EXPANDED SITE INSPECTION ANALYTICAL RESULTS REPORT

EMPIRE CANYON

Summit County, Utah

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Utah Department of Environmental Quality
Division of Environmental Response and Remediation
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1.0 INTRODUCTION

The Empire Canyon site is a historic ore mining and processing area located immediately south of Park City, Summit County, Utah. Empire Canyon is located south of downtown Park City. Historic mine and mill waste material is present in certain areas of the canyon. Surface-water flow from Empire Canyon occurs in a small ephemeral channel. Surface-water sampling has identified elevated concentrations of certain metals in waters flowing from the canyon. This creek is a tributary to Silver Creek, which in turn feeds the Weber River. The Weber River is a Class 4, 3A, 2B, 1C stream (DWQ, 2000).

The purpose of this Expanded Site Inspection is to gather information to determine if further action is warranted at the Empire Canyon site. The Expanded Site Inspection was conducted under the authorities of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) of 1980, the Superfund Amendments and Reauthorization Act (SARA) of 1986, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and through a Cooperative Agreement between the U.S. Environmental Protection Agency, Region VIII (EPA), and the Utah Department of Environmental Quality (UDEQ), Division of Environmental Response and Remediation (DERR). The purpose of this report is to document field procedures and to present the results from the sampling and data collection procedures. Samples were submitted to and analyzed through the Contract Laboratory Program (CLP) of the EPA. A Site Inspection Data Summary is included as Appendix A.

2.0 OBJECTIVES

In 1999, The Upper Silver Creek Watershed Stakeholders Group was formed. This group brought together interested parties (e.g. state, local and federal governmental representatives, ski industry representatives, mining industry representatives, community groups, etc.) to take a holistic watershed approach to investigate environmental issues related to hazardous substances in the Upper Silver Creek Watershed/Park City area. This Stakeholders Group, primarily through the funding and efforts of United Park City Mines and under the oversight of the EPA and the UDEQ, has collected a significant amount of data from the upper part of the Silver Creek Watershed, which reaches from the headwaters to Richardson Flats. The intent of this Expanded Site Inspection is not to duplicate the efforts of United Park City Mines or the Upper Silver Creek Stakeholders Group, but to confirm their findings and to fill in some data gaps in the area of Empire Canyon.

The scope of sampling involved the collection of:

- 22 total metals surface-water samples, 2 of which were duplicates,
- 4 dissolved metals surface-water samples,
- 15 sediment samples, and

- 26 soil samples.

The surface-water samples were collected directly from the streams by dipping the sample container. Sediment samples were collected at the same location as a surface water sample by scooping sediment from the streambed and placing it in the appropriate container. The soil samples were collected from 0-6 inches below ground surface (bgs), using hand tools (i.e spoons or scoops). The purpose of the sampling event was to confirm that hazardous constituents are present on-site and to determine if these constituents have migrated, or are migrating, and if they pose a threat to human health and the environment.

Additionally, 3 tracer studies were conducted to gain some preliminary background information of the ground-water/surface-water interaction. Attachment A (bound separately) provides an overview and analyses of these tests.

The sampling event included the following objectives:

- To determine if contamination can be attributed to the site.
- Assessment and quantitation of sources of potentially hazardous materials.
- The evaluation of human and environmental targets in the vicinity of the site.

The field team consisted of:

Alan V. Jones	Project Manager/Environmental Scientist
Ann Tillia	Environmental Scientist
Michael Zucker	Environmental Scientist

3.0 SITE DESCRIPTION

3.1 Site Location and Description

The site is situated on the eastern slope of the Wasatch Mountain Range, approximately 25 miles east of Salt Lake City. Park City rests at the convergence of Woodside Gulch, Ontario Canyon, and Empire Canyon. These canyons were some of the main ore producing areas of Park City (Figure 1).

Empire Canyon is located just south of Park City. The geographic coordinates for the site are 40°38'40.0" north latitude and 111°29'38.5" west longitude (Thiros, 2000). To reach the site, travel south on Main Street in Park City. Travel past the houses until the paved road changes to gravel, this is the beginning of the canyon. There were several mills, mines, concentrators, an assay office, trams, and other mine workings on both sides of the canyon up to the drainage divide (Figure 1 and 2).

The site, as generally defined by this Expanded Site Inspection, includes the drainage area of Empire Canyon. This includes the side drainages: Daly Draw, Walker and Webster Gulch, and

the Little Bell Drainage, as well as the main Empire Canyon Channel. These drainages are defined on Figure 2 as are most of the major mining features in the canyon.

The site is easily accessible, as no fences or signs are present to limit access to the site. The canyon is gated to restrict vehicle traffic but activities such as hiking and mountain biking regularly occur. These activities are generally confined to designated trails. Much of the area is part of ski resorts which allows skiers access during the winter months, but during that time the site is effectively capped with several feet of snow. Empire Canyon is bounded by mountains on the east, west, and south, and a Park City residential area is located on the north (Figure 1).

The topographic layout of the Park City mining district lies between the precipitous cliffs and ledges that mark the main crest of the range and the verdant mountain meadows of Heber City, Kamas, and Parley's Canyon that lie along its eastern foothills. Park City is near the Weber River/Provo River divide which is the most prominent spur on the east slope of the central Wasatch. This divide is also the boundary between Summit and Wasatch counties. Park City itself sits on the divide between East Canyon Creek and Silver Creek, both of which are tributaries to the Weber River. Empire Canyon originates approximately one mile to the south near the Summit/Wasatch County line. Empire Creek is a tributary to Silver Creek.

Empire Canyon is typical alpine terrain with topography varying from steep canyon walls to gentle slopes. Mine and/or mill wastes are present at certain areas of the canyon. In some instances mine and/or mill wastes slope directly into Empire Creek. Some areas in the canyon have not been impacted by mining activities.

Several worn trails parallel the creek and traverse the mill and mine sites. The canyon and the channel are popular areas for residents and visitors to hike and mountain bike.

In 1988, United Park City Mines began looking into developing Flagstaff Mountain Development, a mixed-use community on Flagstaff Mountain. Flagstaff Mountain is the slope on the east side of Empire Canyon. Flagstaff Mountain Development was annexed into Park City in 1999. Through an agreement with EPA and Park City, United Park City Mines, with assistance from DERR, has done extensive soil sampling in the Flagstaff Mountain Development. The area was divided into small parcels and each parcel was sampled. The sampling identified some isolated areas of contamination and delineated areas with no contamination. The isolated contamination will be cleaned up prior to the property development with oversight by the EPA and the UDEQ.

3.2 Site History

In the fall of 1869, a few miners ventured east over the divide from Big and Little Cottonwood Canyons into the narrow gulches of the Parley's Park. The first record of a claim in the area was in 1869 by Rufus Walker. The first shipment of ore from the Park City area came in July, 1870, from the Flagstaff Mine (Butler, 1918).

In 1872, a prospect was discovered in Ontario Canyon. This prospect was purchased by George Hearst (father of San Francisco newspaper magnate William Randolph Hearst) for $27,000. By the turn of the century, the Ontario Mine had produced over $50 million (McPhee, 1977).

About 1880, John Daly, a miner working in the Ontario mine, acquired 24 claims in Empire Canyon. In 1885, he formed the Daly Mining Company, and began sinking the Daly shaft (Thompson and Buck, 1968).

In 1883, E. P. Ferry acquired a promising prospect further up Empire Canyon and developed it into the Anchor Mine. For a few years ore from the Anchor mine was milled at the Union Mill in Empire Canyon. The Union Mill was replaced by the Daly-Judge Mill in 1916 (Thompson and Buck, 1968).

Mines in the Park City area had significant problems with water at depth (Weston, 1997). Early in the workings of the Ontario Mine a large Cornish pump was installed to drain the mine. Eventually a tunnel was completed in Ontario Canyon to drain the mine. Daly's workings were connected to the Ontario workings and effectively drained through the Ontario Tunnel, but the Anchor workings had no such connection (Price, 1972). In 1886, John Daly won a contract to drill a 6000 foot tunnel from the mouth of Walker and Webster Gulch to the Anchor Shaft at the 1200 foot level (Thompson and Buck, 1968). This tunnel was completed in 1889, later became known as the Judge Tunnel (named for John Judge), and is presently a drinking water source for Park City (Gee, 2001; Reynolds, 1984).

In 1893, the Daly-West Shaft was sunk in a prospect located approximately halfway between the Daly Mine and the Anchor Mine. The Daly-West Mining Company was established in 1895 and a concentrator was constructed at the Daly-West Mine.

John Judge was the foreman at the Daly mine and held several claims on Bonanza Flat, where Daly also held claims.(Price, 1972). They merged these claims and formed the Daly-Judge Mining Company in 1901. During a dispute with the Anchor Mine, the Daly-Judge Mining Company acquired the Anchor Mine that same year and changed its name to the Daly-Judge Mine. In 1902, The Daly-Judge acquired the Quincy and Little Bell Mines located further up Empire Canyon essentially giving John Daly control of all the major mines in the canyon at that time (Thompson and Buck, 1968).

The Thunderer group of claims were originally located in the Empire Canyon in 1898, but were soon consolidated as the American Flag Company (Thompson and Buck, 1968). The American Flag was one of the few mines in the district that produced any significant amount of gold (Gee 2001).

In 1925, several mining interests in the area were consolidated as the Park Utah Consolidated Mining Company. Several mines still existed in the area which were not part of this consolidation. This consolidation allowed disputed ore bodies, located between the major mines, to be mined during the booms of the next few decades (Thompson and Buck, 1968).

Silver prices had dipped during the market scare of 1897. Due to labor strife and fluctuating silver prices, all of the mines in the area operated intermittently during the first 2 decades of the twentieth century. In 1919, congress passed the Walsh-Pittman Act which established the minimum price of silver at $1 per ounce. This brought another boom to the area in the 1920s.

The depression again caused fluctuation in the metals market and in 1938, President Roosevelt lowered the price of silver creating a bust. However in the early 1940s, the lead and zinc in the Park City area was needed for the war effort and the mines were again active (Thompson and Buck, 1968).

In 1953, another consolidation of mining interests occurred in the area resulting in the creation of the United Park City Mines Company. Although this consolidation brought most of the large mines under the same management, this consolidation was not all inclusive and several mining interests still existed independent of this consolidation.

By the 1950s, mining was essentially dead and the area was on the verge of suffering the fate of many western mining camps: becoming a ghost town (Thompson and Buck, 1968). United Park City Mines bought up additional property during the 1950s (Price, 1972).

In 1958, Summit County ran a full page tourism advertisement in the Salt Lake Tribune showing a map of the county. Absent from this map was Park City and even the highway leading there. In the late 1950s, the population of Park City dipped below 1000 and publications began referring to Park City as a ghost town, but the town never completely died (Price, 1972).

In 1961, United Park City Mines board member, Clark Wilson, was in Washington lobbying Congress on mining interests. He stopped at the Commerce Department's Area Redevelopment Administration with a proposal that 1700 jobs could be created in Utah with the development of a ski resort in the Park City area. The Commerce Department granted a $1.23 million loan with matching funds from United Park City Mines, American Smelting and Refining Company, and Anaconda Company (Reynolds, 1984).

The construction on the lifts began in the summer of 1962 and the following winter (December 1963) the ski industry was born in Park City. During the 1960s, the ski industry struggled, so in 1970, United Park City Mines sold its recreational interests in the ski resort but retained ownership of the property, which it leases to the ski areas on a long term contract. In 1968, a California company purchased a large ranch between Kimball Junction and Park City and opened Park West Ski Area (now known as The Canyons). In 1973, the U.S. Ski Team selected Park City as its home and originally used the old Silver King Mine Boarding House to house athletes. In the 1980s, Deer Valley ski area opened (Reynolds, 1984).

During the 1970s and 1980s, Park City made the transition to a destination resort community. In the late 1970s and early 1980s, as metal prices soared, some mining was once again undertaken. No ore is currently being mined in the Park City area although several mines are being maintained.

United Park City Mines is in the process of developing the Flagstaff Mountain Area. This will be a residential area and is located partially on the eastern edge of Empire Canyon.

Park City is now a world class resort area . In February 2002, Park City hosted alpine and snowboarding events during the 2002 Salt Lake City Winter Olympic Games. Park City has survived by making the transition from mining boom town to tourist destination.

4.0 FIELD ACTIVITIES

The majority of the samples were collected on property owned by United Park City Mines. United Park City Mines provided unfettered escorted access to DERR personnel and often provided personnel to assist with the logistics of sampling. As such, no signed access agreement was obtained from United Park City Mines.

Samples were collected on 3 residential properties along Daly Avenue. United Park City Mines arranged for access to these properties, after consultation with the project manager. Because United Park City Mines arranged this access, again no signed access agreements were obtained.

The stream flows in Empire Canyon are highly dependent on snowmelt. Because of this the sampling at this site was very dynamic. Stream flows in Daly Gulch began and concluded while upper Walker and Webster Gulch still had several feet of snow pack. As such it was impossible to collect all of the samples on the same day or even within a few days.

In early April, 2001, the field crew began making trips to the site to observe the melting of the snow pack. On April 30, the first tracer test was conducted and the first water samples were collected. The collection of the surface-water and sediment samples was completed on June 25, 2001.

Soil Samples in Upper Walker and Webster Gulch were collected on July 2, 2001. At this time it was decided to put the sampling on hold until the Work Plan was finalized. Due to the dynamic situation of the site the surface-water samples had to be collected while the snow pack was melting and the sediment samples were co-located with surface-water samples. This work was done under a draft Work Plan.

On September 4, 2001, United Park City Mines had secured access to the private residences on Daly Avenue so those 3 soil samples were collected. The Work Plan was finalized on October 3, 2001, and the remaining soil samples were collected on October 16, 2001. Between April and October 2001, countless trips were made to the site to make observations and to conduct the 3 tracer tests.

All sample locations were photographed, as were the samples. A log of the photographs is included as Appendix B.

4.1 Deviations from the Work Plan

Only minor deviations were made from the Work Plan (Jones, 2001). The Work Plan called for the collection of 2 residential soil samples and 3 were actually collected. An opportunity soil sample was used to account for this.

One surface-water sample (EC-SW-21) and 1 sediment sample (EC-SD-39) were specified as opportunity samples but neither of these were collected. Eleven soil samples (EC-SF-65 to EC-SF-75) were specified as opportunity samples. Soil sample EC-SF-65 was collected on a residential property as mentioned above. The rest of the soil opportunity samples were not collected.

4.2 Quality Assurance/Quality Control

During the sampling trip, documentation procedures included the completion of all CLP forms, tags, and sample seals as required for routine analytical services (RAS) using Forms II Lite, an EPA developed software package. Strict chain-of-custody was maintained and chain-of-custody forms were filled out completely and accompanied shipments to the laboratory. Copies of these forms are included as Appendix C. The samples (all inorganic) were submitted to Sentinel, Inc., in Huntsville, Alabama, or to Liberty Analytical in Cary, North Carolina, via FedEx, as per CLP instructions.

As specified in the Work Plan, 2 duplicate surface-water samples (EC-SW-22 and EC-SW-23) were collected (Jones, 2001). Three surface water samples (EC-SW-13, EC-SW-17, and EC-SW-19), 2 sediment samples (EC-SD-32 and EC-SD-36), and 4 soil samples (EC-SF-43, EC-SF-46, EC-SF-58, and EC-SF-64) were submitted for internal laboratory quality control.

Sampling equipment was not reused so no decontamination blank was collected. Also no volatile organics were submitted so no trip blank was collected.

As per CLP protocol, the results of the sample analyses were validated by URS Operating Services, Inc. The validated data is included as Appendix D (bound separately).

5.0 WASTE/SOURCE CHARACTERISTICS

The primary source at this site are mine wastes. Mining, primarily for silver, but also for gold, lead, zinc, and other metals has occurred, off and on, for over 100 years. Part of this process was to concentrate the metals into a salable product. Residual metals remain in the waste materials for various reasons. Metals of concern include, but are not limited to: zinc, lead, silver, mercury, arsenic, antimony, cadmium, chromium, manganese, and copper.

During the field work, areas of the canyon were observed that were quite pristine while other areas bore the scars of decades of mining activities. It was in these areas of obvious mining activity that the sampling effort was focused. Mine waste piles were sampled but these samples will be analyzed under the Soil Exposure Pathway.

6.0 SURFACE-WATER PATHWAY

6.1 Hydrology

The topographic layout of the site and immediate area is multiple terraces and steep mountain slopes. The terraces are generally sloping towards Empire Creek. In some areas, the creek is immediately adjacent to the mine waste piles in the canyon bottom. Flows in the creek are ephemeral, typically occur only in the spring and early summer months, and generally last in duration from a few days to several weeks depending on the snow pack; water also flows down the creek during extreme summer storm events. Run-off from the site flows directly into Empire Creek or soaks into the soil adjacent to the creek. It is unclear how much upgradient run-

off water flows through the site, but the upgradient drainage area that contributes run-off to the site is approximately 1700 acres (approximated using GIS) (Figure 1). Empire Creek flows though the site and into Silver Creek about 1¼ mile below the lower confluence area.

The surface-water flow from Empire Canyon is small relative to other similar mountain watersheds. This small flow is attributed to the loss of surface water to the subsurface because of the thin unconsolidated layer and highly fractured bedrock (Ashland et al., 2001). Subsurface mine workings also likely contribute to these surface-water losses (Brooks et al., 1998).

Ground water is a vital source of water in the Park City area (Ashland et al., 2001). The Empire Canyon area is a significant recharge area to the wells and tunnels that are used to supply water to the Park City Area (Weston, 1997).

6.2 Targets

While there are no known surface water PODs on Empire Creek. There are 16 PODs on Silver Creek, all of which have a current use designations as irrigation (Thiros, 2000). At the time of the PA, there were no known PODs in Silver Creek that have been designated for drinking water. Silver Creek is however designated as a cold water fishery by the State of Utah.

There are a number of targets down gradient of the site and adjacent to the site. These targets include; wetlands along Silver Creek, contact exposure to the water in Empire Creek and Silver Creek, residents that use Silver Creek as an irrigation source, and Silver Creek's contribution to the Weber River. The drinking water for the Park City area is primarily from ground-water sources including wells and mine drainage tunnels (Ashland et al., 2001). There are no known down gradient diversions of surface water for drinking water from Silver Creek. There are approximately 7 miles of wetland frontage along the 15 mile down gradient migration pathway of Silver Creek and the Weber River (Thiros, 2000).

Silver Creek is currently listed on the 303(d) list for Utah. Section 303 of the Clean Water Act established the principle of the total maximum daily load (TMDL) as a means of reducing water pollution in impaired waters. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and non-point sources and includes a margin of safety and consideration of seasonal variations (DWQ, 2000).

In addition, a TMDL contains the reductions needed to meet water quality standards and allocates those reductions among the sources in the watershed. The calculation must include a margin of safety to ensure that the water body can be used for the purposes that have been designated. The calculation must also account for seasonal variation in water quality (DWQ, 2000).

Each state must identify the uses for each water body, for example, drinking water supply, contact recreation (swimming), and aquatic life support (fishing) as well as the scientific criteria to support these uses. Streams, lakes, and other water bodies that do not meet the standards are impaired and are required by the Clean Water Act to be listed as such (i.e. the 303(d) list). Section 303(d) also requires development of TMDLs for listed waters. TMDLs are an important step in the restoration of these impaired water bodies (DWQ, 2000).

Work by United Park City Mines has found zinc to be an indicator metal in surface water (Gee, 2001). Zinc is almost always present when any metals contamination is found and zinc itself is a contaminant. Flows to Silver Creek from Empire Canyon, although relatively small, are considered to be a significant source of metals loading in Silver Creek and contributes to the 303(d) problem.

6.3 Sample Locations

Sample locations were generally selected above and below each of the major mining features in the canyon. Surface water sample locations are shown on Figure 3 and sediment sample locations are shown on Figure 4. Each location was surveyed using a Trimble GeoExplorer 3 GPS unit and subsequently differentially corrected using base station data, downloaded over the internet, from the Utah County Public Works base station located in Spanish Fork, Utah.

In the Empire drainage, no surface water was observed above or at the Daly-Judge waste rock pile and as such, no samples were collected there. Samples were collected above the Daly-West (EC-SW-11) and just above the upper confluence (EC-SW-10).

Two samples were collected from the Little Bell Drainage above the Little Bell Mine, one (EC-SW-13) was taken from a spring and the other (EC-SW-14) from the stream. A sample (EC-SW-12) was taken below the Quincy Mine and another (EC-SW-09) from the Little Bell drainage just above the upper confluence.

In the vicinity of the lower confluence, several samples were collected. United Park City Mines installed 4 Parshall flumes in the Canyon, prior to the beginning of this project and each of these flumes were used as sample locations. These flumes (and the respective samples) are located: 1) in Empire Creek above the lower confluence (EC-SW-07), 2) in Empire Creek at the Iron Gate (EC-SW-02), 3) in Daly Draw above the lower confluence (EC-SW-06) and, 4) in Walker and Webster Gulch above the lower confluence (EC-SW-08 and EC-SW-22).

Occasionally, water from the Judge Tunnel is too turbid for drinking water use. A turbidity meter automatically turns Judge Tunnel water from the municipal drinking water system into Empire Creek when this occurs. Samples were collected above (EC-SW-05) and below (EC-SW-04) this turnout. Additionally, several small seeps were observed along Empire Creek just below the Water Storage tank. The sample location below the Judge Tunnel Turnout (EC-SW-04) is up gradient of these seeps. The Parshall flume at the Iron Gate (EC-SW-02) is down gradient.

Samples were also collected just above the catch basin pond at the end of Daly Avenue (EC-SW-01), from the culvert where Daly Draw empties into Empire Creek (EC-SW-17), and at a small seep on the east side of the road at the Iron Gate (EC-SW-03).

In Walker and Webster Gulch, samples were collected from above (EC-SW-15) and below (EC-SW-16 and EC-SW-23) the Walker and Webster Mine. Several small seeps were observed in the stream channel and the downgradient sample was collected downgradient of these seeps

In late June, additional samples were collected from the Judge Tunnel Turnout (EC-SW-18), from the Parshall Flume at the Iron Gate (EC-SW-19), and from just above the catch basin pond at the end Daly Avenue (EC-SW-20) while Judge Tunnel was being turned out in an effort to see if the stream picked up additional contamination from the stream channel. These 3 samples were analyzed for total and dissolved metals.

The sample collected at the Parshall Flume in Empire Creek above the Judge Tunnel (EC-SW-07) was also analyzed for total and dissolved metals at the request of United Park City Mines. This was done because the sample was collected early in the runoff process (May 9, 2001) and it was desired to see if the sample got most of its metal content from suspended particles.

Sediment samples were co-located with most of the surface-water samples. The exceptions were: the seep at the Iron Gate, from the culvert where Daly Draw empties into Empire Creek, and the 3 surface-water samples collected while the Judge Tunnel was being turned out.

6.4 Analytical Results

The analytical results are summarized on Tables 1, 2, and 3. Table 1 summarizes the total metal analyses for surface water, Table 2 compares total and dissolved metals concentrations for the 4 samples where both were analyzed, and Table 3 summarizes the total metal analyses for sediments. The validated data reports are included as Appendix D (bound separately).

As specified by the Hazard Ranking System (HRS), analytical results from field samples were compared to analytical results from the background sample(s) and to sample quantitation limits (SQL) for determining areas of observed contamination. The criteria for determining observed contamination is as follows:

1. If the background concentration is not detected, observed releases are established when the sample concentration equals or exceeds the SQL; or

2. If the background concentration equals or exceeds the detection limit, observed releases are established when the sample concentration "significantly exceeds" the background concentration. Generally, "significantly exceeds" is defined to be situations where the sample concentration exceeds the background concentration by 3 times (U.S. EPA, 1990).

Analytical results from the field samples were also compared to screening standards. The benchmark data from the Superfund Chemical Data Matrix (SCDM) are the accepted benchmark values and they are also included in Table 1. SCDM's Environmental Freshwater benchmarks are the only values applicable in this setting. There are no drinking water intakes on Empire Creek so the Maximum Contaminant Levels (MCLs) are not applicable. Because Empire Creek is ephemeral, and as such not used as a fishery, the Reference Dose Screen Concentrations and the Cancer Risk Screen Concentrations for the human food chain are not applicable. SCDM gives no benchmark values for sediment.

Certain results are highlighted if they are observed contamination (exceed background by 3 times). Analyses where the SCDM value is exceeded are bolded on Table 1.

6.4.1 Total Metals

According to United Park City Mines, zinc is an indicator metal in Empire Canyon (Gee, 2001). Zinc shows up most often in analytical results from this area. If other metals are present zinc usually is too. This was the case in the sampling done for this ESI.

Zinc was not detected in the background sample (EC-SW-13) or in the sample collected from the spring in the Little Bell Drainage (EC-SW-14). In the remaining 20 samples, zinc was detected in concentrations ranging from 3.9 µg/ℓ to 8870 µg/ℓ. The quantity in each of these 20 samples was enough to constitute observed releases. The SCDM zinc benchmark is 110 µg/ℓ. This was exceeded in 17 of the samples.

The highest zinc concentration was observed in the spring at the Iron Gate (EC-SW-03). This spring was coming directly out of mine waste material. The next highest concentrations of zinc were observed in Empire Creek just above the confluence with the Little Bell Drainage (EC-SW-10 at 5,100 µg/ℓ) and at the Empire Creek Flume (EC-SW-07 at 4,840 µg/ℓ). The samples collected at the Walker and Webster Flume (EC-SW-08 and its duplicate EC-SW-22) and all of the samples down gradient from the lower confluence had zinc values in excess of 1,000 µg/ℓ. However, of the 3 samples collected down gradient of the Judge Tunnel during the turnout of the Judge Tunnel water (EC-SW- 18, EC-SW-19, and EC-SW-20), only the most down gradient sample (EC-SW-20) exceeded 1,000 µg/ℓ.

Lead was detected in 21 of the samples in concentrations ranging from 0.90 µg/ℓ to 2,040 µg/ℓ. The SCDM benchmark value for lead is 3.2 µg/ℓ. Eighteen of the samples had concentrations sufficient to constitute observed releases and all 18 of the observed releases exceeded SCDM too.

Lead was not detected in the up gradient sample from Daly Draw (EC-SW-06) and in 3 other samples (EC-SW-13 from the spring in above Little Bell Mine, EC-SW-14 the background sample from the stream above Little Bell Mine, and EC-SW-15 from Upper Walker and Webster Gulch) had concentrations of 0.90 µg/ℓ, which is below the SCDM value.

The lead concentration in samples collected from the Empire Flume (EC-SW-07 at 2,010 µg/ℓ) and Walker and Webster Flume (EC-SW-08 at 2,040 µg/ℓ) had values in excess of 2,000 µg/ℓ, the duplicate sample from the Walker Webster Flume (EC-SW-22) however only had a lead concentration of 1,360 µg/ℓ. All other samples had lead concentrations below 455 µg/ℓ.

Cadmium was detected in 21 of the 22 samples. The background sample (EC-SW-13) was the only sample where cadmium was not detected. Again, most of the up gradient samples (i.e. EC-SW-12, EC-SW-14, and EC-SW-15) had low concentrations (all 3 had 0.30 µg/ℓ).

Seventeen samples had concentrations high enough to constitute observed releases for cadmium (the background sample had an SQL of 0.43 µg/ℓ) and of these, 16 exceeded the SCDM value of 1.1 µg/ℓ. The sample from the spring at the Iron Gate (EC-SW-03) had the highest concentration (37.7 µg/ℓ), and other relatively high concentrations were observed at the Empire Flume (EC-SW-07 at 30.9 µg/ℓ), the Walker and Webster Flume (EC-SW-08 at 22.8 µg/ℓ and EC-SW-22

(duplicate) at 20.9 µg/l), and Empire Creek just above the upper confluence (EC-SW-10 at 33.3 µg/l). All other samples had concentrations below 12.1 µg/L

Copper was detected in all 22 samples in concentrations ranging from 0.9 µg/l (in sample EC-SW-13, the background sample) to 225 µg/l (in sample EC-SW-07 at the Empire Flume). There were 16 samples that had concentrations high enough to establish observed releases, 9 of which exceeded the SCDM benchmark value of 12 µg/L

Iron was detected in 20 samples in concentrations ranging from 54.6 µg/l to 4,980 µg/L This resulted in 8 observed releases, 4 of which exceeded the SCDM benchmark of 1,000 µg/L The highest value was observed at the Empire Flume (EC-SW-07) and all other values were 1,540 µg/l or below.

Mercury had an SQL of 0.10 µg/L which is higher than the SCDM benchmark of 0.012 µg/L Mercury was detected in 12 samples, including the background sample, at the concentration of 0.10 µg/l and in 1 sample (EC-SW-07, the Empire Flume) at 0.40 µg/L As such only this last sample qualifies as an observed release.

For other analytes:

- Arsenic was detected in all 22 surface-water samples in concentrations ranging from 2.1 µg/l to 86.1 µg/l, constituting 9 observed releases, none of which exceeded the SCDM benchmark of 190 µg/L

- Chromium was detected in 17 of the 22 surface-water samples in concentrations ranging from 0.70 µg/l to 14.3 µg/l, constituting 10 observed releases (because chromium was undetected in the background sample, SQL = 1.0 µg/l) 1 of which exceeded the SCDM benchmark of 11 µg/L

- Nickel was detected in 20 of the 22 surface-water samples in concentrations ranging from 0.70 µg/l to 7.0 µg/l, constituting 4 observed releases (because nickel was not detected in the background sample SQL = 1.8 µg/l), none of which exceeded the SCDM benchmark of 160 µg/L

- Selenium was detected in 21 of the 22 surface-water samples in concentrations ranging from 2.3 µg/l to 7.4 µg/l, constituting 1 observed release which exceeded the SCDM benchmark of 5 µg/L

- Silver was detected in 20 of the 22 surface-water samples in concentrations ranging from 0.50 µg/l to 22.9 µg/l, constituting 2 observed releases, 1 of which exceeded the SCDM benchmark of 4.1 µg/L

- Antimony was detected in 19 of the 22 surface-water samples in concentrations ranging from 1.6 µg/l to 111.0 µg/l, constituting 12 observed releases. Antimony has no SCDM benchmark value,

- Manganese was detected in 19 of the 22 surface-water samples in concentrations ranging from 4.4 µg/ℓ to 584 µg/ℓ, constituting 19 observed releases (because manganese was not detected in the background sample SQL = 3.6 µg/ℓ). Manganese has no SCDM benchmark value,

- Aluminum was detected in 18 of the 22 surface-water samples in concentrations ranging from 39.1 µg/ℓ to 2,650 µg/ℓ, constituting 9 observed releases (aluminum was not detected in the background sample, SQL = 311 µg/ℓ). Aluminum has no SCDM benchmark value, and

- Observed releases of calcium, magnesium, potassium, and sodium were also documented in surface-water samples but these constituents are generally considered non-hazardous.

6.4.2 Total Metals vs. Dissolved Metals

At 4 of the surface-water sample points, samples were collected and analyzed for total and dissolved metals. In Table 2, the total and dissolved analyses are presented. Also on Table 2, a "suspended fraction" is presented. This "suspended fraction" was computed by subtracting the dissolved concentration from the total concentration.

Table 2 has several results that are colored orange. This was done to indicate analytes where the dissolved fraction was greater than the total fraction, which theoretically, is not possible. This discrepancy might be do to natural variations in the concentrations during the time the samples were being collected, filter or other equipment failure, laboratory error, and/or other unknown reasons.

During the early stages of the runoff, sample EC-SW-07 was collected from the Empire Flume. This sample was submitted for both total metals and dissolved analysis to determine the amount of the suspended fraction in runoff. In this sample, the majority of the analytes of concern occur in the suspended fraction. Exceptions to this are zinc and cadmiun where about equal parts come from the total and dissolved fractions and selenium which registers as 100% from the dissolved fraction.

At a later point in time, while water from the Judge Tunnel was being turned into Empire Creek, samples were collected at 3 locations along the stream. For these 3 samples, a general trend should be observed while moving from the upstream sample (EC-SW-18), through the midway sample (EC-SW-19), and to the downstream sample (EC-SW-20). This sequence shall be referred to as the flow path.

Zinc, lead, manganese, and aluminum saw increases in the suspended fraction going along the flow path. Suspended zinc increased from 220 µg/ℓ to 535 µg/ℓ while the dissolved zinc fluctuated between 582 µg/ℓ and 685 µg/ℓ. Suspended lead increased from 8.0 µg/ℓ to 34.4 µg/ℓ over the flow path while the dissolved lead increased from 1.8 µg/ℓ to 4.0 µg/ℓ. Suspended manganese increased from 4.9 µg/ℓ to 9.3µg/ℓ while dissolved manganese decreased from 8.0 µg/ℓ to undetected. Aluminum also under went a suspended fraction increase (from 0.0 µg/ℓ to

64.8 µg/ℓ) as dissolved aluminum fluctuated but essentially remained constant (from 43.6 µg/ℓ to 49.2 µg/ℓ).

An increase in dissolved fraction was observed in cadmium, arsenic, and antimony as one moves down the flow path. The dissolved cadmium went from 2.1 µg/ℓ to 6.1 µg/ℓ while the suspended cadmium fluctuated between 0.2 µg/ℓ and 0.6 µg/ℓ. Dissolved arsenic was undetected in the up gradient sample and 2.9 µg/ℓ and 2.5 µg/ℓ in the mid and down gradient samples. Suspended arsenic values were 4.8 µg/ℓ, 1.1 µg/ℓ, and 2.0 µg/ℓ, moving along the flow path. The dissolved antimony increased from 7.6 µg/ℓ to 15.0 µg/ℓ. The suspended antimony decreased from 4.0 µg/ℓ to 2.5 µg/ℓ in the first 2 points and at the most down gradient point the dissolved fraction was greater than the total fraction giving a negative concentration for the suspended fraction, which is not theoretically possible but maintains the trend of decreasing suspended antimony.

The suspended fraction of iron, chromium, copper, and nickel decreased down the flow path. Suspended iron went from 295.4 µg/ℓ to 168.4 µg/ℓ while dissolved iron remained at 10.6µg/ℓ. Suspended chromium decreased from 14.3 µg/ℓ to 1.0 µg/ℓ while dissolved chromium was 1.0 µg/ℓ at the up gradient and down gradient points (it was 3.0 µg/ℓ at the mid point). Suspended copper decreased from 10.0 µg/ℓ to 6.3 µg/ℓ (it was 5.4 µg/ℓ at the mid point). Dissolved copper also decreased over the flow path (from 6.7 µg/ℓ to 4.2 µg/ℓ). Suspended nickel started at 5.6 µg/ℓ and ended at 0.0 µg/ℓ, while dissolved nickel was 1.4 µg/ℓ at the 2 endpoints (it was 2.7 µg/ℓ at the mid point).

Silver and selenium had higher dissolved concentrations than total concentrations, but both (total and dissolved concentrations for both analytes) remained fairly consistent along the flow path. Mercury was undetected in both the total and dissolved fractions for all 3 samples along the flow path.

6.4.3 Sediment

Fifteen sediment samples were collected, each of which was co-located with a surface water sample (Figure 4). These sediment samples are summarized on Table 3. SCDM provides no benchmark values for sediment. Sample EC-SD-35, collected above the Little Bell Mine in the Little Bell Drainage, was selected as the background sample. Two other samples, EC-SD-36 (from the spring near the Little Bell Mine) and EC-SD-37 (in Upper Walker and Webster Gulch near the McConkie Ski Lift) had concentrations similar to the background sample.

Zinc was detected in all 15 samples, 12 of which were in concentrations high enough to constitute observed releases. The 3 locations where zinc concentrations did not constitute observed releases were the 3 samples mentioned in the previous paragraph (EC-SD-35, EC-SD-36, and EC-SD-37). Zinc concentrations in sediments ranged from 63.4 mg/kg (in the background sample) to 24,200 mg/kg (in sample EC-SD-30 at the Walker and Webster Flume).

Lead was also detected in all 15 samples. Concentrations ranged from 31.9 mg/kg, in the background sample, to 13,500 mg/kg, in sample EC-SD-30 at the Walker and Webster Flume. Eleven of the samples qualified as observed releases.

Cadmium was detected in 12 of the 15 samples, and all 12 of these constituted observed releases because it was not detected in the background sample (or in samples EC-SD-36, and EC-SD-37). Concentrations ranged from 2.9 mg/kg (in sample EC-SD-29 from the Little Bell Drainage near the Ruby Ski lift) to 117 mg/kg (in sample EC-SD-30 at the Walker and Webster Flume).

Copper was detected in 10 of the 15 sediment samples in concentrations ranging from 11.9 mg/kg (in sample EC-SD-35, the background sample) to 530 mg/kg (in sample EC-SD-29 at the Walker and Webster Flume). There were 10 samples that had concentrations high enough to establish observed releases.

Iron was detected in all 15 samples in concentrations ranging from 10,500 mg/kg to 48,300 mg/kg. None of these were observed releases. The highest value was observed in Empire Creek above the seeps (EC-SD-26).

Mercury was detected in all 15 samples at the concentration ranging from 0.066 mg/kg (in the Upper Walker and Webster sample taken near the McConkie Ski Lift) and 1.1 mg/kg (in 2 samples). There were 6 observed releases of mercury.

For other analytes:

- Arsenic was detected in all 15 of the sediment samples in concentrations ranging from 7.7 mg/kg to 276 mg/kg , constituting 6 observed releases,
- Chromium was detected in all 15 of the sediment samples in concentrations ranging from 10.9 mg/kg 33.5 mg/kg, non constituting observed releases,
- Nickel was detected in all 15 of the sediment samples in concentrations ranging from 7.5 mg/kg to 75.1 mg/kg, constituting 1 observed release,
- Selenium was detected in all 15 of the sediment samples in concentrations ranging from 0.94 mg/kg to 6.1 mg/kg, constituting 1 observed release,
- Silver was detected in 13 of the 15 sediment samples in concentrations ranging from 0.21 mg/kg to 68.7 mg/kg, constituting 13 observed releases,
- Antimony was detected in 14 of the 15 sediment samples in concentrations ranging from 0.83 mg/kg to 140 mg/kg, constituting 11 observed releases,
- Manganese was detected in all 15 of the sediment samples in concentrations ranging from 523 mg/kg to 9,310 mg/kg, constituting 6 observed releases, and
- Aluminum was detected in all 15 of the sediment samples in concentrations ranging from 5,630 mg/kg to 15,300 mg/kg, with no observed releases.

6.5 Conclusions

The historic mining activity in the Empire Canyon Drainage has undoubtedly impacted the surface water. The samples collected high in the drainage (surface-water samples: EC-SW-13, EC-SW-14, and EC-SW-15; and co-located sediment samples: EC-SD-35, EC-SD-36, and EC-SW-37), where mining activities had little or no impact, generally had low concentrations of inorganic constituents. In these samples, inorganic constituents were detected, but these constituents occur naturally so their presence is expected. However, lower in the drainage concentrations of these constituents increase significantly.

As mentioned previously, zinc is the most prevalent metal in the drainage. The highest concentration of zinc in surface water was observed at the seep at the Iron Gate (EC-SW-03). The highest concentrations of cadmium and selenium were also observed here. This is reasonable as this seep comes directly out of mine waste but this sample seems to be somewhat an anomaly as it only had observed releases for 5 constituents (zinc, cadmium, selenium, lead, and antimony).

The samples collected between the Empire Flume (EC-SW-07) and the Walker Webster Flume (EC-SW-08) on the up gradient end and the catch basin on Daly Avenue (EC-SW-01) on the down gradient end, including the end points, generally had the highest contaminant concentrations. Interestingly enough, the 2 up gradient samples usually had the highest concentrations, which might indicate that significant contaminants were picked up in the Daly area and in Walker and Webster Gulch. The fact that the concentrations were lower down gradient is not necessarily of concern as several sources of relatively clean water contributed to the stream down gradient of these points (i.e. Daly Draw, seeps along Empire Creek, Judge Tunnel, etc.). Interestingly, the sample from Daly Draw (EC-SW-06) was collected at a similar point in the drainage as EC-SW-07 and EC-SW-08, but from a side drainage that essentially had no mining activity and it had relatively low levels of all constituents.

When comparing total metals to dissolved metals, the sample from the Empire Flume that was collected during high runoff, EC-SW-07, had a significantly greater concentrations of constituents in the suspended fraction than similar samples collected later in the runoff cycle. This is expected due to the turbulent flow associated with high runoff.

The comparison of total metals and dissolved metals samples collected while water from the Judge Tunnel was being turned into Empire Creek give an interesting snapshot of the effects of the mine wastes on the surface water. The water in the Judge Tunnel is ground water and although it is flowing in a relatively open channel, it seems that it would not have the turbulent flow that surface water has nor would it have the sediments available to contribute to the suspended fraction. Also, the water from Judge Tunnel is normally used in the Park City Municipal System with minimal treatment, further indicating that it has fewer constituents than waters observed on the surface.

Without going into a detailed discussion of the chemistry, a few interesting trends emerge when comparing the suspended and dissolved fractions from these 3 samples (EC-SW-18, EC-SW-19,

and EC-SW-20). The suspended fraction increase in the concentrations of zinc, lead, manganese, and aluminum can probably be attributed to the erosion of mine wastes through the lower reaches of the canyon. This is reasonable as these 4 constituents have significant concentrations in the sediment samples collected in this area.

Cadmium, arsenic, and antimony concentrations underwent an increase in the dissolved fraction. The concentrations of these constituents were relatively low in both fractions and the observed variations might be due to natural fluctuations. These elements are typically not highly soluble so it seems unlikely that they would increase by 2 to 3 times over such a short distance.

Finally, iron, chromium, nickel, and copper made unsuspected changes as they underwent a decrease in the suspended fraction. These elements are highly susceptible to redox reactions and with the water coming from the underground environment of the Judge Tunnel to the open atmosphere, this might be occurring.

The sediment samples, like the surface water-samples, confirm the suspicion that contaminants are present. As with the surface-water samples the highest concentrations were measured in the lowest reaches of the canyon, between the Empire Flume (EC-SD-29) and the Walker Webster Flume (EC-SD-30) on the up gradient end and the catch basin on Daly Avenue (EC-SD-24) on the down gradient end, including the end points. The samples collected high in the drainage (EC-SD-35, EC-SD-36, and EC-SD-37) had very little contamination.

7.0 SOIL EXPOSURE PATHWAY

7.1 Geology

The geology in the Park City area is relatively complex. It lies on the north side of a broad east-west trending uplift, generally considered to be the westward extension of the Unita arch (Bromfield, 1968). The major structural feature in the area is the Park City anticline which tends to follow the Ontario Ridge (Gill and Lund, 1984). The bedrock underlying the area consists of quartzites, limestones, sandstones, siltstones, and shales ranging in age from Pennsylvanian to Jurrassic with Tertiary volcanic and intrusive rocks (Gill and Lund, 1984).

Natural soils in Empire canyon are relatively thin. Apparently during Quarternary glaciation, ice reached the mouth of Empire Canyon (Gill and Lund, 1984). Natural soils in the canyon consist of glacial till and alluvium.

7.2 Targets

Direct exposure to soil contaminated with heavy metals is a pathway of concern. Heavy metals are not only contained within the mine wastes, but may also have been released off-site by various mechanism including erosion/deposition of unprocessed ore and mine waste.

Based on 1990 Census data, there are 8,041 persons living within a 4-mile radius of the site (Appendix E). It is not known how many people use the foot trails and mountain biking trails in the canyon.

Previous work by United Park City Mines has demonstrated that a large portion of Flagstaff Mountain has non-contaminated soils, except for a few isolated areas, and as such has been excluded from the site. The vast majority of the remainder of the area is used for hiking and mountain biking on designated trails in the summer and skiing in the winter. Because the designated trails keep users in a relatively small portion of the canyon and during the ski season the soils are effectively capped with snow, the exposure of targets is probably minimal.

Of particular concern are houses along Daly Avenue. Daly Avenue is an older residential area immediately downgradient of the historical mining areas. Daly Avenue is essentially in the mouth of Empire Canyon. The yards of houses along Daly Avenue may have contaminated soils which were deposited by flood events or just through normal deposition processes.

Most of the soil deposits that contain contamination were expected to be in the bottom of the canyon or immediately below distinct mining features. No large scale smelting took place in the Park City area so there is likely no impact by emissions from such operations. Soil sampling was focused on the canyon bottom and distinct mining related features.

7.3 Sample Locations

Twenty-six soil samples were collected as part of this Expanded Site Inspection. Sample locations were generally collected from areas that appeared as though they were mining related. As specified in the Work Plan, personnel began high in the canyon and walked down the drainages, collecting soil samples from obvious mining related features and from any deposits of suspect looking soil.

Soil sample locations are shown on Figure 5. Each location was surveyed using a Trimble GeoExplorer 3 GPS unit and subsequently differentially corrected using base station data, downloaded over the internet, from the Utah County Public Works base station located in Spanish Fork, Utah.

All soil samples were collected from the surface (<6 inches deep) using hand tools (i.e. spoons or scoops). When soil samples were collected from residential properties, the sod was removed, the soil was collected from beneath the sod, and the sod was replaced but in all instances, the soil was collected from 0-6 bgs.

On July 2, 2001, personnel from DERR and United Park City Mines began at the top of Walker Webster Gulch and collected samples from: a prospect high in the drainage (EC-SF-40), from a small working just below the Walker and Webster Mine (EC-SF-41), and from a small working believed to be the St. Louis Mine (EC-SF-42). Throughout the lower part of the Walker and Webster Drainage (below the McConkie Ski Lift), deposits of a grey silt were noticed. Down gradient from sample EC-SF-42 was a large deposit of this material and it was sampled (EC-SF-43).

After the samples were collected on July 2, it was decided to put the sampling on hold until the Work Plan was finalized. Due to the dynamic situation of the site the surface-water samples had to be collected while the snow pack was melting and the sediment samples were co-located with surface-water samples. Work done on and prior to July 2, and work done on September 4 (as

described in the next paragraph) was done under a draft Work Plan. The Work Plan was finalized on October 3, 2001.

On September 4, 2001, United Park City Mines had arranged for 3 private homes along Daly Avenue to be sampled. Samples were collected: from the southeast corner of the house (from a flower garden) at 249 Daly Avenue (EC-SF-63), from the front yard of the house at 167 Daly Avenue (EC-SF-64), and from the yard between the house and the garage at 180 Daly Avenue (EC-SF-65).

Finally, on October 16, 2001, 19 samples were collected from mining features in the Little Bell and Empire Drainages. The first sample collected this day was taken high in the Little Bell Drainage from an area that appeared to have no mining impact and was used as the background sample (EC-SF-44). Two more samples were collected in the Little Bell Drainage, one from the Little Bell Mine waste rock pile near an old ore chute (EC-SF-45) and one near the historical marker near the New Quincy Mine waste rock pile (EC-SF-46).

The sampling personnel then moved into the main Empire Drainage and collected 2 samples from the Daly-Judge Mine (a.k.a. Anchor Mine) waste rock pile (EC-SF-47 and EC-SF-48). As personnel moved down this drainage, they continued to collect samples from mining related features and the samples were numbered consecutively ending with sample EC-SF-62, taken from the waste rock pile just north of the iron gate on the east side of the canyon. A brief description of each of these locations is given on Table 4.

7.4 Analytical Results

The analytical results are summarized on Table 4. The validated data reports are included as Appendix D (bound separately).

As specified by the Hazard Ranking System (HRS), analytical results from field samples were compared to analytical results from the background sample and to sample quantitation limits (SQL) for determining areas of observed contamination. The criteria for determining observed contamination in soil is as follows:

1. If the background concentration is not detected, observed contamination is established when the sample concentration equals or exceeds the sample quantitation limit; or

2. If the background concentration equals or exceeds the detection limit, observed contamination is established when the sample concentration "significantly exceeds" the background concentration. Generally, "significantly exceeds" is defined to be situations where the sample concentration exceeds the background concentration by 3 times (U.S. EPA, 1990).

Analytical results from the field samples were also compared to screening standards. The benchmark data from the Superfund Chemical Data Matrix (SCDM) are the accepted benchmark values and they are also included in Table 4. For soil samples, 2 benchmarks are applied: 1) the Reference Dose Screen Concentrations, and 2) the Cancer Risk Screen Concentrations.

Certain results are highlighted in blue on Table 4 if they are observed contamination (exceed background or the SQL by 3 times) without exceeding the SCDM value. Results are highlighted yellow on Table 4 if they are observed contamination and exceed a SCDM benchmark. Analyses where the SCDM Reference Dose Screen Concentration was exceeded are bolded in black on Table 4 and analyses were the SCDM Cancer Risk Screen Concentration value is exceeded are bolded in blue on Table 4.

In both instances where a constituent has a SCDM Cancer Risk Screen Concentration value (for arsenic and beryllium), it also has a SCDM Reference Dose Screen Concentration. The SCDM Cancer Risk Screen Concentration is significantly lower than the Reference Dose Screen Concentration. Therefore, samples that exceed the SCDM Cancer Risk Screen Concentration value (bolded in blue) also exceed the SCDM Reference Dose Screen Concentration, although they cannot also be bolded black.

There were very few undetected concentrations ("U" or "UJ" qualified) of analytes among the soil samples. Each of the analytes included in the inorganic analyses occur naturally and so the presence of most of these analytes, at least in low concentrations, is expected.

Arsenic was detected in all 26 soil samples ranging from 10 mg/kg (EC-SF-53) to 1170 mg/kg (EC-SF-45). Arsenic has a SCDM Reference Dose Screen Concentration benchmark of 23 mg/kg which was exceeded by 21 of the soil samples. Arsenic also has a SCDM Cancer Risk Screen Concentration benchmark of 0.43 mg/kg which was exceeded by 21 of the samples. The background sample had a concentration of 16 mg/kg and there were 19 observed releases of arsenic.

The greatest arsenic concentration was observed in the Little Bell Drainage at the Little Bell Mine ore chute (EC-SF-45). The next 3 highest concentrations all occurred in the vicinity of the lower confluence (EC-SF-59 at 761 mg/kg, EC-SF-55 at 688 mg/kg, and EC-SF-62 at 571 mg/kg). After this there was a significant drop off in concentration although, as mentioned previously, the arsenic concentration in all soil samples exceeded at least one of its SCDM benchmarks.

As with surface water, zinc is prevalent in the soil exposure pathway. Zinc concentrations ranged from 63.2 mg/kg, in the background sample (EC-SF-44), to 51,600 mg/kg, in the sample collected from the ore chute at the Little Bell Mine (EC-SF-45). Zinc has a SCDM Reference Screen Dose Concentration benchmark of 2300 mg/kg. There were 23 observed releases of zinc, 15 of which exceeded the benchmark value.

Soil samples EC-SF-59 (20,600 mg/kg), EC-SF-55 (19,400 mg/kg), and EC-SF-58 (13,100 mg/kg) collected in the lower confluence area and samples EC-SF-41 (29,200 mg/kg) and EC-SF-43 (18,900 mg/kg) were the other samples that exceeded 10,000 mg/kg in zinc concentration.

Antimony has a SCDM Reference Screen Dose Concentration benchmark of 31 mg/kg. Fourteen of the samples exceeded this benchmark and a total of 23 of the soil samples had observed releases for antimony. Antimony values ranged from undetected (in EC-SF-44 and

EC-SF-53) to 742 mg/kg in soil sample EC-SF-59 taken between the water supply storage tank and the Iron Gate.

There were 23 observed releases of cadmium, 8 of which exceeded the SCDM Reference Screen Dose Concentration benchmark of 39 mg/kg. Cadmium concentrations ranged from undetected ("U" qualified in sample EC-SF-42) to 165 mg/kg in sample EC-SF 41 taken from just below the Walker and Webster Mine site. Relatively high concentrations were also observed from the ore chute at the Little Bell Mine and from samples collected in the vicinity of the lower confluence.

Beryllium was detected in all 26 soil samples ranging from 0.06 mg/kg (EC-SF-59) to 0.82 mg/kg (EC-SF-41). Beryllium has a SCDM Reference Dose Screen Concentration benchmark of 390 mg/kg which was not exceeded by any of the soil samples but beryllium also has a SCDM Cancer Risk Screen Concentration benchmark of 0.15 mg/kg which was exceeded by 23 of the samples. The background sample had a concentration of 0.62 mg/kg and since this was one of the higher concentrations observed, there were no observed releases of beryllium.

Lead was detected in all 26 of the soil samples in concentrations ranging from 27 mg/kg, in the background sample (EC-SF-44), to 171,000 mg/kg, in the sample collected along Empire Creek between the water supply storage tank and the Iron Gate (EC-SF-59) constituting 23 observed releases. Samples collected from the ore chute at the Little Bell Mine (EC-SF-45), from the lower reaches of Walker and Webster Gulch (EC-SF-41 and EC-SF-43), and from the area around the lower confluence (EC-SF-55, EC-SF-62, EC-SF-57, EC-SF-58), also had high concentrations of lead. SCDM gives no screening concentrations for lead.

Additionally:

- Mercury was detected in 25 of the 26 soil samples in concentrations ranging from 0.048 mg/kg to 5.1 mg/kg, constituting 24 observed releases, none of which exceeded the SCDM benchmark of 23 mg/kg,

- Silver was detected in all 26 of the soil samples in concentrations ranging from 0.25 mg/kg to 338 mg/kg, constituting 22 observed releases, none of which exceeded the SCDM benchmark of 390 mg/kg,

- Selenium was detected in 24 of the 26 soil samples in concentrations ranging from 1.0 mg/kg to 34.7 mg/kg, constituting 11 observed releases, none of which exceeded the SCDM benchmark of 390 mg/kg,

- Nickel was detected in all 26 of the soil samples in concentrations ranging from 1.5 mg/kg to 37.4 mg/kg, constituting 1 observed release, which did not exceed the SCDM benchmark of 1600 mg/kg,

- Manganese was detected in all 26 of the soil samples in concentrations ranging from 99.5 mg/kg to 9640 mg/kg, constituting 5 observed releases, none of which exceeded the SCDM benchmark of 11,000 mg/kg,

- Chromium was detected in all 26 of the soil samples in concentrations ranging from 5.1 mg/kg to 128 mg/kg, constituting 3 observed releases, none of which exceeded the SCDM benchmark of 390 mg/kg,

- Barium was detected in all 26 of the soil samples in concentrations ranging from 27.2 mg/kg to 999 mg/kg, constituting 1 observed release, which did not exceed the SCDM benchmark of 5500 mg/kg, and

- Vanadium was detected in all 26 of the soil samples in concentrations ranging from 6.3 mg/kg to 102 mg/kg, constituting 1 observed release, which did not exceed the SCDM benchmark of 550 mg/kg.

7.5 Conclusions

The soils in Empire Canyon and its associated drainages contain soils that are very contaminated. Although the targets in the canyon are typically limited to recreationalists (hikers and bicyclists in the summer who generally stay on trails and skiers in the winter when the snow effectively caps the soils) 3 of the samples were collected from the yards of houses along Daly Avenue and these samples too showed contamination.

Arsenic concentrations in all 26 soil samples exceeded SCDM Cancer Risk Screen Concentration benchmark values and 19 to the 26 samples had concentrations that exceeded the SCDM Reference Dose Screen Concentration benchmark. Furthermore, 2 of the 3 soil samples collected from the yards of houses along Daly Avenue had concentrations that exceeded both benchmarks.

Zinc too is very prevalent in the soils in the canyon. Zinc concentrations in 15 of the 26 samples exceeded the SCDM benchmark concentration including samples from 2 of the houses along Daly Avenue. SCDM benchmark concentrations were also exceeded in soil samples for cadmium and antimony

Lead in soil samples also presents a major concern. SCDM gives no screening concentrations for lead in soil. In the State of Utah, cleanup levels for lead in residential areas are established by risk assessment analysis for a specific site. Lead cleanup concentrations on residential properties have recently been in the range of 400 mg/kg. In the 26 soil samples collected for this Expanded Site Inspection, 19 of the samples, including 2 from residences along Daly Avenue, had concentrations in excess of 1500 mg/kg.

The presence of these inorganic constituents in soils presents a risk to human and environmental targets in Empire Canyon. Residents along Daly Avenue and perhaps further down gradient are especially at risk. Recreationalists who use the trails in Empire Canyon may inhale or ingest metal contaminated soils. Many of these individuals have pets that accompany them into the canyon, and these pets, as well as the hikers and bikers, may track this contaminated dust into their vehicles and homes. Furthermore, these constituents in soil may also become available to surface water and ground water.

8.0 GROUND-WATER PATHWAY

Ground water at the site occurs in unconsolidated valley fill and consolidated rocks. The unconsolidated valley fill consists of poorly sorted cobbles, gravel, sand, silt, and clay of glacial and alluvial origin. The thickness of the unconsolidated valley fill near the site varies but is probably relatively thin. The installation of the Pacific Bridge Well, located near Prospector Square, revealed alluvium 260 feet thick. Prospector Square is in the basin (approximately 3 miles from the upper reaches of Empire Canyon) where alluvial thicknesses are believed to be much thicker than in the surrounding canyons (Thiros, 2000).

The Permian Weber Quartzite contained vast amounts of water which created major problems for mining operations (Weston, 1997; Gill and Lund, 1984). Most of the tunnels in the area were excavated to remove this water from mine workings (Weston, 1997). This unit probably still supplies most of the water which flows from the Judge Tunnel, although it is believed that there is a component of surface runoff that contributes to these flows. The vast mine workings in the area create a complex preferential flow pathway for subsurface flows in the bedrock (Gee, 2001).

It is suspected that shallow ground water flows in the same general path as surface water in the area. Therefore ground water flows towards Empire Creek then towards Silver Creek in a northerly direction through the Park City area. It is also suspected that ground water in the canyon flows several feet below the surface in the fill in the bottom of the canyon.

The PA identified 15 municipal water sources within 4 miles of the site (Thiros, 2000). The Judge Tunnel (a.k.a. the Anchor Tunnel) is located in Empire Canyon and is a major source of drinking water to Park City.

Surface water recharges ground water in the Empire Canyon (Ashland et al., 2001; Brooks et al., 1998). Of particular concern is the shallow ground water in the lower confluence area. In this area, the surface-water flow is lost to the subsurface and then resurfaces several hundred feet downgradient. It appears that while the water is in the shallow subsurface, it picks up significant metal concentrations, specifically zinc.

Due to the nature of the subsurface (fractured geologic units and mine workings which provide preferential flow paths) there exists the potential for contaminants to migrate into the ground water. This is true, especially if metals loaded surface water recharges ground water via these preferential flow paths.

The main emphasis of this Expanded Site Inspection was on surface water. Because of the perceived interaction of the shallow ground water and surface water, surface-water samples might indicate the quality of the shallow ground water. Outside of this consideration, ground water was not looked at, but future investigations should consider in more detail the ground-water pathway.

9.0 AIR EXPOSURE PATHWAY

There are 8,041 persons living within 4 miles of the site, which are potential targets for exposure to contaminants in the air. Previous work done in Park City and at mine waste sites in the inter-mountain west has determined that the air pathway is not a significant threat to human health or the environment. For instance, when EPA conducted air monitoring at Richardson Flat (a CERCLIS site on the outskirts of Park City, approximately 5 miles northeast of Empire Canyon) in 1984, there were approximately 160 acres of exposed tailings. Results of the air monitoring showed that no ambient air standards were exceeded. It is also important to note that while air entrainment has the potential to spread contamination to surrounding soils and wetlands, the impact of air transport is small when compared to water transport.

10.0 SUMMARY AND CONCLUSIONS

The Empire Canyon site is a historic ore mining and processing area located in Park City, Summit County, Utah. Empire Canyon is located south of downtown Park City. Historic mine and mill waste material is present in certain areas of the canyon. Surface-water flow from Empire Canyon occurs in a small ephemeral channel.

The site is situated on the eastern slope of the Wasatch Range, approximately 25 miles east of Salt Lake City. Park City rests at the convergence of Woodside Gulch, Ontario Canyon, and Empire Canyon. These canyons were some of the main ore producing areas of Park City

The first record of claim in the Park City area was in 1869. About 1880, John Daly, a miner working in the Ontario mine, acquired 24 claims in Empire Canyon. In 1885, he formed the Daly Mining Company, and began sinking the Daly shaft. In 1883, the Anchor Mine was developed further up the canyon. For a few years ore from the Anchor mine was milled at the Union Mill in Empire Canyon. The Union Mill was replaced by the Daly-Judge Mill in 1916.

In 1886, John Daly won a contract to drill a 6000 foot tunnel from the mouth of Walker and Webster Gulch to the Anchor Shaft at the 1200 foot level. This tunnel was completed in 1889, later became known as the Judge Tunnel, and is presently a drinking water source for Park City.

In 1893, the Daly-West Shaft was sunk in a prospect located approximately halfway between the Daly Mine and the Anchor Mine. The Daly-West Mining Company was established in 1895 and a concentrator was constructed at the Daly-West Mine.

In 1901, the Daly-Judge Mining Company acquired the Anchor Mine and changed its name to the Daly-Judge Mine. In 1902, The Daly-Judge acquired the Quincy and Little Bell Mines located further up Empire Canyon essentially giving John Daly control of all the major mines in the canyon at that time.

The Thunderer group of claims were originally located in the Empire Canyon in 1898, but were soon consolidated as the American Flag Company. The American Flag was one of the few mines in the district that produced any significant amount of gold.

In 1953, a consolidation of mining interests occurred in the area resulting in the creation of the United Park City Mines Company. Although this consolidation brought most of the large mines under the same management, this consolidation was not all inclusive and several mining interests still existed independent of this consolidation.

In 1961, United Park City Mines received a loan from the United States Commerce Department for $1.23 million, which was used in the construction of a ski resort. The construction on the lifts began in the summer of 1962, and in December 1963, the ski industry was born in Park City. In 1973, the U.S. Ski Team selected Park City as its home and originally used the old Silver King Mine Boarding House to house athletes. In the 1980s, Deer Valley ski area opened.

During the 1970s and 1980s, as metal prices soared, some mining was once again undertaken. No ore is currently being mined in the Park City area although several mines are being maintained. Park City is now a world class resort area . In February 2002, Park City hosted alpine and snowboarding events during the 2002 Salt Lake City Winter Olympic Games.

The majority of the samples that were collected as part of this Expanded Site Inspection were collected on property owned by United Park City Mines. United Park City Mines provided unfettered escorted access to DERR personnel and often provided personnel to assist with the logistics of sampling. Samples were also collected on 3 residential properties along Daly Avenue. United Park City Mines arranged for access to these properties, after consultation with the project manager.

All totaled, 22 surface-water samples, 15 sediment samples, and 26 soil samples, were collected between April 30 and October 16, 2001. The stream flows in Empire Canyon are highly dependent on snowmelt so the sampling at this site was very dynamic and lead to this time duration.

The historic mining activity in the Empire Canyon Drainage has undoubtedly impacted the surface water. The surface-water and sediment samples collected high in the drainage, where mining activities had little or no impact, generally had low concentrations of inorganic constituents. In these samples, inorganic constituents were detected, but these constituents occur naturally so their presence is expected. However, lower in the drainage concentrations of these constituents increase significantly.

Zinc is the most prevalent metal in samples collected from the surface-water pathway. The highest concentration of zinc in surface water was observed at the seep at the Iron Gate (EC-SW-03). The highest concentrations of cadmium and selenium were also observed here. This is reasonable as this seep comes directly out of mine waste.

The samples collected between the Empire Flume (EC-SW-07) and the Walker Webster Flume (EC-SW-08) on the up gradient end and the catch basin on Daly Avenue (EC-SW-01) on the

down gradient end, including the end points, generally had the highest contaminant concentrations. Interestingly enough, the 2 up gradient samples usually had the highest concentrations, which might indicate that significant contaminants were picked up in the Daly area and in Walker and Webster Gulch. The fact that the concentrations were lower down gradient is not necessarily of concern as several sources of relatively clean water contributed to the stream down gradient of these points (i.e. Daly Draw, seeps along Empire Creek, Judge Tunnel, etc.). Interestingly, the sample from Daly Draw (EC-SW-06) was collected at a similar point in the drainage as EC-SW-07 and EC-SW-08, but from a side drainage that essentially had no mining activity and it had relatively low levels of all constituents.

The soils in Empire Canyon and its associated drainages contain soils that are very contaminated. Although the targets in the canyon are typically limited to recreationalists (hikers and bicyclists in the summer who generally stay on trails and skiers in the winter when the snow effectively caps the soils), 3 of the samples were collected from the yards of houses along Daly Avenue and these samples too showed contamination.

Arsenic concentrations in all 26 soil samples exceeded SCDM Cancer Risk Screen Concentration benchmark values and 19 of the 26 samples had concentrations that exceeded the SCDM Reference Dose Screen Concentration benchmark. Furthermore, 2 of the 3 soil samples collected from the yards of houses along Daly Avenue had concentrations that exceeded both benchmarks.

Zinc is very prevalent in the soils in the canyon. Zinc concentrations in 15 of the 26 samples exceeded the SCDM benchmark concentration including samples from 2 of the houses along Daly Avenue. SCDM benchmark concentrations were also exceeded in soil samples for cadmium and antimony

Lead in soil also presents a major concern. SCDM gives no screening concentrations for lead, but in the State of Utah, clean up levels for lead in residential areas of about 400 mg/kg are commonly established by risk assessment analysis. In the 26 soil samples collected for this Expanded Site Inspection, 19 of the samples, including 2 from houses along Daly Avenue, had concentrations in excess of 1500 mg/kg.

The presence of these inorganic constituents in soils presents a risk to human and environmental targets in Empire Canyon. Residents along Daly Avenue and perhaps further down gradient are especially at risk. Furthermore, these constituents in soil may also become available to surface water and ground water.

Ground-water Pathway and Air Pathway samples were not collected as part of this Expanded Site Inspection. These pathways, especially the Ground-water Pathway, present concern but the Surface-water Pathway is the most significant pathway of concern.

There is undoubtedly contamination in, and down gradient from, Empire Canyon. Many of the constituents detected in the analyses done for this Expanded Site Inspection are harmful to human health and the environment, primary among these are zinc, arsenic, lead, and cadmium.

While there are no surface water intakes on Empire Creek, the Judge Tunnel supplies water to the Park City municipal system. Within 4 miles of the site are 8,041 residents according to the 2000 census. Of specific concern is the fact that soil samples collected from residences along Daly Avenue had observed releases for several of the constituents and in several cases exceeded SCDM benchmarks.

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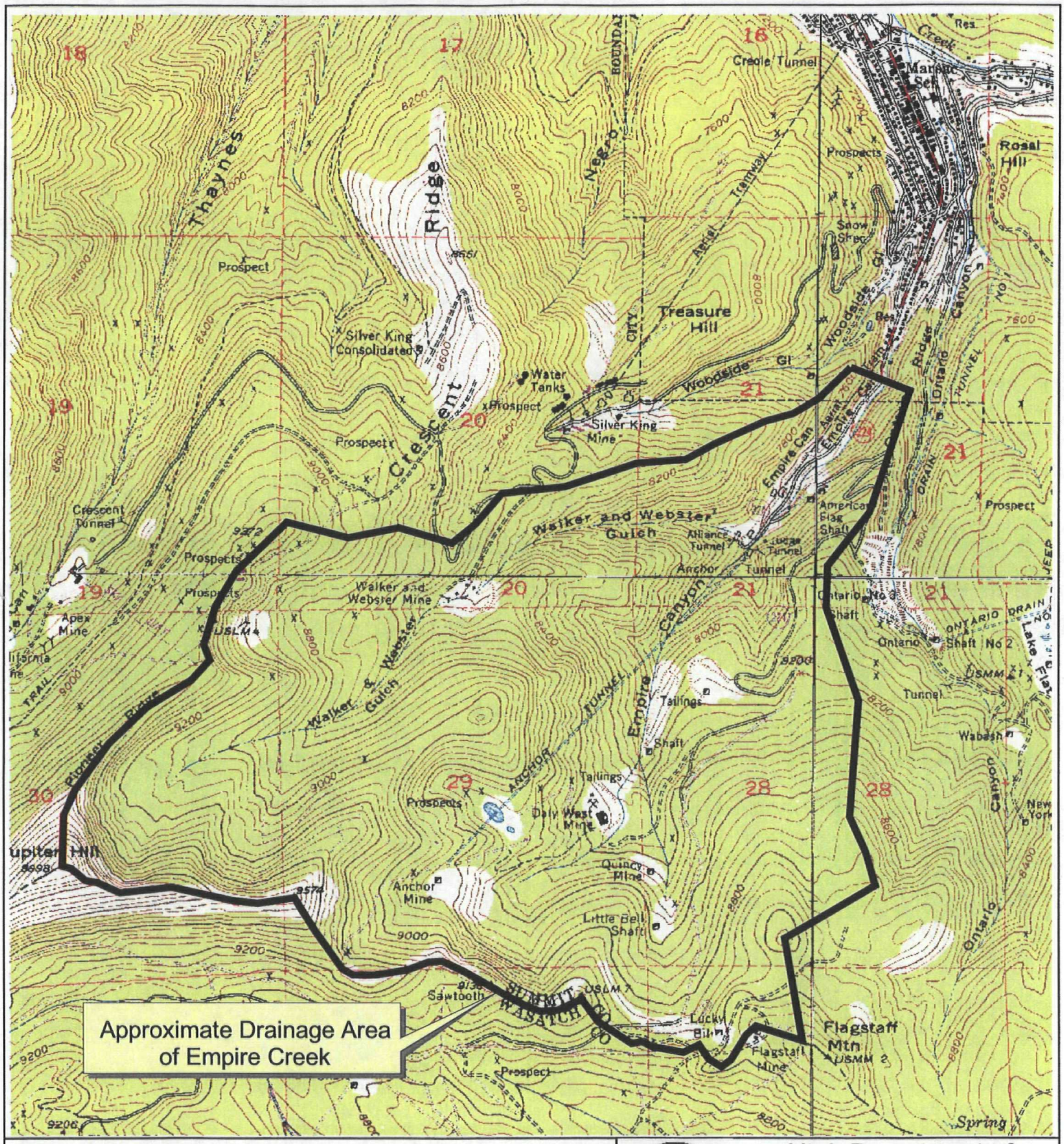

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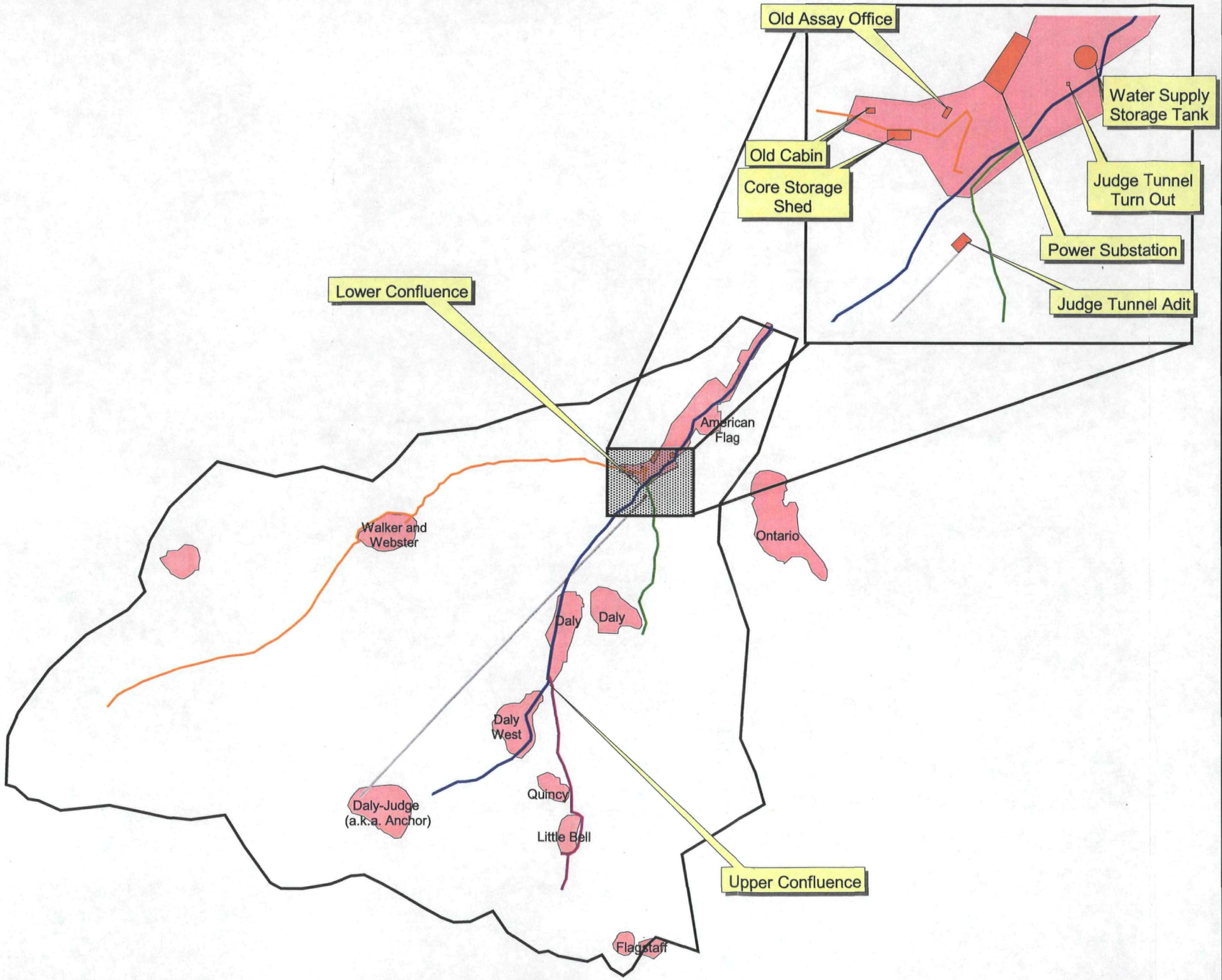
FIGURE 1
GENERAL AREA MAP

Empire Canyon
Summit County, Utah

by: Alan V. Jones date: 11/20/02



Structures
Daly Draw
Main Empire Canyon
Little Bell Drainage
Walker and Webster Gulch
Empire Creek Drainage Boundary
Judge Tunnel
Mine Waste Piles

N
W
E
S

Utah Department of Environmental Quality
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FIGURE 2

KEY TO SITE FEATURES

Empire Canyon
Summit County, Utah

by: Alan V. Jones date: 11/20/02

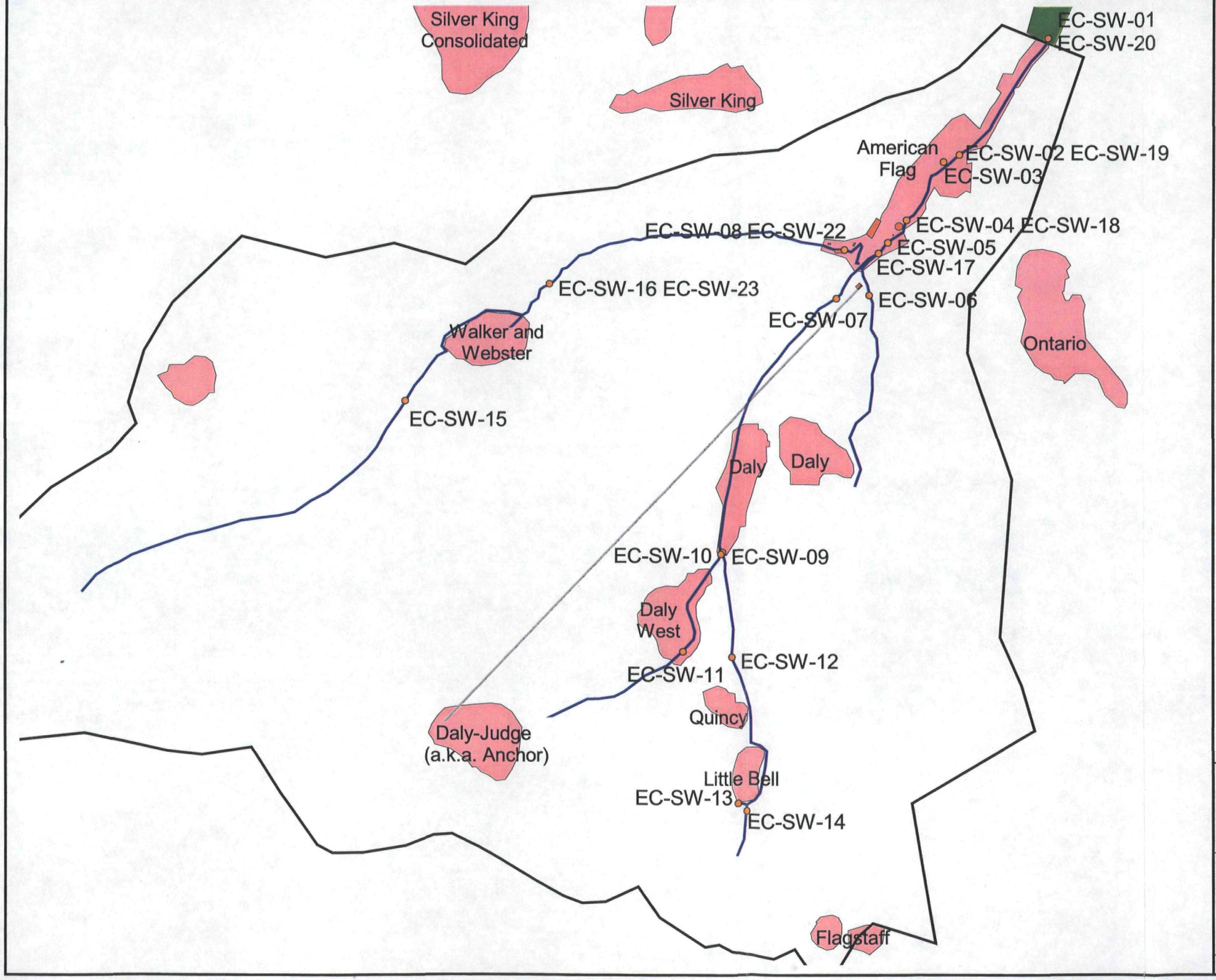

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FIGURE 3
SURFACE WATER SAMPLE LOCATION MAP

Empire Canyon
Summit County, Utah

by: Alan V. Jones date: 11/20/02

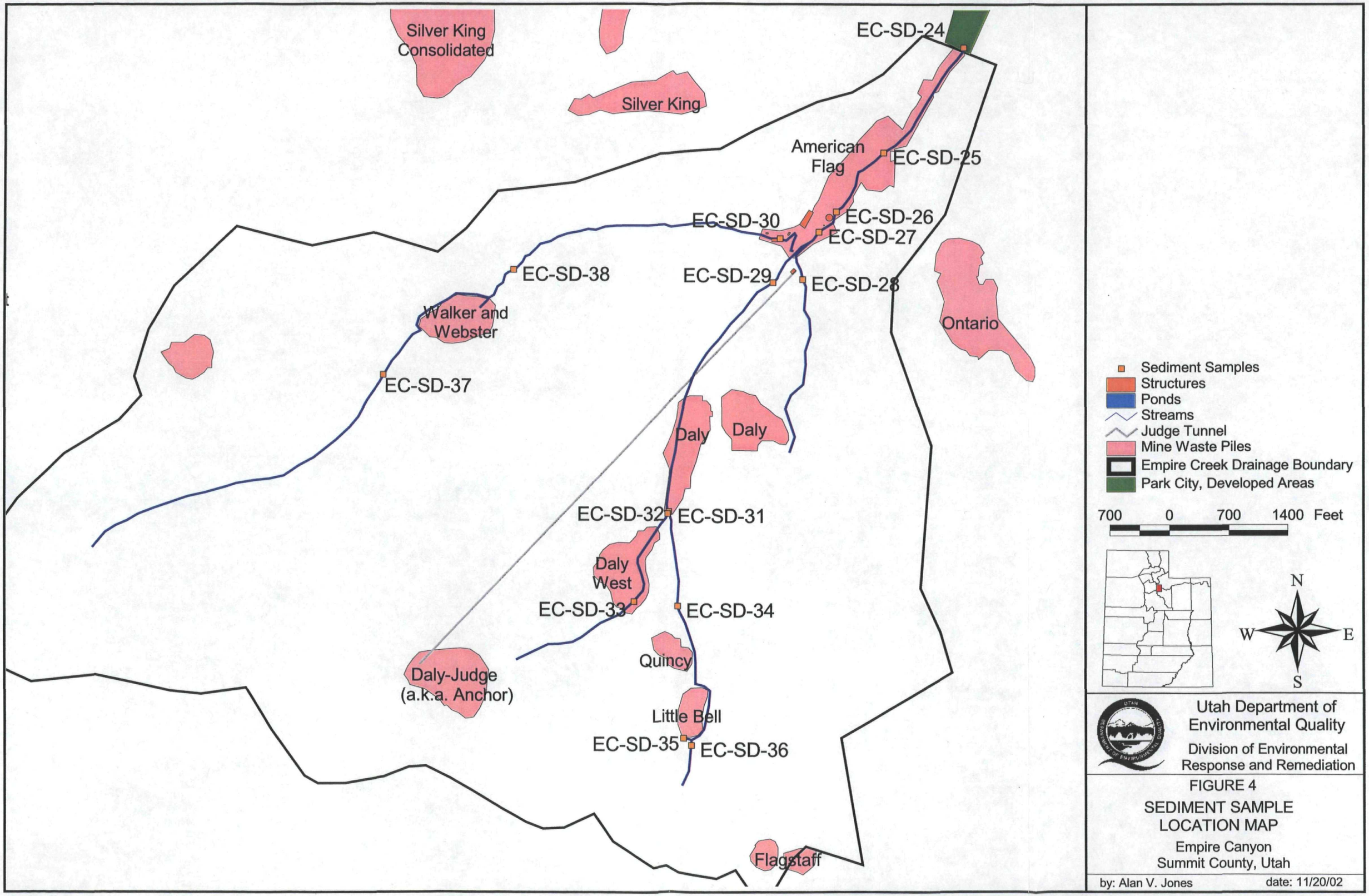

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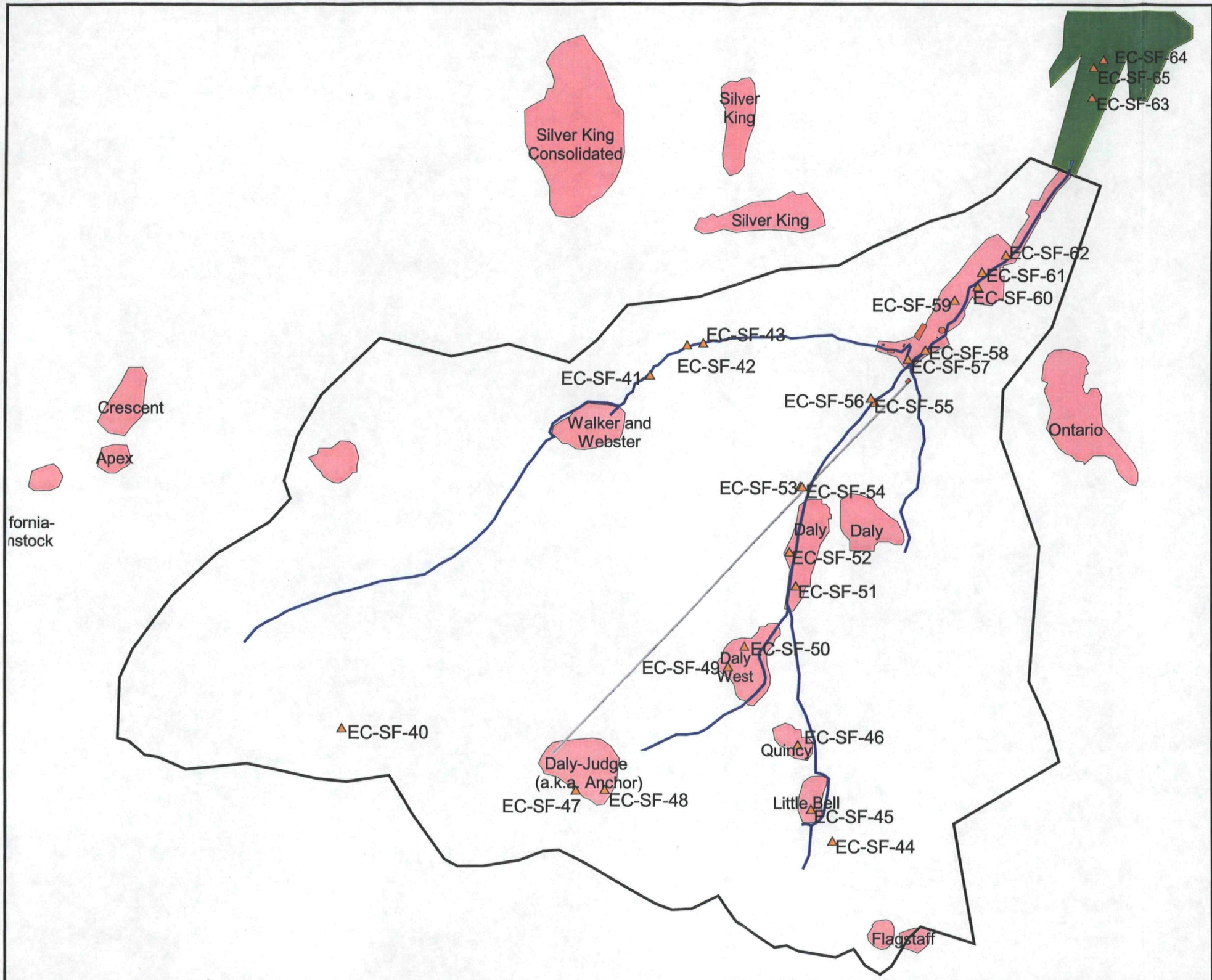
FIGURE 4

SEDIMENT SAMPLE LOCATION MAP

Empire Canyon
Summit County, Utah

by: Alan V. Jones date: 11/20/02



Utah Department of Environmental Quality

Division of Environmental Response and Remediation

FIGURE 5

SOIL SAMPLE LOCATION MAP

Empire Canyon
Summit County, Utah

by: Alan V. Jones date: 11/20/02

Table 1. Inorganic (Total Metals) Data Results for Surface Water Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	--	EC-SW-01			EC-SW-02			EC-SW-03			EC-SW-04			EC-SW-05			EC-SW-06			EC-SW-07			EC-SW-08		
	Traffic #	--	MHFD13			MHFD14			MHFD15			MHFD16			MHFD17			MHFD18			MHFD19			MHFD21		
	Sample Location	Benchmark Values	Empire Creek before entering Sediment Basin at south end of Daly Avenue			Empire Creek at Iron Gate Flume			Spring (on west side of road) at Iron Gate			Empire Creek above seeps but below ponds			Empire Creek above seeps and Judge Tunnel Turnout			Upper Daly Draw at salt injection point			Empire Creek at Empire Flume			Walker Webster Creek at Walker Webster Flume		
	Date/Time	--	5/14/01 15:25			5/14/01 15:05			4/30/01 16:50			5/14/01 14:20			5/14/01 14:00			4/30/01 15:05			5/9/01 15:05			5/14/01 12:35		
	Sample Type	SCDM	Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals		
CAS No.	analyte	µg/l	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio
7429-90-5	Aluminum	--	687		2.2	591		1.9	168		0.5	630		2.0	704		2.3	168		0.5	2650		8.5	826		2.7
7440-36-0	Antimony	--	21 .4		5.6	16 .4		4.3	16 .3		4.3	14 .1		3.7	17 .8		4.7	3 .0		0.8	111		29	31 .5		8.3
7440-38-2	Arsenic	190	15 .8		7.5	10 .6		5.0	4 .0		1.9	8 .2		3.9	4 .0		1.9	4 .0		1.9	86 .1		41	13 .6		6.5
7440-39-3	Barium	--	45 .9		0.9	42 .5		0.8	42 .7		0.8	42 .1		0.8	54 .9		1.0	42 .5		0.8	90 .4		1.7	58 .2		1.1
7440-41-7	Beryllium	--	0 .20		0.5	0 .20		0.5	0 .20		0.5	0 .20		0.5	0 .20		0.5	0 .20		0.5	0 .20		0.5	0 .20		0.5
7440-43-9	Cadmium	1.1	**12 .1**		28	**9 .2**		21	**37 .7**		88	**7 .4**		17	**9 .7**		23	0 .30		0.7	**30 .9**		72	**22 .8**		53
7440-70-2	Calcium	--	59800		13	5700		1.3	93600		21	55300		12	46900		10	27600		6.1	57700		13	77500		17
7440-47-3	Chromium	11	1 .7		1.7	1 .3		1.3	0 .70		0.7	1 .1		1.1	1 .6		1.6	0 .70		0.7	6 .9		6.9	1 .8		1.8
7440-48-4	Cobalt	--	1 .1		0.5	1 .9		0.9	1 .1		0.5	1 .1		0.5	1 .1		0.5	1 .1		0.5	1 .9		0.9	1 .1		0.5
7440-50-8	Copper	12	**31 .2**		35	**24**		27	2 .6		2.9	**18 .6**		21	**19 .5**		22	1 .3		1.4	**225**		250	**43 .5**		48
7439-89-6	Iron	1000	**1140**		6.9	926		5.6	183		1.1	820		4.9	793		4.8	68 .1		0.4	**4980**		30	**1180**		7.1
7439-92-1	Lead	3.2	**419**		466	**332**		369	**13 .4**		15	**246**		273	**455**		506	1 .5	UJ	1.7	**2010**		2233	**2040**		2267
7439-95-4	Magnesium	--	8260		6.0	7920		5.7	10900		7.9	8000		5.8	6980		5.1	6270		4.5	8150		5.9	8590		6.2
7439-96-5	Manganese	--	96 .9		27	92 .2		26	8 .6		2.4	47 .1		13	65 .6		18	4 .4		1.2	584		162	146		41
7439-97-6	Mercury	0.012	**0 .10**		1.0	**0 .10**		1.0	0 .10	UJ	1.0	**0 .10**		1.0	**0 .10**		1.0	0 .10	UJ	1.0	**0 .40**		4.0	**0 .10**		1.0
7440-02-0	Nickel	160	1 .5		0.8	1 .8		1.0	3 .7		2.1	1 .5		0.8	1 .5		0.8	1 .5		0.8	3 .8		2.1	1 .5		0.8
7440-09-7	Potassium	--	1590	J	5.0	1490	J	4.7	2090	J	6.6	1460	J	4.6	1440	J	4.6	1140	J	3.6	2000	J	6.3	1480	J	4.7
7782-49-2	Selenium	5	4 .9		2.1	3 .4		1.5	**7 .4**		3.2	3 .4		1.5	3 .4		1.5	3 .4		1.5	3 .4		1.5	3 .4		1.5
7440-22-4	Silver	4.1	1 .9		2.5	1 .1		1.5	0 .80		1.1	0 .86		1.1	1 .2		1.6	0 .80		1.1	**22 .9**		31	2 .7		3.6
7440-23-5	Sodium	--	4770	J	1.5	4350	J	1.4	7880	J	2.5	4340	J	1.4	4360	J	1.4	4450	J	1.4	3130	J	1.0	3250	J	1.0
7440-28-0	Thallium	--	3 .9		1.1	3 .9		1.1	3 .9		1.1	3 .9		1.1	3 .9		1.1	3 .9		1.1	3 .9		1.1	3 .9		1.1
7440-62-2	Vanadium	--	1 .5		0.6	1 .3		0.5	0 .90		0.3	1 .1		0.4	1 .4		0.5	0 .90		0.3	5 .7		2.1	1 .8		0.7
7440-66-2	Zinc	110	**2130**		2130	**1680**		1680	**8870**		8870	**1210**		1210	**1450**		1450	8 .7		8.7	**4840**		4840	**3430**		3430
Field Parameters	pH	not applicable	8 .29			8 .22			7 .33			8 .02			8 .30			6 .89			7 .75			8 .45		
	Conductivity (mS/cm)	not applicable	0 .387			0 .322			600			0 .360			0 .282			0 .210			0 .346			0 .407		
	Temperature (°C)	not applicable	7 .6			6 .3			5 .9			5 .9			5 .9			3 .1			8 .0			6 .8		

SCDM = Superfund Chemical Data Matrix, 6/96, Environmental Fresh Water
*ratio = The number of times the concentration of this analyte exceeds background
Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
J = Reported concentration is an estimate because quality control criteria were not met.
UJ = Reported concentration is an estimate because quality control criteria were not met. The element or compound was not detected.
BOLD = Values that exceed SCDM value.

- Background Sample
- Constiuents that exceed background by 3 times but pose no health risk
- Observed Contamination
- Observed Contamination that exceeded SCDM benchmark value

Table 1 (continued). Inorganic (Total Metals) Data Results for Surface Water Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	--	EC-SW-09			EC-SW-10			EC-SW-11			EC-SW-12			EC-SW-13		EC-SW-14			EC-SW-15			EC-SW-16		
	Traffic #	--	MHFD22			MHFD23			MHFD24			MHFD25			MHFD39		MHFD40			MHFD41			MHFD42		
	Sample Location	Benchmark Values	Little Bell Drainage at the Little Bell/Empire Confluence			Empire Creek at Little Bell/Empire Confluence			Empire Creek on Daly Mine Dump near Empire Ski Lift			Little Bell Drainiage near Ruby Ski Lift			Little Bell Drainage above Little Bell Mine BACKGROUND		Spring near Little Bell Mine			Upper Walker-Webster Gulch at McConkie Ski Lift			Upper Walker Webster Gulch below area where stream bed was reclaimed		
	Date/Time	--	5/18/01 14:00			5/18/01 14:05			5/18/01 13:50			5/18/01 13:35			5/31/01 11:40		5/31/01 11:20			5/31/01 13:40			5/31/01 14:10		
	Sample Type	SCDM	Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals		Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals		
CAS No.	analyte	µg/l	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio
7429-90-5	Aluminum	--	168		0.5	168		0.5	1580		5.1	495		1.6	311	U	391	U	1.3	39 .1		0.1	198	U	0.6
7440-36-0	Antimony	--	5 .7		1.5	51 .6		14	10 .9		2.9	3 .0		0.8	3 .8	U	1 .6		0.4	1 .6		0.4	6 .0	U	1.6
7440-38-2	Arsenic	190	4 .0		1.9	8 .7		4.1	9 .5		4.5	4 .0		1.9	2 .1		2 .1		1.0	2 .1		1.0	2 .1		1.0
7440-39-3	Barium	--	97 .2		1.8	62 .8		1.2	18 .9		0.4	17 .1		0.3	53 .9	J	32 .1	J	0.6	16 .4	J	0.3	36 .3	J	0.7
7440-41-7	Beryllium	--	0 .20		0.5	0 .20		0.5	0 .20		0.5	0 .20		0.5	0 .40		0 .40		1.0	0 .40		1.0	0 .40		1.0
7440-43-9	Cadmium	1.1	**3 .8**		8.8	**33 .3**		77	0 .80		1.9	0 .30		0.7	0 .43	U	0 .30		0.7	0 .30		0.7	**5 .0**		12
7440-70-2	Calcium	--	64200		14	162000		36	8090		1.8	7540		1.7	4490		4200		0.9	38000		8.5	59400		13
7440-47-3	Chromium	11	0 .70		0.7	0 .70		0.7	2 .2		2.2	0 .70		0.7	1 .0	U	0 .73	U	0.7	0 .73	U	0.7	0 .92	U	0.9
7440-48-4	Cobalt	--	1 .1		0.5	1 .1		0.5	1 .1		0.5	1 .1		0.5	2 .1	U	0 .30		0.1	0 .30		0.1	0 .32	U	0.2
7440-50-8	Copper	12	3 .8		4.2	9 .7		11	**19 .3**		21	4 .9		5.4	0 .90		0 .90		1.0	0 .90		1.0	3 .5		3.9
7439-89-6	Iron	1000	54 .6		0.3	54 .6		0.3	**1540**		9.3	428		2.6	166		177		1.1	12 .4	UJ	0.1	211		1.3
7439-92-1	Lead	3.2	**13 .8**		15	**30 .5**		34	**105**		117	**16 .7**		19	0 .90		0 .90		1.0	0 .90		1.0	**102**		113
7439-95-4	Magnesium	--	9080		6.6	14200		10	1460		1.1	1300		0.9	1380		1220		0.9	4860		3.5	6620		4.8
7439-96-5	Manganese	--	36 .9		10	5 .4		1.5	205		57	296		82	3 .6	U	3 .1	U	0.9	0 .15	U	0.0	14 .1		3.9
7439-97-6	Mercury	0.012	**0 .10**		1.0	**0 .10**		1.0	**0 .10**		1.0	**0 .10**		1.0	**0 .10**		**0 .10**		1.0	**0 .10**		1.0	**0 .10**		1.0
7440-02-0	Nickel	160	1 .5		0.8	1 .5		0.8	1 .5		0.8	1 .5		0.8	1 .8	U	0 .70		0.4	0 .70		0.4	0 .70		0.4
7440-09-7	Potassium	--	1190	J	3.8	2130	J	6.7	956	J	3.0	1390	J	4.4	316		190	J	0.6	413		1.3	851		2.7
7782-49-2	Selenium	5	3 .4		1.5	5 .3		2.3	3 .4		1.5	3 .4		1.5	2 .3		2 .3		1.0	2 .3		1.0	2 .3		1.0
7440-22-4	Silver	4.1	0 .80		1.1	0 .80		1.1	1 .4		1.9	0 .80		1.1	0 .75	J	0 .70	UJ	0.9	0 .70	UJ	0.9	0 .71	J	0.9
7440-23-5	Sodium	--	4450	J	1.4	6310	J	2.0	857	J	0.3	995	J	0.3	3140		2610	J	0.8	2950		0.9	2720		0.9
7440-28-0	Thallium	--	3 .9		1.1	3 .9		1.1	3 .9		1.1	3 .9		1.1	3 .5		3 .5		1.0	3 .5		1.0	3 .5		1.0
7440-62-2	Vanadium	--	0 .90		0.3	0 .90		0.3	2 .6		1.0	0 .90		0.3	2 .7	U	0 .58	U	0.2	0 .65	UJ	0.2	0 .75	U	0.3
7440-66-2	Zinc	110	**569**		569	**5100**		5100	**162**		162	35 .5		36	1 .0	UJ	1 .0	UJ	1.0	3 .9	J	3.9	**697**		697
Field Parameters	pH	not applicable	not measured			not measured			not measured			not measured			not measured		not measured			not measured			not measured		
	Conductivity (mS/cm)	not applicable	not measured			not measured			not measured			not measured			not measured		not measured			not measured			not measured		
	Temperature (°C)	not applicable	not measured			not measured			not measured			not measured			not measured		not measured			not measured			not measured		

SCDM = Superfund Chemical Data Matrix, 6/96, Environmental Fresh Water
*ratio = The number of times the concentration of this analyte exceeds background
Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
J = Reported concentration is an estimate because quality control criteria were not met.
UJ = Reported concentration is an estimate because quality control criteria were not met. The element or compound was not detected.
BOLD = Values that exceed SCDM value.

Background Sample
Constiuents that exceed background by 3 times but pose no health risk
Observed Contamination
Observed Contamination that exceeded SCDM benchmark value

Table 1 (continued). Inorganic (Total Metals) Data Results for Surface Water Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	--	EC-SW-17			EC-SW-18			EC-SW-19			EC-SW-20			EC-SW-22			EC-SW-23		
	Traffic #	--	MHFD26			MHEH53			MHEH55			MHEH57			MHFD27			MHFD43		
	Sample Location	Benchmark Values	Lower Daly Draw at culvert where Daly Draw enters Empire Creek			Judge Tunnel Turnout			Empire Creek at Empire Flume while water was being turned out from Judge Tunnel			Empire Creek at Sediment basin on Daly Avenue while water was being turned out from Judge Tunnel			Duplicate of EC-SW-08			Duplicate of EC-SW-16		
	Date/Time	--	4/30/01 15:30			6/25/01 14:40			6/25/01 14:25			6/25/01 14:00			5/14/01 12:55			5/14/01 14:30		
	Sample Type	SCDM	Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals			Surface Water Total Metals		
CAS No.	analyte	µg/l	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio	µg/l	Q	ratio
7429-90-5	Aluminum	--	221		0.7	43 .6		0.1	55 .3		0.2	114		0.4	760		2.4	112	U	0.4
7440-36-0	Antimony	--	8 .7		2.3	11 .6		3.1	13 .9		3.7	13 .4		3.5	25 .0		6.6	4 .7	U	1.2
7440-38-2	Arsenic	190	6 .4		3.0	6 .0	J	2.9	4 .0	J	1.9	4 .5	J	2.1	7 .7		3.7	2 .1		1.0
7440-39-3	Barium	--	30 .8		0.6	7 .5	J	0.1	11 .8	J	0.2	12 .5	J	0.2	51 .3		1.0	36 .2	J	0.7
7440-41-7	Beryllium	--	0 .20		0.5	0 .40		1.0	0 .40		1.0	0 .40		1.0	0 .20		0.5	0 .40		1.0
7440-43-9	Cadmium	1.1	**5 .2**		12	**2 .5**		5.8	**3 .7**		8.6	**6 .7**		16	**20 .9**		49	**5 .1**		12
7440-70-2	Calcium	--	33300		7.4	63600		14	60000		13	61700		13.7	73600		16	60400		13
7440-47-3	Chromium	11	0 .83		0.8	**14 .3**		14	9 .8		9.8	1 .0		1.0	1 .2		1.2	0 .78	U	0.8
7440-48-4	Cobalt	--	1 .1		0.5	0 .70		0.3	1 .1		0.5	0 .70		0.3	1 .1		0.5	0 .32	U	0.2
7440-50-8	Copper	12	5 .7		6.3	**16 .7**		19	11 .3		12.6	8 .7		9.7	**34 .0**		38	2 .0		2.2
7439-89-6	Iron	1000	164		1.0	306		1.8	198		1.2	179		1.1	928		5.6	74 .2	U	0.4
7439-92-1	Lead	3.2	**22 .6**		25	**9 .8**		11	**17 .5**		19	**38 .4**		43	**1360**		1511	**51 .8**		58
7439-95-4	Magnesium	--	5570		4.0	8740		6.3	8150		5.9	8330		6.0	8220		6.0	6700		4.9
7439-96-5	Manganese	--	9 .1		2.5	13 .2		3.7	8 .0		2.2	9 .8		2.7	97 .6		27	8 .5		2.4
7439-97-6	Mercury	0.012	0 .10	UJ	1.0	0 .10	UJ	1.0	0 .10	UJ	1.0	0 .10	UJ	1.0	**0 .10**		1.0	**0 .10**		1.0
7440-02-0	Nickel	160	1 .5		0.8	7 .0		3.9	5 .6		3.1	1 .4		0.8	1 .5		0.8	0 .80	U	0.4
7440-09-7	Potassium	--	1340	J	4.2	1210		3.8	1140		3.6	1220		3.9	1440	J	4.6	817		2.6
7782-49-2	Selenium	5	3 .4		1.5	4 .1	UJ	1.8	2 .8		1.2	2 .8		1.2	3 .4		1.5	2 .3		1.0
7440-22-4	Silver	4.1	0 .80		1.1	0 .50		0.7	0 .50		0.7	0 .59		79	2 .0		2.7	0 .70	UJ	0.9
7440-23-5	Sodium	--	13900	J	4.4	4170		1.3	3800		1.2	4040		1.3	3170	J	1.0	2790		0.9
7440-28-0	Thallium	--	3 .9		1.1	4 .1	UJ	1.2	4 .1	UJ	1.2	4 .1	UJ	1.2	3 .9		1.1	3 .5		1.0
7440-62-2	Vanadium	--	0 .90		0.3	0 .76		0.3	1 .3		0.5	0 .69		0.3	1 .4		0.5	0 .79	U	0.3
7440-66-2	Zinc	110	**1020**		1020	**824**		824	**897**		897	**1220**		1220	**3070**		3070	**663**		663
Field Parameters	pH	not applicable	7 .78			not measured			not measured			not measured			8 .45			not measured		
	Conductivity (mS/cm)	not applicable	0 .293			not measured			not measured			not measured			0 .407			not measured		
	Temperature (°C)	not applicable	2 .3			not measured			not measured			not measured			6 .8			not measured		

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*ratio = The number of times the concentration of this analyte exceeds background
Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
J = Reported concentration is an estimate because quality control criteria were not met.
UJ = Reported concentration is an estimate because quality control criteria were not met. The element or compound was not detected.
BOLD = Values that exceed SCDM value.

- Background Sample
- Constiuents that exceed background by 3 times but pose no health risk
- Observed Contamination
- Observed Contamination that exceeded SCDM benchmark value

Table 2. Comparison of Total and Dissolved Metals results in Surface Water samples where both were collected at the Empire Canyon Site, Park City, Utah.

	Sample #	EC-SW-07			EC-SW-18			EC-SW-19			EC-SW-20		
	Traffic #	MHFD19	MHFD20	[redacted]	MHEH53	MHEH54	[redacted]	MHEH55	MHEH56	[redacted]	MHEH57	MHEH58	[redacted]
	Sample Location	Empire Creek at Empire Flume			Judge Tunnel Turnout			Empire Creek at Empire Flume while water was being turned out from Judge Tunnel			Empire Creek at Sediment Basin on Daly Avenue while water was being turned out from Judge Tunnel		
	Date/Time	5/9/01 15:05			6/25/01 14:40			6/25/01 14:25			6/25/01 14:00		
	Sample Type	Surface Water Total Metals	Surface Water Dissolved Metals	Suspended Fraction	Surface Water Total Metals	Surface Water Dissolved Metals	Suspended Fraction	Surface Water Total Metals	Surface Water Dissolved Metals	Suspended Fraction	Surface Water Total Metals	Surface Water Dissolved Metals	Suspended Fraction
CAS No.	analyte	µg/l Q	µg/l Q	µg/l	µg/l Q	µg/l Q	µg/l	µg/l Q	µg/l Q	µg/l	µg/l Q	µg/l Q	µg/l
7429-90-5	Aluminum	2650	168	2482	43 .6	43 .6	0 .0	55 .3	43 .6	11 .7	114	49 .2	64 .8
7440-36-0	Antimony	111	25 .1	85 .9	11 .6	7 .6	4 .0	13 .9	11 .4	2 .5	13 .4	15 .0	-1 .6
7440-38-2	Arsenic	86 .1	4 .4	81 .7	6 .0 J	1 .2 UJ	6 .0	4 .0 J	2 .9 J	1 .1	4 .5 J	2 .5 J	2 .0
7440-39-3	Barium	90 .4	41 .4	49 .0	7 .5 J	6 .3 J	1 .2	11 .8 J	11 .6 J	0 .2	12 .5 J	11 .7 J	0 .8
7440-41-7	Beryllium	0 .20	0 .20	0 .00	0 .40	0 .40	0 .00	0 .40	0 .40	0 .00	0 .40	0 .40	0 .00
7440-43-9	Cadmium	30 .9	17 .8	13 .1	2 .5	2 .1	0 .4	3 .7	3 .5	0 .2	6 .7	6 .1	0 .6
7440-70-2	Calcium	57700	50500	7200	63600	60800	2800	60000	63200	-3200	61700	62300	-600
7440-47-3	Chromium	6 .9	0 .70	6 .20	14 .3	1 .0	13 .3	9 .8	3 .0	6 .8	1 .0	1 .0	0 .0
7440-48-4	Cobalt	1 .9	1 .1	0 .8	0 .70	0 .70	0 .00	1 .1	0 .70	0 .40	0 .70	0 .70	0 .00
7440-50-8	Copper	225	7 .7	217 .3	16 .7	6 .7	10 .0	11 .3	5 .9	5 .4	8 .7	2 .4	6 .3
7439-89-6	Iron	4980	54 .6	4925 .4	306	10 .6	295 .4	198	10 .6	187 .4	179	10 .6	168 .4
7439-92-1	Lead	2010	13 .7	1996 .3	9 .8	1 .8	8 .0	17 .5	1 .8	15 .7	38 .4	4 .0	34 .4
7439-95-4	Magnesium	8150	5670	2480	8740	8360	380	8150	8630	-480	8330	8360	-30
7439-96-5	Manganese	584	2 .2 U	584	13 .2	8 .0	5 .2	8 .0	3 .1	4 .9	9 .8	0 .51 U	9 .8
7439-97-6	Mercury	0 .40	0 .10	0 .30	0 .10 UJ	0 .10 UJ	0 .00	0 .10 UJ	0 .10 UJ	0 .00	0 .10 UJ	0 .10 UJ	0 .00
7440-02-0	Nickel	3 .8	1 .5	2 .3	7 .0	1 .4	5 .6	5 .6	2 .7	2 .90	1 .4	1 .4	0 .0
7440-09-7	Potassium	2000 J	1460 J	540	1210	1160	50	1140	1240	-100	1220	1220	0
7782-49-2	Selenium	3 .4	3 .4	0 .0	4 .1 UJ	2 .8	-2 .8	2 .8	4 .9	-2 .1	2 .8	4 .2	-1 .4
7440-22-4	Silver	22 .9	0 .80	22 .10	0 .50	0 .50	0 .00	0 .50	0 .74	-0 .24	0 .59	0 .66	-0 .07
7440-23-5	Sodium	3130 J	3050 J	80	4170	4050	120	3800	4360	-560	4040	4180	-140
7440-28-0	Thallium	3 .9	3 .9	0 .0	4 .1 UJ	4 .1 UJ	0 .0	4 .1 UJ	4 .1 UJ	0 .0	4 .1 UJ	4 .1 UJ	0 .0
7440-62-2	Vanadium	5 .7	0 .90	4 .8	0 .76	0 .60	0 .16	1 .3	0 .98	0 .32	0 .69	0 .60	0 .09
7440-66-2	Zinc	4840	2350	2490	824	604	220	897	582	315	1220	685	535

Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
J = Reported concentration is an estimate because quality control criteria were not met.
UJ = Reported concentration is an estimate because quality control criteria were not met. The element or compound was not detected.
Analytes where Dissolved Fraction was greater than Total Fraction

Table 3. Inorganic (Total Metals) Data Results for Sediment Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	EC-SD-24			EC-SD-25			EC-SD-26			EC-SD-27			EC-SD-28			EC-SD-29			EC-SD-30			EC-SD-31		
	Traffic #	MHFD28			MHFD29			MHFD30			MHFD31			MHFD32			MHFD33			MHFD34			MHFD35		
	Sample Location	Empire Creek before entering Sediment Basin at south end of Daly Avenue			Empire Creek at Iron Gate Flume			Empire Creek above seeps but below ponds			Empire Creek above seeps and Judge Tunnel Turnout			Upper Daly Draw at salt injection point			Empire Creek at Empire Flume			Walker Webster Creek at Walker Webster Flume			Little Bell Drainage at the Little Bell/Empire Confluence		
	Date/Time	5/14/01 15:25			5/14/01 15:05			5/14/01 14:20			5/14/01 14:00			5/14/01 13:05			5/14/01 12:50			5/14/01 12:40			5/18/01 14:00		
	Sample Type	sediment			sediment			sediment			sediment			sediment			sediment			sediment			sediment		
CAS No.	analyte	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio
7429-90-5	Aluminum	6540		0.7	6470		0.7	5870		0.6	5630		0.6	7330		0.8	8180		0.9	5660		0.6	13500		1.4
7440-36-0	Antimony	36.8	J	44	80.4	J	97	2.3	J	2.8	50.5	J	61	9.4	J	11	140	J	169	82.2	J	99	55.0	J	66
7440-38-2	Arsenic	74.6		3.3	177		7.8	21.6		1.0	96.3		4.3	22.0		1.0	276		12.2	65.1		2.9	79.3		3.5
7440-39-3	Barium	91.0		0.6	198		1.3	238		1.5	60.8		0.4	180		1.1	143		0.9	101		0.6	207		1.3
7440-41-7	Beryllium	0.36		0.6	0.43		0.7	1.8		3.0	0.23		0.4	0.51		0.9	0.43		0.7	0.30		0.5	0.72		1.2
7440-43-9	Cadmium	25.3		39	56.0		86	8.6		13	76.3		117	3.4		5.2	30.9		48	117		180	11.8		18
7440-70-2	Calcium	26200		7.9	32800		9.9	2700		0.8	54200		16	9430		2.8	29400		8.9	58100		18	10500		3.2
7440-47-3	Chromium	18.6		1.3	19.7		1.4	12.5		0.9	29.8		2.1	19.2		1.4	18.8		1.3	10.9		0.8	25.9		1.9
7440-48-4	Cobalt	12.6		1.5	14.9		1.8	85.0		10	7.3		0.9	8.4		1.0	4.9		0.6	21.9		2.6	9.0		1.1
7440-50-8	Copper	154		13	433		36	21.6		1.8	242		20	31.9		2.7	530		45	246		21	323		27
7439-89-6	Iron	16800		0.9	21600		1.2	48300		2.7	17900		1.0	10500		0.6	19300		1.1	28100		1.6	22900		1.3
7439-92-1	Lead	2960	J	93	7700	J	241	87.1	J	2.7	4670	J	146	322	J	10	5840	J	183	13500	J	423	2130	J	67
7439-95-4	Magnesium	8180		1.9	7880		1.8	5000		1.1	9840		2.2	3990		0.9	7130		1.6	7840		1.8	8870		2.0
7439-96-5	Manganese	1780		3.2	3860		7.0	9310		17	1040		1.9	1700		3.1	1670		3.0	1670		3.0	1510		2.7
7439-97-6	Mercury	0.27		3.9	1.1		16	0.07		1.0	0.11		1.6	0.49		7.0	1.1		16	0.24		3.4	0.15		2.1
7440-02-0	Nickel	18.0		2.0	17.9		2.0	75.1		8.3	8.9		1.0	12.9		1.4	10.7		1.2	12.7		1.4	14.6		1.6
7440-09-7	Potassium	881		0.9	1060		1.1	356		0.4	846		0.9	1140		1.2	1210		1.3	933		1.0	2000		2.1
7782-49-2	Selenium	1.9		1.6	3.4		2.8	2.3		1.9	2.8		2.3	1.4		1.2	1.9		1.6	6.1		5.1	1.2		1.0
7440-22-4	Silver	17.1		81	44.5		212	3.3		16	12.5		60	4.0		19	68.7		327	26.6		127	36.0		171
7440-23-5	Sodium	202		0.8	199		0.8	170		0.7	217		0.9	306		1.3	265		1.1	226		0.9	293		1.2
7440-28-0	Thallium	2.1		0.7	6.8		2.3	1.7		0.6	1.1		0.4	1.4		0.5	6.5		2.2	1.1		0.4	1.4		0.5
7440-62-2	Vanadium	14.1		0.5	15.2		0.5	6.3		0.2	13.2		0.5	13.5		0.5	18.2		0.6	12.8		0.5	31.9		1.1
7440-66-2	Zinc	4830		76	9610		152	1580		25	15100		238	345		5.4	5360		85	24200		381.7	3170		50

*ratio = The number of times the concentration of this analyte exceeds background
Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
J = Reported concentration is an estimate because quality control criteria were not met.
UJ = Reported concentration is an estimate because quality control criteria were not met. The element or compound was not detected.

Background Sample
Constiuents that exceed background by 3 times but pose no health risk
Observed Contamination

Note: SCDM (Superfund Chemical Data Matrix) gives no benchmark values for sediments

Table 3 (continued). Inorganic (Total Metals) Data Results for Sediment Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	EC-SD-32			EC-SD-33			EC-SD-34			EC-SD-35			EC-SD-36			EC-SD-37			EC-SD-38		
	Traffic #	MHFD36			MHFD37			MHFD38			MHFD44			MHFD45			MHFD46			MHFD47		
	Sample Location	Empire Creek at Little Bell/Empire Confluence			Empire Creek on Daly Mine Dump near Empire Ski Lift			Little Bell Drainiage near Ruby Ski Lift			Little Bell Drainage above Little Bell Mine BACKGROUND			Spring near Little Bell Mine			Upper Walker-Webster Gulch at McConkie Ski Lift			Upper Walker Webster Gulch below area where stream bed was reclaimed		
	Date/Time	5/18/01 14:05			5/18/01 13:50			5/18/01 13:35			5/31/01 11:40			5/31/01 11:20			5/31/01 13:40			5/31/01 14:10		
	Sample Type	sediment			sediment			sediment			sediment			sediment			sediment			sediment		
CAS No.	analyte	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio
7429-90-5	Aluminum	6140		0.7	13200		1.4	15300		1.6	9370			11200		1.2	11600		1.2	10400		1.1
7440-36-0	Antimony	94 .3	J	114	18 .2	J	22	10 .4	J	13	0 .83	J		0 .90	J	1.1	0 .48	UJ	0.6	44 .3	J	53
7440-38-2	Arsenic	139		6.2	50 .5		2.2	39 .4		1.7	22 .6			17 .8		0.8	7 .7		0.3	49 .2		2.2
7440-39-3	Barium	95 .9		0.6	128		0.8	84 .8		0.5	158			170		1.1	58 .5		0.4	57 .4		0.4
7440-41-7	Beryllium	0 .36		0.6	0 .66		1.1	0 .92		1.5	0 .60	U		0 .62	U	1.0	0 .60	U	1.0	0 .66	U	1.1
7440-43-9	Cadmium	16 .7		26	6 .8		10	2 .9		4.5	0 .65	U		1 .2	U	1.8	0 .55	U	0.8	29 .7		46
7440-70-2	Calcium	6320		1.9	16700		5.0	14200		4.3	3320			4090		1.2	4070		1.2	7310		2.2
7440-47-3	Chromium	12 .5		0.9	24 .5		1.8	33 .5		2.4	14 .0			27 .8		2.0	18 .0		1.3	17 .0		1.2
7440-48-4	Cobalt	4 .9		0.6	6 .6		0.8	8 .1		1.0	8 .4	J		11 .3		1.3	7 .7		0.9	12 .9		1.5
7440-50-8	Copper	314		26	128		11	61 .9		5.2	11 .9			20 .4	J	1.7	16 .4	J	1.4	228	J	19
7439-89-6	Iron	16100		0.9	20300		1.1	19600		1.1	18000			21700		1.2	14700		0.8	17000		0.9
7439-92-1	Lead	3380	J	106	720	J	23	438	J	14	31 .9			64 .4		2.0	46 .2		1.4	3070		96
7439-95-4	Magnesium	3760		0.9	11800		2.7	15400		3.5	4400			6870		1.6	12300		2.8	10300		2.3
7439-96-5	Manganese	1040		1.9	1250		2.3	1060		1.9	552			1010		1.8	523		0.9	939		1.7
7439-97-6	Mercury	0 .25		3.6	0 .13		1.9	0 .14		2.0	0 .070			0 .081		1.2	0 .066		0.9	0 .150		2.1
7440-02-0	Nickel	7 .5		0.8	16 .0		1.8	17 .5		1.9	9 .0			10 .8		1.2	15 .6		1.7	14 .4		1.6
7440-09-7	Potassium	956		1.0	817		0.9	1250		1.3	948		J	694	J	0.7	896	J	0.9	886	J	0.9
7782-49-2	Selenium	1 .1		0.9	1 .4		1.2	1 .3		1.1	1 .2		J	0 .94	J	0.8	0 .70	UJ	0.6	2 .5	J	2.1
7440-22-4	Silver	34 .9		166	6 .5		31	4 .9		23	0 .21		UJ	0 .48	J	2.3	0 .21	UJ	1.0	9 .2	J	44
7440-23-5	Sodium	179		0.7	175		0.7	196		0.8	242		U	202	U	0.8	187	U	0.8	53 .1	UJ	0.2
7440-28-0	Thallium	3 .9		1.3	1 .1		0.4	1 .0		0.3	2 .9		U	5 .0		1.7	2 .6	U	0.9	2 .5	U	0.9
7440-62-2	Vanadium	13 .6		0.5	25 .7		0.9	31 .6		1.1	28 .3			25 .4		0.9	20 .5		0.7	19 .2		0.7
7440-66-2	Zinc	4220		67	1150		18	549		8.7	63 .4			119		1.9	101		1.6	6080		96

*ratio = The number of times the concentration of this analyte exceeds background
Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
J = Reported concentration is an estimate because quality control criteria were not met.
UJ = Reported concentration is an estimate because quality control criteria were not met. The element or compound was not detected.
Background Sample
Constiuents that exceed background by 3 times but pose no health risk
Observed Contamination
Note: SCDM (Superfund Chemical Data Matrix) gives no benchmark values for sediments

Table 4. Inorganic (Total Metals) Data Results for Soil Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	--	--	EC-SF-40			EC-SF-41			EC-SF-42			EC-SF-43			EC-SF-44			EC-SF-45			EC-SF-46		
	Traffic #	--	--	MHEH59			MHEH60			MHEH61			MHEH62			MHEH65			MHEH66			MHEH67		
	Sample Location	Benchmark Values	Benchmark Values	Upper Walker-Webster Gulch at old working above McConkie Ski Lift			Walker-Webster Gulch at Power Pole			Walker-Webster Gulch at old working (St. Louis Mine?)			Gray deposit along stream in Walker-Webster Gulch			Little Bell Drainage above Little Bell Mine BACKGROUND			Little Bell Drainage from ore chute at Little Bell Mine			Little Bell Drainage near historical marker at New Quincy Mine		
	Date/Time	SCDM	SCDM*	7/2/01 11:10			7/2/01 13:15			7/2/01 13:35			7/2/01 14:00			10/16/01 9:00			10/16/01 9:10			10/16/01 9:40		
	Sample Type	mg/kg	mg/kg	Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil		
CAS No.	analyte	--	—	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q		mg/kg	Q	ratio	mg/kg	Q	ratio
7429-90-5	Aluminum	--	--	6640		0.5	3970		0.3	4100		0.3	1840		0.1	12300			3350		0.3	9680		0.8
7440-36-0	Antimony	31	--	1.3	J	1.4	**188**	**J**	**198**	0.88	J	0.9	**336**	**J**	**354**	0.95	UJ		**599**	**J**	**631**	12.0	J	13
7440-38-2	Arsenic	23	0.43	**35.9**		**2.2**	**164**		**10**	**16.0**		**1.0**	**79.6**		**5.0**	**16.0**			**1170**		**73**	**53.6**		**3.4**
7440-39-3	Barium	5,500	--	41.1		0.2	76.5		0.4	35.4		0.2	61.5		0.3	192			169		0.9	166		0.9
7440-41-7	Beryllium	390	0.15	**0.79**		**1.3**	**0.20**		**0.3**	**0.44**		**0.7**	0.11		0.2	**0.62**			**0.20**		**0.3**	**0.44**		**0.7**
7440-43-9	Cadmium	39	--	2.0		14	**165**		**1179**	0.44	U	3.1	**110**		**786**	0.14			**134**		**957**	5.7		41
7440-70-2	Calcium	--	--	1740		0.6	54400		19	53700		19	87100		30	2870			50700		18	6630		2.3
7440-47-3	Chromium	390	--	16.4		1.0	7.0		0.4	128		7.6	5.4		0.3	16.9			14.6		0.9	48.7		2.9
7440-48-4	Cobalt	--	--	11.9		1.4	23.3		2.7	3.8		0.4	9.2		1.1	8.5			2.1		0.2	3.6		0.4
7440-50-8	Copper	--	--	22.5	J	1.9	664	J	55	18.6	J	1.6	171	J	14	12.0	J		2520	J	210	114	J	9.5
7439-89-6	Iron	--	--	19000		1.1	30100		1.8	11800		0.7	13300		0.8	16800			8250		0.5	9730		0.6
7439-92-1	Lead	--	--	203		7.5	17500		648	52.6		1.9	11300		419	27.0			22300		826	513		19
7439-95-4	Magnesium	--	--	7290		1.3	6300		1.1	6760		1.2	5960		1.0	5790			22000		3.8	18200		3.1
7439-96-5	Manganese	11,000	--	1250		1.6	1400		1.7	99.5		0.1	1730		2.2	804			5510		6.9	1560		1.9
7439-97-6	Mercury	23	--	0.048		0.8	0.77		13	0.15		2.5	0.35		5.8	0.06	UJ		5.1	J	85	0.97	J	16
7440-02-0	Nickel	1,600	--	21.5		2.0	7.3		0.7	37.4		3.5	4.6		0.4	10.8			10.9		1.0	20.8		1.9
7440-09-7	Potassium	--	--	493	J	0.3	873	J	0.5	1970	J	1.2	623	J	0.4	1710	J		374	J	0.2	478	J	0.3
7782-49-2	Selenium	390	--	1.4	J	1.1	9.0	J	6.9	4.9	J	3.8	6.2	J	4.8	1.3			5.5		4.2	1.0		0.8
7440-22-4	Silver	390	--	0.38	J	0.4	44.0	J	44	0.25	J	0.3	19.7	J	20	1.0			241		241	9.5		9.5
7440-23-5	Sodium	--	--	320		1.5	68.8		0.3	828		3.8	70.4		0.3	216			795		3.7	230		1.1
7440-28-0	Thallium	--	--	0.82		0.8	0.84		0.8	0.81		0.8	0.86		0.9	1.0			2.7		2.7	1.0		1.0
7440-62-2	Vanadium	550	--	18.4		0.6	9.3		0.3	11.5		0.4	6.3		0.2	28.9			16.40		0.6	13.0		0.4
7440-66-2	Zinc	2,300	--	379		6.0	**29200**		**462**	150		2.4	**18900**		**299**	63.2			**51600**		**816**	1140		18

SCDM = Superfund Chemical Data Matrix, 6/96, Reference Dose Screen Concentration
SCDM* = Superfund Chemical Data Matrix, 6/96, Cancer Risk Screen Concentration
*ratio = The number of times the concentration of this analyte exceeds background
Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
J = Reported concentration is an estimate because quality control criteria were not met.
UJ = Reported concentration is an estimate because quality control criteria were not met. The element or compound was not detected.
BOLD = Analytes that exceed SCDM Reference Dose Screen Concentration and SCDM Cancer Risk Screen Concentration (where applicable) values.
BOLD = Analytes that exceed SCDM Cancer Risk Screen Concentration values.

Background Sample
Constiuents that exceed background by 3 times but pose no health risk
Observed Contamination
Observed Contamination that exceeded SCDM benchmark value

Table 4 (continued). Inorganic (Total Metals) Data Results for Soil Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	--	--	EC-SF-47			EC-SF-48			EC-SF-49			EC-SF-50			EC-SF-51			EC-SF-52			EC-SF-53		
	Traffic #	--	--	MHEH68			MHEH69			MHEH70			MHEH71			MHEH72			MHEH73			MHEH74		
	Sample Location	Benchmark Values	Benchmark Values	From Ski Run on the south side of Anchor Mine Dump			Southeast corner of Anchor Mine Dump in channel			Top of Daly West Mine Dump near head frame			Toe of Daly West Mine Dump			Small working on east side of Empire Canyon below Daly West Mine Dump			West side of Empire Canyon near access road			Working above large culvert in Empire Canyon (Massechusetts Mine?) Grey colored material		
	Date/Time	SCDM	SCDM*	10/16/01 10:15			10/16/01 11:10			10/16/01 12:25			10/16/01 12:40			10/16/01 13:00			10/16/01 13:20			10/16/01 13:35		
	Sample Type	mg/kg	mg/kg	Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil		
CAS No.	analyte	--	—	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio
7429-90-5	Aluminum	--	--	7200		0.6	5610		0.5	2680		0.2	3170		0.3	5540		0.5	3370		0.3	11100		0.9
7440-36-0	Antimony	31	--	27 .4	J	29	**45 .1**	**J**	**47**	**282**	**J**	**297**	**37 .8**	**J**	**40**	**79 .6**	**J**	**84**	**53 .1**	**J**	**56**	1 .7	UJ	1.8
7440-38-2	Arsenic	23	0.43	**62 .7**		**3.9**	**96 .2**		**6.0**	**264**		**17**	**146**		**9.1**	**90 .8**		**5.7**	**124**		**7.8**	**10**		**0.6**
7440-39-3	Barium	5,500	--	27 .2		0.1	45 .8		0.2	98 .0		0.5	108		0.6	209		1.1	334		1.7	113		0.6
7440-41-7	Beryllium	390	0.15	**0 .34**		**0.5**	**0 .30**		**0.5**	**0 .20**		**0.3**	**0 .23**		**0.4**	**0 .28**		**0.5**	**0 .20**		**0.3**	**0 .46**		**0.7**
7440-43-9	Cadmium	39	--	15 .6		111	12 .6		90	34 .2		244	15 .7		112	29 .6		211	**57 .9**		**414**	0 .24		1.7
7440-70-2	Calcium	--	--	78200		27	57100		20	61700		21	72200		25	2500		0.9	3900		1.4	85700		30
7440-47-3	Chromium	390	--	55 .2		3.3	35 .9		2.1	19 .1		1.1	23 .5		1.4	39 .6		2.3	7 .0		0.4	37 .7		2.2
7440-48-4	Cobalt	--	--	3 .6		0.4	4 .8		0.6	14 .3		1.7	6 .3		0.7	2 .8		0.3	2 .3		0.3	2 .9		0.3
7440-50-8	Copper	--	--	170	J	14	137	J	11	504	J	42	122	J	10	991	J	83	396	J	33	13 .4	J	1.1
7439-89-6	Iron	--	--	10500		0.6	15800		0.9	16800		1.0	16500		1.0	15100		0.9	5740		0.3	9940		0.6
7439-92-1	Lead	--	--	5440		201	3600		133	4290		159	2810		104	3930		146	2320		86	50 .2		1.9
7439-95-4	Magnesium	--	--	16600		2.9	9680		1.7	10100		1.7	8490		1.5	4740		0.8	1460		0.3	38500		6.6
7439-96-5	Manganese	11,000	--	1170		1.5	1510		1.9	2190		2.7	1730		2.2	4720		5.9	5360		6.7	217		0.3
7439-97-6	Mercury	23	--	2 .0	J	33	0 .82	J	14	1 .7	J	28	0 .37	J	0.0	0 .88	J	15	0 .81	J	14	0 .22	J	3.7
7440-02-0	Nickel	1,600	--	12 .1		1.1	14 .6		1.4	11 .6		1.1	15 .2		1.4	9 .3		0.9	7 .7		0.7	14 .4		1.3
7440-09-7	Potassium	--	--	269	J	0.2	588	J	0.3	490	J	0.3	367	J	0.2	402	J	0.2	524	J	0.3	799	J	0.5
7782-49-2	Selenium	390	--	2 .2		1.7	3 .6		2.8	8 .9		6.8	5 .6		3.8	1 .8		1.4	1 .8		1.4	2 .3		1.8
7440-22-4	Silver	390	--	16 .5		17	19 .9		20	65 .8		66	25 .3		25	112		112	62 .7		63	0 .95		1.0
7440-23-5	Sodium	--	--	195		0.9	197		0.9	213		1.0	197		0.9	409		1.9	176		0.8	361		1.7
7440-28-0	Thallium	--	--	0 .99		1.0	1 .0		1.0	7 .2		7.2	5 .9		5.0	1 .0		1.0	1 .0		1.0	0 .96		1.0
7440-62-2	Vanadium	550	--	16 .9		0.6	14 .5		0.5	8 .7		0.3	11 .2		0.4	33 .5		1.2	8 .5		0.3	15 .4		0.5
7440-66-2	Zinc	2,300	--	2070		33	**2420**		**38**	**5360**		**85**	**2410**		**38**	**6980**		**110**	**4900**		**78**	75 .3		1.2

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SCDM* = Superfund Chemical Data Matrix, 6/96, Cancer Risk Screen Concentration
*ratio = The number of times the concentration of this analyte exceeds background
Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
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BOLD = Analytes that exceed SCDM Cancer Risk Screen Concentration values.

- Background Sample
- Constiuents that exceed background by 3 times but pose no health risk
- Observed Contamination
- Observed Contamination that exceeded SCDM benchmark value

Table 4 (continued). Inorganic (Total Metals) Data Results for Soil Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	--	--	EC-SF-54			EC-SF-55			EC-SF-56			EC-SF-57			EC-SF-58			EC-SF-59		
	Traffic #	--	--	MHEH75			MHEH76			MHEH77			MHEH78			MHEH79			MHEH80		
	Sample Location	Benchmark Values	Benchmark Values	Working above large culvert in Empire Canyon (Massechusetts Mine?) Black colored material			Just above storm sewer catch basin at power pole 66, east side of canyon			Just above storm sewer catch basin at power pole 66, west side of canyon			At confluence of Walker-Webster Gulch and Empire Canyon			100' above switchback in road			Between water supply storage tank and Iron Gate		
	Date/Time	SCDM	SCDM*	10/16/01 13:45			10/16/01 14:10			10/16/01 14:25			10/16/01 14:50			10/16/01 15:05			10/16/01 15:15		
	Sample Type	mg/kg	mg/kg	Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil		
CAS No.	analyte	--	—	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio
7429-90-5	Aluminum	--	--	16600		1.3	6540		0.5	12200		1.0	5890		0.5	3270		0.3	891		0.1
7440-36-0	Antimony	31	--	5.7	J	6.0	**415**	**J**	**437**	21.7	J	23	**41.2**	**J**	**43**	**96.5**	**J**	**102**	**742**	**J**	**781**
7440-38-2	Arsenic	23	0.43	**17.3**		**1.1**	**688**		**43**	**74.4**		**4.7**	**66.4**		**4.2**	**73.7**		**4.6**	**761**		**48**
7440-39-3	Barium	5,500	--	471		2.5	107		0.6	238		1.2	999		5.2	55.3		0.3	84.4		0.4
7440-41-7	Beryllium	390	0.15	**0.61**		**1.0**	**0.39**		**0.6**	**0.71**		**1.1**	**0.43**		**0.7**	**0.21**		**0.3**	0.06		0.1
7440-43-9	Cadmium	39	--	1.6		11.4	**128**		**914**	14.1		101	12.5		89	**79.9**		**571**	**133**		**950**
7440-70-2	Calcium	--	--	67600		24	12300		4.3	9850		3.4	67200		23	66200		23	918		0.3
7440-47-3	Chromium	390	--	20.7		1.2	19.3		1.1	22.7		1.3	45.0		2.7	13.7		0.8	5.1		0.3
7440-48-4	Cobalt	--	--	3.2		0.4	4.2		0.5	8.6		1.0	6.0		0.7	8.9		1.0	0.44		0.1
7440-50-8	Copper	--	--	83.5	J	7.0	1590	J	133	247		21	502		42	227		19	1340	J	112
7439-89-6	Iron	--	--	11400		0.7	20600		1.2	19100		1.1	45700		2.7	13500		0.8	81700		4.9
7439-92-1	Lead	--	--	231		8.6	9880		366	1930		71	7660		284	6680		247	171000		6333
7439-95-4	Magnesium	--	--	8680		1.5	6260		1.1	7870		1.4	9630		1.7	7380		1.3	1230		0.2
7439-96-5	Manganese	11,000	--	956		1.2	1430		1.8	2750		3.4	532		0.7	1560		1.9	186		0.2
7439-97-6	Mercury	23	--	0.15	J	2.5	3.8	J	63	0.38		6.3	0.39		6.5	0.15		2.5	2.8	J	47
7440-02-0	Nickel	1,600	--	10.4		1.0	11.3		1.0	13.7		1.3	17.7		1.6	8.0		0.7	1.5		0.1
7440-09-7	Potassium	--	--	545	J	0.3	848	J	0.5	2180	J	1.3	948	J	0.6	537	J	0.3	2330	J	1.4
7782-49-2	Selenium	390	--	2.0		1.5	2.1		1.6	1.4	J	1.1	4.6	J	3.5	3.1	J	2.4	34.7		27
7440-22-4	Silver	390	--	8.5		8.5	177		177	13.9		14	23.2		23	14.2		14	338		338
7440-23-5	Sodium	--	--	412		1.9	524		2.4	269	U	1.2	479		2.2	429	U	2.0	522		2.4
7440-28-0	Thallium	--	--	1.1		1.1	9.7		9.7	1.0		1.0	0.93		0.9	1.6		1.6	7.8		7.8
7440-62-2	Vanadium	550	--	22.1		0.8	13.8		0.5	27.4	J	0.9	28.4	J	1.0	8.8	J	0.3	10.5		0.4
7440-66-2	Zinc	2,300	--	333		5.3	**19400**		**307**	2040		32	**2820**		**45**	**13100**		**207**	**20600**		**326**

SCDM = Superfund Chemical Data Matrix, 6/96, Reference Dose Screen Concentration
SCDM* = Superfund Chemical Data Matrix, 6/96, Cancer Risk Screen Concentration
*ratio = The number of times the concentration of this analyte exceeds background
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U = Undetected. Reported value is the detection limit.
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- Background Sample
- Constiuents that exceed background by 3 times but pose no health risk
- Observed Contamination
- Observed Contamination that exceeded SCDM benchmark value

Table 4 (continued). Inorganic (Total Metals) Data Results for Soil Collected at the Empire Canyon Site, Park City, Utah.

	Sample #	--	--	EC-SF-60			EC-SF-61			EC-SF-62			EC-SF-63			EC-SF-64			EC-SF-65		
	Traffic #	--	--	MHEH81			MHEH82			MHEH83			MHEH84			MHEH85			MHEH86		
	Sample Location	Benchmark Values	Benchmark Values	South of Iron Gate on east side of Empire Canyon (American Flag Mine?)			West side of Empire Canyon at the Iron Gate			Orange waste material north of Iron Gate			SE corner of house at 249 Daly Avenue			Front yard of house at 167 Daly Avenue			Beneath grass between house and garage at 180 Daly Avenue		
	Date/Time	SCDM	SCDM*	10/16/01 15:30			10/16/01 15:35			10/16/01 15:50			9/4/01 9:30			9/4/01 9:45			9/4/01 10:00		
	Sample Type	mg/kg	mg/kg	Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil			Surface Soil		
CAS No.	analyte	--	—	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio	mg/kg	Q	ratio
7429-90-5	Aluminum	--	--	854		0.1	7650		0.6	2520		0.2	8630		0.7	8360		0.7	14200		1.2
7440-36-0	Antimony	31	--	**93 .6**	J	**99**	21 .9	J	23	**228**	J	**240**	4 .3	J	4.5	27 .5	J	29	30 .0	J	32
7440-38-2	Arsenic	23	0.43	**194**		**12**	**44 .0**		**2.8**	**571**		**36**	**22 .4**		**1.4**	**74 .8**		**4.7**	**108**		**6.8**
7440-39-3	Barium	5,500	--	337		1.8	85 .0		0.4	62 .4		0.3	151		0.8	184		1.0	204		1.1
7440-41-7	Beryllium	390	0.15	**0 .27**		**0.4**	**0 .44**		**0.7**	0 .07		0.1	**0 .57**		**0.9**	**0 .53**		**0.9**	**0 .82**		**1.3**
7440-43-9	Cadmium	39	--	**127**		**907**	4 .9		35	0 .75	J	5.4	3 .3		24	15 .7		112	36 .6		261
7440-70-2	Calcium	--	--	32200		11	56800		20	47000		16	4160		1.4	23900		8.3	7030		2.4
7440-47-3	Chromium	390	--	9 .2		0.5	48 .5		2.9	39 .7		2.3	14 .7		0.9	55 .8		3.3	20 .7		1.2
7440-48-4	Cobalt	--	--	6 .2		0.7	14 .9		1.8	0 .46		0.1	6 .7		0.8	7 .1		0.8	10 .2		1.2
7440-50-8	Copper	--	--	240		20	163		14	289		24	37 .7		3.1	424		35	275		23
7439-89-6	Iron	--	--	11300		0.7	20300		1.2	96900		5.8	13500		0.8	33700		2.0	21500		1.3
7439-92-1	Lead	--	--	5230		194	1850		69	7900		293	291		11	1590		59	2670		99
7439-95-4	Magnesium	--	--	13100		2.3	20100		3.5	4210		0.7	5940		1.0	8070		1.4	7080		1.2
7439-96-5	Manganese	11,000	--	9640		12	358		0.4	119		0.1	1140		1.4	2020		2.5	1340		1.7
7439-97-6	Mercury	23	--	4 .3		72	0 .2		3.3	0 .49		8.2	0 .51		8.5	1 .6		27	1 .2		20
7440-02-0	Nickel	1,600	--	16 .1		1.5	20 .0		1.9	2 .3	J	0.2	15 .3		1.4	14 .6		1.4	19 .3		1.8
7440-09-7	Potassium	--	--	409	J	0.2	1040	J	0.6	2290	J	1.3	1270	J	0.7	1920	J	1.1	2580	J	1.5
7782-49-2	Selenium	390	--	7 .7	J	5.9	15 .7	J	12	27 .1	J	21	1 .1	UJ	0.8	1 .1	UJ	0.8	1 .3	J	1.0
7440-22-4	Silver	390	--	78 .6		79	11 .0		11	42 .9		43	3 .2		3.2	14 .0		14	16 .3		16
7440-23-5	Sodium	--	--	326		1.5	489		2.3	335		1.6	391		1.8	485		2.2	313		1.4
7440-28-0	Thallium	--	--	14 .7		15	1 .1		1.1	1 .6		1.6	1 .1		1.1	1 .1		1.1	1 .2		1.2
7440-62-2	Vanadium	550	--	7 .4	J	0.3	15 .8	J	0.5	9 .8	J	0.3	17 .9	J	0.6	102	J	3.5	29 .3	J	1.0
7440-66-2	Zinc	2,300	--	**8380**		**133**	602		9.5	263		4.2	552		8.7	**2940**		**47**	**4590**		**73**

SCDM = Superfund Chemical Data Matrix, 6/96, Reference Dose Screen Concentration
SCDM* = Superfund Chemical Data Matrix, 6/96, Cancer Risk Screen Concentration
*ratio = The number of times the concentration of this analyte exceeds background
Q = Data Qualifer
U = Undetected. Reported value is the detection limit.
J = Reported concentration is an estimate because quality control criteria were not met.
UJ = Reported concentration is an estimate because quality control criteria were not met. The element or compound was not detected.
BOLD = Analytes that exceed SCDM Reference Dose Screen Concentration and SCDM Cancer Risk Screen Concentration (where applicable) values.
BOLD = Analytes that exceed SCDM Cancer Risk Screen Concentration values.
Background Sample
Constiuents that exceed background by 3 times but pose no health risk
Observed Contamination
Observed Contamination that exceeded SCDM benchmark value

Appendix A

Site Inspection Data Summary

SITE INSPECTION DATA SUMMARY

Site Name: Empire Canyon EPA Region: VIII Date: 11/21/2002

State Office or Contractor Name and Address: Utah Division of Environmental Response and Remediation; 168 North 1950 West; Salt Lake City, Utah 84114-4840

GENERAL SITE INFORMATION

1. **CERCLIS ID Number:** UT0002005981

   Address: _____ City: Park City

   County: Summit State: UT Zip Code: 84060 Cong. Dist.: UT01

2. **Owner Name:** United Park City Mines

   Owner Address: P.O. Box 1450 City: Park City State: UT

   Operator Name: same

   Operator Address: _____ City: _____ State: UT

3. **Type of Ownership** (check all that apply):

   ☒ Private ☐ Municipal ☐ County ☐ State

   ☐ Federal/Agency Name: _____ ☐ Other: _____

   References: Gee, 2001

4. **Approximate size of Property:** 1700 acres.

   References: GIS, 2002

5. **Latitude:** 40° 38′ 40″
   Longitude: 111° 29′ 38″

   References: Thiros, 2000

6. **Status:** ☐ Active ☒ Inactive ☐ Unknown

   References: Gee, 2001

7. **Years of Operation:** From: 1880 To: 1950

   References: Thompson and Buck, 1968

8. **Previous Investigations:**

TYPE	AGENCY/STATE/CONTRACTORS	DATE	REFERENCES
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

WASTE SOURCE INFORMATION

1. **Waste source types** (check all that apply):

☐ Constituent ☐ Wastestream (type): _____

☐ Landfill ☐ Tanks or non-drum containers (type):

☐ Drums ☐ Pile (type):

☐ Contaminated Soil ☐ Surface Impoundment (buried)

☐ Land Treatment ☐ Surface Impoundment (backfilled)

☒ Other: Mine waste rock piles

References: Gee, 2001

2. **Types of wastes** (check all that apply):

☐ Organic Chemicals ☐ Inorganic Chemicals ☐ Municipal Wastes

☐ Pesticides/Herbicides ☒ Metals ☐ Solvents

☐ Radionuclides ☐ Other: _____

References: Jones, 2002

3. **Summarize history of waste disposal operations:** This is a historic mining area and most of the waste material was simply dumped into the canyon.

References: Gee, 2001

4. **Source characterization** (Attach pages to show quantity and calculations):

Source 1 name: Uncapped/unremediated mining waste rock piles
Source Type: mining waste rock piles

Describe Source: Uncapped and unlined waste rock piles associated with historic mining

Ground water migration containment: none

Surface water migration containment: none

Air migration (gas and migration) containment: none

Physical State of Wastes:
☒ Solid ☐ Liquid ☐ Sludge/Slurry ☐ Gas ☐ Unknown

Constituent Quantity of Hazardous Substances: _____ (specify units).

Wastestream Quantity Containing Hazardous Substances: _____ (specify units).

Volume of Source (yd^3): _____ Area of Source (ft^2): 3,417,750

Hazardous substances associated with source 1: lead, arsenic, cadmium, zinc, and other metals

References: Jones, 2002

Source 2 name: _____ Source Type: _____

Describe Source: _____

Ground water migration containment: _____

Surface water migration containment: _____

Air migration (gas and migration) containment: _____

Physical State of Wastes:
☐ Solid ☐ Liquid ☐ Sludge/Slurry ☐ Gas ☐ Unknown

Constituent Quantity of Hazardous Substances: _____ (specify units).

Wastestream Quantity Containing Hazardous Substances: _____ (specify units).

Volume of Source (yd^3): _____Area of Source (ft^2): _____

Hazardous substances associated with source 1: _____

References: _____

Source 3 name: _____ Source Type: _____

Describe Source: _____

Ground water migration containment: _____

Surface water migration containment: _____

Air migration (gas and migration) containment: _____

Physical State of Wastes:
☐ Solid ☐ Liquid ☐ Sludge/Slurry ☐ Gas ☐ Unknown

Constituent Quantity of Hazardous Substances: _____ (specify units).

Wastestream Quantity Containing Hazardous Substances: _____ (specify units).

Volume of Source (yd^3): _____Area of Source (ft^2): _____

Hazardous substances associated with source 1: _____

References: _____

5. **Description of removal or remedial activities:**
If Removal has occurred, identify the removal authority and describe the activities. Specify the date(s) of the removal.

none

References: _____

GROUND WATER INFORMATION

1. Ground water drinking water use within 4 miles of site sources:

☒ Municipal ☐ Private ☐ Both ☐ No Drinking Water Use

References: Thiros, 2000

2. Is ground water contaminated?

☐ Yes ☐ No ☒ Uncertain but likely ☐ Uncertain but not likely

☐ Additional sampling required

Is analytical evidence available? ☒ Yes ☐ No

References: Thiros, 2000

3. Is ground water contamination attributable to the site?

☒ Yes ☐ No ☐ Additional sampling required

References: Jones, 2002

4. Are drinking water wells contaminated?

☐ Yes ☐ No ☐ Uncertain but likely ☐ Uncertain but not likely

☒ Additional sampling required

Is analytical evidence available? ☐ Yes ☒ No

References: _____

5. Net precipitation (HRS Section 3.1.2.2): _____ inches.

6. County average number of persons per residence: __ people.

References: _____

7. Discuss general stratigraphy underlying the site. Attach sketch of stratigraphic column.

Thin alluvium overlying bedrock

Reference: Bromfield, 1968

8. **Using Table GW-1, summarize geology underlying the site (starting with formation #1 closest to ground surface). Indicate if formation is interconnected with overlying formation.**

TABLE GW-1: SITE GEOLOGY

NAME OF FORMATION	INTERCONNECT (YES/NO)	TYPE OF MATERIAL	AVERAGE THICKNESS (FEET)	HYDRAULIC CONDUCTIVITY (cm/sec)	USED FOR DRINKING WATER?
Alluvium		Alluvuim	<30		no
Weber Quartzite		Bedrock			yes

References: Jones, 2002

9. **Does a karst aquifer underlie any site source?**

☐ Yes ☒ No References: _____

10. **Depth to top of aquifer:** _____ feet Elevation: _____ feet

References: _____

11. **In the table below, enter the number of people obtaining drinking water from wells located within 4 miles of the site.** For each aquifer, attach population calculation sheets. Key aquifer to formations listed in Table GW-1.

POPULATION SERVED BY WELLS WITHIN DISTANCE CATEGORIES BY AQUIFER

DISTANCE OF WELL(S) FROM SITE SOURCES	AQUIFER A: INCLUDES FORMATIONS _____	AQUIFER B: INCLUDES FORMATIONS _____	AQUIFER C: INCLUDES FORMATIONS _____
¼-mile or less			
>¼ to ½ mile			
>½ to 1 mile			
>1 to 2 miles			
>2 to 3 miles			
>3 to 4 miles			

References: _____

12. **Is ground water from multiple wells blended prior to distribution?**

☒ Yes ☐ No References: _____

13. **Is ground water blended with surface water?**

☐ Yes ☒ No References: _____

14. **Distance from any incompletely contained source available to ground water to nearest drinking water well** (HRS Section 3.3.1):

0 feet References: _____

15. Briefly describe standby drinking water wells within 4 miles of sources at the site:

Judge Tunnel is a mine drainage tunnel that is used for drinking water

References: _____

16. Ground water resources within 4 miles of site sources (HRS Section 3.3.3):

☐ Irrigation (5-acre minimum) of commercial food or commercial forage crops.

☐ Commercial livestock watering.

☐ Ingredient in commercial food preparation.

☐ Supply for commercial aquaculture.

☐ Supply for major or designated water recreation area, excluding drinking water use.

☐ Water usable for drinking water but no drinking water wells are within 4 miles.

☒ None of the above.

References: Jones, 2002

17. Wellhead protection area (WHPA) within 4 miles of site sources (HRS Section 3.3.4):

☐ Source with non-zero containment factor value lies within or above the WHPA.

☐ Observed ground water contamination attributable to site source(s) lies within the WHPA.

☒ WHPA lies within 4 miles of site sources.

☐ None

References: _____

Additional ground water pathway description: _____

References: _____

SURFACE WATER INFORMATION

COMPLETE A COPY OF THIS SECTION OF THE DATA SUMMARY FOR EACH WATERSHED

1. **Describe the surface water migration path from site sources to at least 15 miles downstream.** Attach a sketch of the surface water migration route.

   Surface water in the canyon is ephemeral but when water is flowing it flows into Silver Creek 1.5 miles down gradient. Silver Creek enters the Weber River but after 15 miles.

   References: Thiros, 2000

2. **Is Surface Water Contaminated?**

   ☒ Yes ☐ No ☐ Uncertain but likely ☐ Uncertain but not likely

   ☐ Additional sampling is required

   Is analytical evidence available? ☒ Yes ☐ No

   References: Jones, 2002

3. **Is surface water contamination attributable to the site?**

   ☒ Yes ☐ No ☐ Additional sampling required

   References: Jones, 2002

4. **Floodplain category in which site sources are located** (check all that apply):

   ☒ 1-year ☐ 10-year ☐ 100-year ☐ 500-year ☐ None

   References: Jones, 2002

5. **Describe flood containment for each source** (HRS Section 4.1.2.1.2.2):

   Source #1 Mining wastes Flood Containment none

   Source #2 _____ Flood Containment _____

   References: Jones, 2002

6. **Shortest overland distance to surface water from any source** (HRS Section 4.1.2.1.2.1.3):

   0 feet References: Jones, 2002

7. **Size of drainage area** (HRS Section 4.4.3):

   1700 acres References: GIS, 2002

8. **Describe the predominant soil group within the drainage area** (HRS Section 4.1.2.1.2.1.2):

   Thin alluvuim much of which is derived from mining waste

   References: Jones, 2002

9. **2-year 24-hour Rainfall** (HRS Section 4.1.2.1.2.1.2): _____ inches

Reference: _____

10. **Elevation of the bottom of nearest surface water body:** _____ feet above sea level

References: _____

11. **Elevation of top of uppermost aquifer:** _____ feet above sea level

References: _____

12. **Predominant type of water body between probable point of entry to surface water and nearest drinking water intake:**

☒ River ☐ Lake References: Jones, 2002

13. **Identify all drinking water intakes, fisheries, and sensitive environments within 15 miles downstream.**

TARGET NAME/TYPE	WATER BODY TYPE	DISTANCE FROM PPE	FLOW (CFS)	TARGET CHARACTERISTICS	TARGET SAMPLED?
Silver Creek	stream	1.5		fishery and wetlands	no

* If target is a drinking water intake, provide number of people served by intake. If target is a fishery, provide species and annual production of human food chain organisms (pounds per year). If target is a wetland, specify wetland frontage (in miles). Attach calculation pages.

References: Jones, 2002

14. **Is surface water drinking water blended prior to distribution?**

☐ Yes ☐ No References: _____

15. **Describe any standby drinking water intakes within 15 miles downstream:**

_____

References: _____

16. **Surface water resources within 15 miles downstream** (HRS Section 4.1.2.3.3):

☐ Irrigation (5 acres minimum) of commercial food or commercial forage crops

☐ Commercial livestock watering

☐ Ingredient in commercial food preparation

☐ Major or designated water recreation area, excluding drinking water use

☐ Water designated by the state for drinking water use but is not currently used

☐ Water usable for drinking water but no drinking water intakes within 15 miles downstream

☒ None of the above

References: Jones, 2002

SOIL EVALUATION

1. **Is surficial or soil contamination present at the site?**

   ☒ Yes ☐ No ☐ Uncertain but likely ☐ Uncertain but not likely

   ☐ Additional sampling is required

   Is analytical evidence available? ☒ Yes ☐ No

   References: Jones, 2002

2. **Is surficial or soil contamination attributable to the site?**

   ☒ Yes ☐ No ☐ Additional Sampling Required

3. **Is surficial contamination on the property and within 200 feet of a residence, school, daycare center, or workplace?**

   ☒ Yes ☐ No ☐ Uncertain but likely ☐ Uncertain but not likely

   ☐ Additional sampling is required

   Is analytical evidence available? ☒ Yes ☐ No

   References: Jones, 2002

4. **Total area of surficial contamination** (HRS Section 5.2.1.2):

   3,417,750 square feet References: GIS, 2002

5. **Attractiveness/accessibility of the areas of observed contamination** (HRS Section 5.2.1.1). Check all that apply:

   ☐ Designated recreational area

   ☒ Used regularly, or accessible and unique recreational area

   ☐ Moderately accessible with some use

   ☐ Slightly accessible with some use

   ☐ Accessible with no use

   ☐ Inaccessible with some use

   ☐ Inaccessible with no use References: Gee, 2001

6. **Population within 1-mile travel distance from site.**

DISTANCE FROM SITE SOURCES	POPULATION
¼ mile or less	119
¼ to ½ mile	284
½ to 1 mile	684

References: Jones, 2002

AIR INFORMATION

1. **Is air contamination present at the site?**

☐ Yes ☐ No ☒ Uncertain but likely ☐ Uncertain but not likely

☒ Additional sampling is required

Is analytical evidence available? ☐ Yes ☒ No

References: Jones, 2002

2. **Is air contamination attributable to the site?**

☐ Yes ☐No ☒ Additional sampling required

3. **Are populations, sensitive environments, or wetlands exposed to airborne hazardous substances released from the site?**

☐ Yes ☐ No ☒ Uncertain but likely ☐ Uncertain but not likely

☒ Additional sampling is required

Is analytical evidence available? ☐ Yes ☒ No

References: Jones, 2002

4. **Evidence of biogas release from any of the following source types at the site:**

☐ Below-ground containers or tanks ☐ Landfill

☐ Buried surface impoundment

References: _____

5. **Particulate migration potential factor value:** _____ (HRS Figure 6-2)

6. **Particulate mobility factor value:** _____ (HRS Figure 6-3)

7. **Distance from any incompletely contained source to nearest residence or regularly occupied area:**

.25 miles References: Jones, 2002

8. **Population within 4 miles of site sources.**

DISTANCE FROM SITE SOURCES	POPULATION
0 (within sources)	0
¼ mile or less	119
>¼ to 2 mile	284
>½ to 1 mile	684
>1 to 2 miles	1682
>2 to 3 miles	3779

>3 to 4 miles	1492

References: Jones, 2002

9. Resources within 2 mile of site sources (HRS Section 6.3.3):

☐ Commercial agriculture

☐ Commercial silviculture

☒ Major or designated recreation area

☐ None of the above

References: Jones, 2002

10. Sensitive environments and wetlands within 4 miles of the site:

NAME/DESCRIPTION/ LOCATION OF SENSITIVE ENVIRONMENT OR WETLAND	DISTANCE FROM SITE (MILES)	TYPE OF SENSITIVE ENVIRONMENT	WETLAND SIZE (ACRES)

References: _____

LIST OF REFERENCES

Bromfield, C.S.; 1968; General Geology of the Park City Region, Utah; Utah Geological Society Guidebook to the Geology of Utah, no. 22.

Gee, Kerry; 2001; Vice President, United Park City Mines Company; Personal Communication with Alan V. Jones on various dates.

GIS (Geographic Information System); 2002; Calculated using ARCView GIS available at the Utah Utah Department of Environmental Quality, Division of Environmental Response and Remediation; Salt Lake City.

Jones, Alan V.; 2002; Expanded Site Inspection Analytical Results Report for Empire Canyon (UT0002005981); Utah Department of Environmental Quality, Division of Environmental Response and Remediation; Salt Lake City; OR from field observations made while preparing report.

Thiros, Jim; 2000; Preliminary Assessment Report for Empire Canyon (UT0002005981); Utah Department of Environmental Quality, Division of Environmental Response and Remediation; Salt Lake City; September 28.

Thompson, George A. and Buck Fraser; 1968; Treasure Mountain Home: A Centennial History of Park City, Utah; Deseret Book, Salt Lake City, Utah.

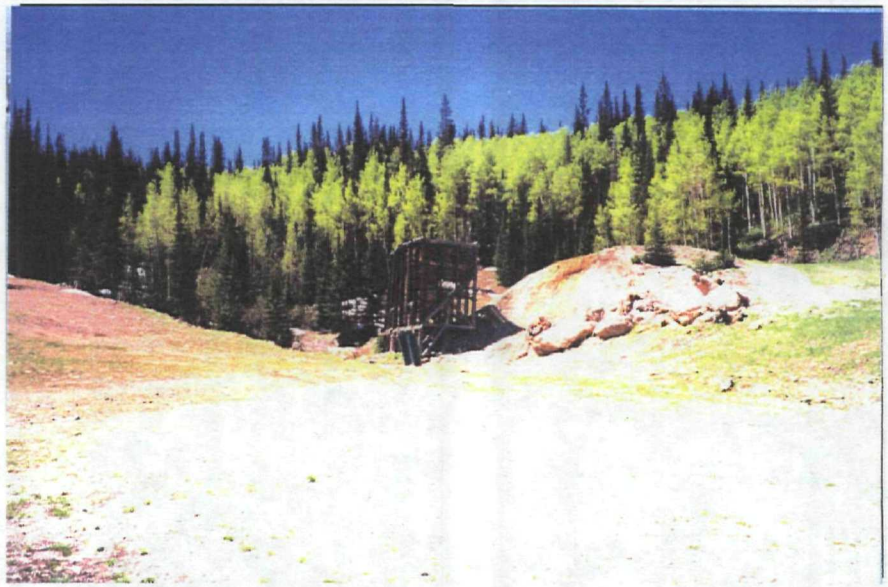
Appendix B

Log of Photographs

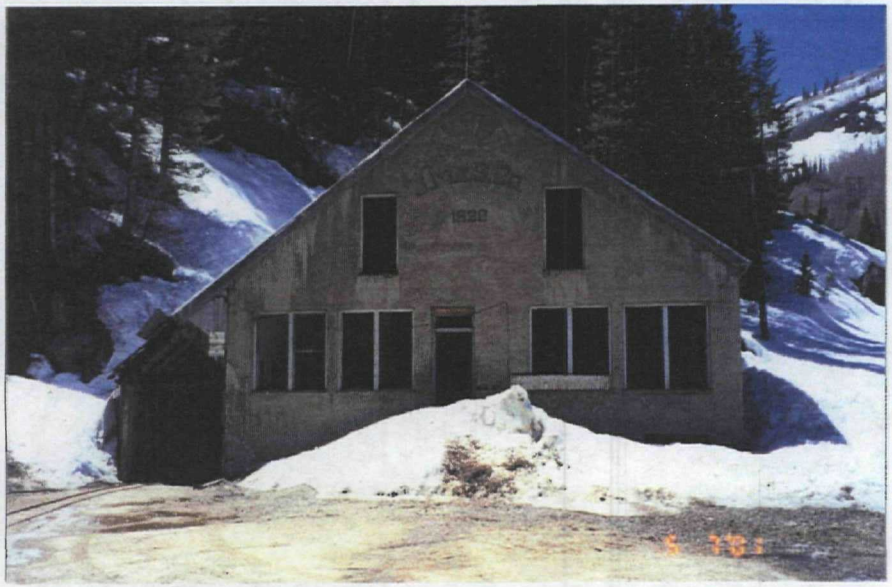
Empire Canyon View: E 5/14/2001
Sampler used during dye tracer test near Judge Tunnel turnout.

Empire Canyon View: E 5/5752001
Sampler used during dye tracer test below seeps near the Iron Gate.

Empire Canyon View: SW 6/4/2001
Sampler used during dye tracer test on reclaimed Walker and Webster Mine waste rock pile.



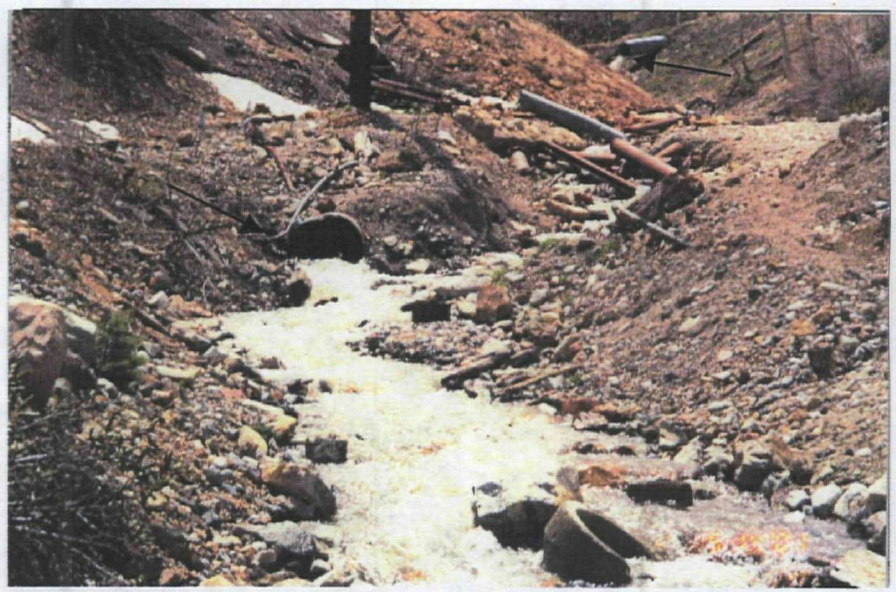
Empire Canyon View: S 5/31/2001
Ore Chute at the Little Bell Mine.



Empire Canyon View: S 5/7/2001
Judge Tunnel (on left side of building) at the old Judge Mining and Smelting Company Building.

Empire Canyon View: W 5/7/2001
Spring at Iron Gate. Surface-water sample EC-SW-03 was collected here

Empire Canyon View: N 5/14/2001
Water from Walker and Webster Gulch emptying into Empire Creek at the lower confluence.



Empire Canyon View: S 5/14/2001
Lower Confluence with water from Daly Draw (left) and Walker and Webster Gulch (right) entering Empire Creek.

Empire Canyon View: E 5/14/2001
Daly Draw at location where EC-SW-06 and EC-SD-28 were collected and the salt for Salt Tracer Test was injected.

Empire Canyon View: SE 5/7/2001
Daly Draw flume

Empire Canyon View: E 5/14/2001
Daly Draw Flume. Notice snowmelt over week since previous photo.

Empire Canyon View: E 5/18/2001
Daly Draw flume. Notice that runoff is now overflowing the dike for the flume.

Empire Canyon View: E 5/7/2001
Iron gate flume.

Empire Canyon View: W 5/14/2001
Walker and Webster flume. Samples EC-SW-08, EC-SW-22, and EC-SD-30 were collected here. Notice old cabin in background.

Empire Canyon View: W 5/14/2001
Walker and Webster flume along side of core storage building.

Empire Canyon View: S 5/14/2001
Empire flume. Samples EC-SW-07 and EC-SD-29 collected here.

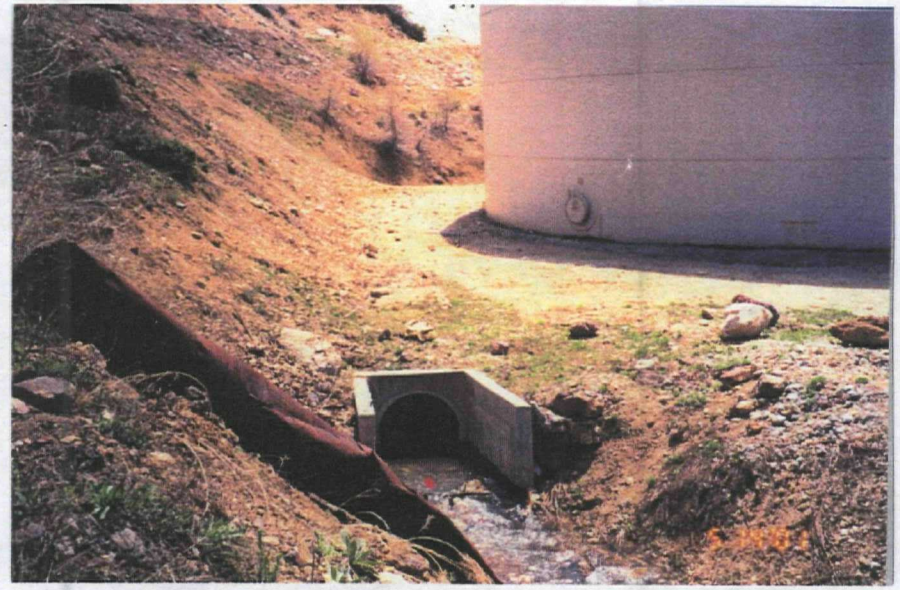
Empire Canyon View: Vertical 5/14/2001
Samples EC-SW-01 and EC-SD-24 at sample location. Sample EC-SW-20 was also collected here at a later date

Empire Canyon View: N 5/14/2001
Catch Basin Pond at the end of Daly Avenue showing sampling location of samples EC-SW-01, EC-SW-20, and EC-SD-24.

Empire Canyon View: Vertical 5/14/2001
Samples EC-SW-02 and EC-SD-25 at Iron Gate flume. Sample EC-SW-19 was collected here at a later date.

Empire Canyon View: N 5/14/2001
Samples EC-SW-02 and EC-SD-25 at Iron Gate flume.

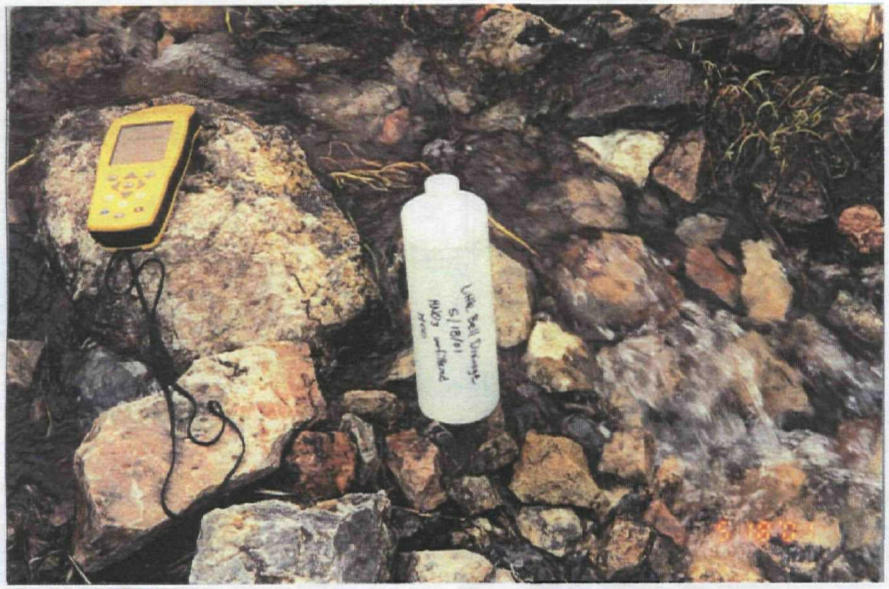
Empire Canyon View: E 5/14/2001
Samples EC-SW-04 and EC-SD-26 at sample location. Sample EC-SW-18 was also collected here at a later date



Empire Canyon View: S 10/14/2001
Location of samples EC-SW-04, EC-SW-18, and EC-SD-26. Notice Water Supply Storage tank.

Empire Canyon View: E 5/14/2001
Samples EC-SW-05 and EC-SD-27 at sample location.

Empire Canyon View: S 5/14/2001
Location of samples EC-SW-05 and EC-SD-27



Empire Canyon View: Vertical 5/18/2001
Sample EC-SW-09. Sample EC-SD-31 was collected here too but is not pictured.

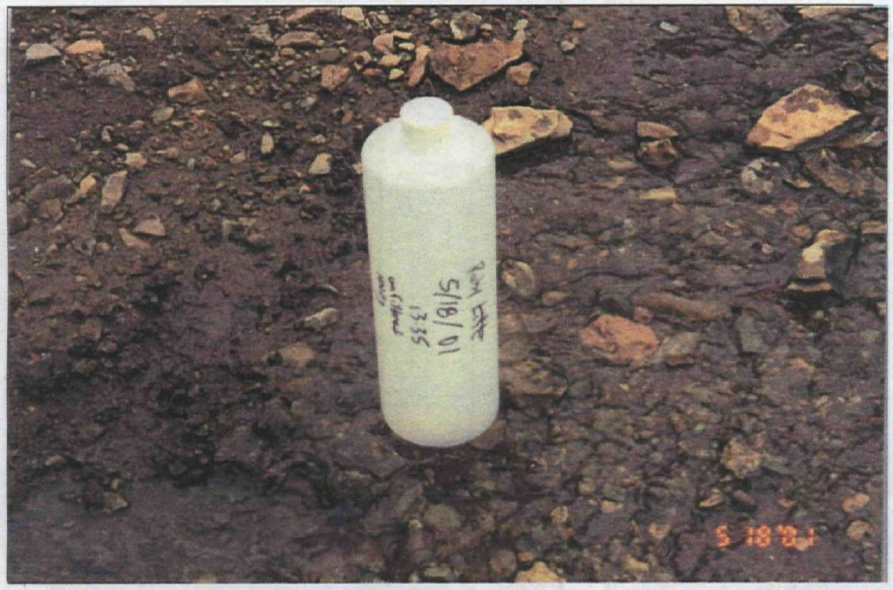
Empire Canyon View: S 5/18/2001
Location of samples EC-SW-09 and EC-SD-31.

Empire Canyon View: Vertical 5/18/2001
Sample EC-SW-010. Sample EC-SD-32 was collected here too but is not pictured.

Empire Canyon View: N 5/18/2001
Location of samples EC-SW-10 and EC-SD-32.

Empire Canyon View: Vertical 5/18/2001
Samples EC-SW-11 and EC-SD-33 at sample location.

Empire Canyon View: S 5/18/2001
Location of samples EC-SW-11 and EC-SD-33. Notice Ruby Ski Lift in background.

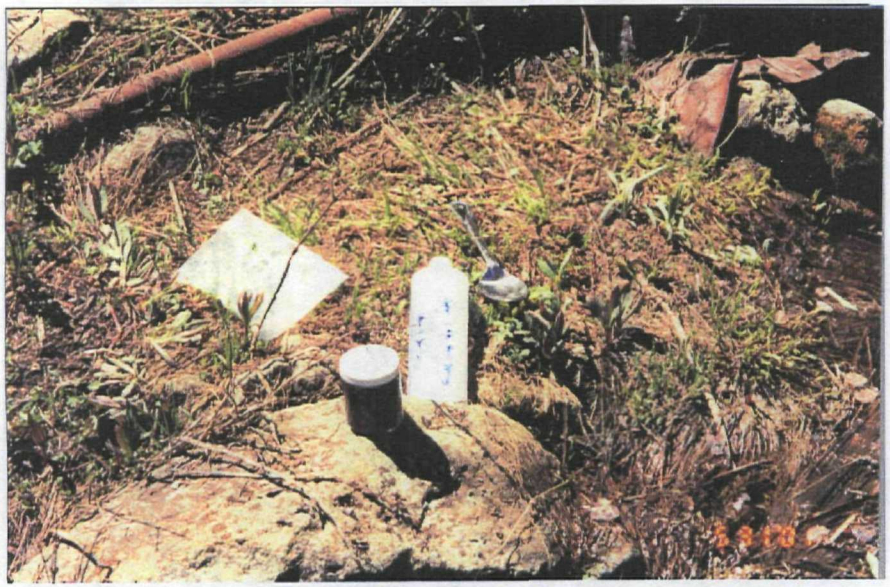


Empire Canyon View: Vertical 5/18/2001
Sample EC-SW-12. Sample EC-SD-34 was collected here too but is not pictured.

Empire Canyon View: S 5/18/2001
Location of samples EC-SW-12 and EC-SD-34. Notice Empire Ski Lift in background.

Empire Canyon View: Vertical 5/31/2001
Samples EC-SW-13 and EC-SD-35 at sample location.

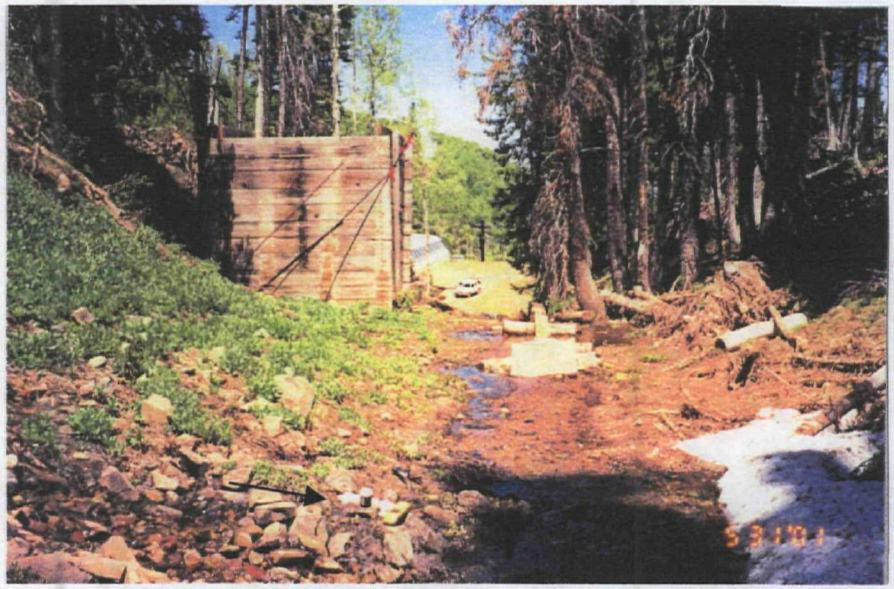
Empire Canyon View: S 5/31/2001
Location of samples EC-SW-13 and EC-SD-35.



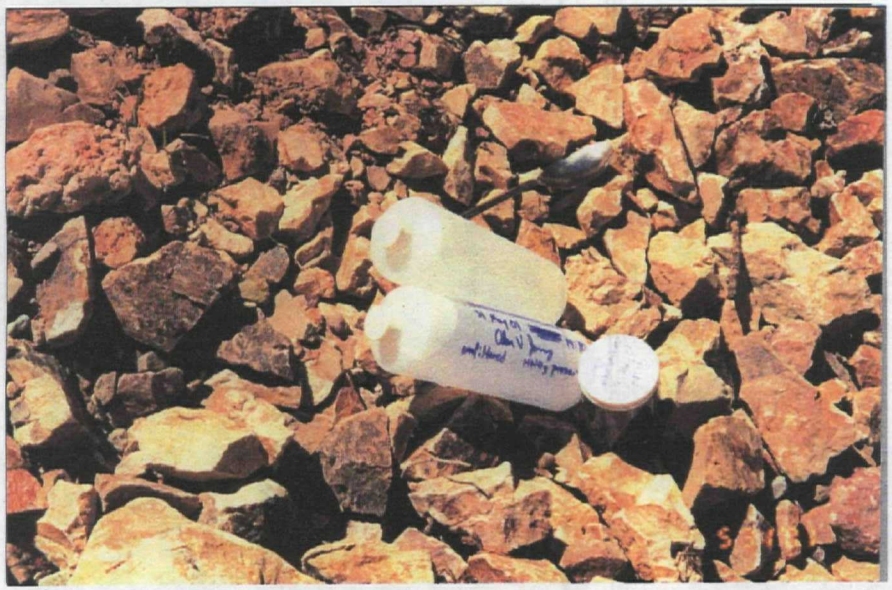
Empire Canyon View: Vertical 5/31/2001
Samples EC-SW-14 and EC-SD-36 at sample location.

Empire Canyon View: W 5/31/2001
Location of samples EC-SW-14 and EC-SD-36.

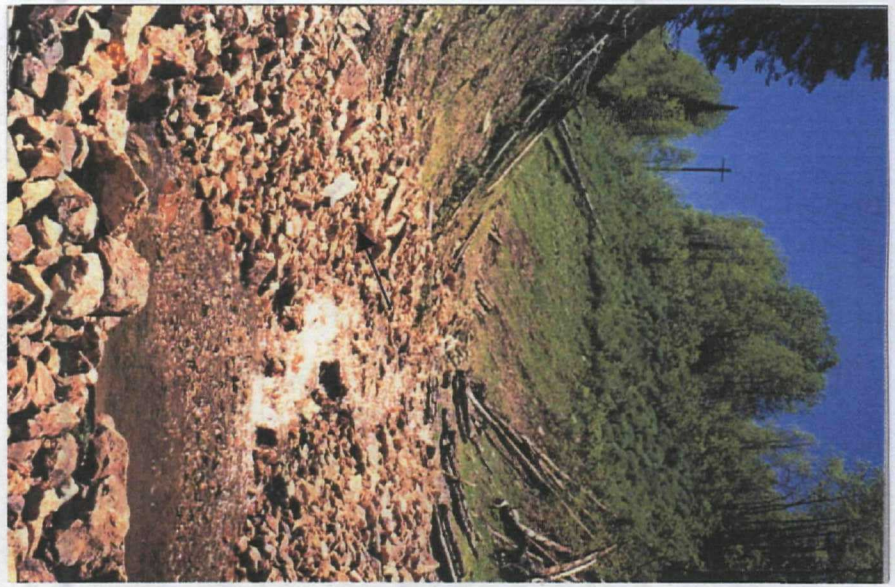
Empire Canyon View: Vertical 5/31/2001
Samples EC-SW-15 and EC-SD-37 at sample location.



Empire Canyon View: NE 5/31/2001
Location of samples EC-SW-15 and EC-SD-37. Notice McConkie Ski Lift in background.



Empire Canyon View: Vertical 5/31/2001
Samples EC-SW-16, EC-SW-23, and EC-SD-38 at sample location.



Empire Canyon View: S 5/31/2001
Location of samples EC-SW-16, EC-SW-23, and EC-SD-38.

Empire Canyon View: Vertical 7/2/2001
Sample EC-SF-40 at sample location.

Empire Canyon View:S 7/2/2001
Location of sample EC-SF-40.

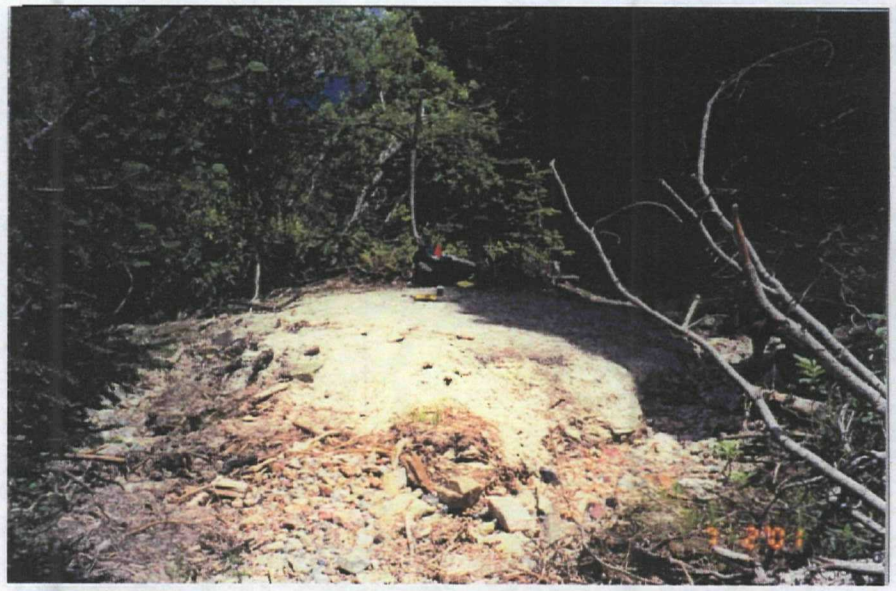
Empire Canyon View: Vertical 7/2/2001
Sample EC-SF-41 at sample location.

Empire Canyon View: E 7/2/2001
Location of sample EC-SF-41.

Empire Canyon View: Vertical 7/2/2001
Sample EC-SF-42 at sample location.

Empire Canyon View: NE 7/2/2001
Location of sample EC-SF-42.

Empire Canyon View: Vertical 7/2/2001
Sample EC-SF-43 at sample location.



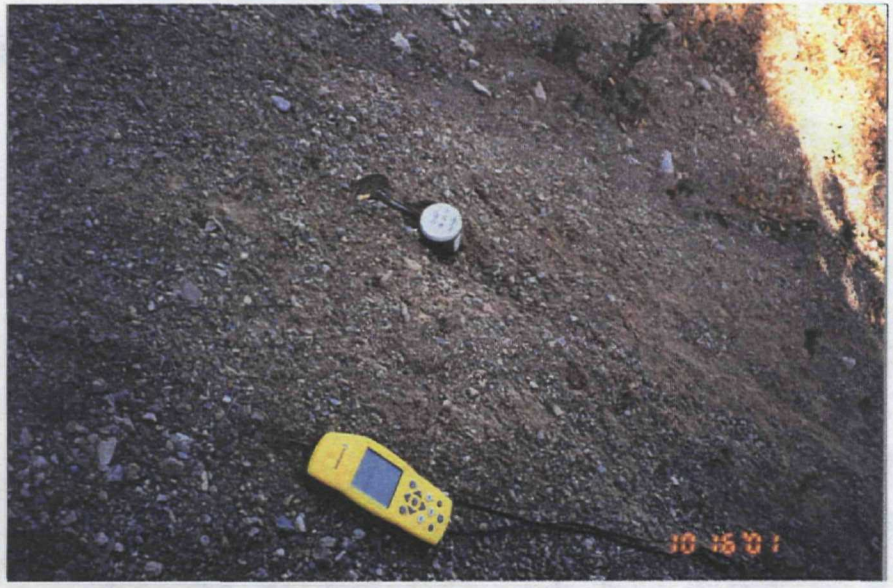
Empire Canyon View: NE 7/2/2001
Location of sample EC-SF-43.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-44 at sample location.

Empire Canyon View: W 10/16/2001
Location of sample EC-SF-44.

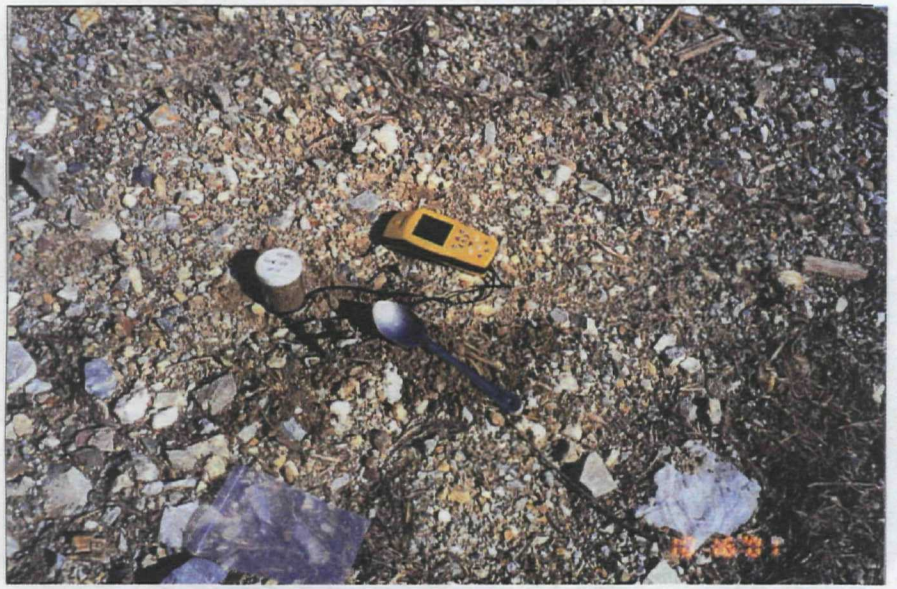
Empire Canyon View: N 10/16/2001
Sample EC-SF-45 at sample location.

Empire Canyon View: N 10/16/2001
Location of sample EC-SF-45.

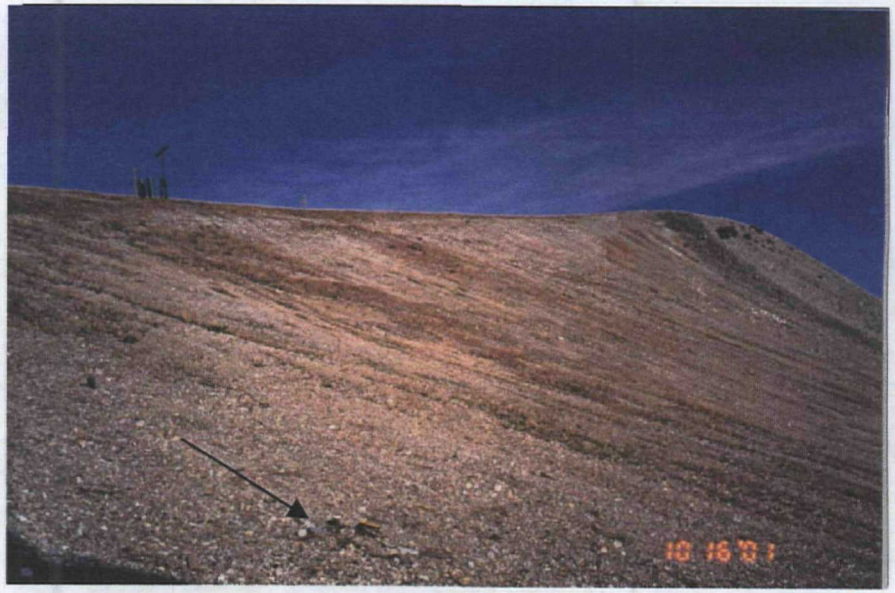


Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-46 at sample location.

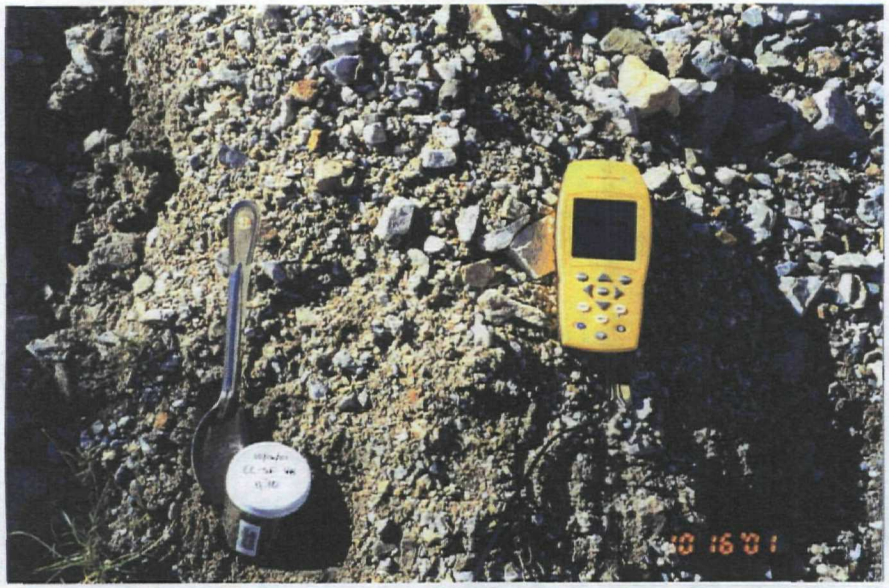
Empire Canyon View: W 10/16/2001
Location of sample EC-SF-46.



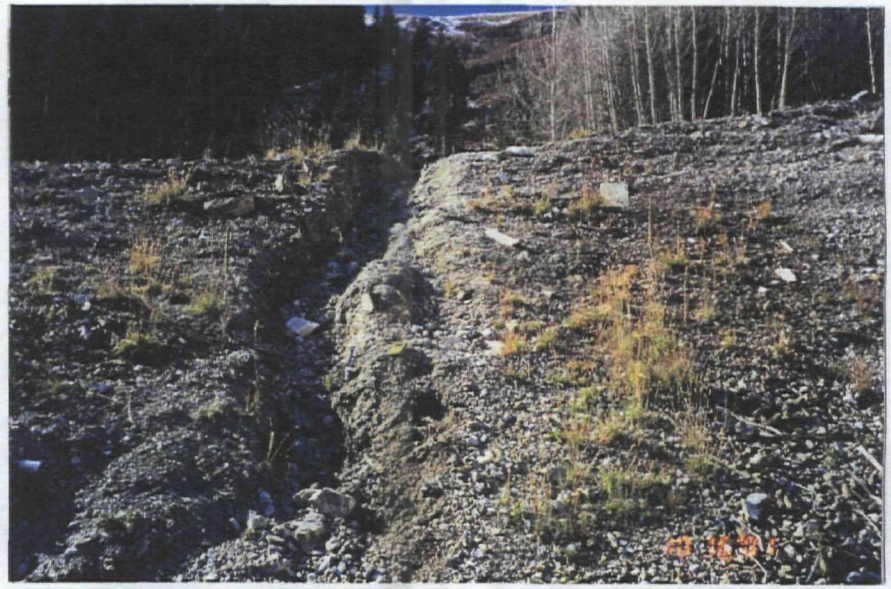
Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-47 at sample location.



Empire Canyon View: W 10/16/2001
Location of sample EC-SF-47.



Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-48 at sample location.



Empire Canyon View: W 10/16/2001
Location of sample EC-SF-48.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-49 at sample location.

Empire Canyon View: S 10/16/2001
Location of sample EC-SF-49.

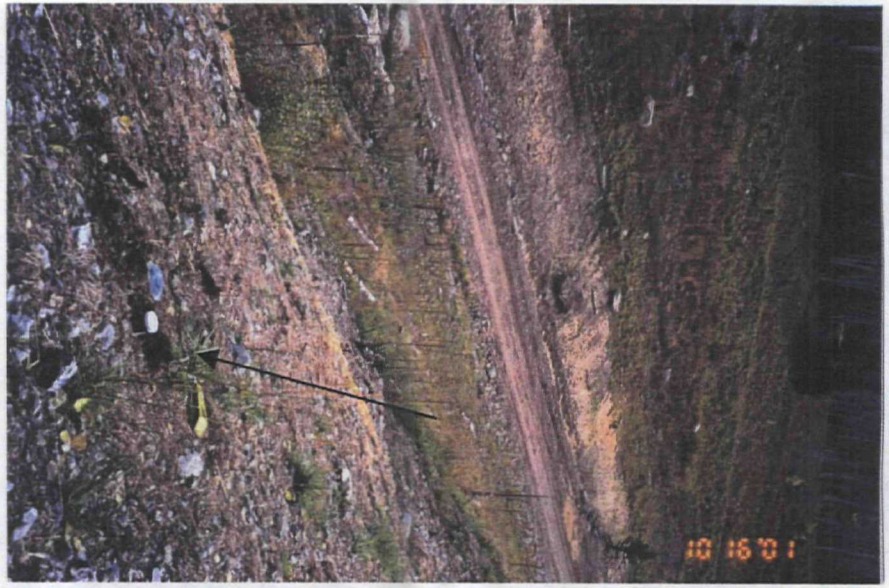
Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-50 at sample location.

Empire Canyon View: E 10/16/2001
Location of sample EC-SF-50. New Deer Valley Lodge in background.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-51 at sample location.

Empire Canyon View: SW 10/16/2001
Location of sample EC-SF-51.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-52 at sample location.



Empire Canyon View: SE 10/16/2001
Location of sample EC-SF-52.

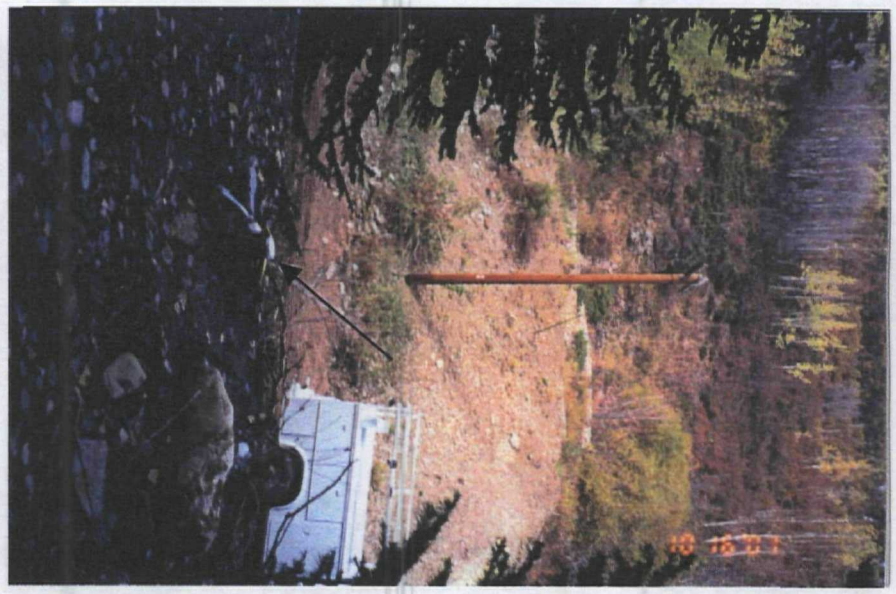
Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-53 at sample location.

Empire Canyon View: SW 10/16/2001
Location of sample EC-SF-53.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-54 at sample location.

Empire Canyon View: E 10/16/2001
Location of sample EC-SF-54.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-55 at sample location.

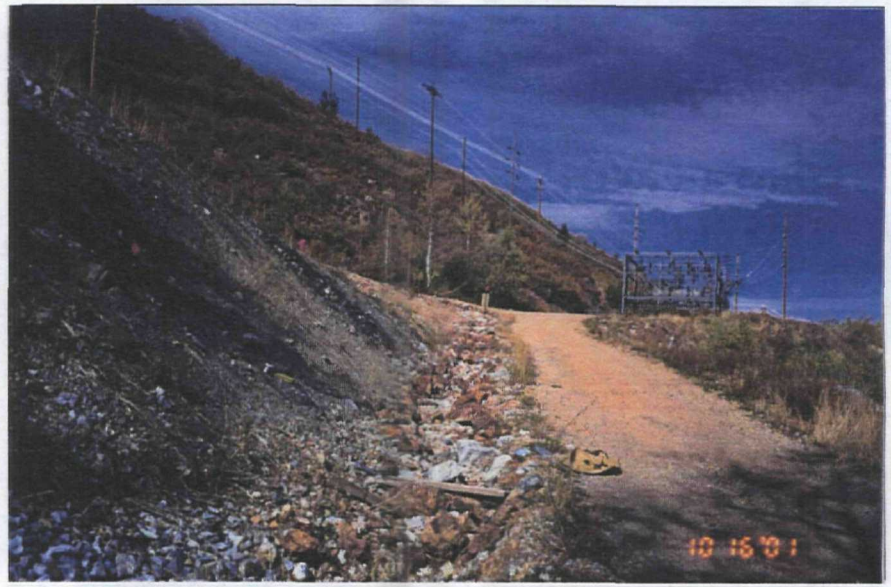


Empire Canyon View: W 10/16/2001
Location of sample EC-SF-55.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-56 at sample location.

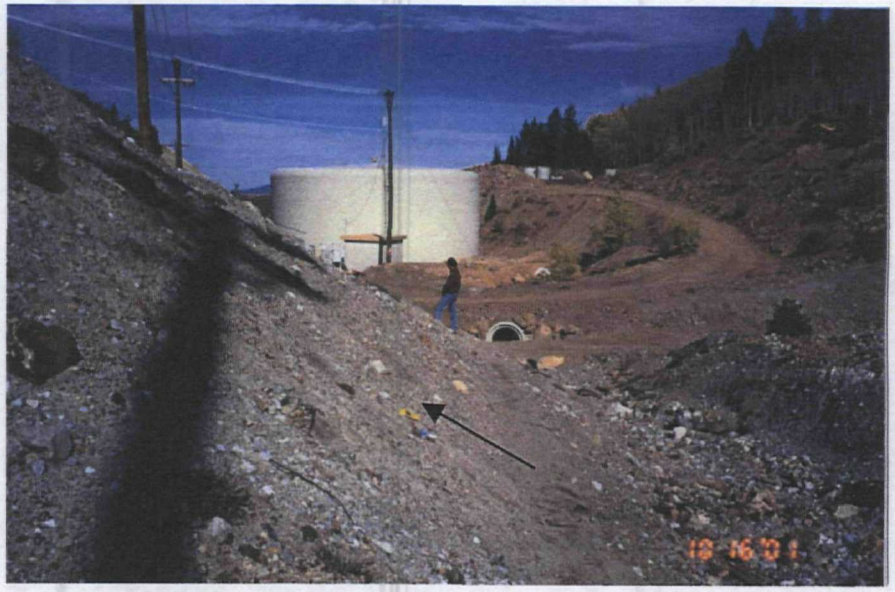
Empire Canyon View: E 10/16/2001
Location of sample EC-SF-56.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-57 at sample location.



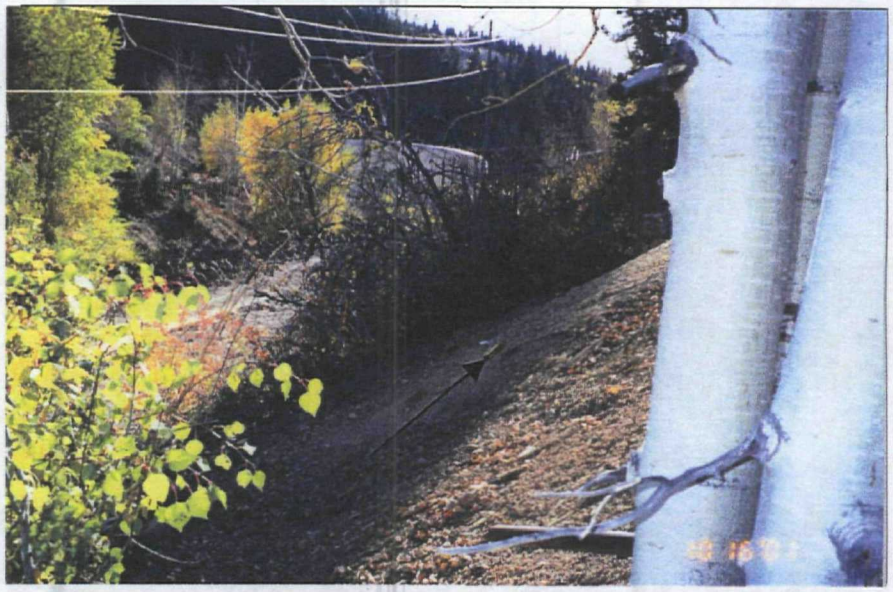
Empire Canyon View: NW 10/16/2001
Location of sample EC-SF-57.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-58 at sample location.



Empire Canyon View: N 10/16/2001
Location of sample EC-SF-58.

Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-59 at sample location.

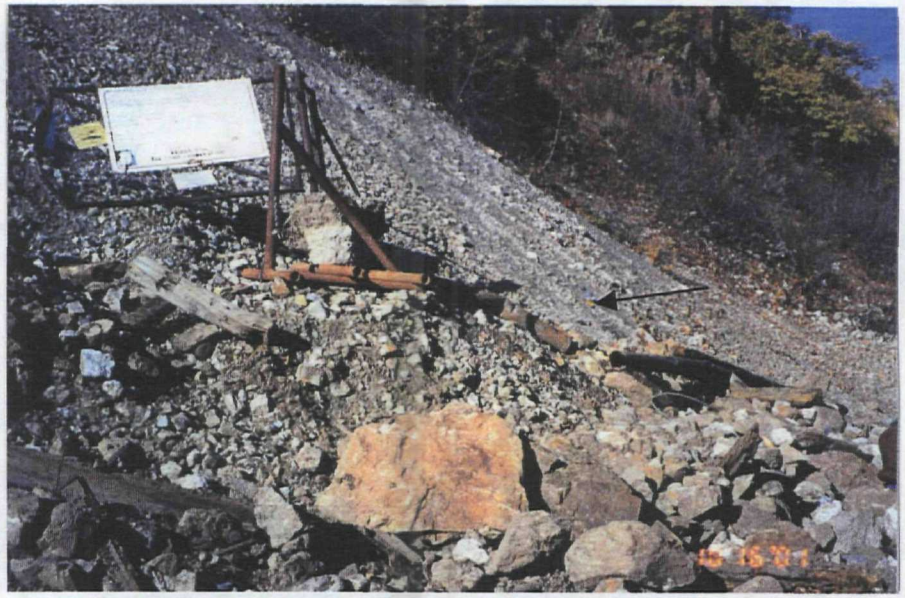


Empire Canyon View: SE 10/16/2001
Location of sample EC-SF-59.

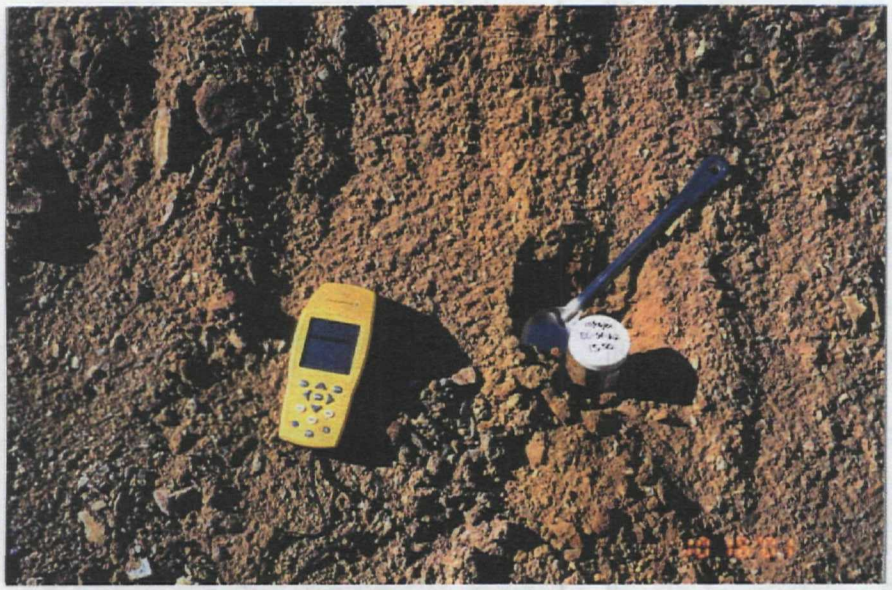
Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-60 at sample location.

Empire Canyon View: NW 10/16/2001
Location of sample EC-SF-61.

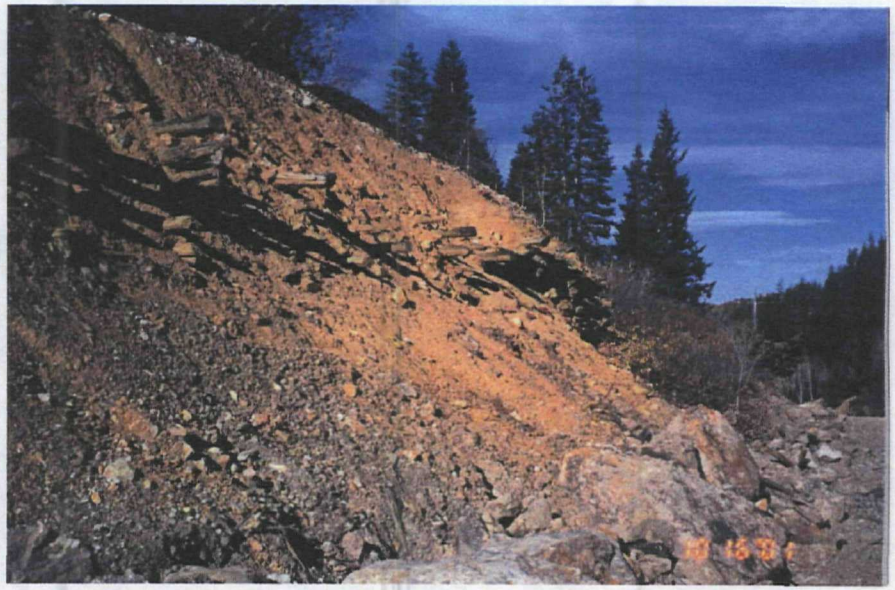
Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-61 at sample location.



Empire Canyon View: NW 10/16/2001
Location of sample EC-SF-61.



Empire Canyon View: Vertical 10/16/2001
Sample EC-SF-62 at sample location.



Empire Canyon View: NW 10/16/2001
Location of sample EC-SF-62.

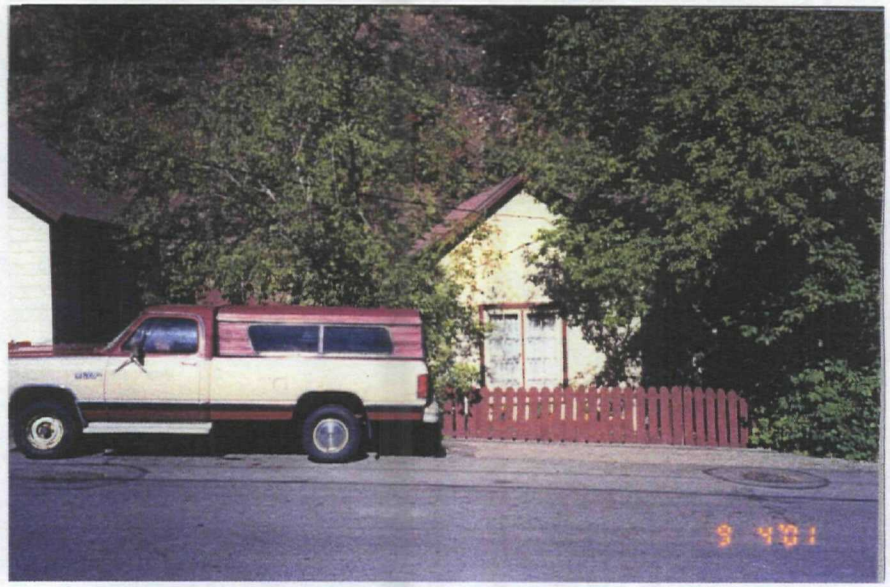
Empire Canyon View: Vertical 9/4/2001
Sample EC-SF-63 at sample location.

Empire Canyon View: E 9/4/2001
House at 249 Daly Avenue where sample EC-SF-63 was collected.

Empire Canyon View: Vertical 9/4/2001
Sample EC-SF-64 at sample location.

Empire Canyon View: E 9/4/2001
House at 167 Daly Avenue where sample EC-SF-64 was collected.

Empire Canyon View: Vertical 9/4/2001
Sample EC-SF-65 at sample location.



Empire Canyon View: W 9/4/2001
House at 180 Daly Avenue where sample EC-SF-65 was collected.

Appendix C

Sample Documentation

FedEx. USA Airbill

Tracking Number 219106264 6

10102

Sender's Copy

00085/00100

From (please print)

Date 24 May 01 Sender's FedEx Account Number 1828-8775-7

Sender's Name ALAN V JONES Phone (801 536-4100

Dept./Floor/Suite/Room

Company DEPT OF ENVIRONMENTAL QUALITY

Address 168 N 1950 WEST

City SALT LAKE CITY State UT Zip 84116

Your Internal Billing Reference Information (Optional) (First 24 characters will appear on invoice) [redacted] 100 480 4654NAC KIA6 M074PSIM

To (please print)

Recipient's Name KIMBERLY HAYES Phone 256 534-9800

Dept./Floor/Suite/Room

Company SENTINEL INC

Address 116 WASHINGTON STREET NE

"HOLD" at FedEx location, print FedEx address here (We Cannot Deliver to P.O. Boxes or P.O. Zip Codes)

City HUNTSVILLE State AL Zip 35801

For HOLD at FedEx Location check here

☐ Hold Weekday (Not available with FedEx First Overnight) ☐ Hold Saturday (Not available at all locations) (Not available with FedEx First Overnight or FedEx Standard Overnight)

For Saturday Delivery check here

☐ (Extra Charge. Not available to all locations) (Not available with FedEx First Overnight or FedEx Standard Overnight)

4a Express Package Service *Packages under 150 lbs.* Delivery commitment may be later in some areas.

☒ FedEx Priority Overnight (Next business morning) ☐ FedEx Standard Overnight (Next business afternoon) ☐ FedEx 2Day* (Second business day)

☐ NEW FedEx First Overnight (Earliest next business morning delivery to select locations) (Higher rates apply)

* FedEx Letter Rate not available. Minimum charge: One pound FedEx 2Day rate.

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some areas.

☐ FedEx Overnight Freight (Next business-day service for any distance) ☐ FedEx 2Day Freight (Second business-day service for any distance) ☐ FedEx Express Saver Freight (Up to 3 business-day service based upon distance)

(Call for delivery schedule. See back for detailed descriptions of freight products.)

5 Packaging ☐ FedEx Letter ☐ FedEx Pak ☐ FedEx Box ☐ FedEx Tube ☐ Other Pkg. Declared value limit $500

6 Special Handling

Does this shipment contain dangerous goods? ☐ Yes (As per attached Shipper's Declaration) ☐ Yes (Shipper's Declaration not required)

☐ Dry Ice Dry Ice, 9, UN 1845 III ____ x ____ kg, 904 (Dangerous Goods Shipper's Declaration not required) CA ☐ Cargo Aircraft Only

7 Payment

Bill to: ☒ Sender (Account no. in Section 1 will be billed) ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check (Enter FedEx account no. or Credit Card no. below)

FedEx Account No. ____

Credit Card No. ____ Exp. Date ____

Total Packages	Total Weight	Total Declared Value*	Total Charges
1		$ 5000 .00	

* When declaring a value higher than $100 per shipment, you pay an additional charge. See SERVICE CONDITIONS, DECLARED VALUE AND LIMIT OF LIABILITY section for further information.

8 Release Signature *Sign to authorize delivery without obtaining signature.*

Your signature authorizes Federal Express to deliver this shipment without obtaining a signature and agrees to indemnify and hold harmless Federal Express from any resulting claims.

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Service Conditions, Declared Value, and Limit of Liability – By using this Airbill, you agree to the service conditions in our current Service Guide or U.S. Government Service Guide. Both are available on request. SEE BACK OF YOUR COPY OF THIS AIRBILL FOR INFORMATION AND ADDITIONAL TERMS. FedEx will not be responsible for any claim in excess of $100 per package whether result of loss, damage, or delay, non-delivery, misdelivery, or misinformation, unless you declare a higher value, pay an additional charge, and document your actual loss in a timely manner. Your right to recover from us for any loss includes intrinsic value of the package, loss of sales, interest, profit, attorney's fees, costs, and other forms of damage, whether direct, incidental, consequential, or special, and is limited to the greater of $100 or the declared value but cannot exceed actual documented loss. The maximum declared value for any FedEx Letter and FedEx Pak is $500. Federal Express may, upon your request, and with some limitations, refund all transportation charges paid. See the FedEx Service Guide for further details.

Questions? Call 1-800-Go-FedEx (1-800-463-3339)

The World On Time®

Rev. Date 6/96
PART #147956
©1994-96 FedEx
PRINTED IN U.S.A.

FedEx. USA Airbill

FedEx Tracking Number 8214 1898 3118

0215

Sender's Copy

From *Please print and press hard.*

Date 12 June 01 Sender's FedEx Account Number 1828-8775-7

Sender's Name ALAN V JONES Phone (801) 536-4100

Company DEPT OF ENVIRONMENTAL QUALITY

Address 168 N 1950 W

Dept./Floor/Suite/Room

City SALT LAKE CITY State UT ZIP 84116

Your Internal Billing Reference 100/480/4654/NAC/KIA6/M074P

First 24 characters will appear on invoice.

To Recipient's Name ALICE EVANS Phone (919) 379-4100

Company LIBERTY ANALYTICAL

Address 501 Madison Avenue

To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept./Floor/Suite/Room

City Cary State NC ZIP 27513

Peel and Stick FedEx USA Airbill

See back for application instructions.

Questions? Call 1-800-Go-FedEx® (800-463-3339)

Visit our Web site at www.fedex.com

By using this Airbill you agree to the service conditions on the back of this Airbill and in our current Service Guide, including terms that limit our liability.

4a Express Package Service *Packages up to 150 lbs.* Delivery commitment may be later in some areas.

☒ FedEx Priority Overnight Next business morning ☐ FedEx Standard Overnight Next business afternoon ☐ FedEx First Overnight Earliest next business morning delivery to select locations

☐ FedEx 2Day* Second business day ☐ FedEx Express Saver* Third business day

* FedEx Envelope/Letter Rate not available Minimum charge: One-pound rate

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some areas.

☐ FedEx 1Day Freight* Next business day ☐ FedEx 2Day Freight Second business day ☐ FedEx 3Day Freight Third business day

* Call for Confirmation: ____

5 Packaging * Declared value limit $500

☐ FedEx Envelope/Letter* ☐ FedEx Pak* ☐ Other Pkg. Includes FedEx Box, FedEx Tube, and customer pkg.

6 Special Handling Include FedEx address in Section 3.

☐ SATURDAY Delivery Available for FedEx Priority Overnight and FedEx 2Day to select ZIP codes ☐ SUNDAY Delivery Available for FedEx Priority Overnight to select ZIP codes ☐ HOLD Weekday at FedEx Location Not available with FedEx First Overnight ☐ HOLD Saturday at FedEx Location Available for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

☒ No ☐ Yes As per attached Shipper's Declaration ☐ Yes Shipper's Declaration not required ☐ Dry Ice Dry Ice, 9, UN 1845 ____ x ____ kg

Dangerous Goods cannot be shipped in FedEx packaging. ☐ Cargo Aircraft Only

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check

FedEx Acct. No. ____ Exp. Date ____

Credit Card No. ____

Total Packages	Total Weight	Total Declared Value†	FedEx Use Only
1		$ 2000.00	

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Release Signature *Sign to authorize delivery without obtaining signature.*

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

402

0147142711

FedEx. USA Airbill Express

FedEx Tracking Number 8291 6197 2168

0216 Sender's Copy

1 From Please print and press hard.

Date 16 JUL 01 Sender's FedEx Account Number 1828-8775-7

Sender's Name ALAN V JONES Phone (801) 536-4100

Company DEPT OF ENVIRONMENTAL QUALITY

Address 168 N 1950 W Dept./Floor/Suite/Room

City SALT LAKE CITY State UT ZIP 84116

Your Internal Billing Reference 4654/NAC/KAI6/M074P
First 24 characters will appear on invoice.

To Recipient's Name ALICE EVANS Phone 919 379-4100

Company LIBERTY ANALYTICAL

Address 501 Madison Ave
To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.

Dept./Floor/Suite/Room

City CARY State NC ZIP 27513

Peel and Stick FedEx USA Airbill

See back for application instructions.

Questions? Visit our Web site at fedex.com
or call 1-800-Go-FedEx® (800)463-3339.

By using this Airbill you agree to the service conditions on the back of this Airbill and in our current Service Guide, including terms that limit our liability.

4a Express Package Service — Packages up to 150 lbs. Delivery commitment may be later in some areas.

- [X] FedEx Priority Overnight — Next business morning
- [ ] FedEx Standard Overnight — Next business afternoon
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations
- [ ] FedEx 2Day — Second business day
- [ ] FedEx Express Saver — Third business day
- [ ] NEW FedEx Extra Hours — Later drop-off with next business afternoon delivery for select locations

FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service — Packages over 150 lbs. Delivery commitment may be later in some areas.

- [ ] FedEx 1Day Freight* — Next business day
- [ ] FedEx 2Day Freight — Second business day
- [ ] FedEx 3Day Freight — Third business day

* Call for Confirmation:

5 Packaging * Declared value limit $500

- [ ] FedEx Envelope*
- [ ] FedEx Pak* — Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak
- [ ] Other Pkg. — Includes FedEx Box, FedEx Tube, and customer pkg.

6 Special Handling — Include FedEx address in Section 3.

- [ ] SATURDAY Delivery — Available only for FedEx Priority Overnight and FedEx 2Day to select ZIP codes
- [ ] SUNDAY Delivery — RESTRICTIONS Available only for FedEx Priority Overnight to select ZIP codes
- [ ] HOLD Weekday at FedEx Location — RESTRICTIONS Not available with FedEx First Overnight
- [ ] HOLD Saturday at FedEx Location — RESTRICTIONS Available only for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

- [X] No
- [ ] Yes — As per attached Shipper's Declaration
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg
- [ ] Cargo Aircraft Only

Dangerous Goods (incl. Dry Ice) cannot be shipped in FedEx packaging or with FedEx Extra Hours service.

7 Payment Bill to: — Enter FedEx Acct. No. or Credit Card No. below.

- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

FedEx Acct. No. / Credit Card No. Exp. Date

Total Packages	Total Weight	Total Declared Value†	FedEx Use Only
		$ 1500 .00	

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Release Signature Sign to authorize delivery without obtaining signature.

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

406

0183648659

SRP • Rev. Date 12/00 • Part #155918S • ©1994–2000 FedEx • PRINTED IN U.S.A.

FedEx. USA Airbill FedEx Tracking Number 8214 1898 3173

0216 Sender's Copy

From Please print and press hard.

Date 24 OCT 01 Sender's FedEx Account Number 1828-8775-7

Sender's Name ALAN V JONES Phone (801) 536-~~4400~~ 4287

Company DEPT OF ENVIRONMENTAL QUALITY

Address 168 N 1950 W Dept./Floor/Suite/Room

City SALT LAKE CITY State UT ZIP 84116

Your Internal Billing Reference 100/480/4654/NAC/KAI6/M074P
First 24 characters will appear on invoice.

To Recipient's Name JESSICA BALTZ Phone (256) 534-9800

Company SENTINEL INC

Address 116 WASHINGTON STREET, NE
To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.

E

Dept./Floor/Suite/Room

City HUNTSVILLE State AL ZIP 35801

Peel and Stick FedEx USA Airbill

See back for application instructions.

Questions? Call 1-800-Go-FedEx® (800-463-3339)
Visit our Web site at www.fedex.com

By using this Airbill you agree to the service conditions on the back of this Airbill and in our current Service Guide, including terms that limit our liability.

4a Express Package Service — Packages up to 150 lbs. Delivery commitment may be later in some areas.

- [ ] FedEx Priority Overnight — Next business morning
- [X] FedEx Standard Overnight — Next business afternoon
- [ ] FedEx First Overnight — Earliest next business morning delivery to select locations
- [ ] FedEx 2Day* — Second business day
- [ ] FedEx Express Saver* — Third business day

* FedEx Envelope/Letter Rate not available. Minimum charge: One-pound rate

4b Express Freight Service — Packages over 150 lbs. Delivery commitment may be later in some areas.

- [ ] FedEx 1Day Freight* — Next business day
- [ ] FedEx 2Day Freight — Second business day
- [ ] FedEx 3Day Freight — Third business day

* Call for Confirmation:

5 Packaging * Declared value limit $500

- [ ] FedEx Envelope/Letter*
- [ ] FedEx Pak*
- [ ] Other Pkg. — Includes FedEx Box, FedEx Tube, and customer pkg.

6 Special Handling — Include FedEx address in Section 3.

- [ ] SATURDAY Delivery — Available for FedEx Priority Overnight and FedEx 2Day to select ZIP codes
- [ ] SUNDAY Delivery — Available for FedEx Priority Overnight to select ZIP codes
- [ ] HOLD Weekday at FedEx Location — Not available with FedEx First Overnight
- [ ] HOLD Saturday at FedEx Location — Available for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

- [X] No
- [ ] Yes — As per attached Shipper's Declaration
- [ ] Yes — Shipper's Declaration not required
- [ ] Dry Ice — Dry Ice, 9, UN 1845 ____ x ____ kg
- [ ] Cargo Aircraft Only

Dangerous Goods cannot be shipped in FedEx packaging.

7 Payment Bill to: — Enter FedEx Acct. No. or Credit Card No. below.

- [X] Sender — Acct. No. in Section 1 will be billed.
- [ ] Recipient
- [ ] Third Party
- [ ] Credit Card
- [ ] Cash/Check

FedEx Acct. No. / Credit Card No. Exp. Date

Total Packages	Total Weight	Total Declared Value†	FedEx Use Only
1		$ 1000 .00	

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Release Signature Sign to authorize delivery without obtaining signature.

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

402

0147142711

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No:	29304
DAS No:	

R

Region:	8
Project Code:	
Account Code:	
CERCLIS ID:	UT0002005981
Spill ID:	
Site Name/State:	Empire Canyon/UT
Project Leader:	Alan V. Jones
Action:	
Sampling Co:	Utah DEQ/DERR

Date Shipped:	5/24/01
Carrier Name:	FedEx
Airbill:	2191062646
Shipped to:	Sentinel Inc. 116 Washington Street, NE Huntsville AL 35801 (256) 534-9800

Chain of Custody Record

Relinquished By	(Date / Time)	Received By	(Date / Time)
1 Alan V Jones	5/24/01 15:30		
2			
3			
4			

Sampler Signature: Alan V Jones

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MHFD13	Surface Water/ Alan V. Jones	L/G	TM (14)	8188951 (HNO3) (1)	EC-SW-01	S: 5/14/01 15:25		–
MHFD14	Surface Water/ Alan V. Jones	L/G	TM (14)	8188952 (HNO3) (1)	EC-SW-02	S: 5/14/01 15:05		–
MHFD15	Surface Water/ Alan V. Jones	L/G	TM (14)	8188953 (HNO3) (1)	EC-SW-03	S: 4/30/01 16:50		–
MHFD16	Surface Water/ Alan V. Jones	L/G	TM (14)	8188954 (HNO3) (1)	EC-SW-04	S: 5/14/01 14:20		–
MHFD17	Surface Water/ Alan V. Jones	L/G	TM (14)	8188955 (HNO3) (1)	EC-SW-05	S: 5/14/01 14:00		–
MHFD18	Surface Water/ Alan V. Jones	L/G	TM (14)	8188956 (HNO3) (1)	EC-SW-06	S: 4/30/01 15:05		–
MHFD19	Surface Water/ Alan V. Jones	L/G	TM (14)	8188957 (HNO3) (1)	EC-SW-07	S: 5/9/01 15:05		–
MHFD20	Surface Water/ Alan V. Jones	L/G	DM (14)	8188958 (HNO3) (1)	EC-SW-07	S: 5/9/01 15:05		–
MHFD21	Surface Water/ Alan V. Jones	L/G	TM (14)	8188959 (HNO3) (1)	EC-SW-08	S: 5/14/01 12:35		–
MHFD22	Surface Water/ Alan V. Jones	L/G	TM (14)	8188960 (HNO3) (1)	EC-SW-09	S: 5/18/01 14:00		–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MHFD26, MHFD36	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = Hig	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____
DM = CLP TAL Dissolved Metals, TM = CLP TAL Total Metals			

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 29304
DAS No:
R

Region: 8	Date Shipped: 5/24/01	Chain of Custody Record	Sampler Signature: Alan V Jones
Project Code:	Carrier Name: FedEx	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 2191062646	1 Alan V Jones 5/24/01 15:20	
CERCLIS ID: UT0002005981	Shipped to: Sentinel Inc. 116 Washington Street, NE Huntsville AL 35801 (256) 534-9800	2	
Spill ID:		3	
Site Name/State: Empire Canyon/UT		4	
Project Leader: Alan V. Jones			
Action:			
Sampling Co: Utah DEQ/DERR			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MHFD23	Surface Water/ Alan V. Jones	L/G	TM (14)	8188961 (HNO3) (1)	EC-SW-10	S: 5/18/01 14:05		--
MHFD24	Surface Water/ Alan V. Jones	L/G	TM (14)	8188962 (HNO3) (1)	EC-SW-11	S: 5/18/01 13:50		--
MHFD25	Surface Water/ Alan V. Jones	L/G	TM (14)	8188963 (HNO3) (1)	EC-SW-12	S: 5/18/01 13:35		--
MHFD26	Surface Water/ Alan V. Jones	L/G	TM (14)	8188964 (HNO3), 8188977 (HNO3) (2)	EC-SW-17	S: 4/30/01 15:30		--
MHFD27	Surface Water/ Alan V. Jones	L/G	TM (14)	8188965 (HNO3) (1)	EC-SW-22	S: 5/14/01 12:55		Field Duplicate
MHFD28	Sediment/ Alan V. Jones	L/G	TM (14)	8188966 (Ice Only) (1)	EC-SD-24	S: 5/14/01 15:25		--
MHFD29	Sediment/ Alan V. Jones	L/G	TM (14)	8188967 (Ice Only) (1)	EC-SD-25	S: 5/14/01 15:05		--
MHFD30	Sediment/ Alan V. Jones	L/G	TM (14)	8188968 (Ice Only) (1)	EC-SD-26	S: 5/14/01 14:20		--
MHFD31	Sediment/ Alan V. Jones	L/G	TM (14)	8188969 (Ice Only) (1)	EC-SD-27	S: 5/14/01 14:00		--
MHFD32	Sediment/ Alan V. Jones	L/G	TM (14)	8188970 (Ice Only) (1)	EC-SD-28	S: 5/14/01 13:05		--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MHFD26, MHFD36	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = Hig	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____
DM = CLP TAL Dissolved Metals, TM = CLP TAL Total Metals			

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EPA USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No:	29304
DAS No:	

R

Region:	8
Project Code:	
Account Code:	
CERCLIS ID:	UT0002005981
Spill ID:	
Site Name/State:	Empire Canyon/UT
Project Leader:	Alan V. Jones
Action:	
Sampling Co:	Utah DEQ/DERR

Date Shipped:	5/24/01
Carrier Name:	FedEx
Airbill:	2191062646
Shipped to:	Sentinel Inc. 116 Washington Street, NE Huntsville AL 35801 (256) 534-9800

Chain of Custody Record

Sampler Signature: Alan V Jones

Relinquished By	(Date / Time)	Received By	(Date / Time)
1 Alan V Jones	5/24/01 15:30		
2			
3			
4			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MHFD33	Sediment/ Alan V. Jones	L/G	TM (14)	8188971 (Ice Only) (1)	EC-SD-29	S: 5/14/01 12:50		--
MHFD34	Sediment/ Alan V. Jones	L/G	TM (14)	8188972 (Ice Only) (1)	EC-SD-30	S: 5/14/01 12:40		--
MHFD35	Sediment/ Alan V. Jones	L/G	TM (14)	8188973 (Ice Only) (1)	EC-SD-31	S: 5/18/01 14:00		--
MHFD36	Sediment/ Alan V. Jones	L/G	TM (14)	8188974 (Ice Only) (1)	EC-SD-32	S: 5/18/01 14:05		--
MHFD37	Sediment/ Alan V. Jones	L/G	TM (14)	8188975 (Ice Only) (1)	EC-SD-33	S: 5/18/01 13:45		--
MHFD38	Sediment/ Alan V. Jones	L/G	TM (14)	8188976 (Ice Only) (1)	EC-SD-34	S: 5/18/01 13:35		--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MHFD26, MHFD36	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = Hi	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____
DM = CLP TAL Dissolved Metals, TM = CLP TAL Total Metals			

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EPA USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 29410
DAS No:
R

Region: 8	Date Shipped: 6/12/01	Chain of Custody Record	Sampler Signature: Alan V Jones
Project Code:	Carrier Name: FedEx	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 821418983116	1 Alan V Jones 6/12/01 / 0800	
CERCLIS ID: UT0002005981	Shipped to: Liberty Analytical 501 Madison Avenue Cary NC 27513 (919) 379-4080	2	
Spill ID:		3	
Site Name/State: Empire Canyon/UT		4	
Project Leader: Alan V. Jones			
Action:			
Sampling Co: Utah DEQ/DERR			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MHFD39	Surface Water/ Alan V. Jones	L/G	TM (14)	8188292 (HNO3), 8188293 (HNO3) (2)	EC-SW-13	S: 5/31/01 11:40		–
MHFD40	Surface Water/ Alan V. Jones	L/G	TM (14)	8188294 (HNO3) (1)	EC-SW-14	S: 5/31/01 11:20		–
MHFD41	Surface Water/ Alan V. Jones	L/G	TM (14)	8188295 (HNO3) (1)	EC-SW-15	S: 5/31/01 13:40		–
MHFD42	Surface Water/ Alan V. Jones	L/G	TM (14)	8188296 (HNO3) (1)	EC-SW-16	S: 5/31/01 14:10		–
MHFD43	Surface Water/ Alan V. Jones	L/G	TM (14)	8188297 (HNO3) (1)	EC-SW-23	S: 5/31/01 14:30		Field Duplicate
MHFD44	Sediment/ Alan V. Jones	L/G	TM (14)	8188298 (Ice Only) (1)	EC-SD-35	S: 5/31/01 11:40		–
MHFD45	Sediment/ Alan V. Jones	L/G	TM (14)	8188299 (Ice Only) (1)	EC-SD-36	S: 5/31/01 11:20		–
MHFD46	Sediment/ Alan V. Jones	L/G	TM (14)	8188300 (Ice Only) (1)	EC-SD-37	S: 5/31/01 13:40		–
MHFD47	Sediment/ Alan V. Jones	L/G	TM (14)	8188978 (Ice Only) (1)	EC-SD-38	S: 5/31/01 14:10		–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MHFD39 MHFD45	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = Hig	Type/Designate: Composite = C, Grab = G	Shipment Iced? _____
TM = CLP TAL Total Metals			

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EPA USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 29516 **R**
DAS No:

Region: 8	**Date Shipped:** 7/16/01	**Chain of Custody Record**	**Sampler Signature:** Alan V Jones
Project Code:	**Carrier Name:** FedEx	**Relinquished By (Date / Time)**	**Received By (Date / Time)**
Account Code:	**Airbill:** 829161972168	1 Alan V Jones 7/16/01 11:30	
CERCLIS ID: UT0002005981	**Shipped to:** Liberty Analytical 501 Madison Avenue Cary NC 27513 (919) 379-4080	2	
Spill ID:		3	
Site Name/State: Empire Canyon/UT		4	
Project Leader: Alan V. Jones			
Action:			
Sampling Co: Utah DEQ/DERR			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MHEH53	Surface Water/ Alan V. Jones	L/G	TM (14)	8171698 (HNO3) (1)	EC-SW-18	S: 6/25/01 14:40		--
MHEH54	Surface Water/ Alan V. Jones	L/G	DM (14)	8171699 (HNO3) (1)	EC-SW-18	S: 6/25/01 14:40		--
MHEH55	Surface Water/ Alan V. Jones	L/G	TM (14)	8171700 (HNO3) (1)	EC-SW-19	S: 6/25/01 14:25		--
MHEH56	Surface Water/ Alan V. Jones	L/G	DM (14)	8189911 (HNO3) (1)	EC-SW-19	S: 6/25/01 14:25		--
MHEH57	Surface Water/ Alan V. Jones	L/G	TM (14)	8189912 (HNO3) (1)	EC-SW-20	S: 6/25/01 14:00		--
MHEH58	Surface Water/ Alan V. Jones	L/G	DM (14)	8189913 (HNO3) (1)	EC-SW-20	S: 6/25/01 14:00		--
MHEH59	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189914 (1)	EC-SF-40	S: 7/2/01 11:10		--
MHEH60	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189915 (1)	EC-SF-41	S: 7/2/01 13:15		--
MHEH61	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189916 (1)	EC-SF-42	S: 7/2/01 13:35		--
MHEH62	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189917 (1)	EC-SF-43	S: 7/2/01 14:00		--

Shipment for Case Complete? N	**Sample(s) to be used for laboratory QC:** MHEH55, MHEH62	**Additional Sampler Signature(s):**	**Chain of Custody Seal Number:**
Analysis Key:	**Concentration:** L = Low, M = Low/Medium, H = Hig	**Type/Designate:** Composite = C, Grab = G	**Shipment Iced?** _____
DM = CLP TAL Dissolved Metals, TM = CLP TAL Total Metals			

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 29882
DAS No:
R

Region: 8	Date Shipped: 10/24/01	Chain of Custody Record	Sampler Signature: Alan V Jones
Project Code:	Carrier Name: FedEx	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 8214 1898 3173	1 Alan V Jones 10/24/01 13:00	
CERCLIS ID: UT0002005981	Shipped to: Sentinel Inc. 116 Washington Street, NE Huntsville AL 35801 (256) 534-9800	2	
Spill ID:		3	
Site Name/State: Empire Canyon/UT		4	
Project Leader: Alan V. Jones			
Action:			
Sampling Co: Utah DEQ/DERR			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MHEH65	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189918 (Not preserved) (1)	EC-SF-44	S: 10/16/01 9:00		--
MHEH66	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189919 (Not preserved) (1)	EC-SF-45	S: 10/16/01 9:10		--
MHEH67	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189920 (Not preserved) (1)	EC-SF-46	S: 10/16/01 9:40		--
MHEH68	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189921 (Not preserved) (1)	EC-SF-47	S: 10/16/01 10:15		--
MHEH69	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189922 (Not preserved) (1)	EC-SF-48	S: 10/16/01 11:10		--
MHEH70	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189923 (Not preserved) (1)	EC-SF-49	S: 10/16/01 12:25		--
MHEH71	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189924 (Not preserved) (1)	EC-SF-50	S: 10/16/01 12:40		--
MHEH72	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189925 (Not preserved) (1)	EC-SF-51	S: 10/16/01 13:00		--
MHEH73	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189926 (Not preserved) (1)	EC-SF-52	S: 10/16/01 13:20		--
MHEH74	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189927 (Not preserved) (1)	EC-SF-53	S: 10/16/01 13:35		--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MHEH67, MHEH79, MHEH85	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = Hig	Type/Designate: Composite = C, Grab = G	Shipment Iced? NO
TM = CLP TAL Total Metals			

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USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 29882
DAS No:
R

Region: 8	Date Shipped: 10/24/01	Chain of Custody Record	Sampler Signature: Alan V Jones
Project Code:	Carrier Name: FedEx	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 8214 1898 3173	1 Alan V Jones 10/24/01 13:00	
CERCLIS ID: UT0002005981	Shipped to: Sentinel Inc. 116 Washington Street, NE Huntsville AL 35801 (256) 534-9800	2	
Spill ID:		3	
Site Name/State: Empire Canyon/UT		4	
Project Leader: Alan V. Jones			
Action:			
Sampling Co: Utah DEQ/DERR			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MHEH75	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189928 (Not preserved) (1)	EC-SF-54	S: 10/16/01 13:45		--
MHEH76	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189929 (Not preserved) (1)	EC-SF-55	S: 10/16/01 14:10		--
MHEH77	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189930 (Not preserved) (1)	EC-SF-56	S: 10/16/01 14:25		--
MHEH78	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189931 (Not preserved) (1)	EC-SF-57	S: 10/16/01 14:50		--
MHEH79	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189932 (Not preserved) (1)	EC-SF-58	S: 10/16/01 15:05		--
MHEH80	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189933 (Not preserved) (1)	EC-SF-59	S: 10/16/01 15:15		--
MHEH81	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189934 (Not preserved) (1)	EC-SF-60	S: 10/16/01 15:30		--
MHEH82	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189935 (Not preserved) (1)	EC-SF-61	S: 10/16/01 15:35		--
MHEH83	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189936 (Not preserved) (1)	EC-SF-62	S: 10/16/01 15:50		--
MHEH84	Surface Soil (0'-12")/ Alan V. Jones	L/G	TM (14)	8189937 (Not preserved) (1)	EC-SF-63	S: 9/4/01 9:30		--

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MHEH67, MHEH79, MHEH85	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = Hig	Type/Designate: Composite = C, Grab = G	Shipment Iced? NO
TM = CLP TAL Total Metals			

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EPA USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No: 29882
DAS No:
R

Region: 8	Date Shipped: 10/24/01	Chain of Custody Record	Sampler Signature: Alan V Jones
Project Code:	Carrier Name: FedEx	Relinquished By (Date / Time)	Received By (Date / Time)
Account Code:	Airbill: 8214 1898 3173	1 Alan V Jones 10/24/01 13:00	
CERCLIS ID: UT0002005981	Shipped to: Sentinel Inc. 116 Washington Street, NE Huntsville AL 35801 (256) 534-9800	2	
Spill ID:		3	
Site Name/State: Empire Canyon/UT		4	
Project Leader: Alan V. Jones			
Action:			
Sampling Co: Utah DEQ/DERR			

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	QC Type
MHEH85	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189938 (Not preserved) (1)	EC-SF-64	S: 9/4/01 9:45		–
MHEH86	Surface Soil (0"-12")/ Alan V. Jones	L/G	TM (14)	8189939 (Not preserved) (1)	EC-SF-65	S: 9/4/01 10:00		–

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC: MHEH67, MHEH79, MHEH85	Additional Sampler Signature(s):	Chain of Custody Seal Number:
Analysis Key:	Concentration: L = Low, M = Low/Medium, H = Hig	Type/Designate: Composite = C, Grab = G	Shipment Iced? No
TM = CLP TAL Total Metals			

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Appendix D

Data Validation Summary and CLP Data Sheets

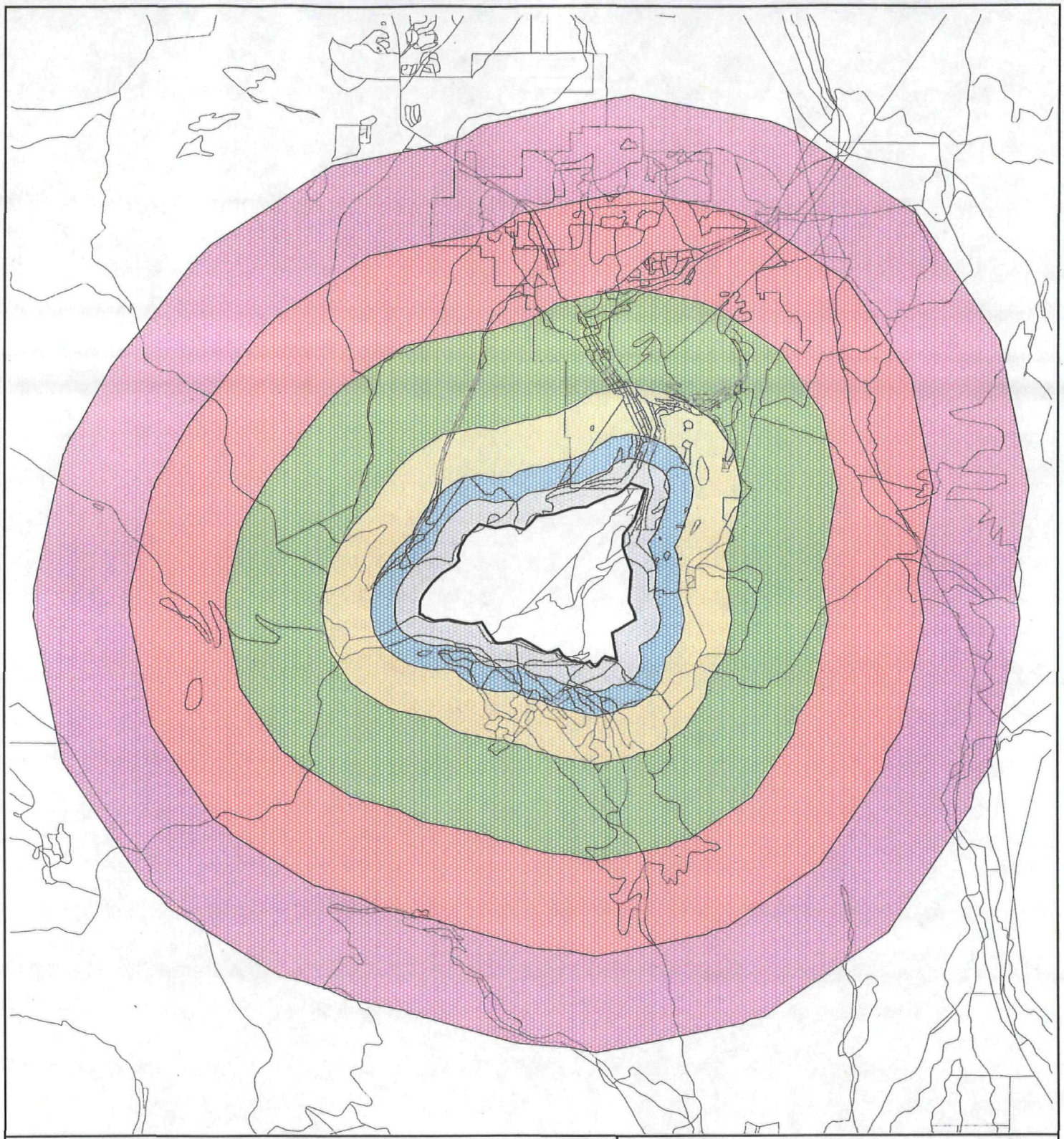
(See volume bound separately)

Appendix E

Population Analysis using 2000 Census Data

Empire Canyon Population Analysis based on 2000 Census.

DISTANCE	POPULATION	CUMULATIVE POPULATION
Site Property	0	0
0 - 0.25 Miles	119	119
0.25 - 0.5 Miles	284	404
0.5 - 1 Miles	684	1088
1 - 2 Miles	1682	2770
2 - 3 Miles	3779	6549
3 - 4 Miles	1492	8041



2000 0 2000 4000 6000 F

0 - 0.25 Miles
0.25 - 0.5 Miles
0.5 - 1 Miles
1 - 2 Miles
2 - 3 Miles
3 - 4 Miles
Site Property

N
W E
S

Utah Department of Environmental Quality

Division of Environmental Response and Remediation

APPENDIX E

POPULATION BLOCKS WITHIN 4 MILES, 2000 CENSUS

Empire Canyon
Summit County, Utah

by: Alan V. Jones date: 11/20/02

Attachment A

Tracer Study Results Report
(See volume bound separately)