilution. The correct selenium result for MFQ-251 appears in the Data Summary Table.

10. **Other QC:**

    Field Duplicates: Acceptable. The differences between all field duplicate results were acceptable.

11. **Overall Assessment:** The data package is technically provisional. The following QC problems were noted.

    Two mercury results were estimated because of a high CRDL standard recovery.

    Ten lead results and all selenium results were estimated because of outlying matrix spike recoveries.

    Four cadmium results were estimated because of high coefficients of variance.

    Four arsenic, four lead, six selenium, and one thallium results were estimated because of failed FAA QC.

In Reference to
Case 22894 SDG MFQ248
Page 1 of 2 Pages

Contract Laboratory Program
REGIONAL/LABORATORY COMMUNICATION SYSTEM
FAX Record Log

Date of FAX: December 27, 1994

Laboratory Name: SILVER

Lab Contact: Melba Bencich

Region: 6

Regional Contact: Elizabeth M. Cox

Initiated by: Region

In Reference to data for the following sample numbers:

MFQ-248	MFQ-252	MFQ-256	MFQ-260	MFQ-264
MFQ-249	MFQ-253	MFQ-257	MFQ-261	MFQ-265
MFQ-250	MFQ-254	MFQ-258	MFQ-262	MFQ-267
MFQ-251	MFQ-255	MFQ-259	MFQ-263	MFQ-268

Summary of Questions/Issues:

1. Incorrect lead analytical spike recoveries were reported on the Form 14 for the following samples:

   -- the preparation blank on page 69
   -- samples MFQ-253, MFQ-255, MFQ-258, MFQ-259, MFQ-260, and MFQ-261 on pages 70 and 71.

   Please note that the above changes will require some results to be flagged with a "W" on the Form 1. Please correct and resubmit the necessary Forms 1 and 14.

2. The selenium raw data (pages 170 - 172) does not list the location of the original raw data. Please resubmit the first page of the raw data with the location of the originals noted.

3. According to the SOW, E-25, b.1, the selenium result for sample MFQ-251 (page 168) diluted by 10 (analysis time 11:08 and 11:13 on 12/7/94) should have been reported. On Form 1 (page 6), the selenium result should be 10.0 U and the "E" flag removed. On the Form 14's, "X"'s should be placed for the analysis times of 11:08 and 11:13 (page 78) and removed from analysis times 17:56 and 18:01 (page 80).

In Reference to
Case 22894 SDG MF0248
Page 2 of 2 Pages

Region expects lab to look into items and submit data within fourteen days to: Attn: Christy Macdowell; US EPA Regional Laboratory; 10625 Fallstone Road; Houston, TX 77099.

E. Cox jy

Signature

12/27/94
Date

Distribution: (1) Lab Copy, (2) Region Copy, (3) SMO Copy

MantTech Environmental Technology, Inc.
ESAT Region 6

c/o USEPA, 10625 Fallstone Road, Houston, TX 77099 (713) 983-2132

FACSIMILE COVER SHEET

Please deliver the following pages to:

Name Melba Bencich

Firm SILVER

City Kellogg **State** ID

Telephone No. (208) 784-1258 **Ext.** _____

Fax Telephone No. (208) 783-0891

Sender:

Name Elizabeth M. Cox

Date December 27, 1994 **Time** _____

Total number of pages including this Cover Sheet 3

If you do not receive all the pages or if any page is unclear, please call: (713) 983-2132.

MESSAGE: _____

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

v Negative bias.

DATA SUMMARY

Case No.: 22894 SDG. No.: MFQ248 Reviewer: E. COX
Laboratory: SILVER Matrix: WATER Units: UG/L

EPA I.D.==>	MFQ-248	FLAG	MFQ-249	FLAG	MFQ-250	FLAG	MFQ-251	FLAG	MFQ-252	FLAG	COMMENTS
ALUMINUM	45900		48800		6720		777000		876		
ANTIMONY	25.6 U		25.6 U		25.6 U		25.6 U		28.9		
ARSENIC	1.2 U		1.2 U		1.2 U		46.2 J		1.4 J^		
BARIUM	19 2		16.2		35 8		111		59.6		
BERYLLIUM	10.7		11.3		5.4		92.8		2.2		
CADMIUM	32.3		30.3 J		23.3 J		97.4		3.9 U		
CALCIUM	214000		227000		326000		435000		545000		
CHROMIUM	3.8		3.7 U		3.7 U		147		3.7 U		
COBALT	222		234		62.5		3760		74.3		
COPPER	787		832		111		4220		16.7		
IRON	37.1 UC		48.7 UC		227		329000		121 J^		
LEAD	11.8 J^		12.9 J^		19.7 J^		41.5 J^		0.97 J^		
MAGNESIUM	101000		108000		81200		1080000		100000		
MANGANESE	23600		24900		7640		54700		28400		
MERCURY	0.2 U		0.2 U		0.2 U		0.2		0.2 U		
NICKEL	485		500		175		7850		210		
POTASSIUM	3410		2870		2840		10300		7140		
SELENIUM	1.4 Jv		1.4 Jv		1 UJv		10 UJv		1 UJv		
SILVER	5		3.6 U		3.6 U		19 3		5.8		
SODIUM	24000		24800		26100		156000		105000		
THALLIUM	0.9 U		0.9 U		0.9 U		1.7 Jv		0.9 U		
VANADIUM	3.7 U		3.7 U		3.7 U		124		3.7 U		
ZINC	4090		4330		1120		8750		1190		

GW-6 GW-5C GW-4E GW 2S GW-1C

DATA SUMMARY

Case No.: 22894 SDG. No.: MFQ248 Reviewer: E. COX
Laboratory: SILVER Matrix: WATER Units: UG/L

EPA [illegible]=>	MFQ-253	FLAG	MFQ-254	FLAG	MFQ-255	FLAG	MFQ-256	FLAG	MFQ-257	FLAG	COMMENTS
ALUMINUM	163	UC	45.8	UC	101	UC	62.2	UC	55.9	UC	
ANTIMONY	25.6	U	25.6	U	25.6	U	25.6	U	25.6	U	
ARSENIC	1.2	U	1.2	U	1.2	U	1.2	U	1.2	U	
BARIUM	37		43.4		37		36.1		35.4		
BERYLLIUM	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	
CADMIUM	3.9	U	3.9	U	3.9	U	3.9	U	3.9	U	
CALCIUM	42200		24600		38400		46500		48600		
CHROMIUM	3.7	U	3.7	U	3.7	U	3.7	U	3.7	U	
COBALT	4.6	U	4.6	U	4.6	U	4.6	U	4.6	U	
COPPER	4.3		2.8	U	3.1		3.7		3.1		
IRON	18.6	UC	29	UC	24.9	UC	211		20.4	UC	
LEAD	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	
MAGNESIUM	9540		2540		8080		10800		11200		
MANGANESE	275		7.4	UC	216		513		550		
MERCURY	0.22	J^	0.2	J^	0.2	U	0.2	U	0.2	U	
NI[illegible]	16.7	U	16.7	U	16.7	U	16.7	U	22.1		
POTASSIUM	720		697		1170		613		1020		
SELENIUM	1	UJv	1	UJv	1	UJv	1	UJv	1	UJv	
SILVER	3.6	U	3.6	U	3.6	U	3 6	U	3.6	U	
SODIUM	5250		2160		4660		5290		5560		
THALLIUM	0.9	U	1		0.9	U	0.9	U	1.1		
VANADIUM	3.7	U	3.7	U	3.7	U	3.7	U	3.7	U	
ZINC	49.4		6.6		45.1		103		103		

DATA SUMMARY

Case No.: 22894 SDG. No.: MFQ248 Reviewer: E. COX
Laboratory: SILVER Matrix: WATER Units: UG/L

EPA TR #=>	MFQ-258	FLAG	MFQ-259	FLAG	MFQ-260	FLAG	MFQ-261	FLAG	MFQ-262	FLAG	COMMENTS
ALUMINUM	55.1	UC	32.5	UC	49.3	UC	66.8	UC	36700		
ANTIMONY	25.6	U	25.6	U	25.6	U	25.6	U	25.6	U	
ARSENIC	1.2	U	1.2	U	1.2	U	1.2	U	1.2	UJv	
BARIUM	35		36.3		35.2		36.5		5.3		
BERYLLIUM	0.3	U	0.3	U	0.3	U	0.3	U	5.2		
CADMIUM	3.9	U	3.9	U	3.9	U	3.9	U	7.8	J	
CALCIUM	48800		49200		49000		49900		151000		
CHROMIUM	3.7	U	3.7	U	3.7	U	3.7	U	8.5		
COBALT	5.1		4.6	U	4.6	U	6.7		101		
COPPER	5.6		4.9		6.2		6.8		60.8		
IRON	25.3	UC	22	UC	25.6	UC	10.4	UC	30200		
LEAD	0.9	U	0.9	U	0.9	U	0.9	U	3.6	J^	
MAGNESIUM	11100		11200		11200		11600		52200		
MANGANESE	573		630		628		875		5720		
MERCURY	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	
NICKEL	19.5		28.7		20.4		33		232		
POTASSIUM	1110		1080		1190		1070		2910		
SELENIUM	1	UJv	1	UJv	1	UJv	1	UJv	10	UJv	
SILVER	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U	
SODIUM	5480		5480		5410		5600		14900		
THALLIUM	1.4		0.9	U	0.9	U	0.9	U	0.9	U	
VANADIUM	3.7	U	3.7	U	3.7	U	3.7	U	3.7	U	
ZINC	110		125		126		159		2090		

DATA SUMMARY

Case No.: 22894 SDG. No.: MFQ248 Reviewer: E. COX
Laboratory: SILVER Matrix: WATER Units: UG/L

EPA [redacted] #=>	MFQ-263	FLAG	MFQ-264	FLAG	MFQ-265	FLAG	MFQ-267	FLAG	MFQ-268	FLAG	COMMENTS
ALUMINUM	28.4	U	28.4	U	716		36500		28.4	U	
ANTIMONY	25.6	U	25.6	U	25.6	U	25.6	U	25.6	U	
ARSENIC	1.2	U	1.2	U	1.2	U	1.2	UJv	1.2	U	
BARIUM	34.1		39		22.2		11.1		32.9		
BERYLLIUM	0.3	U	0.3	U	0.3	U	5.1		0.3	U	
CADMIUM	3.9	U	3.9	U	3.9	U	6.1	J	3.9	U	
CALCIUM	34300		36600		45700		151000		33900		
CHROMIUM	3.7	U	3.7	U	3.7	U	5.8		3.7	U	
COBALT	4.6	U	4.6	U	4.6	U	97.4		4.6	U	
COPPER	12.4		54.7		21.6		58.3		5		
IRON	610		4850		273		30100		97.1	J^	
LEAD	1.5	J^	5.6	J^	3.1	J^	3.7	J^	0.9	U	
MAGNESIUM	6710		7620		9190		51500		6600		
MANGANESE	6.1		78.5		108		5700		5.6		
MERCURY	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	
[redacted]	16.7	U	16.7	U	16.7	U	227		16.7	U	
POTASSIUM	535		585		941		2540		792		
SELENIUM	1	UJv	1	UJv	1	UJv	10	UJv	1	UJv	
SILVER	3.6	U	3.6	U	3.6	U	3.6	U	3.6	U	
SODIUM	3720		4060		4810		15100		3870		
THALLIUM	0.9	U	0.9	U	0.9	U	0.9	U	0.9	U	
VANADIUM	3.7	U	3.7	U	3.7	U	3.7	U	3.7	U	
ZINC	109		404		46.1		2090		107		

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. 22894 SDG No. MFQ248 SDG Nos. To Follow SAS No. Date Rec 12-14-94

EPA Lab ID: SILVER

Lab Location: Kellogg, ID

Region: 6 Audit No.: 22894/MFQ248

Re_Submitted CSF? Yes ____ No X

Box No(s): ONE

COMMENTS.

3. The reviewer noted and corrected several errors on the Form DC-2.

20a. Some selenium raw data (pages 170 - 172) did not list the location of the original raw data. The laboratory was contacted for resubmission.

Over for additional comments.

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1. Present on package?	X		
2 Intact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?		X	
4. Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6. Present?	X		
7 Complete?	X		
8. Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9. Signed?	X		
10. Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11. Signed?	X		
12. Dated?	X		
AIRBILLS/AIRBILL STICKER			
13. Present?	X		
14. Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16. Does DC-1 list tags as being included?	X		
17. Present?	X		
OTHER DOCUMENTS			
18. Complete?	X		
19. Legible?	X		
20. Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Audited by: [signature] Elizabeth Cox - ESAT Data Reviewer Date 12-16-94

Audited by: _____ _____ Date _____

Audited by: _____ _____ Date _____

Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: _____ Date Entered: _____ Date Reviewed: _____

Entered by: _____ _____

Reviewed by: _____ _____

Signature Printed Name/Title

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894 SAS No.: _____ SDG No.:MFQ248

SOW No.: ILM02.1

EPA Sample No.	Lab Sample ID
_MFQ248_____	_MFQ248_____
_MFQ248D____	_MFQ248D____
_MFQ248S____	_MFQ248S____
_MFQ249_____	_MFQ249_____
_MFQ250_____	_MFQ250_____
_MFQ251_____	_MFQ251_____
_MFQ252_____	_MFQ252_____
_MFQ253_____	_MFQ253_____
_MFQ254_____	_MFQ254_____
_MFQ255_____	_MFQ255_____
_MFQ256_____	_MFQ256_____
_MFQ257_____	_MFQ257_____
_MFQ258_____	_MFQ258_____
_MFQ259_____	_MFQ259_____
_MFQ260_____	_MFQ260_____
_MFQ261_____	_MFQ261_____
_MFQ262_____	_MFQ262_____
_MFQ263_____	_MFQ263_____
_MFQ264_____	_MFQ264_____
_MFQ265_____	_MFQ265_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

_____

_____

_____

_____

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: _____

Date: _____ Title: _____

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

2

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894 SAS No.: _____ SDG No.:MFQ248

SOW No.: ILM02.1

EPA Sample No.	Lab Sample ID
_MFQ267_____	_MFQ267_____
_MFQ268_____	_MFQ268_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

_____

_____

_____

_____

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: _____

Date: _____ Title: _____

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ248

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ248

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	45900	_		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	19.2	B		P_
7440-41-7	Beryllium	10.7	_		P_
7440-43-9	Cadmium__	32.3	_		P_
7440-70-2	Calcium__	214000	_		P_
7440-47-3	Chromium_	3.8	B		P_
7440-48-4	Cobalt___	222	_		P_
7440-50-8	Copper___	787	_		P_
7439-89-6	Iron_____	37.1	B		P_
7439-92-1	Lead_____	11.8	_	SN	F_
7439-95-4	Magnesium	101000	_		P_
7439-96-5	Manganese	23600	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	485	_		P_
7440-09-7	Potassium	3410	B		P_
7782-49-2	Selenium_	1.4	B	WN	F_
7440-22-4	Silver___	5.0	B		P_
7440-23-5	Sodium___	24000	_		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	4090	_		P_
_____	Cyanide__	_____	_		NR
_____	_____	_____	_		__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. 4

MFQ249

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ249

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	48800	_		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U	W	F_
7440-39-3	Barium___	16.2	B		P_
7440-41-7	Beryllium	11.3	_		P_
7440-43-9	Cadmium__	30.3	_		P_
7440-70-2	Calcium__	227000	_		P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	234	_		P_
7440-50-8	Copper___	832	_		P_
7439-89-6	Iron_____	48.7	B		P_
7439-92-1	Lead_____	12.9	_	SN	F_
7439-95-4	Magnesium	108000	_		P_
7439-96-5	Manganese	24900	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	500	_		P_
7440-09-7	Potassium	2870	B		P_
7782-49-2	Selenium_	1.4	B	WN	F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	24800	_		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	4330	_		P_
_____	Cyanide__	_____	_		NR
_____	_____	_____	_		__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ250

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ250

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	6720	_		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	35.8	B		P_
7440-41-7	Beryllium	5.4	_		P_
7440-43-9	Cadmium__	23.3	_		P_
7440-70-2	Calcium__	326000	_		P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	62.5	_		P_
7440-50-8	Copper___	111	_		P_
7439-89-6	Iron_____	227	_		P_
7439-92-1	Lead_____	19.7	_	SN	F_
7439-95-4	Magnesium	81200	_		P_
7439-96-5	Manganese	7640	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	175	_		P_
7440-09-7	Potassium	2840	B		P_
7782-49-2	Selenium_	1.0	U	WN	F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	26100	_		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	1120	_		P_
_____	Cyanide__	_____	_		NR
_____	_____	_____	_		__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

_____

_____

_____

_____

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ251

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ251

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	777000			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	46.2		+	F
7440-39-3	Barium	111	B		P
7440-41-7	Beryllium	92.8			P
7440-43-9	Cadmium	97.4			P
7440-70-2	Calcium	435000			P
7440-47-3	Chromium	147			P
7440-48-4	Cobalt	3760			P
7440-50-8	Copper	4220			P
7439-89-6	Iron	329000			P
7439-92-1	Lead	41.5		+N	F
7439-95-4	Magnesium	1080000			P
7439-96-5	Manganese	54700			P
7439-97-6	Mercury	0.20			CV
7440-02-0	Nickel	7850			P
7440-09-7	Potassium	10300			P
7782-49-2	Selenium	25.1		EN	F
7440-22-4	Silver	19.3			P
7440-23-5	Sodium	156000			P
7440-28-0	Thallium	1.7	B	+	F
7440-62-2	Vanadium	124			P
7440-66-6	Zinc	8750			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: YELLOW___ Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. 7

MFQ252

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ252

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	876	_		P_
7440-36-0	Antimony_	28.9	B		P_
7440-38-2	Arsenic__	1.4	B	W	F_
7440-39-3	Barium___	59.6	B		P_
7440-41-7	Beryllium	2.2	B		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	545000	_		P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	74.3	_		P_
7440-50-8	Copper___	16.7	B		P_
7439-89-6	Iron_____	121	_		P_
7439-92-1	Lead_____	0.97	B	WN	F_
7439-95-4	Magnesium	100000	_		P_
7439-96-5	Manganese	28400	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	210	_		P_
7440-09-7	Potassium	7140	_		P_
7782-49-2	Selenium_	1.0	U	WN	F_
7440-22-4	Silver___	5.8	B		P_
7440-23-5	Sodium___	105000	_		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	1190	_		P_
_____	Cyanide__	_____	_		NR
_____	_____	_____	_		__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. 8

MFQ253

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ253

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	163	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	37.0	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	42200			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	4.3	B		P
7439-89-6	Iron	18.6	B		P
7439-92-1	Lead	0.90	U	N	F
7439-95-4	Magnesium	9540			P
7439-96-5	Manganese	275			P
7439-97-6	Mercury	0.22			CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	720	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5250			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	49.4			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ254

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ254

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	45.8	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U	W	F
7440-39-3	Barium	43.4	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	24600			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	2.8	U		P
7439-89-6	Iron	29.0	B		P
7439-92-1	Lead	0.90	U	N	F
7439-95-4	Magnesium	2540	B		P
7439-96-5	Manganese	7.4	B		P
7439-97-6	Mercury	0.20			CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	697	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	2160	B		P
7440-28-0	Thallium	1.0	B		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	6.6	B		P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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EPA SAMPLE NO. 10

INORGANIC ANALYSES DATA SHEET

MFQ255

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ255

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	101	B		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	37.0	B		P_
7440-41-7	Beryllium	0.30	U		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	38400			P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	4.6	U		P_
7440-50-8	Copper___	3.1	B		P_
7439-89-6	Iron_____	24.9	B		P_
7439-92-1	Lead_____	0.90	U	N	F_
7439-95-4	Magnesium	8080			P_
7439-96-5	Manganese	216			P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	16.7	U		P_
7440-09-7	Potassium	1170	B		P_
7782-49-2	Selenium_	1.0	U	N	F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	4660	B		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	45.1			P_
_____	Cyanide__	_____			NR
_____	_____	_____			__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. MFQ256

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ256

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	62.2	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	36.1	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	46500			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	3.7	B		P
7439-89-6	Iron	211			P
7439-92-1	Lead	0.90	U	N	F
7439-95-4	Magnesium	10800			P
7439-96-5	Manganese	513			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	613	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5290			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	103			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. 12

MFQ257

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ257

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	55.9	B		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	35.4	B		P_
7440-41-7	Beryllium	0.30	U		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	48600			P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	4.6	U		P_
7440-50-8	Copper___	3.1	B		P_
7439-89-6	Iron_____	20.4	B		P_
7439-92-1	Lead_____	0.90	U	WN	F_
7439-95-4	Magnesium	11200			P_
7439-96-5	Manganese	550			P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	22.1	B		P_
7440-09-7	Potassium	1020	B		P_
7782-49-2	Selenium_	1.0	U	N	F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	5560			P_
7440-28-0	Thallium_	1.1	B		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	103			P_
_____	Cyanide__	_____			NR
_____	_____	_____			

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ258

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ258

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	55.1	B		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	35.0	B		P_
7440-41-7	Beryllium	0.30	U		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	48800			P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	5.1	B		P_
7440-50-8	Copper___	5.6	B		P_
7439-89-6	Iron_____	25.3	B		P_
7439-92-1	Lead_____	0.90	U	N	F_
7439-95-4	Magnesium	11100			P_
7439-96-5	Manganese	573			P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	19.5	B		P_
7440-09-7	Potassium	1110	B		P_
7782-49-2	Selenium_	1.0	U	WN	F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	5480			P_
7440-28-0	Thallium_	1.4	B		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	110			P_
_____	Cyanide__	_____			NR
_____	_____	_____			__

Color Before: COLORLESS Clarity Before CLEAR_ Texture: _____

Color After: COLORLESS Clarity After CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. MFQ259

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ259

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	32.5	B		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	36.3	B		P_
7440-41-7	Beryllium	0.30	U		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	49200			P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	4.6	U		P_
7440-50-8	Copper___	4.9	B		P_
7439-89-6	Iron_____	22.0	B		P_
7439-92-1	Lead_____	0.90	U	N	F_
7439-95-4	Magnesium	11200			P_
7439-96-5	Manganese	630			P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	28.7	B		P_
7440-09-7	Potassium	1080	B		P_
7782-49-2	Selenium_	1.0	U	N	F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	5480			P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	125			P_
_____	Cyanide__	_____			NR
_____	_____	_____			__

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.: MFQ260

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ260

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	49.3	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	35.2	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	49000			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	6.2	B		P
7439-89-6	Iron	25.6	B		P
7439-92-1	Lead	0.90	U	N	F
7439-95-4	Magnesium	11200			P
7439-96-5	Manganese	628			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	20.4	B		P
7440-09-7	Potassium	1190	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5410			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	126			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. 16

MFQ261

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ261

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	66.8	B		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	36.5	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	49900			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	6.7	B		P
7440-50-8	Copper	6.8	B		P
7439-89-6	Iron	10.4	B		P
7439-92-1	Lead	0.90	U	N	F
7439-95-4	Magnesium	11600			P
7439-96-5	Manganese	875			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	33.0	B		P
7440-09-7	Potassium	1070	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5600			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	159			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. 17

MFQ262

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ262

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	36700			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U	W	F
7440-39-3	Barium	5.3	B		P
7440-41-7	Beryllium	5.2			P
7440-43-9	Cadmium	7.8			P
7440-70-2	Calcium	151000			P
7440-47-3	Chromium	8.5	B		P
7440-48-4	Cobalt	101			P
7440-50-8	Copper	60.8			P
7439-89-6	Iron	30200			P
7439-92-1	Lead	3.6		WN	F
7439-95-4	Magnesium	52200			P
7439-96-5	Manganese	5720			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	232			P
7440-09-7	Potassium	2910	B		P
7782-49-2	Selenium	10.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	14900			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	2090			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO. 18

MFQ263

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ263

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	28.4	U		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	34.1	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	34300			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	12.4	B		P
7439-89-6	Iron	610			P
7439-92-1	Lead	1.5	B	N	F
7439-95-4	Magnesium	6710			P
7439-96-5	Manganese	6.1	B		P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	535	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	3720	B		P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	109			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ264

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ264

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	28.4	U		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	39.0	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	36600			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	54.7			P
7439-89-6	Iron	4850			P
7439-92-1	Lead	5.6		N	F
7439-95-4	Magnesium	7620			P
7439-96-5	Manganese	78.5			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	585	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	4060	B		P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	404			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ265

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ265

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	716			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	22.2	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	45700			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	21.6	B		P
7439-89-6	Iron	273			P
7439-92-1	Lead	3.1		N	F
7439-95-4	Magnesium	9190			P
7439-96-5	Manganese	108			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	941	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	4810	B		P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	46.1			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

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INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ267

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ267

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	36500			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U	W	F
7440-39-3	Barium	11.1	B		P
7440-41-7	Beryllium	5.1			P
7440-43-9	Cadmium	6.1			P
7440-70-2	Calcium	151000			P
7440-47-3	Chromium	5.8	B		P
7440-48-4	Cobalt	97.4			P
7440-50-8	Copper	58.3			P
7439-89-6	Iron	30100			P
7439-92-1	Lead	3.7		WN	F
7439-95-4	Magnesium	51500			P
7439-96-5	Manganese	5700			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	227			P
7440-09-7	Potassium	2540	B		P
7782-49-2	Selenium	10.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	15100			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	2090			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ268

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ248

Matrix (soil/water): WATER Lab Sample ID: MFQ268

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	28.4	U		P
7440-36-0	Antimony_	25.6	U		P
7440-38-2	Arsenic__	1.2	U		F
7440-39-3	Barium___	32.9	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium__	3.9	U		P
7440-70-2	Calcium__	33900			P
7440-47-3	Chromium_	3.7	U		P
7440-48-4	Cobalt___	4.6	U		P
7440-50-8	Copper___	5.0	B		P
7439-89-6	Iron_____	97.1	B		P
7439-92-1	Lead_____	0.90	U	N	F
7439-95-4	Magnesium	6600			P
7439-96-5	Manganese	5.6	B		P
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	16.7	U		P
7440-09-7	Potassium	792	B		P
7782-49-2	Selenium_	1.0	U	N	F
7440-22-4	Silver___	3.6	U		P
7440-23-5	Sodium___	3870	B		P
7440-28-0	Thallium_	0.90	U		F
7440-62-2	Vanadium_	3.7	U		P
7440-66-6	Zinc_____	107			P
_____	Cyanide__	_____			NR
_____	_____	_____			

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

JAN 1995
RECEIVED

MEMORANDUM

Date: 12/30/94

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

M L Ritter 12/30

To: K. Hill, 6H-MA

Site: MOLYCORP

Case#: 22894

SDG#: MFQ182

The EPA Region 6 Houston Branch ESAT data validation team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site. The samples analyzed and reviewed are detailed in the attached Regional data review and assessment report for this case.

The data package was found to be:

( ) Acceptable: No major problems with data package.

(X) Provisional: Use of data requires caution.
Data is acceptable for Regional use. Problems are noted in the review report.

( ) Unacceptable: Some or all of data should not be used.
Problems are noted in the review report.

Questions regarding the data review report can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. El-feky, Region 6 Data Coordinator
Regional CLP/TPO (if lab out of Region 6)
Mike Hiatt, EMSL/Las Vegas
Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION. VI

440

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

LAB CODE SILVER	CASE NO.. 22894	SDG NO.. MFQ182
SITE NAME: MOLY CORP QUESTA MINE	NUMBER OF SAMPLES: 24	

FORM DUE DATE
01/14/95
SDG MAILDATE
12/20/94

RT I DATA ACCEPTANCE OR REJECTION

STRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM ST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR JECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC.), 2.) ALL REJECTED DATA

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

✓ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG.
ALL FRACTIONS NOT MARKED AS REJECTED ARE ACCEPTED

REJECT ALL ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

RT II REDUCED VALUE

STRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA FOR A REDUCED VALUE TO BE PROCESSED, THIS ORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE, E DOLLAR AMOUNT FOR REDUCED VALUE, AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS TERMINED FOR EACH AFFECTED SAMPLE ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS, ETC.)

ECK ONE OF THE FOLLOWING

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

DENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM

********** THIS FORM CANNOT BE PROCEESSED WITHOUT A SIGNATURE **********

NAME OF REGIONAL OFFICIAL Melvin L Ritter ESAT RPO 6E-HO

SIGNATURE Melvin L Ritter DATE. 12/30/94

SEND THIS FORM TO CLASS C/O DYNCORP
INVOICE PROCESSING & CALCULATION GROUP
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

****

* SEE LIST OF SAMPLES ON REVERSE SIDE *

****

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TX 77099

MEMORANDUM

DATE: December 28, 1994

TO: Melvin Ritter, ESAT RPO, Region VI

FROM: Bill Blanton
Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD # 6-5199

Attached is the data review summary for Case #22894
SDG #MFQ182
Site MOLYCORP

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

The laboratory was contractually non-compliant when they analyzed the mercury soil samples one day past the holding time required in the SOW. CCS and the hardcopy data review confirmed this missed holding time. Mercury soil results weren't affected by the missed holding time.

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

A total of 414 results were reviewed for this data package. Nine percent of the results were qualified due to technical problems. The package is technically provisional, and the significant technical problems are summarized below.

The antimony and arsenic soil and selenium water matrix spike recoveries are below the lower QC limits.

The FAA lead water matrix spike recovery is above the upper QC limit.

One arsenic, one lead, and one selenium result failed FAA QC requirements.

The sampler listed an incorrect sample and case number on the ITR/COC's.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. 22894 — SITE MOLYCORP
LABORATORY SILVER — NO. OF SAMPLES/
CONTRACT # 68-D2-0042 — MATRIX 5/WATER 13/SOIL
SDG # MFQ182 — REVIEWER (IF NOT ESD) ESAT
SOW# ILM02.1 — REVIEWER'S NAME Linda Hoffman
ACCT # 5TFAJN34 SF # TFAUZZ — COMPLETION DATE December 28, 1994

SAMPLE NO.:					
	MFQ-182	MFQ-187	MFQ-191	MFQ-270	MFT-695
	MFQ-184	MFQ-188	MFQ-247	MFQ-271	MFT-696
	MFQ-185	MFQ-189	MFQ-266	MFQ-398	
	MFQ-186	MFQ-190	MFQ-269	MFQ-399	

DATA ASSESSMENT SUMMARY

	ICP	AA	HG
1. HOLDING TIMES	O	O	O
2. CALIBRATIONS	O	O	O
3. BLANKS	O	O	O
4. MATRIX SPIKES	M	M	O
5. DUPLICATE ANALYSIS	O	O	O
6. ICP QC	O		
7. FAA QC		M	
8. LCS	O	O	O
9. SAMPLE VERIFICATION	O	O	O
10. OTHER QC	O	O	O
11. OVERALL ASSESSMENT	M	M	O

O = Data had no problems.
M = Data qualified due to major or minor problems.
Z = Data unacceptable.
N/A= Not applicable

ACTION ITEMS:

AREAS OF CONCERN: The contractual holding time for the mercury soil samples was exceeded by one day. The technical holding time for the mercury water samples was exceeded by one day. The matrix spike recoveries for the antimony and arsenic soil and the selenium water samples were low. The FAA lead water matrix spike recovery was high. One arsenic sample had low MSA correlation coefficients. One lead and one selenium sample had outlying analytical spike recoveries.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ182 Site MOLYCORP Lab SILVER

COMMENTS: The data package consisted of five water and 13 soil samples for RAS inorganic analysis (ILM02.1). According to the ITR/COC, samples MFQ-246 (from SDG MFQ183) and MFQ-247 were field duplicates for the water samples. There were no field duplicates for the soil samples. Sample MFQ-191 was identified as the soil QC sample, and the laboratory used sample MFQ-247 as the water QC sample. The laboratory met the 35-day turnaround time requirement. At least half of the reported concentrations were above the CRDL's.

The data package is technically provisional due to problems with matrix spike recoveries and FAA QC. The technical usability of all reported results is indicated in the attached Data Summary Table.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. **Holding Times:** Acceptable. Sample preservation criteria were met. However, the contractual holding time for the mercury soil samples and the technical holding time for the mercury water samples were each exceeded by one day. The reviewer didn't qualify the mercury results because one day wasn't significant. Technical holding times for soil samples haven't been established.

2. **Calibrations:** Acceptable. All calibrations were acceptable. ICV/CCV analyses met contractual frequency and had acceptable recoveries. The CRDL standard results indicated that instrument performance near the CRDL's was acceptable.

3. **Blanks:** Acceptable. Preparation and calibration blanks met contractual requirements. Only results below the CRDL's were affected by iron and lead concentrations in the preparation blank. Preparation and/or calibration blanks also contained antimony, barium, calcium, and thallium concentrations, but sample results weren't affected.

4. **Pre-digestion Matrix Spike Recovery:** Provisional. All antimony and arsenic soil and selenium water sample results are estimated and biased low because the matrix spike recoveries were below the lower QC limits. The lead water sample results are estimated and biased high because the lead FAA matrix spike recovery was above the upper QC limit.

5. **Duplicate Analysis:** Acceptable. Laboratory precision was acceptable because duplicate differences met QC criteria.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ182 Site MOLYCORP Lab SILVER

6. **ICP Quality Control:** Acceptable. Acceptable serial dilution differences and ICS results showed there are no major matrix interferences and the inter-element correction factors are correct.

7. **Furnace Atomic Absorption Quality Control:**

   FAA Analytical Spike Recovery: Provisional. The analytical spike recoveries for selenium sample MFQ-247 was low and lead sample MFQ-266 was high. The above two results are estimated.

   The thallium analytical spike recovery was high for sample MFQ-190, but no results were qualified because the reported thallium result was below the IDL. Since the following samples had analytical spike recoveries that were only marginally outside the QC limits, no results were qualified.

   Arsenic and thallium results for sample MFQ-247.

   The lead result for samples MFQ-269, MFQ-270, and MFQ-271.

   The selenium result for samples MFQ-186, MFQ-266, and MFQ-399.

   Method of Standard Addition: Provisional. Ten arsenic and six lead samples required MSA analyses. Arsenic sample MFQ-187 is estimated because the correlation coefficients were less than 0.995. The laboratory "+" flagged arsenic MSA results for samples MFQ-186 and MFT-696, but the reviewer didn't qualify these results because the correlation coefficients rounded to 0.995.

8. **Laboratory Control Sample:** Acceptable. Sample preparation was adequate as seen by acceptable LCS results.

9. **Sample Verification:** The data reviewer couldn't confirm all the errors detected by CCS and noted one error that CCS failed to identify (See attached Fax Record Log).

10. **Other QC:**

    Field Duplicates: Acceptable. Field duplicate differences demonstrated good precision.

INORGANIC QA REVIEW
CONTINUATION PAGE

Case 22894 SDG MFQ182 Site MOLYCORP Lab SILVER

11. **Overall Assessment:** The data package is technically provisional for the following reasons.

Outlying matrix spike recoveries for antimony, arsenic, lead, and selenium caused some results to be estimated.

One arsenic, one lead, and one selenium result was estimated because FAA QC wasn't met.

In Reference to
Case 22894/SDG MFQ182
Page 1 of 1 page

Contract Laboratory Program
REGIONAL/LABORATORY COMMUNICATION SYSTEM

FAX Record Log

Date of FAX: December 28, 1994

Laboratory Name: SILVER

Lab Contact: Blake Johnson

Region: 6

Regional Contact: Linda Hoffman (ESAT)

FAX Initiated by: Region

In reference to data for the following sample number(s):

MFQ-187

Summary of Questions/Issues:

The arsenic MSA results for sample MFQ-187 from page 233 aren't reported on Form 8 (page 62). Please correct Form 8 and resubmit.

The EPA expects the laboratory to look into items and submit data within fourteen days to Christy Macdowell, U.S. EPA, 10625 Fallstone Road, Houston TX 77099.

Signature

12-28-94
Date

I1639

Distribution: (1) Lab Copy, (2) Region Copy, (3) SMO Copy

ManTech Environmental Technology
ESAT Region 6

c/o US EPA 10625 Fallstone Rd, Houston, TX 77099 TEL:(713) 983-2125

FACSIMILE COVER SHEET

Please deliver the following pages to:

Name Blake Johnson

Firm SILVER

City Kellogg **State** ID

Telephone 208-784-1258 **Ext.** _____

Fax Telephone No. 208-783-0891 **Ext.** _____

Sender:

Name Linda Hoffman ESAT

Date 12-28-94 **Time** _____

Total Number of pages including this Cover Sheet 2

If you do not receive all the pages or if any pages are unclear, please call: (713) 983-2125

MESSAGES: _____

Fax Model No. Panafax UF-620 Fax No. (713) 983-2248

DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

N Questionable identification.

UC Undetected at the listed detection limit which was raised due to apparent blank contamination.

UJ Estimated detection limit due to the outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

v Negative bias.

DATA SUMMARY

Case No.: 22894 SDG. No. MFQ182 Reviewer: Nhan Tran
Laboratory: SILVER Matrix SOIL Units: MG/KG

EPA TR #=>	MFQ-182	FLAG	MFQ-184	FLAG	MFQ-185	FLAG	MFQ-186	FLAG	MFQ-187	FLAG	COMMENTS
ALUMINUM	12600		16000		19500		24200		10900		
ANTIMONY	9 9	UJ/	11 3	UJ/	12 7	UJv	19	UJv	12 5	UJ/	
ARSENIC	11	Jv	6 1	J/	3 8	J/	9 2	J/	6 1	J/	
BARIUM	499		508		569		578		406		
BERYLLIUM	1 8		1.5		1 3		2 4		1.1		
CADMIUM	1.5	U	1.7	U	1 9	U	2 9	U	1 9	U	
CALCIUM	2990		1980		2150		1860		2210		
CHROMIUM	18 5		20 7		23 9		22 3		20 3		
COBALT	21.8		12.2		14 6		13.5		13.3		
COPPER	116		98 3		116		152		104		
IRON	34400		38000		41800		47600		31300		
LEAD	132		102		119		144		91.1		
MAGNESIUM	4670		4970		5680		5400		5090		
MANGANESE	1310		468		501		553		466		
MERCURY	0 19	U	0.22	U	0 25	U	0 37	U	0 24	U	
NICKEL	53.6		27.3		32 5		29 4		18.1		
POTASSIUM	2890		3390		3960		4330		2540		
SELENIUM	1.3		0.94		1.3		1 1		1.4		
SILVER	1.5		1 8		1 8	U	2 7	U	2.3		
SODIUM	232		241		290		326		245		
THALLIUM	0.35	U	0.4	U	0.45	U	0 69		0.44	U	
VANADIUM	18.6		21.6		24 7		21.2		22.2		
ZINC	469		220		250		298		182		
% SOLIDS	51.7		45.5		40.2		27		40.9		

Case No.: 22894
Laboratory: SIL.[illegible]

DATA SUMMARY
SDG. No.. MFQ182
Matrix. SOIL

Reviewer: Nhan Tran
Units: MG/KG

EPA [illegible] =>	MFQ-188	FLAG	MFQ-189	FLAG	MFQ-190	FLAG	MFQ-191	FLAG	MFQ-398	FLAG	COMMENTS
ALUMINUM	13900		10500		10500		12600		12200		
ANTIMONY	11	UJv	9.5	UJv	6 7	Jv	10.1	UJv	17	UJv	
ARSENIC	7 4	Jv	8 4	J.	1 2	Jv	11.2	Jv	8.5	Jv	
BARIUM	537		567		78 5		601		694		
BERYLLIUM	2.1		1 1		0.46		1.2		1.3		
CADMIUM	2 1		1 4	U	0 96	U	1 5	U	2.6	U	
CALCIUM	3230		3020		2490		2900		2340		
CHROMIUM	18.7		16.8		12 5		20 5		22.1		
COBALT	19		12.7		13 1		14.1		13.2		
COPPER	126		71.1		21 2		78 9		135		
IRON	33700		33600		26700		38400		40600		
LEAD	97 5		106		118		130		94.1		
MAGNESIUM	4640		4560		7420		5300		5310		
MANGANESE	1080		550		701		538		534		
MERCURY	0 23		0.18	U	0.13		0.2	U	0 33	U	
NI[illegible]	59.2		30.9		[illegible] 4		31.2		24		
POTASSIUM	3080		3130		1030		3980		3640		
SELENIUM	1.1		1.1		0 25	U	1 6		1.1		
SILVER	2.5		1.9		1 9		1 4	U	2.4	U	
SODIUM	254		238		54 4		277		297		
THALLIUM	0 39	U	0.33	U	0 22	U	0.35	U	0.6	U	
VANADIUM	18 9		16.8		43 6		20 6		20.5		
ZINC	548		221		136		237		190		
% SOLIDS	46.5		54.1		81 3		50.9		30.2		

DATA SUMMARY

Case No.. 22894 SDG. No. MFQ182 Reviewer: Nhan Tran
Laboratory: SIL.ER Matrix. SOIL Units. MG/KG

EPA # =>	MFQ-399	FLAG	MFT-695	FLAG	MFT-696	FLAG		FLAG		FLAG		COMMENTS
ALUMINUM	5250		4510		15000							
ANTIMONY	7 1	UJ,	7.8	UJ,	19 8	UJv						
ARSENIC	4	J,	5.6	J,	10	J,						
BARIUM	439		262		787							
BERYLLIUM	0 43		0.34		1 1							
CADMIUM	1.1	U	1.2	U	3	U						
CALCIUM	1470		1190		3690							
CHROMIUM	8.8		6.5		23 5							
COBALT	6.9		4		12 9							
COPPER	25.1		22		142							
IRON	1760C		14800		45800							
LEAD	29.3		21.4		163							
MAGNESIUM	2210		1700		6110							
MANGANESE	165		115		636							
MERCURY	0.14	U	0.15	U	0 39	U						
NICKEL	13.9		8.6		23 2							
POTASSIUM	1700		1980		5290							
SELENIUM	0.28	U	0.44		1 3							
SILVER	0 99	U	1.1	U	3.3							
SODIUM	122		76.5		292							
THALLIUM	0 25	U	0.27	U	0 7	U						
VANADIUM	7 9		6.5		24 8							
ZINC	93.9		44.5		274							
% SOLIDS	72.5		65.8		25.8							

DATA SUMMARY

Case No.: 22894 SDG. No.: MFQ182 Reviewer: L. Hoffman
Laboratory: SILVER Matrix: WATER Units: ug/L

EPA [illegible]=>	MFQ-247	FLAG	MFQ-266	FLAG	MFQ-269	FLAG	MFQ-270	FLAG	MFQ-271	FLAG	COMMENTS
ALUMINUM	53500		34500		28.4 U		144		1290		
ANTIMONY	25.6 U		25.6 U		25.6 U		25.6 U		25.6 U		
ARSENIC	1.2		1.2 U		1.2 U		1.2 U		1.2 U		
BARIUM	16.1		29.8		34 4		21		39.8		
BERYLLIUM	12.6		7.7		0.3 U		0.3 U		0.3 U		
CADMIUM	34.3		28.8		3.9 U		3.9 U		3.9 U		
CALCIUM	236000		218000		34200		43700		40700		
CHROMIUM	3.8		3.7 U		3.7 U		3 7 U		3.7 U		
COBALT	245		166		4 6 U		4.6 U		4.6 U		
COPPER	867		424		2.8 U		4.9		15.9		
IRON	88.8 ^J		13.9 UC		128		39.8 UC		557		
LEAD	12 J^		1.6 UCJ^		1 UCJ^		0.75 UCJ^		1.4 UCJ^		
MAGNESIUM	112000		96300		6920		8880		9200		
MANGANESE	26100		20100		82.6		110		299		
MERCURY	0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		
NI[illegible]	536		427		16.7 U		16.7 U		16.7 U		
POTASSIUM	2780		2110		732		771		999		
SELENIUM	1.5 Jv		1.9 Jv		1 UJv		1 UJv		1 UJv		
SILVER	3.6 U		3.6 U		3.6 U		3.6 U		3.6 U		
SODIUM	27000		24400		4180		5140		5230		
THALLIUM	0.9 U		0.9 U		0.9 U		0.9 U		0.9 U		
VANADIUM	3.7 U		3.7 U		3 7 U		3.7 U		3.7 U		
ZINC	4490		3540		252		41		92.8		

Lab-n
Spt.

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case No. 22894 SDG No. MFQ182 SDG Nos. To Follow SAS No. Date Rec 12-14-94

EPA Lab ID: SILVER
Lab Location: Kellogg, ID
Region: 6 Audit No.: 22894/MFQ182
Re_Submitted CSF? Yes ____ No X
Box No(s): ONE
COMMENTS:

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1. Present on package?	X		
2. Intact upon receipt?	X		
FORM DC-2			
3. Numbering scheme accurate?	X		
4. Are enclosed documents listed?	X		
5. Are listed documents enclosed?	X		
FORM DC-1			
6. Present?	X		
7. Complete?	X		
8. Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9. Signed?	X		
10. Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11. Signed?	X		
12. Dated?	X		
AIRBILLS/AIRBILL STICKER			
13. Present?	X		
14. Signed?	X		
15. Dated?	X		
SAMPLE TAGS			
16. Does DC-1 list tags as being included?	X		
17. Present?	X		
OTHER DOCUMENTS			
18. Complete?	X		
19. Legible?	X		
20. Original?		X	
20a. If "NO", does the copy indicate where original documents are located?	X		

Over for additional comments.

Audited by: Linda Hoffman/ESAT Data Reviewer Date 12-27-94
Audited by: ____ ____ Date ____
Audited by: ____ ____ Date ____
Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT: ____ Date Entered: ____ Date Reviewed: ____
Entered by: ____ ____
Reviewed by: ____ ____
Signature Printed Name/Title

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COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894 SAS No.: _____ SDG No.:MFQ182

SOW No.: ILM02.1

EPA Sample No.	Lab Sample ID
MFQ182	MFQ182
MFQ184	MFQ184
MFQ185	MFQ185
MFQ186	MFQ186
MFQ187	MFQ187
MFQ188	MFQ188
MFQ189	MFQ189
MFQ190	MFQ190
MFQ191	MFQ191
MFQ191D	MFQ191D
MFQ191S	MFQ191S
MFQ247	MFQ247
MFQ247D	MFQ247D
MFQ247S	MFQ247S
MFQ266	MFQ266
MFQ269	MFQ269
MFQ270	MFQ270
MFQ271	MFQ271
MFQ398	MFQ398
MFQ399	MFQ399

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: Melba Bencich Name: MELBA BENCICH

Date: DECEMBER 12, 1994 Title: DOCUMENT CONTROL OFFICER

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COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894 SAS No.: _____ SDG No.:MFQ182

SOW No.: ILM02.1

EPA Sample No.	Lab Sample ID
_MFT695_____	_MFT695_____
_MFT696_____	_MFT696_____
_____	_____
_____	_____
_____	_____
_____	_____
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_____	_____
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_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES

If yes - were raw data generated before application of background corrections ? Yes/No NO_

Comments:

_____

_____

_____

_____

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: MELBA BENCICH

Date: DECEMBER 12, 1994 Title: DOCUMENT CONTROL OFFICER

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Red River abv ? pipeline cross.
MFQ182

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ182

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _51.7

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	12600			P
7440-36-0	Antimony	9.9	U	N	P
7440-38-2	Arsenic	11.0		SN	F
7440-39-3	Barium	499			P
7440-41-7	Beryllium	1.8	B		P
7440-43-9	Cadmium	1.5	U		P
7440-70-2	Calcium	2990			P
7440-47-3	Chromium	18.5			P
7440-48-4	Cobalt	21.8			P
7440-50-8	Copper	116			P
7439-89-6	Iron	34400			P
7439-92-1	Lead	132			F
7439-95-4	Magnesium	4670			P
7439-96-5	Manganese	1310			P
7439-97-6	Mercury	0.19	U		CV
7440-02-0	Nickel	53.6			P
7440-09-7	Potassium	2890			P
7782-49-2	Selenium	1.3	B		F
7440-22-4	Silver	1.5	B		P
7440-23-5	Sodium	232	B		P
7440-28-0	Thallium	0.35	U		F
7440-62-2	Vanadium	18.6	B		P
7440-66-6	Zinc	469			P
	Cyanide				NR

Color Before: BROWN____ Clarity Before: _____ Texture: MEDIUM

Color After: YELLOW___ Clarity After: _____ Artifacts: _____

Comments:

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Red River below Capulin
MFQ184

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ184

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _45.5

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	16000			P
7440-36-0	Antimony	11.3	U	N	P
7440-38-2	Arsenic	6.1		SN	F
7440-39-3	Barium	508			P
7440-41-7	Beryllium	1.5	B		P
7440-43-9	Cadmium	1.7	U		P
7440-70-2	Calcium	1980	B		P
7440-47-3	Chromium	20.7			P
7440-48-4	Cobalt	12.2	B		P
7440-50-8	Copper	98.3			P
7439-89-6	Iron	38000			P
7439-92-1	Lead	102		S	F
7439-95-4	Magnesium	4970			P
7439-96-5	Manganese	468			P
7439-97-6	Mercury	0.22	U		CV
7440-02-0	Nickel	27.3			P
7440-09-7	Potassium	3390			P
7782-49-2	Selenium	0.94	B		F
7440-22-4	Silver	1.8	B		P
7440-23-5	Sodium	241	B		P
7440-28-0	Thallium	0.40	U		F
7440-62-2	Vanadium	21.6	B		P
7440-66-6	Zinc	220			P
	Cyanide				NR

Color Before: BROWN____ Clarity Before: _____ Texture: MEDIUM

Color After: YELLOW___ Clarity After: _____ Artifacts: _____

Comments:

5

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Red River blw Capulin seep (chip)

MFQ185

B

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ185

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _40.2

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	19500	_		P_
7440-36-0	Antimony_	12.7	U	N	P_
7440-38-2	Arsenic__	8.8	_	SN	F_
7440-39-3	Barium___	569	_		P_
7440-41-7	Beryllium	1.8	B		P_
7440-43-9	Cadmium__	1.9	U		P_
7440-70-2	Calcium__	2150	B		P_
7440-47-3	Chromium_	23.9	_		P_
7440-48-4	Cobalt___	14.6	B		P_
7440-50-8	Copper___	116	_		P_
7439-89-6	Iron_____	41800	_		P_
7439-92-1	Lead_____	119	_		F_
7439-95-4	Magnesium	5680	_		P_
7439-96-5	Manganese	501	_		P_
7439-97-6	Mercury__	0.25	U		CV
7440-02-0	Nickel___	32.5	_		P_
7440-09-7	Potassium	3960	_		P_
7782-49-2	Selenium_	1.3	B		F_
7440-22-4	Silver___	1.8	U		P_
7440-23-5	Sodium___	290	B		P_
7440-28-0	Thallium_	0.45	U		F_
7440-62-2	Vanadium_	24.7	B		P_
7440-66-6	Zinc_____	250	_		P_
	Cyanide__		_		NR

Color Before: BROWN____ Clarity Before: _____ Texture: MEDIUM

Color After: YELLOW___ Clarity After: _____ Artifacts: _____

Comments:

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Red River btwn upper + lower Capulin seeps

MFQ186

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ186

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _27.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	24200			P
7440-36-0	Antimony	19.0	U	N	P
7440-38-2	Arsenic	9.2		+N	F
7440-39-3	Barium	578			P
7440-41-7	Beryllium	2.4	B		P
7440-43-9	Cadmium	2.9	U		P
7440-70-2	Calcium	1860	B		P
7440-47-3	Chromium	22.3			P
7440-48-4	Cobalt	13.5	B		P
7440-50-8	Copper	152			P
7439-89-6	Iron	47600			P
7439-92-1	Lead	144			F
7439-95-4	Magnesium	5400			P
7439-96-5	Manganese	553			P
7439-97-6	Mercury	0.37	U		CV
7440-02-0	Nickel	29.4	B		P
7440-09-7	Potassium	4330			P
7782-49-2	Selenium	1.1	B	W	F
7440-22-4	Silver	2.7	U		P
7440-23-5	Sodium	326	B		P
7440-28-0	Thallium	0.69	B		F
7440-62-2	Vanadium	21.2	B		P
7440-66-6	Zinc	298			P
	Cyanide				NR

Color Before: BROWN____ Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Red River below Grants
MFQ187 (E)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ187

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _40.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10900			P
7440-36-0	Antimony	12.5	U	N	P
7440-38-2	Arsenic	6.1		+N	F
7440-39-3	Barium	406			P
7440-41-7	Beryllium	1.1	B		P
7440-43-9	Cadmium	1.9	U		P
7440-70-2	Calcium	2210	B		P
7440-47-3	Chromium	20.3			P
7440-48-4	Cobalt	13.3	B		P
7440-50-8	Copper	104			P
7439-89-6	Iron	31300			P
7439-92-1	Lead	91.1		S	F
7439-95-4	Magnesium	5090			P
7439-96-5	Manganese	466			P
7439-97-6	Mercury	0.24	U		CV
7440-02-0	Nickel	18.1	B		P
7440-09-7	Potassium	2540			P
7782-49-2	Selenium	1.4	B		F
7440-22-4	Silver	2.3	B		P
7440-23-5	Sodium	245	B		P
7440-28-0	Thallium	0.44	U		F
7440-62-2	Vanadium	22.2	B		P
7440-66-6	Zinc	182			P
	Cyanide				NR

Color Before: BROWN Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Red River above Copulin se
MFQ188 (D)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ188

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _46.5

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	13900			P
7440-36-0	Antimony	11.0	U	N	P
7440-38-2	Arsenic	7.4		SN	F
7440-39-3	Barium	537			P
7440-41-7	Beryllium	2.1	B		P
7440-43-9	Cadmium	2.1	B		P
7440-70-2	Calcium	3230			P
7440-47-3	Chromium	18.7			P
7440-48-4	Cobalt	19.0	B		P
7440-50-8	Copper	126			P
7439-89-6	Iron	33700			P
7439-92-1	Lead	97.5		S	F
7439-95-4	Magnesium	4640			P
7439-96-5	Manganese	1080			P
7439-97-6	Mercury	0.23			CV
7440-02-0	Nickel	59.2			P
7440-09-7	Potassium	3080			P
7782-49-2	Selenium	1.1	B		F
7440-22-4	Silver	2.5	B		P
7440-23-5	Sodium	254	B		P
7440-28-0	Thallium	0.39	U		F
7440-62-2	Vanadium	18.9	B		P
7440-66-6	Zinc	548			P
_____	Cyanide				NR
_____					

Color Before: BROWN Clarity Before: _____ Texture: MEDIUM

Color After: YELLOW Clarity After: _____ Artifacts: _____

Comments:

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1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Red River below Columbia Crk
MFQ189 (F)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ189

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _54.1

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10500			P
7440-36-0	Antimony	9.5	U	N	P
7440-38-2	Arsenic	8.4		N	F
7440-39-3	Barium	567			P
7440-41-7	Beryllium	1.1	B		P
7440-43-9	Cadmium	1.4	U		P
7440-70-2	Calcium	3020			P
7440-47-3	Chromium	16.8			P
7440-48-4	Cobalt	12.7	B		P
7440-50-8	Copper	71.1			P
7439-89-6	Iron	33600			P
7439-92-1	Lead	106			F
7439-95-4	Magnesium	4560			P
7439-96-5	Manganese	550			P
7439-97-6	Mercury	0.18	U		CV
7440-02-0	Nickel	30.9			P
7440-09-7	Potassium	3130			P
7782-49-2	Selenium	1.1	B		F
7440-22-4	Silver	1.9	B		P
7440-23-5	Sodium	238	B		P
7440-28-0	Thallium	0.33	U		F
7440-62-2	Vanadium	16.8	B		P
7440-66-6	Zinc	221			P
	Cyanide				NR

Color Before: BROWN____ Clarity Before _____ Texture: MEDIUM

Color After: YELLOW___ Clarity After. _____ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Columbine Creek
MFQ190 (G)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ190

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _81.3

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	10500			P
7440-36-0	Antimony	6.7	B	N	P
7440-38-2	Arsenic	1.2	B	N	F
7440-39-3	Barium	78.5			P
7440-41-7	Beryllium	0.46	B		P
7440-43-9	Cadmium	0.96	U		P
7440-70-2	Calcium	2490			P
7440-47-3	Chromium	12.5			P
7440-48-4	Cobalt	13.1			P
7440-50-8	Copper	21.2			P
7439-89-6	Iron	26700			P
7439-92-1	Lead	118			P
7439-95-4	Magnesium	7420			P
7439-96-5	Manganese	701			P
7439-97-6	Mercury	0.13			CV
7440-02-0	Nickel	7.4	B		P
7440-09-7	Potassium	1030	B		P
7782-49-2	Selenium	0.25	U		F
7440-22-4	Silver	1.9	B		P
7440-23-5	Sodium	54.4	B		P
7440-28-0	Thallium	0.22	U	W	F
7440-62-2	Vanadium	43.6			P
7440-66-6	Zinc	136			P
	Cyanide				NR

Color Before: BROWN____ Clarity Before: _____ Texture: COARSE

Color After: YELLOW___ Clarity After: _____ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Red River above Columbine Creek

MFQ191

(H)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ191

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _50.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	12600			P
7440-36-0	Antimony	10.1	U	N	P
7440-38-2	Arsenic	11.2		SN	F
7440-39-3	Barium	601			P
7440-41-7	Beryllium	1.2	B		P
7440-43-9	Cadmium	1.5	U		P
7440-70-2	Calcium	2900			P
7440-47-3	Chromium	20.5			P
7440-48-4	Cobalt	14.1	B		P
7440-50-8	Copper	78.9			P
7439-89-6	Iron	38400			P
7439-92-1	Lead	130			F
7439-95-4	Magnesium	5300			P
7439-96-5	Manganese	538			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	31.2			P
7440-09-7	Potassium	3980			P
7782-49-2	Selenium	1.6	B		F
7440-22-4	Silver	1.4	U		P
7440-23-5	Sodium	277	B		P
7440-28-0	Thallium	0.35	U		F
7440-62-2	Vanadium	20.6			P
7440-66-6	Zinc	237			P
	Cyanide				NR

Color Before: BROWN Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
MW - 11 (dup) (UF)
MFQ247

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): WATER Lab Sample ID: MFQ247

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	53500			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	B	W	F
7440-39-3	Barium	16.1	B		P
7440-41-7	Beryllium	12.6			P
7440-43-9	Cadmium	34.3			P
7440-70-2	Calcium	236000			P
7440-47-3	Chromium	3.8	B		P
7440-48-4	Cobalt	245			P
7440-50-8	Copper	867			P
7439-89-6	Iron	88.8	B		P
7439-92-1	Lead	12.0		SN	F
7439-95-4	Magnesium	112000			P
7439-96-5	Manganese	26100			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	536			P
7440-09-7	Potassium	2780	B		P
7782-49-2	Selenium	1.5	B	WN	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	27000			P
7440-28-0	Thallium	0.90	U	W	F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	4490			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Seep near Fagarquin
MFQ266 (Cabin Sp

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182 (S-6

Matrix (soil/water): WATER Lab Sample ID: MFQ266

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	34500	_		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	29.8	B		P_
7440-41-7	Beryllium	7.7	_		P_
7440-43-9	Cadmium__	28.8	_		P_
7440-70-2	Calcium__	218000	_		P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	166	_		P_
7440-50-8	Copper___	424	_		P_
7439-89-6	Iron_____	13.9	B		P_
7439-92-1	Lead_____	1.6	B	WN	F_
7439-95-4	Magnesium	96300	_		P_
7439-96-5	Manganese	20100	_		P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	427	_		P_
7440-09-7	Potassium	2110	B		P_
7782-49-2	Selenium_	1.9	B	WN	F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	24400	_		P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc_____	3540	_		P_
	Cyanide__		_		NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Juneberg Campground (F)

MFQ269

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): WATER Lab Sample ID: MFQ269

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	28.4	U		P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	34.4	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	34200			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	2.8	U		P
7439-89-6	Iron	128			P
7439-92-1	Lead	1.0	B	WN	F
7439-95-4	Magnesium	6920			P
7439-96-5	Manganese	82.6			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	732	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	4180	B		P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	252			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before CLEAR_ Texture: _____

Color After: COLORLESS Clarity After CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
mc m'll well #1
MFQ270

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): WATER Lab Sample ID: MFQ270

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum_	144	B		P_
7440-36-0	Antimony_	25.6	U		P_
7440-38-2	Arsenic__	1.2	U		F_
7440-39-3	Barium___	21.0	B		P_
7440-41-7	Beryllium	0.30	U		P_
7440-43-9	Cadmium__	3.9	U		P_
7440-70-2	Calcium__	43700			P_
7440-47-3	Chromium_	3.7	U		P_
7440-48-4	Cobalt___	4.6	U		P_
7440-50-8	Copper___	4.9	B		P_
7439-89-6	Iron____	39.8	B		P_
7439-92-1	Lead____	0.75	B	WN	F_
7439-95-4	Magnesium	8880			P_
7439-96-5	Manganese	110			P_
7439-97-6	Mercury__	0.20	U		CV
7440-02-0	Nickel___	16.7	U		P_
7440-09-7	Potassium	771	B		P_
7782-49-2	Selenium_	1.0	U	N	F_
7440-22-4	Silver___	3.6	U		P_
7440-23-5	Sodium___	5140			P_
7440-28-0	Thallium_	0.90	U		F_
7440-62-2	Vanadium_	3.7	U		P_
7440-66-6	Zinc____	41.0			P_
_____	Cyanide__	_____			NR
_____	_____	_____			__

Color Before: COLORLESS Clarity Before CLEAR_ Texture: _____

Color After: COLORLESS Clarity After. CLEAR_ Artifacts: _____

Comments:

_____

_____

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U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
R River blw Adit seep
MFQ271 (UF)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182 (12)

Matrix (soil/water): WATER Lab Sample ID: MFQ271

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: __0.0

Concentration Units (ug/L or mg/kg dry weight): UG/L_

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	1290			P
7440-36-0	Antimony	25.6	U		P
7440-38-2	Arsenic	1.2	U		F
7440-39-3	Barium	39.8	B		P
7440-41-7	Beryllium	0.30	U		P
7440-43-9	Cadmium	3.9	U		P
7440-70-2	Calcium	40700			P
7440-47-3	Chromium	3.7	U		P
7440-48-4	Cobalt	4.6	U		P
7440-50-8	Copper	15.9	B		P
7439-89-6	Iron	557			P
7439-92-1	Lead	1.4	B	WN	F
7439-95-4	Magnesium	9200			P
7439-96-5	Manganese	299			P
7439-97-6	Mercury	0.20	U		CV
7440-02-0	Nickel	16.7	U		P
7440-09-7	Potassium	999	B		P
7782-49-2	Selenium	1.0	U	N	F
7440-22-4	Silver	3.6	U		P
7440-23-5	Sodium	5230			P
7440-28-0	Thallium	0.90	U		F
7440-62-2	Vanadium	3.7	U		P
7440-66-6	Zinc	92.8			P
	Cyanide				NR

Color Before: COLORLESS Clarity Before: CLEAR_ Texture: _____

Color After: COLORLESS Clarity After: CLEAR_ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Real R. blw Ad. + seq

MFQ398 (I)

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ398

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _30.2

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	12200			P
7440-36-0	Antimony	17.0	U	N	P
7440-38-2	Arsenic	8.5		SN	F
7440-39-3	Barium	694			P
7440-41-7	Beryllium	1.3	B		P
7440-43-9	Cadmium	2.6	U		P
7440-70-2	Calcium	2340	B		P
7440-47-3	Chromium	22.1			P
7440-48-4	Cobalt	13.2	B		P
7440-50-8	Copper	135			P
7439-89-6	Iron	40600			P
7439-92-1	Lead	94.1			F
7439-95-4	Magnesium	5310			P
7439-96-5	Manganese	534			P
7439-97-6	Mercury	0.33	U		CV
7440-02-0	Nickel	24.0	B		P
7440-09-7	Potassium	3640			P
7782-49-2	Selenium	1.1	B		F
7440-22-4	Silver	2.4	U		P
7440-23-5	Sodium	297	B		P
7440-28-0	Thallium	0.60	U		F
7440-62-2	Vanadium	20.5	B		P
7440-66-6	Zinc	190			P
	Cyanide				NR

Color Before: BROWN Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

Recd E. abv Molycorp prop.

MFQ399

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFQ399

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _72.5

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	5250			P
7440-36-0	Antimony	7.1	U	N	P
7440-38-2	Arsenic	4.0		SN	F
7440-39-3	Barium	439			P
7440-41-7	Beryllium	0.43	B		P
7440-43-9	Cadmium	1.1	U		P
7440-70-2	Calcium	1470			P
7440-47-3	Chromium	8.8			P
7440-48-4	Cobalt	6.9	B		P
7440-50-8	Copper	25.1			P
7439-89-6	Iron	17600			P
7439-92-1	Lead	29.3		S	F
7439-95-4	Magnesium	2210			P
7439-96-5	Manganese	165			P
7439-97-6	Mercury	0.14	U		CV
7440-02-0	Nickel	13.9			P
7440-09-7	Potassium	1700			P
7782-49-2	Selenium	0.28	U	W	F
7440-22-4	Silver	0.99	U		P
7440-23-5	Sodium	122	B		P
7440-28-0	Thallium	0.25	U		F
7440-62-2	Vanadium	7.9	B		P
7440-66-6	Zinc	93.9			P
	Cyanide				NR

Color Before: BROWN____ Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Red R below Hanson
MFT695

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFT695

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _65.8

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	4510			P
7440-36-0	Antimony	7.8	U	N	P
7440-38-2	Arsenic	5.6		N	F
7440-39-3	Barium	262			P
7440-41-7	Beryllium	0.34	B		P
7440-43-9	Cadmium	1.2	U		P
7440-70-2	Calcium	1190	B		P
7440-47-3	Chromium	6.5			P
7440-48-4	Cobalt	4.0	B		P
7440-50-8	Copper	22.0			P
7439-89-6	Iron	14800			P
7439-92-1	Lead	21.4		S	F
7439-95-4	Magnesium	1700			P
7439-96-5	Manganese	115			P
7439-97-6	Mercury	0.15	U		CV
7440-02-0	Nickel	8.6	B		P
7440-09-7	Potassium	1980			P
7782-49-2	Selenium	0.44	B		F
7440-22-4	Silver	1.1	U		P
7440-23-5	Sodium	76.5	B		P
7440-28-0	Thallium	0.27	U		F
7440-62-2	Vanadium	6.5	B		P
7440-66-6	Zinc	44.5			P
	Cyanide				NR

Color Before: BROWN____ Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
Red R. above Hanson Crk
MFT696 L

Lab Name: SVL_ANALYTICAL_INC._____ Contract: 68-D20042_

Lab Code: SILVER Case No.: 22894_ SAS No.: _____ SDG No.: MFQ182

Matrix (soil/water): SOIL_ Lab Sample ID: MFT696

Level (low/med): LOW__ Date Received: 11/10/94

% Solids: _25.8

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	15000			P
7440-36-0	Antimony	19.8	U	N	P
7440-38-2	Arsenic	10.0		+N	F
7440-39-3	Barium	787			P
7440-41-7	Beryllium	1.1	B		P
7440-43-9	Cadmium	3.0	U		P
7440-70-2	Calcium	3690	B		P
7440-47-3	Chromium	23.5			P
7440-48-4	Cobalt	12.9	B		P
7440-50-8	Copper	142			P
7439-89-6	Iron	45800			P
7439-92-1	Lead	163			F
7439-95-4	Magnesium	6110			P
7439-96-5	Manganese	636			P
7439-97-6	Mercury	0.39	U		CV
7440-02-0	Nickel	23.2	B		P
7440-09-7	Potassium	5290			P
7782-49-2	Selenium	1.8	B		F
7440-22-4	Silver	3.3	B		P
7440-23-5	Sodium	292	B		P
7440-28-0	Thallium	0.70	U		F
7440-62-2	Vanadium	24.8	B		P
7440-66-6	Zinc	274			P
	Cyanide				NR

Color Before: BROWN Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
HOUSTON BRANCH
10625 FALLSTONE RD
HOUSTON, TEXAS 77099

JUN 1995
RECEIVED

MEMORANDUM

Date: 6-7-1995

Subject: **Contract Laboratory Program Data Review**

From: Melvin L. Ritter, ESAT RPO, 6E-HO

To: E. Sierra, 6H-MA

Site: MOLYCORP

Case#: 23566

SDG#: MFQ-082

The EPA Region 6 Houston Branch ESAT data validation team has completed a review of the submitted Contract Laboratory Program (CLP) data package for the referenced site. The samples analyzed and reviewed are detailed in the attached Regional data review and assessment report for this case.

The data package was found to be:

( ) Acceptable: No major problems with data package.

(X) Provisional: Use of data requires caution.
Data is acceptable for Regional use. Problems are noted in the review report.

( ) Unacceptable: Some or all of data should not be used.
Problems are noted in the review report.

Questions regarding the data review report can be addressed to me.

Attachments

cc: R. Flores, Region 6 CLP/TPO
M. El-feky, Region 6 Data Coordinator
Regional CLP/TPO (if lab out of Region 6)

Files (3)

Recycled/Recyclable
Printed with Soy/Canola Ink on paper that

USEPA REGION VI

476

INORGANIC REGIONAL ACCEPTANCE/REJECTION/REDUCED VALUE RECOMMENDATION FORM

LAB CODE SWOK	CASE NO 23566
SITE NAME MOLY CORP QUESTA MINE	SDG NO. MFQ082
	NUMBER OF SAMPLES. 6

FORM DUE DATE
06/26/95

SDG MAILDATE
06/01/95

PART I DATA ACCEPTANCE OR REJECTION

INSTRUCTIONS EPA REGIONS MUST ACCEPT OR REJECT DATA WITHIN 30 DAYS IF DATA ARE BEING REJECTED, THIS FORM MUST BE ACCOMPANIED BY 1) A SIGNED MEMO FROM THE REGIONAL OFFICIAL DESCRIBING THE CONTRACTUAL REASONS FOR REJECTION ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS,TELEPHONE LOGS, ETC.), 2) ALL REJECTED DATA

A FULL DATA ACCEPTANCE OR REJECTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY ACCEPT OR FULLY REJECT ALL SAMPLES IN THIS SDG

✓ ACCEPT ALL ____ REJECT ALL

B REJECTION OF ALL SAMPLES FOR A PARTICULAR FRACTION
CHECK ONE OF THE FOLLOWING IF YOU FULLY REJECT ALL SAMPLES IN A PARTICULAR FRACTION IN THIS SDG
ALL FRACTIONS NOT MARKED AS REJECTED ARE ACCEPTED

REJECT ALL ____ METALS ____ CYANIDE

C REJECTION AT THE SAMPLE AND FRACTIONAL LEVEL
CHECK THE FOLLOWING TO REJECT SAMPLES AT THE SAMPLE/FRACTIONAL LEVEL AND COMPLETE THE REVERSE SIDE OF THIS FORM

____ PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE/FRACTION

PART II REDUCED VALUE

INSTRUCTIONS REGION RECOMMENDS REDUCED VALUE AND RETAINS THE DATA FOR A REDUCED VALUE TO BE PROCESSED, THIS FORM MUST BE ACCOMPANIED BY A SIGNED MEMO FROM THE REGIONAL OFFICIAL CITING THE CONTRACTUAL NON-COMPLIANCE, THE DOLLAR AMOUNT FOR REDUCED VALUE, AND A WRITTEN JUSTIFICATION (NARRATIVE) OF HOW SAMPLE WORTH WAS DETERMINED FOR EACH AFFECTED SAMPLE ATTACH ALL RELATED DOCUMENTS (DATA REVIEWS, TELEPHONE LOGS, ETC)

CHECK ONE OF THE FOLLOWING

✓ NO REDUCED VALUE ____ REDUCED VALUE (COMPLETE REVERSE SIDE)

IDENTIFY THE SAMPLES/FRACTIONS THAT ARE RECOMMENDED FOR REDUCED VALUE ON THE REVERSE SIDE OF THIS FORM

THIS FORM CANNOT BE PROCEESSED WITHOUT A SIGNATURE

NAME OF REGIONAL OFFICIAL MAHMOUD ELFEKY

SIGNATURE M. Elfeky DATE: 6-7-95

SEND THIS FORM TO CLASS C/O DYNCORP
INVOICE PROCESSING & CALCULATION GROUP
300 NORTH LEE STREET, ALEXANDRIA, VA 22314

SEE LIST OF SAMPLES ON REVERSE SIDE

ESAT REGION VI
c/o U.S. ENVIRONMENTAL PROTECTION AGENCY
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

MEMORANDUM

DATE: June 5, 1995

TO: Melvin Ritter, ESAT RPO, USEPA, Region VI

FROM: Bill Blanton by BB
Bill Blanton, ESAT ETM, Region VI

SUBJECT: CLP Data Review

REF: WUD # 6-5571

Attached is the data review summary for Case # 23566
SDG # MFQ082
Site MOLYCORP

COMMENTS:

A. CONTRACTUAL ASSESSMENT OF DATA PACKAGE:

The data package was contractually compliant as determined by CCS and the hard copy data review

B. TECHNICAL/USABILITY ASSESSMENT OF DATA PACKAGE:

A total of 69 results were reviewed for this data package. The data package is technically provisional because of the significant problems summarized below.

1. The antimony matrix spike recovery was below the QC limits.

2. Two selenium results had inconsistent replicate ICP readings.

3. Approximately seven percent of the results were qualified because of technical problems.

LAB CODE SWOK	CASE NO. 23566	SDG NO.. MFQ082

PART III. PARTIAL ACCEPTANCE AND REJECTION BY SAMPLE

ENTER AN "X" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REJECTION
ENTER A "D" IN THE BLOCK TO THE RIGHT OF THE "Y" FOR THE FRACTION RECOMMENDED FOR REDUCED VALUE
ALL SAMPLES THAT ARE NOT MARKED WITH AN "X" OR A "D" ARE ACCEPTED.

	FRACTIONS ANALYZED			
SAMPLE	METALS		CYANIDE	
LCSS	Y			
MFQ082	Y			
MFQ083	Y			
MFQ083D	Y			
MFQ083S	Y			
MFQ084	Y			

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
HOUSTON BRANCH
10625 FALLSTONE ROAD
HOUSTON, TEXAS 77099

INORGANIC REGIONAL DATA ASSESSMENT

CASE NO. 23566 SITE MOLYCORP
LABORATORY SWOK NO. OF SAMPLES 3
CONTRACT # 68-D3-0040 MATRIX SOIL
SDG # MFQ082 REVIEWER (IF NOT ESD) ESAT
SOW # ILM03.0 REVIEWER'S NAME Mervin Doucet
ACCT # 5TFAJNB8 SF # TFAUZZ COMPLETION DATE 6/5/95

SAMPLE NO.: MFQ-082 MFQ-083 MFQ-084

DATA ASSESSMENT SUMMARY

	ICP	Hg
1. HOLDING TIMES	O	O
2. CALIBRATIONS	O	O
3. BLANKS	O	O
4. MATRIX SPIKE	M	O
5. DUPLICATE ANALYSIS	O	O
6. ICP QC	M	
7. FAA QC		
8. LCS	O	O
9. SAMPLE VERIFICATION	O	O
10. OTHER QC	O	O
11. OVERALL ASSESSMENT	M	O

O = Data had no problems.
M = Data qualified due to major or minor problems.
Z = Data unacceptable.
N/A = Not applicable

ACTION ITEMS:

AREAS OF CONCERN: The antimony matrix spike recovery was low. Replicate ICP readings were inconsistent for two selenium results.

NOTABLE PERFORMANCE:

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case 23566 SDG MFQ082 Site MOLYCORP Lab SWOK

COMMENTS: Three soil samples were analyzed for total metals using SOW ILM03.0. According to the ITR/COC, sample MFQ-083 was the QC sample, and samples MFQ-083 and MFQ-084 were identified as field duplicates. The laboratory met the required data package turnaround time. Approximately 67 percent of the sample results were reported above the CRDL's.

The data package is technically provisional because of problems with a matrix spike recovery and inconsistent replicate ICP readings. The technical usability of the sample results is discussed below, and any qualifications are listed in the Data Summary Table.

An Evidence Audit was conducted for the Complete Sample Delivery Group File (CSF), and the Evidence Inventory Checklist is attached to this report.

1. **Holding Times:** Acceptable. All holding time and sample preservation criteria were met.

2. **Calibrations:** Acceptable. All calibrations were acceptable. The CRDL standard results indicated that the instrument performance near the CRDL's was acceptable.

3. **Blanks:** Acceptable. Preparation and calibration blanks met QC requirements. Aluminum, sodium, and thallium were present in the calibration and/or preparation blanks, but no sample results were affected.

4. **Pre-digestion Matrix Spike Recovery:** Provisional. All antimony results are estimated and biased low because the matrix spike recovery was below the lower QC limit. All other matrix spike recoveries were acceptable.

5. **Duplicate Analysis:** Acceptable. All laboratory duplicate results met technical QC criteria.

6. **ICP Quality Control**

   Serial Dilution: Acceptable. All serial dilution results met QC criteria.

   Interference Check Sample: Acceptable. All ICS results were acceptable.

COMMENTS/CLARIFICATIONS
REGION 6 CLP QA REVIEW

Case 23566 SDG MFQ082 Site MOLYCORP Lab SWOK

6. ICP Quality Control, continued

Coefficient of Variation: Provisional. The selenium results for samples MFQ-082 and MFQ-084 are estimated because the inconsistent replicate ICP readings caused high (>20%) coefficients of variation. All other coefficients of variation were acceptable.

7. **Furnace Atomic Absorption Quality Control:** Not applicable.

8. **Laboratory Control Sample:** Acceptable. Laboratory control sample results were within QC limits.

9. **Sample Verification:** All data were correctly reported.

10. **Other QC:**

Field Duplicates: Acceptable. All field duplicate results demonstrated acceptable precision.

11. **Overall Assessment:** The data package is technically provisional because of the following problems.

All antimony results were estimated and biased low because of the low matrix spike recovery.

Two selenium results were estimated because of inconsistent replicate ICP readings.

INORGANIC DATA QUALIFIER DEFINITIONS

The following definitions provide brief explanations of the ESAT-Region 6 qualifiers assigned to results in the data review process.

U Undetected

J Estimated value

R Unusable

F A possibility of a false negative exists.

UC Undetected at the listed detection limit which was raised because of apparent blank contamination.

UJ Estimated detection limit because of outlying quality control parameters such as matrix spike, serial dilution, FAA spike recovery, etc.

^ Positive bias.

v Negative bias.

DATA SUMMARY

Case No.: 23556
Laboratory: SWOK

SDG. No.. MFQ082
Matrix SOIL

Reviewer: M. DOUCET
Units: MG/KG

E[illegible]R #=> LAB ID	MFQ-082	FLAG	MFQ-083	FLAG	MFQ-084	FLAG	FLAG	FLAG	COMMENTS
ALUMINUM	9790		8950		13700				
ANTIMONY	0 64	UJv	0.63	UJv	0.63	UJv			
ARSENIC	4.7		4.4		5 5				
BARIUM	156		159		185				
BERYLLIUM	0.72		0.79		0.97				
CADMIUM	0.21	U	0.57		0.65				
CALCIUM	2570		2280		2580				
CHROMIUM	13.1		13 7		17.7				
COBALT	10		12		14.3				
COPPER	17.4		24.3		29.2				
IRON	17500		19400		25000				
LEAD	20.3		23.5		24.9				
MAGNESIUM	2550		2590		3220				
MANGANESE	655		789		904				
MERCURY	0.11	U	0 11	U	0 1	U			
[illegible]EL	11		11 6		14.3				
POTASSIUM	1850		2230		2910				
SELENIUM	1.1	J	0.92		1 4	J			
SILVER	0 21	U	0.21	U	0.21	U			
SODIUM	86.2		79.6		105				
THALLIUM	1.1	U	1.1	U	1	U			
VANADIUM	36.1		33		41.3				
ZINC	48.5		65.3		85.3				
% SOLIDS	93.9		95		95.9				
	Bk-1		Bk2		Bk2 - Dup				
	Silva								

INORGANIC/ORGANIC COMPLETE SDG FILE (CSF) INVENTORY CHECKLIST

Case 23566 SDG No MFQ082 SDG Nos To Follow SAS No Date Rec 5/24/95

EPA Lab ID SWOK
Lab Location BROKEN ARROW, OK
Region 6 Audit No 23566/MFQ082
Re_Submitted CSF? Yes _____ No X
Box No(s) 1
COMMENTS

ORIGINALS	YES	NO	N/A
CUSTODY SEALS			
1 Present on package?	X		
2 ntact upon receipt?	X		
FORM DC-2			
3 Numbering scheme accurate?	X		
4 Are enclosed documents listed?	X		
5 Are listed documents enclosed?	X		
FORM DC-1			
6 Present?	X		
7 Complete?	X		
8 Accurate?	X		
CHAIN-OF-CUSTODY RECORD(s)			
9 Signed?	X		
10 Dated?	X		
TRAFFIC REPORT(s) PACKING LIST(s)			
11 Signed?	X		
12 Dated?	X		
AIRBILLS/AIRBILL STICKER			
13 Present?	X		
14 Signed?	X		
15 Dated?	X		
SAMPLE TAGS			
16 Does DC-1 list tags as being included?	X		
17 Present?	X		
OTHER DOCUMENTS			
18 Complete?	X		
19 Legible?	X		
20 Original?		X	
20a If "No", does the copy indicate where original documents are located?	X		

Over for additional comments

Audited by Mervin J Doucet MERVIN DOUCET/DATA REVIEWER Date 6/1/95
Audited by _____ _____ Date _____
Audited by _____ _____ Date _____
Signature Printed Name/Title

TO BE COMPLETED BY CEAT

Date Recvd by CEAT _____ Date Entered: _____ Date Reviewed: _____
Entered by _____ _____
Reviewed by _____ _____
Signature Printed Name/Title

U.S. EPA - CLP

COVER PAGE - INORGANIC ANALYSES DATA PACKAGE

Name: SOUTHWEST_LAB_OF_OK Contract: 68-D3-0040

Lab Code: SWOK Case No.: 23566 SAS No.: _____ SDG No.:MFQO82

SOW No.: ILM03

EPA Sample No.	Lab Sample ID
MFQO82	2218101
MFQO83	2218102
MFQO83D	2218102D
MFQO83S	2218102S
MFQO84	2218103

Were ICP interelement corrections applied ? Yes/No YES

Were ICP background corrections applied ? Yes/No YES
If yes - were raw data generated before application of background corrections ? Yes/No NO

Comments:

I certify that this data package is in compliance with the terms and conditions of the contract, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data submitted on floppy diskette has been authorized by the Laboratory Manager or the Manager's designee, as verified by the following signature.

Signature: _____ Name: Jason D. Ruckman

Date: May 23, 1995 Title: Inorganic Program Manager

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQO82

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract: 68-D3-0040

Lab Code: SWOK__ Case No.: 23566_ SAS No.: _____ SDG No.: MFQO82

Matrix (soil/water): SOIL_ Lab Sample ID: 2218101___

Level (low/med): LOW__ Date Received: 05/10/95

% Solids: _93.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	9790		*	P
7440-36-0	Antimony	0.64	U	N	P
7440-38-2	Arsenic	4.7			P
7440-39-3	Barium	156			P
7440-41-7	Beryllium	0.72	B		P
7440-43-9	Cadmium	0.21	U		P
7440-70-2	Calcium	2570			P
7440-47-3	Chromium	13.1			P
7440-48-4	Cobalt	10.0	B		P
7440-50-8	Copper	17.4			P
7439-89-6	Iron	17500			P
7439-92-1	Lead	20.3			P
7439-95-4	Magnesium	2550			P
7439-96-5	Manganese	655			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	11.0			P
7440-09-7	Potassium	1850			P
7782-49-2	Selenium	1.1			P
7440-22-4	Silver	0.21	U		P
7440-23-5	Sodium	86.2	B		P
7440-28-0	Thallium	1.1	U		P
7440-62-2	Vanadium	36.1			P
7440-66-6	Zinc	48.5			P
	Cyanide				NR

Color Before: BROWN____ Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

U.S. EPA - CLP

1

INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.

MFQ083

Lab Name: SOUTHWEST_LAB_OF_OK Contract: 68-D3-0040

Lab Code: SWOK Case No.: 23566 SAS No.: SDG No.: MFQ082

Matrix (soil/water): SOIL Lab Sample ID: 2218102

Level (low/med): LOW Date Received: 05/10/95

% Solids: 95.0

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	8950		*	P
7440-36-0	Antimony	0.63	U	N	P
7440-38-2	Arsenic	4.4			P
7440-39-3	Barium	159			P
7440-41-7	Beryllium	0.79	B		P
7440-43-9	Cadmium	0.57	B		P
7440-70-2	Calcium	2280			P
7440-47-3	Chromium	13.7			P
7440-48-4	Cobalt	12.0			P
7440-50-8	Copper	24.3			P
7439-89-6	Iron	19400			P
7439-92-1	Lead	23.5			P
7439-95-4	Magnesium	2590			P
7439-96-5	Manganese	789			P
7439-97-6	Mercury	0.11	U		CV
7440-02-0	Nickel	11.6			P
7440-09-7	Potassium	2230			P
7782-49-2	Selenium	0.92	B		P
7440-22-4	Silver	0.21	U		P
7440-23-5	Sodium	79.6	B		P
7440-28-0	Thallium	1.1	U		P
7440-62-2	Vanadium	33.0			P
7440-66-6	Zinc	65.3			P
	Cyanide				NR

Color Before: BROWN Clarity Before: Texture: MEDIUM

Color After: COLORLESS Clarity After: Artifacts:

Comments:

U.S. EPA - CLP

1
INORGANIC ANALYSES DATA SHEET

EPA SAMPLE NO.
MFQO84

Lab Name: SOUTHWEST_LAB_OF_OK_____ Contract: 68-D3-0040

Lab Code: SWOK__ Case No.: 23566_ SAS No.: _____ SDG No.: MFQO82

Matrix (soil/water): SOIL_ Lab Sample ID: 2218103___

Level (low/med): LOW__ Date Received: 05/10/95

% Solids: _95.9

Concentration Units (ug/L or mg/kg dry weight): MG/KG

CAS No.	Analyte	Concentration	C	Q	M
7429-90-5	Aluminum	13700		*	P
7440-36-0	Antimony	0.63	U	N	P
7440-38-2	Arsenic	5.5			P
7440-39-3	Barium	185			P
7440-41-7	Beryllium	0.97	B		P
7440-43-9	Cadmium	0.65	B		P
7440-70-2	Calcium	2580			P
7440-47-3	Chromium	17.7			P
7440-48-4	Cobalt	14.3			P
7440-50-8	Copper	29.2			P
7439-89-6	Iron	25000			P
7439-92-1	Lead	24.9			P
7439-95-4	Magnesium	3220			P
7439-96-5	Manganese	904			P
7439-97-6	Mercury	0.10	U		CV
7440-02-0	Nickel	14.3			P
7440-09-7	Potassium	2910			P
7782-49-2	Selenium	1.4			P
7440-22-4	Silver	0.21	U		P
7440-23-5	Sodium	105	B		P
7440-28-0	Thallium	1.0	U		P
7440-62-2	Vanadium	41.3			P
7440-66-6	Zinc	85.3			P
	Cyanide				NR

Color Before: BROWN Clarity Before: _____ Texture: MEDIUM

Color After: COLORLESS Clarity After: _____ Artifacts: _____

Comments:

STATE OF NEW MEXICO DEPARTMENT OF HEALTH

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
WATER CHEMISTRY SECTION [505]-841-2555

483

January 17 1995

Requested Priority 2
ID No. 012900

ANALYTICAL REPORT
SLD Accession No. WC-94-6329

Distribution
( ) User 55340
(X) Submitter 534
(x) SLD Files

To Stuart Kent
ED - Superfund Section
1190 St Francis Dr
P O Box 26110
Santa Fe, NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(2)

DEMOGRAPHIC DATA

COLLECTION			LOCATION	
On 7-Nov-94	*By* Ken		Red River #1	RR above pipeline Crossing
At 12 50 hrs	*In/Near* Questa			

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		54 00		mG/L
magnesium		12 00		mG/L
potassium		4 00		mG/L
sodium		6 00		mG/L
hardness		184 00		mG/L
alkalinity		42 00		mG/L
bicarbonate		52 00		mG/L
chloride	<	5 00		mG/L
sulfate		122 00		mG/L
Ion Balance		108 00		%
total diss resid		283 00		mG/L
total susp solid		8 00		mG/L

Reviewed By: CG
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 — 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 — [505]-841-2500
WATER CHEMISTRY SECTION [505]-841-2555

490

January 17, 1995

Requested Priority 2
ID No. 012902

ANALYTICAL REPORT
SLD Accession No. WC-94-6327

Distribution
( ) User 25340
(X) Submitter 534
(x) SLD Files

To Stuart Kent
ED - Superfund Section
1190 St Francis Dr
P O Box 26110
Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(3)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 7-Nov-94	*By* Ken	Red River #3	RR below (20')
At 13 34 hrs	*In/Near* Questa		Capulin Cyn seep

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		52 00		mG/L
magnesium		12 00		mG/L
potassium		4 00		mG/L
sodium		6 00		mG/L
hardness		176 00		mG/L
alkalinity		47 00		mG/L
bicarbonate		57 00		mG/L
chloride	<	5 00		mG/L
sulfate		[illegible]		mG/L
Ion Balance		[illegible]		%
total diss resid		330		mG/L
total susp solid		[illegible]		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor Water Chemistry Section

STATE OF NEW MEXICO DEPARTMENT OF HEALTH

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
WATER CHEMISTRY SECTION [505]-841 2555

491

January 17 1995

Requested Priority 2
ID No. 012901

ANALYTICAL REPORT
SLD Accession No. WC-94-6328

Distribution
( ) User 55340
(X) Submitter 534
(X) SLD Files

To Stuart Kent
ED - Superfund Section
1190 St Francis Dr
P O Box 26110
Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(3)

DEMOGRAPHIC DATA

COLLECTION		LOCATION
On 7-Nov-94	By Ken	Red River #2
At 13 32 hrs	In/Near Questa	

RR blw Capulin seep (duplicate)

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		53 00		mG/L
magnesium		12 00		mG/L
potassium		4 00		mG/L
sodium		6 00		mG/L
hardness		179 00		mG/L
alkalinity		46 00		mG/L
bicarbonate		57 00		mG/L
chloride	<	5 00		mG/L
sulfate		118 00		mG/L
Ion Balance		108 00		%
total diss resid		284 00		mG/L
total susp solid		13 00		mG/L

Reviewed By: _____
Chris Dean 01/17 95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 — 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 — [505]-841-2500
WATER CHEMISTRY SECTION [505]-841-2555

492

January 17 1995

Requested Priority 2
ID No. 012913

ANALYTICAL REPORT
SLD Accession No. WC-94-6316

Distribution
(_) User 2520
(X) Submitter 534
(x) SLD Files

To Stuart Kent
ED - Superfund Section
1190 St Francis Dr
P O Box 26110
Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(4)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*
On 7-Nov-94	*By* Ken	GW-1/MCMW #3
At 17 35 hrs	*In/Near* Questa	

ANALYTICAL RESULTS

Analysis	Value	D. Lmt	Units
calcium	653 00		mG/L
magnesium	92 00		mG/L
potassium	11 00		mG/L
sodium	102 00		mG/L
hardness	2009 00		mG/L
alkalinity	225 00		mG/L
bicarbonate	274 00		mG/L
chloride	6 60		mG/L
sulfate	1784 00		mG/L
Ion Balance	108 00		%
total diss resid	3038 00		mG/L
total susp solid	23 00		mG/L

Reviewed By: CG
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 — 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 — [505]-841-2500
WATER CHEMISTRY SECTION [505]-841-2555

January 17, 1995

Requested Priority 2
ID No. 012903

ANALYTICAL REPORT
SLD Accession No. WC-94-6325

Distribution
( ) User 55340
(X) Submitter 534
(X) SLD Files

To Stuart Kent
ED - Superfund Section
1190 St Francis Dr
P O Box 26110
Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(5)

DEMOGRAPHIC DATA

COLLECTION			*LOCATION*	
On 7-Nov-94	*By* Ken		Red River #4	Red River btwn upper & lower Capulin Cyn seeps
At 14 50 hrs	*In/Near* Questa -			

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		50 00		mG/L
magnesium		11 00		mG/L
potassium		4 00		mG/L
sodium		6 00		mG/L
hardness		171 00		mG/L
alkalinity		49 00		mG/L
bicarbonate		60 00		mG/L
chloride	<	5 00		mG/L
sulfate		114 00		mG/L
Ion Balance		107 00		%
total diss resid		266 00		mG/L
total susp solid		10.00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

P.O Box 4700 — 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 — [505]-841-2500
WATER CHEMISTRY SECTION [505] 841-2555

494

January 17 1995

Requested Priority 2
ID No. 012904

ANALYTICAL REPORT
SLD Accession No. WC-94-6326

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(_) User 55340
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To Stuart Kent
ED - Superfund Section
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P O Box 26110
Santa Fe, NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

16

DEMOGRAPHIC DATA

COLLECTION			*LOCATION*	
On 7-Nov-94	*By* Ken	Red River #42	RR above Capulin Cyn Seeps	
At 15 20 hrs	*In/Near* Questa			

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		51 00		mG/L
magnesium		11 00		mG/L
potassium		4 00		mG/L
sodium		6 00		mG/L
hardness		175 00		mG/L
alkalinity		50 00		mG/L
bicarbonate		61 00		mG/L
chloride	<	5 00		mG/L
sulfate		112 00		mG/L
Ion Balance		106 00		%
total diss resid		262 00		mG/L
total susp solid		8 00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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495

January 17 1995

Requested Priority 2
ID No. 012905

ANALYTICAL REPORT
SLD Accession No. WC-94-6324

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( ) User 55340
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To Stuart Kent
ED - Superfund Section
1190 St Francis Dr
P O Box 26110
Santa Fe, NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud, N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(7)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 7-Nov-94	*By* Ken	Red River #5	Red River @ South II Gulch seep
At 15 15 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis		Value	D Lmt.	Units
calcium		49 00		mG/L
magnesium		11 00		mG/L
potassium		4 00		mG/L
sodium		6 00		mG/L
hardness		166 00		mG/L
alkalinity		52 00		mG/L
bicarbonate		64 00		mG/L
chloride	<	5 00		mG/L
sulfate		[illegible]		mG/L
Ion Balance		[illegible]		%
total diss resid		286 00		mG/L
total susp solid		00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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WATER CHEMISTRY SECTION [505]-841-2555

January 17 1995

Requested Priority 2
ID No 012914

ANALYTICAL REPORT
SLD Accession No. WC-94-6315

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( ) User 55340
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To Stuart Kent
ED - Superfund Section
1190 St Francis Dr
P O Box 26110
Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(8)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*
On 7-Nov-94	*By* Ken	GW-2/MCMW #7
At 11 55 hrs	*In/Near* Questa	

ANALYTICAL RESULTS

Analysis	Value	D. Lmt.	Units
calcium	548 00		mG/L
magnesium	1106 00		mG/L
potassium	79 00		mG/L
sodium	236 00		mG/L
hardness	5922 00		mG/L
chloride	21 00		mG/L
sulfate	10084 00		mG/L
total diss resid	16932 00		mG/L
total susp solid	334 00		mG/L

Reviewed By. _____
Chris Dean 01/17/95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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WATER CHEMISTRY SECTION [505]-841-2555

497

Januan 17, 1995

Requested Priority 2
ID No. 012906

ANALYTICAL REPORT
SLD Accession No. WC-94-6323

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To Stuart Kent
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1190 St Francis Dr
P O Box 26110
Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(9)

DEMOGRAPHIC DATA

COLLECTION
On 7-Nov-94 *By* Ken
At 16 40 hrs *In/Near* Questa

LOCATION
Red River #6 Red River below Columbine Crk

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		40 00		mG/L
magnesium		8 00		mG/L
potassium		4 00		mG/L
sodium		5 00		mG/L
hardness		135 00		mG/L
alkalinity		58 00		mG/L
bicarbonate		71 00		mG/L
chloride	<	5 00		mG/L
sulfate		71 00		mG/L
Ion Balance		100 00		%
total diss resid		224 00		mG/L
total susp solid		5 00		mG/L

Reviewed By: CD
Chris Dean 01/17/95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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WATER CHEMISTRY SECTION [505] 841-2555

498

January 17 1995

Requested Priority 2
ID No. 012907

ANALYTICAL REPORT
SLD Accession No. WC-94-6322

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P O Box 26110
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From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(10)

DEMOGRAPHIC DATA

COLLECTION

On 7-Nov-94 *By* Ken
At 16 15 hrs *In/Near* Questa

LOCATION

Red River #7 Columbine Crk

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		26 00		mG/L
magnesium		3 00		mG/L
potassium		4 00		mG/L
sodium	<	5 00		mG/L
hardness		74 00		mG/L
alkalinity		64 00		mG/L
bicarbonate		78 00		mG/L
chloride	<	5 00		mG/L
sulfate		10 00		mG/L
Ion Balance		101 00		%
total diss resid		98 00		mG/L
total susp solid	<	3 00		mG/L

Reviewed By: _____
Chris Dean 01/17 95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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WATER CHEMISTRY SECTION [505]-841-2555

499

January 17 1995

Requested Priority 2
ID No. 012908

ANALYTICAL REPORT
SLD Accession No. WC-94-6321

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( ) User 55340
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P O Box 26110
Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(11)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 7-Nov-94	*By* Ken	Red River #8	Red River abv Columbine Crk
At 16 55 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis		Value	D Lmt.	Units
calcium		49 00		mG/L
magnesium		9 00		mG/L
potassium		4 00		mG/L
sodium		6 00		mG/L
hardness		157 00		mG/L
alkalinity		56 00		mG/L
bicarbonate		68 00		mG/L
chloride	<	5 00		mG/L
sulfate		89 00		mG/L
Ion Balance		108 00		%
total diss resid		234 00		mG/L
total susp solid		10 00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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WATER CHEMISTRY SECTION [505]-841 2555

500

January 17, 1995

Requested Priority 2
ID No. 012909

ANALYTICAL REPORT
SLD Accession No. WC-94-6320

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( ) User 25340
(X) Submitter 234
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To Stuart Kent
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1190 St Francis Dr
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Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(12)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 8-Nov-94	*By* Ken	Red River #9	Red River below (30') Adit seep
At 9 20 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		48 00		mG/L
magnesium		9 00		mG/L
potassium		4 00		mG/L
sodium		2 00		mG/L
hardness		154 00		mG/L
alkalinity		56 00		mG/L
bicarbonate		68 00		mG/L
chloride	<	5 00		mG/L
sulfate		33 [illegible]		mG/L
Ion Balance		[illegible]		%
total diss resid		24[illegible]		mG/L
total susp solid				mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

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501

January 17, 1995

Requested Priority 2
ID No. 012915

ANALYTICAL REPORT
SLD Accession No. WC-94-6314

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( ) User 55340
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To Stuart Kent
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Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud, N E
P O Box 4700
Albuquerque NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(13)

DEMOGRAPHIC DATA

COLLECTION				*LOCATION*	
On 7-Nov-94	*By* Ken			GW 4	MW-106
At 15 55 hrs	*In/Near* Questa				

ANALYTICAL RESULTS

Analysis	Value	D Lmt.	Units
calcium	394 00		mG/L
magnesium	82 00		mG/L
potassium	8 00		mG/L
sodium	25 00		mG/L
hardness	1320 00		mG/L
alkalinity	66 00		mG/L
bicarbonate	80 00		mG/L
chloride	25 00		mG/L
sulfate	1137 00		mG/L
Ion Balance	107 00		%
total diss resid	1924 00		mG/L
total susp solid	40 00		mG/L

Reviewed By _____
Chris Dean 01/17/95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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502

January 17 1995

Requested Priority 2
ID No. 012916

ANALYTICAL REPORT
SLD Accession No. WC-94-6313

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( ) User 55340
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To Stuart Kent
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Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(14)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 7-Nov-94	*By* Ken	GW-5	mw - 11
At 14 15 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		258 00		mG/L
magnesium		111 00		mG/L
potassium		21 00		mG/L
sodium		32 00		mG/L
hardness		1100 00		mG/L
chloride		21 00		mG/L
sulfate		1308 00		mG/L
total diss resid		2200 00		mG/L
total susp solid	<	3 00		mG/L

Reviewed By. _____
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 — 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 — [505]-841-2500
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503

January 17, 1995

Requested Priority 2
ID No. 012917

ANALYTICAL REPORT
SLD Accession No. WC-94-6312

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1190 St Francis Dr
P O Box 26110
Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(14)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 7-Nov-94	*By* Ken	GW-6	MW-11 (duplicate)
At 14 20 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		264 00		mG/L
magnesium		119 00		mG/L
potassium		21 00		mG/L
sodium		32 00		mG/L
hardness		850 00		mG/L
chloride		21 00		mG/L
sulfate		1306 00		mG/L
total diss resid		2200 00		mG/L
total susp solid	<	3 00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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504

January 17 1995

Requested Priority 2
ID No. 012918

ANALYTICAL REPORT
SLD Accession No. WC-94-6311

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( ) User 55340
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ED - Superfund Section
1190 St Francis Dr
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Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(15)

DEMOGRAPHIC DATA

COLLECTION			*LOCATION*	
On 8-Nov-94	*By* Ken		GW #7	Molycorp Pumphse @ mine/mill
At 12 44 hrs	*In/Near* Questa			

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		48 00		mG/L
magnesium		9 00		mG/L
potassium		4 00		mG/L
sodium		5 00		mG/L
hardness		159 00		mG/L
alkalinity		50 00		mG/L
bicarbonate		61 00		mG/L
chloride	<	5 00		mG/L
sulfate		98 00		mG/L
Ion Balance		100 00		%
total diss resid		246 00		mG/L
total susp solid		3 00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

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January 17 1995

Requested Priority 2
ID No. 012910

ANALYTICAL REPORT
SLD Accession No. WC-94-6319

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( ) User 55340
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Santa Fe, NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(16)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 8-Nov-94	*By* Ken	Red River #10	Red River abv molycorp property
At 9 48 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis	Value	D. Lmt.	Units
calcium	45 00		mG/L
magnesium	8 00		mG/L
potassium	4 00		mG/L
sodium	6 00		mG/L
hardness	146 00		mG/L
alkalinity	88 00		mG/L
bicarbonate	72 00		mG/L
chloride	< 5 00		mG/L
sulfate	7. 0		mG/L
Ion Balance	[illegible]		%
total diss resid	221 00		mG/L
total susp solid	[illegible]		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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506

January 17 1995

Requested Priority 2
ID No. 012911

ANALYTICAL REPORT
SLD Accession No. WC-94-6318

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Santa Fe, NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(17)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 8-Nov-94	*By* Ken	Red River #11	Red River blw Hanson Cr
At 10 14 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		42 00		mG/L
magnesium		7 00		mG/L
potassium		4 00		mG/L
sodium		5 00		mG/L
hardness		134 00		mG/L
alkalinity		62 00		mG/L
bicarbonate		76 00		mG/L
chloride	<	5 00		mG/L
sulfate		39 00		mG/L
Ion Balance		107 00		%
total diss resid		206 00		mG/L
total susp solid		6 00		mG/L

Reviewed By: CW
Chris Dean 01/17/95
Supervisor Water Chemistry Section

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5 of 7

January 17, 1995

Requested Priority 2
ID No 012912

ANALYTICAL REPORT
SLD Accession No. WC-94-6317

Distribution
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Santa Fe NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(18)

DEMOGRAPHIC DATA

COLLECTION		*LOCATION*	
On 8-Nov-94	*By* Ken	Red River #12	Red River abv Hanson creek
At 10 30 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		41 00		mG/L
magnesium		7 00		mG/L
potassium		4 00		mG/L
sodium		5 00		mG/L
hardness		131 00		mG/L
alkalinity		64 00		mG/L
bicarbonate		78 00		mG/L
chloride	<	5 00		mG/L
sulfate		55 00		mG/L
Ion Balance		98 00		%
total diss resid		200 00		mG/L
total susp solid		4 00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

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508

January 17 1995

Requested Priority 2
ID No. 010490

ANALYTICAL REPORT
SLD Accession No. WC-94-6309

Distribution
( ) User 55240
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To Stuart Kent
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Santa Fe, NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(20)

DEMOGRAPHIC DATA

COLLECTION			*LOCATION*	
On 8-Nov-94	*By* Ken		GW #9	Elephant Rock CG
At 11 58 hrs	*In/Near* Questa			

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		36 00		mG/L
magnesium		7 00		mG/L
potassium		4 00		mG/L
sodium	<	5 00		mG/L
hardness		117 00		mG/L
alkalinity		50 00		mG/L
bicarbonate		61 00		mG/L
chloride	<	5 00		mG/L
sulfate		58 00		mG/L
Ion Balance		105 00		%
total diss resid		178 00		mG/L
total susp solid	<	3 00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor, Water Chemistry Section

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503

January 17 1995

Requested Priority 2
ID No. 010491

ANALYTICAL REPORT
SLD Accession No. WC-94-6308

Distribution
( ) User 95340
(X) Submitter 534
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To Stuart Kent
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From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(21)

DEMOGRAPHIC DATA

COLLECTION		LOCATION	
On 8-Nov-94	By Ken	GW #10	Red River WWTP
At 11 12 hrs	In/Near Questa		

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		157.00		mG/L
magnesium		50.00		mG/L
potassium		24.00		mG/L
sodium		24.00		mG/L
hardness		597.00		mG/L
chloride		6.00		mG/L
sulfate		845.00		mG/L
total diss resid		1492.00		mG/L
total susp solid	<	3.00		mG/L

Reviewed By: CE
Chris Dean 01/17/95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 — 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 — [505]-841-2500
WATER CHEMISTRY SECTION [505] 841-2555

5.0

January 17 1995

Requested Priority 2
ID No. 012919

ANALYTICAL REPORT
SLD Accession No. WC-94-6310

Distribution
( ) User 55340
(A) Submitter 334
(x) SLD Files

To Stuart Kent
ED - Superfund Section
1190 St Francis Dr
P O Box 26110
Santa Fe, NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

(22)

DEMOGRAPHIC DATA

COLLECTION			*LOCATION*	
On 9-Nov-94	*By* Ken		GW #8	Jun BUG CG
At 12 22 hrs	*In/Near* Questa			

ANALYTICAL RESULTS

Analysis		Value	D. Lmt.	Units
calcium		38 00		mG/L
magnesium		3 00		mG/L
potassium		4 00		mG/L
sodium	<	5 00		mG/L
hardness		141 00		mG/L
alkalinity		50 00		mG/L
bicarbonate		61 00		mG/L
chloride	<	3		mG/L
sulfate		8 00		mG/L
Ion Balance		1.03		%
total diss resid		186		mG/L
total susp solid				mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor Water Chemistry Section

SCIENTIFIC LABORATORY DIVISION

P.O. Box 4700 700 Camino de Salud, NE
Albuquerque, NM 87196-4700 [505]-841-2500
WATER CHEMISTRY SECTION [505]-841-2555

511
S-6

January 26, 1995

Requested Priority 2
ID No. 010492

ANALYTICAL REPORT
SLD Accession No. WC-94-6307

Distribution
( ) User 55340
(X) Submitter 534
(x) SLD Files

To Stuart Kent
ED - Superfund Section
1190 St Francis Drive
P O Box 26110
Santa Fe, NM 87502

From Water Chemistry Section
Scientific Laboratory Div
700 Camino de Salud N E
P O Box 4700
Albuquerque, NM 87196-4700

Re **A water sample submitted to this laboratory on November 9, 1994**

DEMOGRAPHIC DATA

COLLECTION			*LOCATION*
On 8-Nov-94	*By* Ken		Sp-1/Cabin Springs
At 13 24 hrs	*In/Near* Questa		

ANALYTICAL RESULTS

Analysis		Value	D Lmt.	Units
calcium		239 00		mG/L
magnesium		96 00		mG/L
potassium		14 00		mG/L
sodium		27 00		mG/L
hardness		990 00		mG/L
chloride		20 00		mG/L
sulfate		1095 00		mG/L
total diss resid		184 00		mG/L
total susp solid	<	3 00		mG/L

Reviewed By: _____
Chris Dean 01/17/95
Supervisor Water Chemistry Section

RECORD OF TELEPHONE CONVERSATION

Time: 4.00 PM	Date: 5-7-93
Originating Party: Stuart Kent	Other Parties: Bilhye Fagerquist - owner
NMED - Superfund	Cottonwood Park Motel

Subject: well water use

Discussion:

+ 22 units but only overnight use. [No seasonal use]

+ only 2 work there

+ well is located near confluence of Columbine Creek & Red River (South of Red River)

+ Proud of her water quality but is afraid of contamination from campground

+ There are seasonal tenants at (called camp hosts) at each of the USFS campgrounds along Red River

+ Located ½ mile from mine site

Stuart Kent

Signed

System Name	Code	Owner	Phone
Fagerquist's Cottonwood Park	030-29	Ed & Billye Fagerquist	586-0285

Mailing Address	County	Type of Establishment	Avg. # Persons Served Daily
P.O. Box 530, Questa	Taos	Motel & Restaurant	N/Av

Location if Different than Address	Disinfection: Avg. Daily Residual
Between Questa & Red River	☐ Chlorine ☐ Iodine ☐ Other ☒ None

Operating Dates, if Seasonal	# Connections	# Meters	Average Daily Water Usage
Year-round	10	2	N/Av

SOURCES (Please Check Boxes if Conditions are Satisfactory)

WELLS - # 1

- ☐ Pedestal Provided
- ☐ Slab Provided
  - Size _____
- ☐ Casing 1 ft. above slab
- ☐ Sanitary Seal
- ☐ Pump House
- ☒ Pressure Tanks 100 gal
- Well Depth 56
- Pump Setting N/Av

☐ SPRING(S) - # _____

- ☐ Approved Box
- ☐ Protection from Run-off
- ☐ Overflow Pipe Protected
- ☐ Cover Locked

☐ SURFACE

- ☐ Intake Protected
- ☐ Filter Provided
- ☐ Treatment: _____
- ☐ Turb. Monitoring Performed
- Avg. Daily Turb. _____

☐ OTHER

- ☐ Transport Approved
- ☐ Approved Source

STORAGE

- ☐ Ground
- ☐ Elevated
- Capacity none

DISTRIBUTION SYSTEM

- ☐ Gravity
- ☒ Pressure

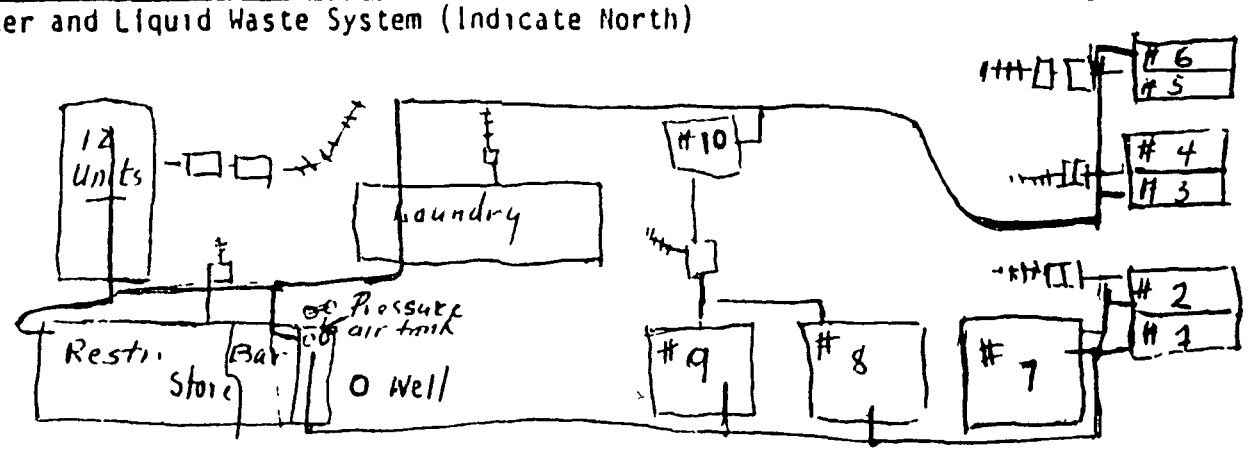
PIPE MATERIAL

- ☐ PVC
- ☐ Steel copper
- ☒ Other galvanized

SAMPLING

- Micro. Sampling Status quarterly
- Last Nitrate Date _____

Schematic of Water and Liquid Waste System (Indicate North)



(Blue) water lines

Cross Connection or Back Siphonage:

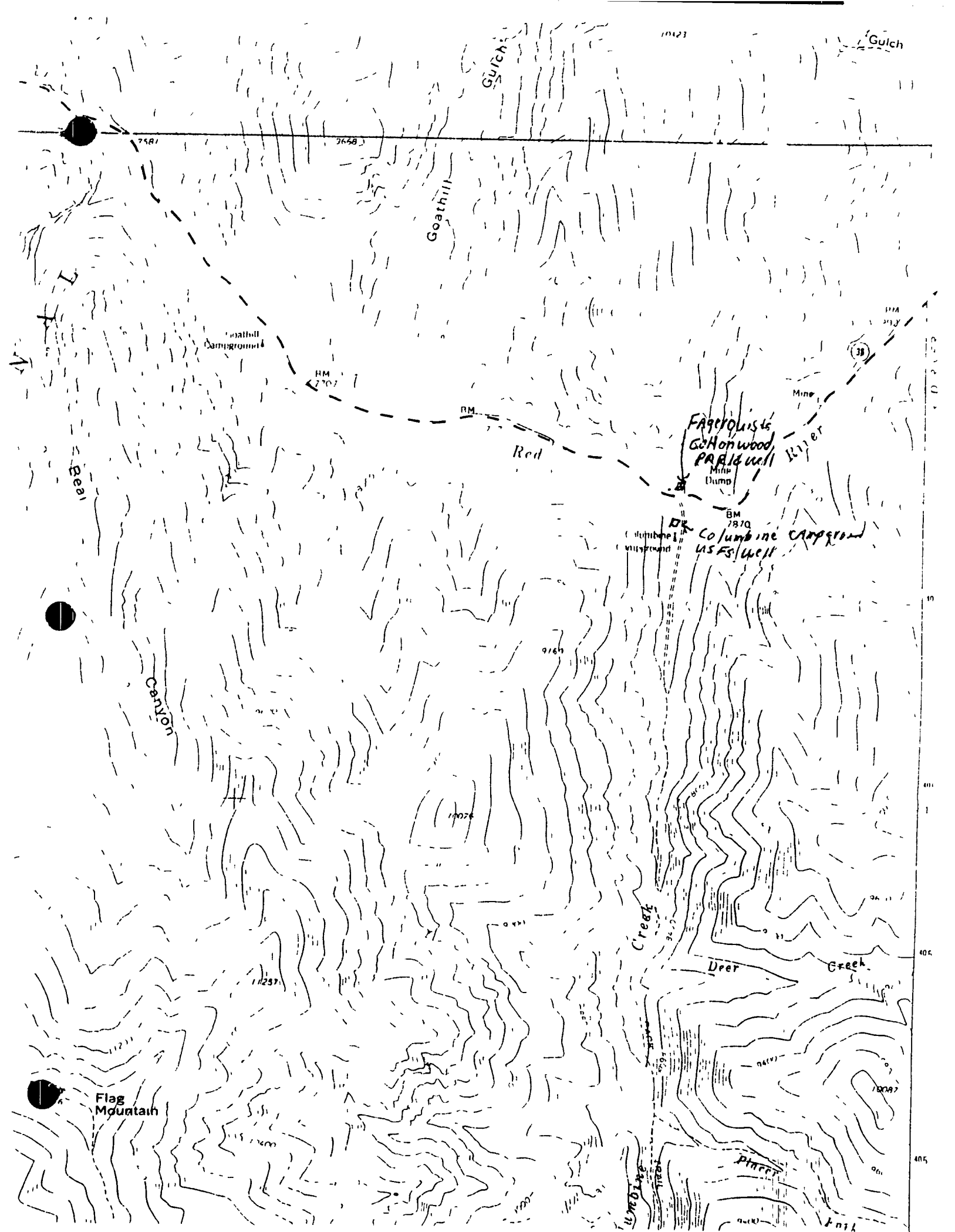
Where Applicable, Give Distances from Nearest:

6	Liquid Waste Disposal Fields	_____	Feed Lots	_____	Septic Tanks, Cessoools
_____	Solid Waste Disposal Site	_____	Deep Well Waste Injection	_____	Other

Comments and Recommendations

New pump and two pressure tanks installed Jan 14, 1989.
Information furnished by Mr. Ed Fagerquist.

Surveyed by:	Date	Phone
Juan P. Ortega	5/15/91	758-8809



Gulch
Gulch
Goathill
Goathill Campground
BM 7707
BM
Red
River
Mine
Mine Dump
BM 7870
Columbine Campground
Fagerquists
Cottonwood
PARK well
Columbine Campground
USFS well
Beal
Canyon
Creek
Deer
Creek
Flag Mountain
Placer