ANALYTICAL RESULTS REPORT

FOREST QUEEN MINE SITE
Gunnison County, Colorado

CERCLIS ID# CON000802625

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1.0 INTRODUCTION

This Analytical Results Report (ARR) for the Forest Queen Mine (FQM) site (CERCLIS ID# CON000802625) in Gunnison County, Colorado (Figure 1) has been prepared to satisfy the requirements of Technical Direction Document (TDD) No. 0603-15 issued to URS Operating Services, Inc. (UOS) under the U.S. Environmental Protection Agency (EPA) Region 8 Superfund Technical Assessment and Response Team 3 (START 3) Contract No. EP-W-05-050. This report has been prepared in accordance with the EPA "Guidance for Performing Site Inspections under CERCLA," Interim Final, September 1992, and the "Region 8 Supplement to Guidance for Performing Site Inspections under CERCLA" (U.S. Environmental Protection Agency (EPA) 1992; EPA 1993). High flow field activities were conducted from June 20 through June 22, 2006, at the FQM site during spring runoff when water flow in Coal Creek was near its highest volume of the year. Low flow field activities were conducted from August 21 and August 22, 2006, at the FQM site during fall runoff when water flow in Coal Creek was near its lowest volume of the year. Field activities followed the Site Inspection (SI) format, applicable UOS Technical Standard Operating Procedures (TSOPs), and the Generic Quality Assurance Project Plan (QAPP) (URS Operating Services, Inc. (UOS) 2005a; UOS 2005b).

This ARR is intended to be used in conjunction with the FQM Field Sampling Plan (FSP) (UOS 2006a) and the FQM Trip Report (UOS 2006b).

1.1 HIGH FLOW FIELD ACTIVITIES – JUNE 2006

High flow field activities specifically included collecting environmental samples comprised of twelve surface water samples, thirteen sediment samples, two surface soil samples, and one groundwater sample (Figure 2). Quality Assurance/Quality Control (QA/QC) samples included the collection of one trip blank sample, one surface water duplicate sample, and one sediment duplicate sample. A laboratory matrix spike/matrix spike duplicate (MS/MSD) was also collected during high flow field activities (Table 1). These samples were shipped via Federal Express to Bonner Analytical Testing located in Hattiesburg, Missouri, a Contract Laboratory Program (CLP) laboratory, for Target Analyte List (TAL) metals analysis.

Additionally, five surface water samples, five sediment samples, and one surface soil sample were also submitted for low-level mercury analyses, per EPA toxicologist request, to Brooks Rand laboratory located in Seattle, Washington. QA/QC samples included one surface water duplicate sample and one sediment duplicate sample.

River flow rate measurements were collected at one-foot intervals across all sample locations on Coal Creek using a Marsh-McBirney apparatus. Refer to section 4.3 of this report for high and low flow rate measurements. Each sample location was also documented using a Global Positioning System (GPS) (Figures 2 and 3).

1.2 LOW FLOW FIELD ACTIVITIES – AUGUST 2006

Low flow field activities specifically included collecting environmental samples comprised of twelve surface water samples and thirteen sediment samples (Figure 3). These samples were collected from the same locations as the high flow samples. QA/QC samples included the collection of one trip blank sample, one surface water duplicate sample, and one sediment duplicate sample. A laboratory MS/MSD was also collected during high flow field activities (Table 1). These samples were shipped via Federal Express to Bonner Analytical Testing for TAL metals analysis. EPA toxicologist did not request low-level mercury analysis of surface or sediment samples and therefore these additional samples were not collected during this sampling event.

River flow rate measurements were collected at one-foot intervals across all sample locations on Coal Creek using a Marsh-McBirney apparatus. Refer to section 4.2 of this report for high and low flow rate measurements.

2.0 <u>OBJECTIVES</u>

The objective of the FQM Site Inspection (SI) is to gather information and data for the evaluation of this site with regard to the EPA's Hazard Ranking System (HRS) criteria. The site will be evaluated using analytical data provided in this ARR for an overall characterization of the site. The specific objectives of this SI are to:

- Determine source area(s) and contaminant characteristics of source area(s) at the site and evaluate the source area(s) by HRS criteria;

- Define the Groundwater Pathway and Surface Water Pathway in the Irwin Township area;

- Evaluate contaminant migration through the Surface Water Pathway;

- Evaluate the impact on groundwater and surface water receptor targets;

- Determine if source area(s) are used recreationally or are adjacent to residences;

- Determine the potential impacts to public health and the environment from source contaminants; and

- Determine if residual mercury from amalgamation is present in the environment.

3.0 SITE DESCRIPTION

3.1 SITE LOCATION

The site is located in the Rocky Mountains of central Colorado approximately 25 miles north of Gunnison, approximately 10 miles west of Crested Butte, and approximately 0.5 mile from the town of Irwin. The site is on the south flank of the Scarp Ridge on Mount Emmons within the Ruby Mining District (Figure 1) (U.S. Geological Survey (USGS) 1983); Thomas and Galey 1982; New Mexico Geological society 1981). The FQM consists of a main shaft at least 250 feet deep with underground workings consisting of nine levels, three shafts, and 7,300 feet of drifts (Colorado Geological Survey (CGS) 1998). FQM was the richest silver producer within the Ruby Mining District and operated from 1875 to 1970, with most production from 1879 to 1897 (CGS 1998). The Standard Mine, which operated between 1931 and 1966 and was listed as a National Priority List (NPL) site in 2005, and Keystone Mine were nearby silver producing mines located within the Ruby Mining District (U.S. Forest Service (USFS) 1996).

The site is located in the Ruby Mining District on the east side of Coal Creek, 0.3 miles southwest of Copley Lake and 0.75 mile southeast of Lake Irwin at an elevation of approximately 10,400 feet above sea level. The Public Lands Survey System (PLSS) description of the FQM location is T. 14 S., R. 87 W. There are no section numbers because PLSS sections have not been surveyed in the site area. The latitude and longitude of the site are (north) 38° 52' 15" and (west) 107° 5' 27", respectively (USGS 1961).

3.2 SITE HISTORY

Mining activity first began in the Irwin silver district of the Ruby Mining District in 1874 when the land was still a part of the Ute Indian Reservation. Silver production in the district had ceased by 1890 in all but the Forest Queen Mine. The larger Ruby Mining District was the site of sporadic mining activity between the years of 1901 and 1974. The three largest producing mines in the district, the Standard (Micawber) Mine, the Forest Queen Mine, and the Keystone Mine are located on the south flank of Scarp Ridge (U.S. Geological Survey (USGS) 1983); Thomas and Galey 1982; New Mexico Geological society 1981).

AMAX Exploration began the delineation of molybdenite ores in the area of Mount Emmons and the Keystone Mine in 1970. By 1976 AMAX had delineated the Red Lady Basin molybdenum deposit on the far eastern edge of Scarp Ridge (Thomas and Galey 1982).

None of the mines in the Ruby Mining District are currently active. Mine sites in the area were inventoried by U.S. Bureau of Mines personnel during the summer of 1995 and the Colorado Geological Survey inventoried mines in the Ruby Mining district during the summers of 1996 and 1997 (CGS 1998).

3.3 SITE CHARACTERISTICS

3.3.1 <u>Physical Geography</u>

The site is located in the Central Rocky Mountain province of Colorado (CGS 1972). Elevations within the area range from a low of 8,900 feet above sea level at the town of Crested Butte at the eastern edge of the Ruby mining district, to a high of 13,000 feet above sea level along the Ruby Range at the western edge of the district (USGS 1961a; USGS 1961b). The terrain is mountainous with incised stream valleys with steep slopes. Vegetation ranges from lush willow shrub and scrub brush undergrowth in stream bottoms through aspen, fir, and spruce forests on the mountain slopes to treeless alpine tundra vegetation on the ridge tops more than 12,800 feet above sea level.

3.3.2 <u>Geology and Hydrogeology</u>

The geology of Gunnison County and the Ruby Mining District is complicated involving several periods of intrusion, structural deformation, and mineralization. Detailed discussions of district and individual mine geology may be found in "Exploration and Geology of the Mt. Emmons Molybdenite Deposits, Gunnison County, Colorado" (Thomas and Galey 1982); "Geology of the Mount Emmons Molybdenum Deposit, Crested Butte, Colorado (New Mexico Geological Society 1981); "Similarity of Cenozoic Igneous Activity in the San Juan and Elk Mountains, Colorado, and Its Regional Significance" (USGS 1969); and "Mineral Resource Potential of the Oh-Be-Joyful Wilderness Study Area, Gunnison County, Colorado" (USGS 1983).

The western boundary of the Ruby Mining District is defined by the Ruby Range in which occurs a series of north-trending Tertiary dikes. East of the Ruby Range along Scarp Ridge are early Tertiary Age sedimentary rocks of the Wasatch and Ohio Creek formations (State of Colorado, Mineral Resources Board 1960). The Wasatch and Ohio Creek formations are composed of varicolored claystone, mudstone, sandstone, and conglomerate and dip to the south along the south side of Scarp Ridge approximately 14 to 17 degrees forming a dip slope (USGS 1979). The Wasatch and Ohio Creek formations may be as much as 2,200 feet thick in the area (USGS 1980). The eastern boundary of the Ruby Mining District is covered by the sedimentary rocks of the Upper Cretaceous Mesa Verde formation (USGS 1979).

The Ruby Mining District was the scene of middle and late Cenozoic epizonal plutonic activity. During the late Cenozoic tectonic activity, regional crustal extension and local structural reaction to plutonic emplacement created a series of fractures and faults that were mineralized (USGS 1969). The mineralized material consists of quartz-arsenopyrite-pyrargyrite-prousite-calcite-rhodochrosite-tetrahedrite-galena-argentite-pyrite-chalcopyrite-sphalerite veins that have produced silver, zinc, lead, copper, and gold ores. The three largest producing mines in the Ruby Mining District are the Forest Queen Mine, the Standard (Micawber) Mine, and the Keystone Mine. A major molybdenum deposit has also been delineated under Mount Emmons (USGS 1987).

There are no extensive aquifer systems associated with the Ruby Mining District. Groundwater location and movement is controlled by fracture systems in the igneous and fine-grained sedimentary rocks of the mining district. Small to medium-sized isolated groundwater aquifers containing groundwater of variable quality are presumed to be present in the coarser grained layers of the Wasatch and Ohio Creek formations but there is no record of wells in much of the mining district to provide consistent lithologic, water quality, or aquifer yield data. It is possible that groundwater is discharged into Coal Creek and its tributaries by general stream bed discharge or through multiple springs or seeps (USGS 1980).

There are several abandoned mine shafts and adits discharging groundwater from underground workings into the surface water streams in the Ruby Mining District. The Standard (Micawber) Mine, for example, was reported to discharge approximately 10 gallons per minute (gpm) from the adit opening into Elk Creek (CGS 1998). During the UOS field sampling of June 1999 the discharge was estimated to be between 100 gpm and 200 gpm and during the September 1999 field sampling the discharge was estimated to be between 20 gpm to 50 gpm (UOS 1999a). There is a history of mines in the Ruby Mining District being abandoned because of flooding (USGS 1967).

Groundwater would also be expected to be present in the alluvium and colluvium found in basins and stream valleys. No direct observations have been made to determine alluvium and colluvium depth, but it could be expected to be at least 10 to 20 feet thick, where present. There is probably a shallow alluvial water table aquifer present in the Lake Irwin area and along Coal Creek Valley.

3.3.3 Hydrology

Surface water drainage from the site area flows to Coal Creek. Coal Creek drains approximately 11 square miles of the mining district. The northern side of the Coal Creek drainage includes, from upstream to downstream, the surface water drainage from the FQM area, the surface water drainage from the Standard (Micawber) Mine area via Elk Creek, the surface water drainage from the Iron Bog, and the surface water drainage from the Keystone Mine area. Coal Creek flows into the Slate River below the town of Crested Butte. The headwater source of Coal Creek is a diversion, via a buried pipe, from Lake Irwin. Lake Irwin is fed by streams originating in Robinson Basin (UOS 1999b).

Most of the flow in the drainage is derived from snow melt. There is very little recorded flow rate data available for the creeks draining the Ruby Mining District. A flow of 12 gpm was given for an unspecified location on Elk Creek below the Standard (Micawber) Mine, dated October 2, 1996 (CGS 1998). Stream gauging conducted during this investigation resulted in flows for the lower stretches of Coal Creek from 100 to 150 cubic feet per second (cfs) for the high flow regime of spring runoff and flows in the lower stretches of Coal Creek from 7 to 12 cfs for the low flow regime of late summer. The daily average annual flow rate for the Slate River immediately downstream of the town of Crested Butte and the confluence of Coal Creek is given as 147 cfs (USGS 1998).

3.3.4 Meteorology

The FQM site is located in a semiarid climate zone. Most of the annual precipitation falls as snow. The mean annual precipitation, as totaled from the University of Delaware (UD) database, is 11.7 inches. The net annual precipitation, as calculated from precipitation and evapotranspiration data obtained from UD, is 3.7 inches (University of Delaware (UD) 1986). The 2-year, 24-hour rainfall event for this area is 1.5 inches (Dunne and Leopold 1978).

4.0 PATHWAY CHARACTERIZATION

4.1 SOURCES (WASTE CHARACTERISTICS)

The mineralized material that was mined consisted of quartz-arsenopyrite-pyrargyrite-prousite-calcite-rhodochrosite-tetrahedrite-galenaargentite-pyrite-chalcopyrite-sphalerite veins that produced silver, zinc, lead, copper, and gold ores. An estimated water flow of greater than 15 gpm was noted in the bottom of the Forest King shaft on site. There is also 1,220 cubic yards (yd^3) of waste rock in three large dump areas on site (Colorado Division of Wildlife 1998).

Two soil source samples were collected as opportunity soil samples from the site. Sample FQSO01 was collected from the rings located under the process runner adjacent to the Forest King Mine shaft. Sample FQSO02 was collected from the waste rock pile located adjacent to the Forest King Mine shaft (Appendix B) (Photos 14 and 15). These samples were collected during the high flow sampling event in June 2006.

One source surface water sample (FQSW12) and one source sediment sample (FQSE12) were collected from within the northern adit located on site (Figures 2 and 3) (Photo 12). One sediment source sample, FQSE13, was collected from within the southern adit located on site (Figures 2 and 3) (Photo 13). No surface water drainage was present at the southern adit, and therefore no surface water source samples were collected from this adit. Samples FQSW12, FQSE12, and FQSE13 were collected during both the high flow sampling event in June 2006 as well as the low flow sampling event in August 2006.

Source sample analytical results are reported in Table 5. Laboratory data and validation reports are presented in Appendix A.

4.2 SURFACE WATER PATHWAY

Site runoff, including any adit drainage, flows into two unlined retention ponds located on the southwestern portion of the site. From the ponds, the runoff flows from the site a few hundred feet to the southwest and into Coal Creek. Coal Creek flows from just west of the site approximately 8.5 miles into the town of Crested Butte and then an additional 1.5 miles to where it merges with the Slate River. The Surface Water Pathway continues along the Slate River another approximate five and a half miles to the 15-mile downstream limit from the site.

The primary surface water drainage in the area of the site is the Coal Creek drainage. The source of Coal Creek is on Scarp Ridge east of the Irwin town site. The Coal Creek drainage is the sole source of the town of Crested Butte's municipal water supply. The Crested Butte municipal water system serves approximately 1,000 connections (approximately 1,600 residents) (Crested Butte Water Department 2006). A diversion of approximately two cfs is taken from Irwin Lake (the Robinson Basin drainage) and fed into upper Coal Creek. This two-cfs diversion is made to maintain water rights that belong to Crested Butte.

The diversion for Crested Butte's municipal water supply is approximately 5.25 miles downstream of Irwin, 5.0 miles downstream of the FQM, and 50 feet upstream of the National Pollution Discharge Elimination System (NPDES) outfall for the Keystone Mine. The surface water diversion for the Crested Butte drinking water flows along the south side of Coal Creek into Crested Butte. At Wildcat Creek a secondary intake continuously diverts surface water from Wildcat Creek at the rate of a few gallons per minute. Wildcat Creek is designated as an emergency intake (UOS 1006c).

Approximately 11.5 miles of streamside wetlands are present from the site along Coal Creek downstream 15 miles. Palustrine scrub-shrub, emergent, and aquatic bed wetlands dominate with the greatest concentrations found in the upper stretches of the drainage, just below Kebler Pass and below the confluence with Elk Creek (U.S. Fish and Wildlife Service (USFWS) 1983). The Mount Emmons Iron Bog/Fen is a naturally occurring characteristic wetland located north of Coal Creek and west of the Keystone Mine. Three surface water and sediment samples were collected in the area of the wetlands at the site. Surface water and sediment samples FQSW08 and FQSE08 were collected from an area just downstream of the wetlands area. Surface water and sediment samples FQSW09 and FQSE09 were collected from within the wetland on site. Surface water and sediment samples FQSW10 and FQSE10 were collected from an area just upstream of the wetlands area on site (Figures 2 and 3). Surface water and sediment sample analytical results are reported in Tables 2 and 3. Laboratory data and validation reports are presented in Appendix A.

The 15-mile downstream segment continues from the confluence of Coal Creek and the Slate River downstream on the Slate River. The Slate River does not have any recorded diversions on the remainder of the 15-mile downstream segment. There are extensive wetlands along the Slate River. Fish production data indicate that rainbow, brown, and brook trout, as well as white suckers, are all present in the Slate River. Population densities for the combined species may exceed 600 fish per acre and fishing pressure is reported as heavy by the Colorado Division of Wildlife (Colorado Division of Wildlife 1998). Fish species present in Coal Creek include brown, brook, and cutthroat trout. Brown trout are present at a density of 163 fish per acre, brook trout at 14 fish per acre, and cutthroat at 14 fish per acre. The Colorado River cutthroat trout is listed as a species of special concern in Gunnison County (Colorado Natural Heritage Program 2006).

The following table shows flow rate measurements taken during both the high flow and low flow sampling events:

High and Low Flow Sampling Events
Flow Rates (ft^2/s)

Sample ID	High Flow	Low Flow
FQSW01	54.16	3.15
FQSW02	43.82	1.52
FQSW03	38.82	4.08
FQSW04	32.67	4.14
FQSW05	23.24	1.75
FQSW06	9.22	1.09
FQSW07	9.01	1.60
FQSW08	5.65	1.55
FQSW09	5.65	0.87
FQSW10	7.05	0.89
FQSW11	4.72	1.36

ft^2/s Cubic feet per second.

Rationale for surface water sample locations is listed in Table 1.

The following deviations from the final FSP, dated June 9, 2006, were made in the field based on assessments made by the START project manager and Region 8 EPA Site Assessment Manager (SAM):

- Surface water and sediment samples FQSW11 and FQSE11 were collected as background samples during both the high flow sampling event in June 2006 and the low flow sampling event in August 2006.

- Surface water and sediment sample location identification numbers were changed in the field because of the deletion of two samples during field activities.

- Samples were not collected from location FQSW03/FQSE03 (downstream of the Crested Butte municipal water intake) as designated in the original FSP because of incorrect mapping of the water intake. The water intake was determined in the field to be located approximately 40 feet south of sample location FQSW02/FQSE02, and therefore sample FQSW01/FQSE01 will be used as the downstream sample from the water intake.

- Samples were not collected from location FQSW12/FQSE12 (downstream of the probable point of entry (PPE) from the site) as designated in the original FSP because of its close proximity to sample FQSW10/FQSE10 collected on June 21, 2006. This sample was not collected in order to reduce redundancy of data and to lower laboratory costs.

Surface water sample analytical results are reported in Table 2. Laboratory data and validation reports are presented in Appendix A.

4.3 GROUNDWATER PATHWAY

Groundwater is used as the primary source of drinking water in the town of Irwin. Groundwater from the upper Robinson Basin mineralized area is expected to flow through the town of Irwin. The Colorado State Engineer's Office has records of approximately19 private domestic wells within the town of Irwin. The average number of persons per household in Gunnison County, Colorado, is 2.30 (U.S. Census Bureau 2000). Assuming that each domestic well serves one household, the total number of residents using groundwater can be calculated to be approximately 75 people. These wells are shallow groundwater wells. There are no records available of any water quality testing for any private domestic wells. Domestic wells within four miles of the site are listed in Table 1 (UOS 2006a).

The town of Crested Butte does not obtain any municipal water supplies from groundwater (UOS 2006a).

Domestic Wells within 4-Mile Radius

Radius	Number of Wells
0 - 0.25	1
0.25 - 0.50	8
0.50 - 1.0	15
1.0 - 2.0	5
2.0 - 3.0	1
3.0 - 4.0	1
Total	**31**

There is no evidence of a continuous aquifer in the area of the site. It is probable that the alluvial and colluvial material in the Coal Creek Valley is a shallow unconfined aquifer at many locations and it is probably interconnected, but not continuously.

One opportunity groundwater sample was collected from a residence adjacent to the site (Figure 2). This sample was collected directly from the kitchen sink faucet in the residence. Water is supplied to the home from a spring. Access was not granted to any other properties near the site for groundwater sampling purposes.

Groundwater sample analytical results are reported in Table 4. Laboratory data and validation reports are presented in Appendix A.

4.4 SOIL EXPOSURE AND AIR PATHWAYS

All of the waste rock associated with former mining operations is reported to be uncovered and there is no fencing specifically associated with any former mining material that has been installed to limit access. Several residences are located adjacent to the site. A large majority of these residences are reportedly inhabited on a part-time basis (seasonally). The Gunnison County Planning Commission reports that no children live in the town of Irwin. Very fine grained and uncontained mine waste rock material at the site could be transported short distances by wind, exposing metals-contaminated material in the wind to nearby residences (UOS 2006a).

The following table shows population density within a four-mile radius of the site (U.S. Census Bureau 2000):

Population Density within Four-Mile Radius

Radius	Population
0 - 0.25	0
0.25 - 0.50	7
0.50 - 1.0	2
1.0 - 2.0	1
2.0 - 3.0	4
3.0 - 4.0	59
Total Population	**73**

Acreage of wetlands located within a four-mile radius of the site is listed in the following table (USFWS 1983):

Wetlands Acreage within Four-Mile Radius

Radius	Wetland Acreage (Approximate)
0 - 0.25	0
0.25 - 0.50	1 - 50
0.50 - 1.0	50 - 100
1.0 - 2.0	100 - 150
2.0 - 3.0	100 - 150
3.0 - 4.0	100 - 150

Specific soil and air samples were not collected for this investigation because of a paucity of workers or residents in the immediate area.

The federally listed endangered southwestern willow flycatcher and the American peregrine falcon inhabit the area. The federally listed threatened bald eagle also inhabits the area. Candidates for federal listing that are known to inhabit the area include the Boreal toad and the lynx. State listed endangered species include the Boreal toad, lynx, and wolverine. State listed threatened species include the American peregrine falcon and the bald eagle. Species listed as of special concern include the northern leopard frog and the Colorado River cutthroat trout (Colorado Division of Wildlife 1998).

5.0 LABORATORY DATA ANALYSIS

5.1 SEPTEMBER 2005 SAMPLING EVENT

The EPA collected surface water and sediment samples at the FQM site and along the drainage of Coal Creek and its tributaries in September 2005 (Figure 2). Metals contaminants including, but not limited to, arsenic, lead, and zinc were detected in surface water and sediment samples collected from the FQM site at levels above their respective non-detect background value or three times the detected background value. Mercury was also detected in one EPA historic sediment sample FQ-01 and silver was detected in both sediment samples FQ-01 and FQ-02 at the FQM site at values significantly exceeding background. Both contaminants were also detected in three EPA historic sediment samples COAL-25, COAL-20, and COAL-15 collected downstream of the site at values significantly exceeding background. Mercury and silver were not detected in samples collected from Elk Creek south of Standard Mine. Refer to the Preliminary Assessment report (completed under TDD # 0602-02) for further information about the locations of these samples (UOS 2006c).

Dr. Dan Wall, a U.S. Fish and Wildlife Service (USFWS) Biologist, provided a data interpretation of the EPA historic samples collected from sample locations FQ-01 and FQ-02. In summary, Dr. Wall indicated that the sample results from the September 2005 sampling event indicated that contaminants associated with the Forest Queen Mine were likely to cause toxicity to aquatic organisms at sample locations FQ-01 and FQ-02. These sample locations were selected based on the high probability that these were "worst-case" scenarios. Dr. Wall also indicated that the locations are not expected to support or attract significant aquatic life because both areas are highly disturbed and do not have the necessary habitat. Drainage from the mine flows to settling ponds before discharging into Coal Creek, which would likely reduce the amount of contamination that would reach Coal Creek. Per Dr. Wall's interpretation, the closest downstream station in Coal Creek did not appear to present unacceptable risk to aquatic life (Appendix C).

5.2 JUNE AND AUGUST 2006 SAMPLING EVENTS

Sediment samples FQSE01, FQSE02, FQSE03, and FQSE04 collected during the high and low flow sampling events all exceeded the three times background values of cadmium (0.37 J and 0.19 J milligrams per kilogram (mg/kg), respectively) and zinc (86.4 and 92.1 J mg/kg, respectively). Sediment sample FQSE01 collected during the low flow sampling event also exceeded the three times background value of arsenic of 27.2 J mg/kg.

Levels of beryllium, chromium, copper, lead, and manganese also exceeded three times background levels in sediment sample FQSE01 during the low flow sampling event. Levels of manganese exceeded three times the background level in sediment sample FQSE02 during the low flow sampling event. Levels of copper and lead exceeded three times background levels in sediment sample FQSE04 during the low flow sampling event.

Metals contamination consistently detected at levels exceeding three times background values in samples FQSW01/FQSE01 through FQSW04/FQSE04, which were collected from sample locations downstream of the convergence of Elk Creek and Coal Creek, can most likely be attributed to the Standard Mine Superfund Site.

Metals contaminants were detected in source soil sample FQSO01, collected from the rings located under the process runner adjacent to the Forest King Mine shaft, and sample FQSO02, collected from the waste rock pile located adjacent to the Forest King Mine shaft (Table 5). Elevated levels of arsenic exceeding background values were also detected in source surface water and sediment samples FQSW12 and FQSE12, collected from the northern adit drainage area. Arsenic detected in surface water sample FQSW12, collected during both the high and low flow sampling events, did not exceed the Superfund Chemical Data Matrix (SCDM) Maximum Contaminant Level (MCL) value of 50 micrograms per liter (µg/L) or the SCDM acute or chronic environmental benchmark values of 340 µg/L or 150 µg/L, respectively. Higher concentrations of metals contamination found in these source samples are most likely byproducts of mining operations at the site.

Arsenic levels detected in surface water samples FQSW07 and FWSW09, collected during the August 2006 low flow sampling event, also exceeded three times background levels, but did not exceed the SCDM MCL value of 50 µg/L or the SCDM acute or chronic environmental benchmark values of 340 µg/L or 150 µg/L, respectively.

Several surface water samples collected during the low flow sampling event also exceeded three times background or non-detect background values for aluminum, calcium, and iron.

Sediment samples FQSE07, FQSE08, and FQSE09 collected during the high and low flow sampling events all exceeded the three times background values of arsenic of 36.0 mg/kg and 27.2 J mg/kg, respectively. Sediment sample FQSE08 collected during the low flow sampling event also exceeded the non-detect level or three times background values of cadmium (0.91 J mg/kg), lead (25.7 mg/kg), mercury (0.045 J mg/kg), silver (1.3 UJ), and zinc (92.1 J mg/kg. Mercury levels in samples collected during the low flow sampling event exceeded three times the background in sediment sample FQSE09.

Groundwater sample FQGW01 contained no analytes at levels exceeding background or SCDM benchmark levels.

Region 8 EPA toxicologists requested samples be collected and submitted for trace mercury and monomethyl mercury analyses. These sample results are presented in Table 6 and Appendix A.

5.2.1 Data Validation and Interpretation

Samples were analyzed for CLP TAL Metals analysis by Bonner Analytical Testing Corporation and for low-level mercury and monomethyl mercury analysis at Brooksrand

Trace Metals Analysis Laboratory. All samples were collected between June 21 and 22, 2006 (high flow period sampling event), and August 21 and 22, 2006 (low flow period sampling event). All CLP data were validated by TechLaw Inc and all low-level mercury data were reviewed by a UOS staff chemist. The data are acceptable for their intended use. While the data met all contractual and methodological requirements, the following issues were revealed by the data validation and review:

The overall quality of the data was good. No data points were rejected (flagged as “R”) by the validator. Some problems with laboratory blanks resulted in the application of additional qualifier flags. Discussion will be limited to those analytes with a potential to impact water quality or affect the HRS score of the site, specifically arsenic, cadmium, lead, and mercury. See Tables 7 and 8 for specific changes to data as a result of data validation.

Blank contamination that was less than the Contract Required Detection Limit (CRDL), but above the Method Detection Limit (MDL) resulted in the elimination of five detections for arsenic, two detections for lead and nine detections for mercury. All of the arsenic and lead detections were within two times the CRDL and less than three times the background sample detection for arsenic or lead. The mercury detections were all less than the SCDM drinking water value and less than three times the background sample detection for mercury. The elimination of these detections for mercury and arsenic has little impact on the overall quality or usability of the data set.

All other changes to data involved the application of J (value is estimated), J+ (indicating a potential high bias) and J- (indicating a potential low bias).

6.0 SUMMARY

The site is located in the Rocky Mountains of central Colorado approximately 25 miles north of Gunnison, approximately 10 miles west of Crested Butte, and approximately 0.5 mile from the town of Irwin. The FQM consists of a main shaft at least 250 feet deep with underground workings consisting of nine levels, three shafts, and 7,300 feet of drifts. FQM was the richest silver producer within the Ruby Mining District and operated from 1875 to 1970, with most production from 1879 to 1897. The Standard Mine, which operated between 1931 and 1966 and was listed as an NPL site in 2005, and Keystone Mine were nearby silver producing mines located within the Ruby Mining District.

The EPA collected surface water and sediment samples at the FQM site and along the drainage of Coal Creek and its tributaries in September 2005. Metals contaminants including, but not limited to, arsenic, lead, mercury, silver, and zinc were detected in these surface water and sediment samples collected from the FQM site at levels above their respective non-detect background value or three times the detected background value. Mercury and silver were also detected in three sediment samples (COAL-25, COAL-20, and COAL-15) collected downstream of the site at values significantly exceeding background but were not detected in samples collected from Elk Creek south of Standard Mine. Dr. Dan Wall of the USFWS indicated that there was a potential for the contaminants associated with these samples collected from the Forest Queen Mine site to cause localized toxicity to aquatic organisms despite these particular sample locations not being expected to support or attract significant aquatic life. Dr. Wall also indicated that the closest downstream station to the site in Coal Creek did not appear to present unacceptable risk to aquatic life.

Analytical results from the June and August 2006 sampling events indicated that metals contamination in August 2006 was consistently detected at levels exceeding three times background values in samples FQSW01/FQSE01 through FQSW04/FQSE04 (collected from sample locations located downstream of the convergence of Elk Creek and Coal Creek). This contamination can most likely be attributed to the Standard Mine Superfund Site.

Elevated levels of arsenic exceeding background values were also detected in source surface water and sediment samples FQSW12 and FQSE12, collected from the northern adit drainage area. Arsenic detected in surface water sample FQSW12, collected during both the high and low flow sampling events, did not exceed the SCDM MCL value of 50 μg/L or the SCDM acute or chronic environmental benchmark values of 340 μg/L or 150 μg/L, respectively. Higher concentrations of metals contamination found in these source samples are most likely byproducts of mining operations at the site.

Arsenic levels detected in surface water samples FQSW07 and FWSW09, collected during the August 2006 low flow sampling event, also exceeded three times background levels, but did not exceed the SCDM MCL value of 50 µg/L or the SCDM acute or chronic environmental benchmark values of 340 µg/L or 150 µg/L, respectively.

Levels exceeding the non-detect or three times background values of arsenic, cadmium, lead, mercury, silver, and/or zinc were found in sediment samples collected from within the wetlands (sample FQSE09) and just downstream of the wetlands located closest to the site (sample FQSE08), and upstream of the convergence of Ohio Creek and Coal Creek (sample FQSE07).

Although data indicate that sediments directly downstream and in the area of the site have been impacted by runoff contamination from the site, surface water contamination remains at levels well below the MCLs or environmental benchmark values.

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Figure 1 Site Location and Area of Influence Map

Figure 2 Sample Results Map

Figure 3 Source Sample Results Map

TABLE 1
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Surface Water	FQSW01	Collected from Coal Creek downstream of Keystone plant outfall. Collocated with historic sample ID# COAL-05.	Document contamination in Coal Creek that can be attributed to Keystone plant outfall.
	FQSW02	Collected from Coal Creek upstream of Keystone plant outfall. Collocated with historic sample ID# COAL-10.	Document Coal Creek contamination and conditions upstream of Keystone plant outfall.
	FQSW03	Collected from Coal Creek downstream of the iron bog.	Document contamination in Coal Creek downstream of the iron bog.
	FQSW04	Collected from Coal Creek downstream of convergence with Elk Creek. Collocated with historic sample ID# COAL-15.	Document contamination in Coal Creek that can be attributed to Elk Creek.
	FQSW05	Collected from Coal Creek upstream of convergence with Elk Creek. Collocated with historic sample ID# COAL-20.	Document Coal Creek contamination and conditions upstream of Elk Creek.
	FQSW06	Collected from Coal Creek downstream of convergence with Ohio Creek. Collected at or near historic sample ID# COAL-25.	Document contamination in Coal Creek that can be attributed to Ohio Creek.
	FQSW07	Collected from Coal Creek upstream of convergence with Ohio Creek.	Document Coal Creek contamination and conditions upstream of Ohio Creek.
	FQSW08	Collected from Coal Creek at outflow of nearest wetlands to the site.	Document mercury contamination found in Coal Creek at the outflow of the nearest wetlands to the site.
	FQSW09	Collected from Coal Creek within nearest wetlands to site.	Document contamination found in wetlands of Coal Creek.
	FQSW10	Collected from Coal Creek downstream of PPE and before wetlands area.	Test for potential site impact on drinking water users, fisheries, and wetlands associated with Coal Creek.
	FQSW11 (MS/MSD)	Collected from Coal Creek above PPE.	Collected as background sample. MS/MSD collected to test the precision of laboratory analytical methods.
	FQSW12	Adit drainage collected from northern most adit on site.	Document source contamination of adit drainage.
Sediment	FQSE01	Collected from Coal Creek downstream of Keystone plant outfall. Collocated with historic sample ID# COAL-05.	Document contamination in Coal Creek that can be attributed to Keystone plant outfall.
	FQSE02	Collected from Coal Creek upstream of Keystone plant outfall. Collocated with historic sample ID# COAL-10.	Document Coal Creek contamination and conditions upstream of Keystone plant outfall.
	FQSE03	Collected from Coal Creek downstream of the iron bog.	Document contamination in Coal Creek downstream of the iron bog.

TABLE 1
Sample Locations and Rationale

Matrix	Sample #	Location	Rationale
Sediment (continued)	FQSE04	Collected from Coal Creek downstream of convergence with Elk Creek. Collocated with historic sample ID# COAL-15.	Document contamination in Coal Creek that can be attributed to Elk Creek.
	FQSE05	Collected from Coal Creek upstream of convergence with Elk Creek. Collocated with historic sample ID# COAL-20.	Document Coal Creek contamination and conditions upstream of Elk Creek.
	FQSE06	Collected from Coal Creek downstream of convergence with Ohio Creek. Collected at or near historic sample ID# COAL-25.	Document contamination in Coal Creek that can be attributed to Ohio Creek.
	FQSE07	Collected from Coal Creek upstream of convergence with Ohio Creek.	Document Coal Creek contamination and conditions upstream of Ohio Creek.
	FQSE08	Collected from Coal Creek at outflow of nearest wetlands to the site.	Document mercury contamination found in Coal Creek at the outflow of the nearest wetlands to the site.
	FQSE09	Collected from Coal Creek within nearest wetlands to site.	Document contamination found in wetlands of Coal Creek.
	FQSE10	Collected from Coal Creek downstream of PPE and before wetlands area.	Test for potential site impact on drinking water users, fisheries, and wetlands associated with Coal Creek.
	FQSE11 (MS/MSD)	Collected from Coal Creek downstream of PPE and before wetlands area.	Test for potential site impact on Coal Creek.
	FQSE12	Adit drainage collected from northern most adit on site.	Document source contamination of adit drainage.
	FQSE13	Collected southern most adit on site.	Document source contamination of adit drainage.
Source/Soil	FQSO01	Collected from rings under process runner at mine workings within at Forest King Mine shaft.	Characterize potential contaminants at the site and test for contamination to soil exposure targets.
	FQSO02	Collected from waste rock pile north of Forest King Mine shaft.	Characterize potential contaminants at the site and test for contamination to soil exposure targets.
Groundwater	FQGW01	Collected from Scott Gates' residence located north of the site.	Test for potential contamination impacting the local drinking water supply resulting from operations at site.
QA/QC	FQSW31	Duplicate of sample FQSW13. Collected from Coal Creek upstream of the PPE.	Document precision of sample collection procedures and lab analysis.
	FQSE31	Duplicate of sample FQSW13. Collected from Coal Creek upstream of the PPE.	Document the precision of sample collection procedures and lab analysis.

Sample designation - e.g., PN-GW-8: PN = Project name, GW = matrix, 8 = sample number

TABLE 2
Surface Water - Inorganic Sample Results
Concentrations in micrograms per liter (μg/L) (parts per billion (ppb))

Analytes	SCDM (Surface Water Pathway) (1/28/04)			FQSW11 (Background)		FQSW01		FQSW02		FQSW03		FQSW04		FQSW05		FQSW06	
	MCL/ MCLG (μg/L)	RDSC (μg/L)	CRSC (μg/L)	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow
Aluminum				142 J-	200 U	126 J-	326	233	200 U	70.3 J-	130 J	88.9 J-	98.8 J	97.6 J-	139 J	155 J-	39.7 J
Antimony	6.0	15		60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U
Arsenic	50 [10††]	11	0.057	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	14.1 U	10 U	11.1 U
Barium	2,000	2,600		200 UJ	16.6 J-	200 UJ	17.7 J-	200 UJ	21.2 J-	200 U	22.2 J-	200 UJ	22.6 J-	200 UJ	24.5 J-	200 UJ	18.0 J-
Beryllium	4.0	73		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Cadmium	5.0	18		5.0 U	5.0 U	5.0 U	0.75 J-	0.73 J	0.46 J-	5.0 U	0.41 J-	0.90 J	0.91 J-	5.0 U	5.0 U	5.0 U	5.0 U
Calcium				9,810	11,300	16,500	130,000	10,100	16,600	10,300	16,700	11,100	16,700	6,310	11,400	8,010	12,500
Chromium	100	110		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Cobalt				3.0 J	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Copper	1,300			2.7 J-	25 U	1.4 J-	25 U	2.1 J-	25 U	25 U	25 U	3.4 J-	25 U	25 U	25 U	25 U	25 U
Iron				136	219	110	109	190	160	122	303	120	206	130	301	197	163
Lead	15			10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Magnesium				5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U
Manganese		5,100		19.4	61.1	50.8	65.7	80.8	59.2	30.4	75.3	29.4	17.5	15 U	17.2	20.6	23.1
Mercury	2.0	11		0.20 U	0.2 U	0.20 U	0.2 U	0.20 U	0.20 U	0.20 U	0.2 U	0.20 U	0.2 U	0.20 U	0.2 U	0.20 U	0.20 U
Nickel		730		4.5 J	40 U	0.93	1.4 J-	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U
Potassium				5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U
Selenium	50	180		35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U
Silver		180		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Sodium				1,140 J-	5,000 U	1,680 J-	5,000 U	1,400 J-	5,000 U	1,670 J-	5,000 U	1,460 J-	5,000 U	1,380 J-	5,000 U	1,320 J-	5,000 U
Thallium	0.50			25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Vanadium		260		50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Zinc		11,000		60 U	60 U	125	136	174	143	91.2	96	184	186	60 U	60 U	60 U	60 U

J Associated numerical value is an estimated quantity and is the approximate concentration of the analyte in the sample.
J+ Associated numerical value is an estimated quantity but the results may be biased high.
J- Associated numerical value is an estimated quantity but the results may be biased low.
UJ The reported quantitation limit is estimated because Quality Control criteria were not met. Element or compound may or may not be present in the sample.
U The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
(grey box) Lower than the CLP ICP-AES CRQL and the CLP ICP-MS CRQL.
†† EPA adopted a new MCL for arsenic in drinking water (10 μg/L) on January 22, 2001, and public water systems must comply with the 10 μg/L standard beginning January 23, 2006. See EPA 2002.
(hatched box) During low flow sampling event, the analyte was detected at a level exceeding three times the background value and/ or three times the background value as well as a SCDM benchmark level.
SCDM Superfund Chemical Data Matrix
RDSC Reference Dose Screening Concentration
CRSC Cancer Risk Screening Concentration
MCLG Maximum Contaminant Level Goal. A non-enforceable health goal that is set at a level at which no known or anticipated adverse effect on the health of persons occurs and which allows an adequate margin of safety.
MCL Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. MCLs are enforceable standards.

TABLE 2
Surface Water - Inorganic Sample Results
Concentrations in micrograms per liter (μg/L) (parts per billion (ppb))
(Continued)

Analytes	SCDM (Surface Water Pathway) (1/28/04)			FQSW11 (Background)		FQSW07		FQSW08		FQSW09		FQSW10		FQSW31	
	MCL/ MCLG (μg/L)	RDSC (μg/L)	CRSC (μg/L)	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow
Aluminum				142 J-	200 U	71.4 J-	610	75.8 J-	58.5 J	85.1 J-	554	62.1 J-	200 U	58.9 J-	108 J
Antimony	6.0	15		60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U
Arsenic	50 [10††]	11	0.057	10 U	10 U	10 U	24.7	10 U	16.3 U	10 U	31.7	10 U	10 U	10 U	10 U
Barium	2,000	2,600		200 UJ	16.6 J-	200 UJ	24.7 J-	200 UJ	16.2 J-	200 UJ	24.4 J-	200 UJ	16.3 J-	200 UJ	16.3 J-
Beryllium	4.0	73		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Cadmium	5.0	18		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Calcium				9,810	11,300	8,460	13,000	8,200	12,300	8,150	12,400	7,720	11,300	7,480	11,200
Chromium	100	110		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Cobalt				3.0 J	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Copper	1,300			2.7 J-	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Iron				136	219	105	751	132	232	140	998	111	217	91.9 J-	234
Lead	15			10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Magnesium				5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U	5,000 UJ	5,000 U
Manganese		5,100		19.4	61.1	15 U	128	28.6	84.4	29.2	272	21.3	63.5	15 U	64.8
Mercury	2.0	11		0.20 U	0.2 U	0.20 U	0.2 U	0.20 U	0.20 U	0.20 U	0.2 U	0.20 U	0.2 U	0.20 U	0.2 U
Nickel		730		4.5 J	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U	40 U
Potassium				5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U	5,000 U
Selenium	50	180		35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U	35 U
Silver		180		10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Sodium				1,140 J-	5,000 U	1,080 J-	5,000 U	1,120 J-	5,000 U	1,080 J-	5,000 U	898 J-	5,000 U	938 J-	5,000 U
Thallium	0.50			25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U
Vanadium		260		50 U	50 U	50 U	1.0 J	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
Zinc		11,000		60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U	60 U

J Associated numerical value is an estimated quantity and is the approximate concentration of the analyte in the sample.
J+ Associated numerical value is an estimated quantity but the results may be biased high.
J- Associated numerical value is an estimated quantity but the results may be biased low.
UJ The reported quantitation limit is estimated because Quality Control criteria were not met. Element or compound may or may not be present in the sample.
U The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
(grey shading) Lower than the CLP ICP-AES CRQL and the CLP ICP-MS CRQL.
†† EPA adopted a new MCL for arsenic in drinking water (10 μg/L) on January 22, 2001, and public water systems must comply with the 10 μg/L standard beginning January 23, 2006. See EPA 2002.
(hatched shading) During low flow sampling event, the analyte was detected at a level exceeding three times the background value and/ or three times the background value as well as a SCDM benchmark level.
SCDM Superfund Chemical Data Matrix
RDSC Reference Dose Screening Concentration
CRSC Cancer Risk Screening Concentration
MCLG Maximum Contaminant Level Goal. A non-enforceable health goal that is set at a level at which no known or anticipated adverse effect on the health of persons occurs and which allows an adequate margin of safety.
MCL Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. MCLs are enforceable standards.

TABLE 3
Sediment - Inorganic Sample Results
Concentrations in milligrams per kilogram (mg/kg)) (parts per million (ppm))

Analytes	FQSE11 (Background)		FQSE01		FQSE02		FQSE03		FQSE04		FQSE05		FQSE06	
	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow
Aluminum	8,090	6,780	5,960	14,100	5,920	7,800	5,930	7,190	9,320	6,010	6,960	6,300	8,800	8,100
Antimony	10.3 UJ	7.6 UJ	7.2 UJ	16.1 UJ	8.6 UJ	8.6 UJ	7.0 UJ	8.3 UJ	8.2 UJ	7.6 UJ	6.8 UJ	8.0 UJ	11.2 UJ	8.5 UJ
Arsenic	36.0	27.2 J	33.2	82.7 J	39.3	51.3 J	42.6	57.6 J	36.4	34.9 J	32.4	72.8 J	82.2	72.9 J
Barium	102	66.7	52.6	111	54.3	88.1	51.8	70.3	78.9	66.0	102	96.1	130	92.8
Beryllium	0.86 UJ	0.38 J+	0.64	1.3 J	0.72 U	0.90	0.58 U	0.60 J	0.68 U	0.52 J	0.72 J+	0.46 J+	0.93 U	0.39 J+
Cadmium	0.37 J	0.19 J	6.0	9.3 J	5.1	8.8	2.8 J+	3.8 J+	11.5	8.8	0.25 J	0.06 J	0.16 J-	0.07 J
Calcium	3,150	1,950	1,950	4,800	1,800	2,380	2,100	2,550	2,970	1,850	3,110	2,540	2,700	1,780
Chromium	2.8	2.0	1.3	6.0	1.1 J	1.6	1.2	1.4	1.4	1.5	1.3	1.4	2.8	2.3
Cobalt	5.9 J	4.7 J	10.7	13.9	10.9	15.4	5.2 J	8.0	9.2	8.8	8.7	4.5 J	4.7 J	5.4 J
Copper	22.2 J	6.1	13.4 J	165	9.8 J	15.9	7.0 J	10.3	46.4 J	42.9	3.3 J	4.1	5.8 J	5.1
Iron	24,800 J	14,300	15,400 J	27,000	12,400 J	17,200	13,600 J	17,500	22,400 J	14,900	15,500 J	13,200	15,000 J	15,800
Lead	59.1	25.7	38.1	366	38.3	45.2	36.5	46.8	140	121	12.2	13.1	28.1	22.1
Magnesium	2,090	2,050	2,450	3,210	1,930	2,280	2,500	2,740	3,480	2,260	4,580	2,580	2,210	2,580
Manganese	889	591	1,640	2,290	1,540	2,280	778	937	1,890	1,640	1,500	657	675	398
Mercury	0.033 J-	0.045 J	0.10 U	0.081 J	0.10 U	0.12 J	0.10 U	0.043 J-	0.10 U	0.044 J-	0.10 U	0.044 J-	0.047 J-	0.070 J-
Nickel	6.9 U	4.5 J	4.8 U	9.5 J	5.7 U	7.0	4.7 U	3.6 J	5.5 U	4.3 J	4.5 U	2.2 J	7.5 U	4.3 J
Potassium	1,210 J	851	600 UJ	2,130	755 J	920	752 J	897	1,240 J	917	657 J	798	961 J	821
Selenium	6.0 UJ	4.4 U	4.2 UJ	9.4 U	5.0 UJ	5.0 U	4.1 UJ	4.9 U	4.8 UJ	4.4 U	4.0 UJ	4.7 U	6.5 UJ	5.0 U
Silver	6.9 J	1.3 UJ	0.24 J-	1.6 J-	0.50 J-	0.19 J-	0.66 J-	0.40 J-	0.36 J-	0.15 J-	1.1 UJ	0.26 J-	3.4 J	1.2 J-
Sodium	860 UJ	635 UJ	600 UJ	1,344 UJ	720 U	716 UJ	580 UJ	695 UJ	680 UJ	631 UJ	570 UJ	670 UJ	930 U	709 UJ
Thallium	4.3 U	3.2 U	3.0 U	6.7 U	3.6 U	3.6 U	2.9 U	3.5 U	3.4 U	3.2 U	2.8 U	3.4 U	4.7 U	3.5 U
Vanadium	12.4	9.9	11.7	19.1	8.5	10.9	9.2	12.3	13.2	10.0	13.8	13.3	13.9	13.1
Zinc	86.4	92.1 J	940	1,780 J	832	1,550 J	427	748 J	1,470	1,250 J	120	70.5 J	108	116 J

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U The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
(grey box) Lower than the CLP ICP-AES CRQL and the CLP ICP-MS CRQL.
†† EPA adopted a new MCL for arsenic in drinking water (10 µg/L) on January 22, 2001, and public water systems must comply with the 10 µg/L standard beginning January 23, 2006. See EPA 2002.
(cross-hatched box) During high flow sampling event, the analyte was detected at a level exceeding three times the background value and/ or three times the background value as well as a SCDM benchmark level.
(line-shaded box) During low flow sampling event, the analyte was detected at a level exceeding three times the background value and/ or three times the background value as well as a SCDM benchmark level.
* Background Sample

TABLE 3
Sediment - Inorganic Sample Results
Concentrations in milligrams per kilogram (mg/kg)) (parts per million (ppm))
(Continued)

Analytes	FQSE11 (Background)		FQSE07		FQSE08		FQSE09		FQSE10		FQSE31	
	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow
Aluminum	8,090	6,780	7,010	8,700	9,070	10,600	9,270	10,500	9,320	9,030	6,830	7,130
Antimony	10.3 UJ	7.6 UJ	8.8 UJ	7.2 UJ	11.7 UJ	6.0 UJ	24.4 UJ	11.0 UJ	13.8 UJ	8.3 UJ	12.4 UJ	8.3 UJ
Arsenic	36.0	27.2 J	121	112 J	125	626 J	204	145 J	87.5	46.1 J	24.5	51.2 J
Barium	102	66.7	88.8	112	133	124	153	126	141	79.5	74.3	71.8
Beryllium	0.86 UJ	0.38 J+	0.73 UJ	0.44 J	0.97 U	0.70 J-	2.0 U	0.59 J	1.1 U	0.41 J+	1.0 U	0.42 J
Cadmium	0.37 J	0.19 J	0.22 J	0.20 J	0.44 J-	2.8 J+	0.32 J-	0.29 J	0.64 J-	0.18 J	0.19 J-	0.32 J
Calcium	3,150	1,950	2,000	2,640	3,180	3,470	5,320	3,090	3,280	2,010	2,180	2,480
Chromium	2.8	2.0	1.6	1.6	2.8	3.6	3.6 J	3.8	3.2	2.1	2.3	2.1
Cobalt	5.9 J	4.7 J	5.1 J	7.0	6.5 J	8.4 J	5.9 J	6.0 J	7.1 J	5.8 J	4.7 J	5.4 J
Copper	22.2 J	6.1	4.3 J	5.0	7.6 J	29.0	10.2 UJ	8.3	10.0 J	6.7	6.0 J	7.0
Iron	24,800 J	14,300	15,800 J	18,700	18,400 J	13,800	17,100 J	17,800	20,400 J	21,200	14,800 J	15,400
Lead	59.1	25.7	29.3	33.4	54.5	227	57.0	46.6	52.6	32.6	37.6	34.2
Magnesium	2,090	2,050	2,330	3,280	2,330	2,760	2,130	2,570	2,820	3,030	2,000	2,700
Manganese	889	591	800	986	1,480	394	2,490	1,100	1,520	578	682	650
Mercury	0.033 J-	0.045 J	0.10 U	0.037 J-	0.10 U	0.35	0.050 J-	0.18	0.10 U	0.14 U	0.038 J-	0.060 J-
Nickel	6.9 U	4.5 J	5.8 U	4.5 J	7.8 U	7.0	16.0 U	5.6 J	9.2 U	4.7 J	8.2 U	4.4 J
Potassium	1,210 J	851	852 J	922	1,220 J	1,290	2,030 UJ	1,170	1,270 J	1,000	1,030 UJ	793
Selenium	6.0 UJ	4.4 U	5.1 UJ	4.2 U	6.8 UJ	6.1 U	14.2 UJ	6.4 U	8.0 UJ	4.8 U	7.2 UJ	4.9 U
Silver	6.9 J	1.3 UJ	4.0 J	0.81 J-	1.8 J-	30.7	4.8 J	2.8	0.49 J-	1.4 UJ	0.26 J-	1.3 J-
Sodium	860 UJ	635 UJ	730 UJ	598 UJ	970 U	870 UJ	2,030 U	914 UJ	1,150 U	691 UJ	1,030 U	693 UJ
Thallium	4.3 U	3.2 U	3.7 U	3.0 U	4.9 U	4.3 U	10.2 U	4.6 U	5.7 U	3.5 U	5.2 U	3.5 U
Vanadium	12.4	9.9	10.9	13.6	12.7	13.0	12.1 J	13.6	13.3	13.6	10.1 J	10.1
Zinc	86.4	92.1 J	118	153 J	170	1,030 J	178	150 J	174	121 J	71.6	125 J

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U The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
Lower than the CLP ICP-AES CRQL and the CLP ICP-MS CRQL.
†† EPA adopted a new MCL for arsenic in drinking water (10 µg/L) on January 22, 2001, and public water systems must comply with the 10 µg/L standard beginning January 23, 2006. See EPA 2002.
During high flow sampling event, the analyte was detected at a level exceeding three times the background value and/ or three times the background value as well as a SCDM benchmark level.
During low flow sampling event, the analyte was detected at a level exceeding three times the background value and/ or three times the background value as well as a SCDM benchmark level.
* Background Sample

TABLE 4
Groundwater - Inorganic Sample Results
Concentrations in micrograms per liter (µg/L)) (parts per million (ppb))

Analytes	SCDM (Groundwater Pathway) (1/28/04)			FQGW01
	MCL/ MCLG (µg/L)	RDSC (µg/L)	CRSC (µg/L)	High Flow
Aluminum				60.3 J-
Antimony	6.0	15		60 U
Arsenic	50 [10††]	11	0.057	10 U
Barium	2,000	2,600		200 UJ
Beryllium	4.0	73		5.0 U
Cadmium	5.0	18		5.0 U
Calcium				13,400
Chromium	100	110		10 U
Cobalt				50 U
Copper	1,300			25 U
Iron				28.9 J-
Lead	15			10 U
Magnesium				5,000 UJ
Manganese		5,100		15 U
Mercury	2.0	11		0.20 U
Nickel		730		40 U
Potassium				5,000 U
Selenium	50	180		35 U
Silver		180		10 U
Sodium				1,120 J-
Thallium	0.50			25 U
Vanadium		260		50 U
Zinc		11,000		60 U

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UJ The reported quantitation limit is estimated because Quality Control criteria were not met. Element or compound may or may not be present in the sample.
U The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
†† EPA adopted a new MCL for arsenic in drinking water (10 µg/L) on January 22, 2001, and public water systems must comply with the 10 µg/L standard beginning January 23, 2006. See EPA 2002.
[shaded box] Lower than the CLP ICP-AES CRQL and the CLP ICP-MS CRQL.
SCDM Superfund Chemical Data Matrix
RDSC Reference Dose Screening Concentration
CRSC Cancer Risk Screening Concentration
MCLG Maximum Contaminant Level Goal. A non-enforceable health goal that is set at a level at which no known or anticipated adverse effect on the health of persons occurs and which allows an adequate margin of safety.
MCL Maximum Contaminant Level. The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLG as feasible using the best available analytical and treatment technologies and taking cost into consideration. MCLs are enforceable standards.

TABLE 5
Source Samples - Inorganic Sample Results
Concentrations in milligram per kilogram (mg/kg)) (parts per million (ppm)) for soil and sediment
Concentrations in microgram per liter (µg/L)) (parts per billion (ppb)) for surface water

Analytes	FQSO01	FQSO02	FQSW12		FQSE12		FQSE13	
	High Flow	High Flow	High Flow	Low Flow	High Flow	Low Flow	High Flow	Low Flow
Aluminum	6,130	3,230	60.6 J-	851	12,100	10,500	13,400	15,200
Antimony	45.5 J-	7.1 J	60 U	60 U	9.3 UJ	12.9 UJ	8.0 UJ	6.5 UJ
Arsenic	9,370	3,510	10.7	14.6	185	114 J	24.2	22.9 J
Barium	94.2	303	200 UJ	30.9 J-	145	131	136	159
Beryllium	0.55 U	0.52 U	5.0 U	5.0 U	0.77 U	1.1	0.66 U	0.52 J
Cadmium	11.1 J	0.28 J	5.0 U	5.0 U	0.28 J	1.4 J+	0.12 J	0.08 J
Calcium	2,650	263 J	15,600	24,500	2,650 J	3,660	3,880	2,620
Chromium ***	31.6	0.69 J	10 U	10 U	2.9	2.2	3.5	5.0
Cobalt	16.0	2.9 J	50 U	50 U	6.4 J	15.2	7.7	7.8
Copper	384 J	16.5 J	25 U	25 U	10.1 J	18.1	11.6 J	7.1
Iron	147,000 J	22,900 J	26.4 J-	619	16,300 J	18,600	19,800 J	17,700
Lead	802	380	10 U	10 U	33.9	27.5	20.1	15.3
Magnesium	1,490	528	5,000 UJ	5,000 U	2,740	2,880	3,780	3,620
Manganese ††††	1,150	441	15 U	99.7	663	823	1,120	875
Mercury	0.13 J-	0.20 J-	0.20 U	0.20 U	0.10 U	0.083 J	0.10 U	0.040 J
Nickel	120	4.2 U	40 U	40 U	6.2 U	10.6	5.3 U	6.7
Potassium	946 J	2,320 J	5,000 U	5,000 U	1,410 J	1,440	1,200 J	1,450
Selenium	15.4 UJ	3.7 UJ	35 U	35 U	5.4 UJ	7.5 U	4.6 UJ	3.8 U
Silver	119 J	46.4 J	10 U	10 U	3.1 J	1.2 J-	1.3 UJ	1.1 UJ
Sodium	550 UJ	520 UJ	1,950 J-	5,000 U	770 UJ	1,075 UJ	660 UJ	545 UJ
Thallium	2.4 J-	2.6 J-	25 U	25 U	3.9 U	5.4 U	3.3 U	2.7 U
Vanadium	11.3 J	5.2 J	50 U	0.89 J	11.5	12.6	20.5	19.1
Zinc	6,930	79.3	60 U	60 U	95.4	523 J	83.7	64.6 J

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U The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.
†† EPA adopted a new MCL for arsenic in drinking water (10 µg/L) on January 22, 2001, and public water systems must comply with the 10 µg/L standard beginning January 23, 2006. See EPA 2002.
*** The EPA Region 3 RBCs benchmarks for chromium in Soil - Industrial and Residential are for Chromium III (CAS No. 16065831).
†††† Region 3 RBCs for manganese (in mg/kg): Manganese-nonfood are listed in this table. Manganese-food: 140,000 N for Industrial; 11,000 N for Residential; 330 for DAF 1 and 6,700 N for DAF 20.

TABLE 6
Surface Water, Source Soil, and Sediment - Trace Mercury and Monomethyl Mercury Concentrations in nanograms per liter (ng/L))

Sample ID	Hg	Monomethyl Hg
FWSW08	1.320	0.032
FWSW09	2.130	0.049
FWSW10	2.170	0.026
FWSW11	2.350	0.045
FWSW12	2.150	0.020 U
FWSW31	2.370	0.020 U
FWSE08	22.961	0.089
FWSE09	37.536	0.687
FWSE10	23.201	0.429
FWSE11	48.424	0.297
FWSE31	68.246	0.304
FWSO01	292.661	NA
FWTB01	0.150 U	NA

NA Not analyzed.
Hg Mercury
U The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

TABLE 7
Validation Changes to Data – Surface Water and Groundwater
Concentrations in micrograms per liter (µg/L)

Sample ID	Arsenic Results	Arsenic Validated Changes	Cadmium Results	Cadmium Validated Changes	Lead Results	Lead Validated Changes	Mercury Results	Mercury Validated Changes
HIGH FLOW								
FQGW01	4.9 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW01	6.4 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW02	7.2 U	10.0 U	0.73 J		6.3 J	10.0 U	0.2	
FQSW03	8.0 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW31	10.0 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW04	6.9 U	10.0 U	0.9 J		10.0 U		0.2	
FQSW05	8.2 U	10.0 U	5.0 U		4.5 J	10.0 U	0.2	
FQSW06	8.3 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW07	12.8 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW08	11.4 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW09	8.9 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW10	6.7 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW11	4.7 U	10.0 U	5.0 U		10.0 U		0.2	
FQSW12	**10.7**		5.0 U		10.0 U		0.2	
LOW FLOW								
FQSW01	10.0 U		0.75 J	0.75 J-	10.0 U		0.034 J	0.2 U
FQSW02	10.0 U		0.46 J	0.46 J-	10.0 U		0.2 U	
FQSW03	6.7 J	10.0 U	0.41 J	0.41 J-	10.0 U		0.068 J	0.2 U
FQSW04	6.4 J	10.0 U	0.91 J	0.91 J-	10.0 U		0.056 J	0.2 U
FQSW05	14.1	14.1 U	5.0 U		10.0 U		0.03 J	0.2 U
FQSW06	11.1	11.1 U	5.0 U		10.0 U		0.2 U	
FQSW07	24.7		5.0 U		10.0 U		0.063 J	0.2 U
FQSW08	16.3	16.3 U	5.0 U		10.0 U		0.2 U	
FQSW09	31.7		5.0 U		10.0 U		0.044 J	0.2 U
FQSW31	10.0 U		5.0 U		10.0 U		0.052 J	0.2 U
FQSW10	10.0 U		5.0 U		10.0 U		0.055 J	0.2 U
FQSW11	10.0 U		5.0 U		10.0 U		0.056 J	0.2 U
FQSW12	14.6		5.0 U		10.0 U		0.2 U	

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(yellow box) Validation changes.

TABLE 8
Validation Changes to Data – Sediment
Concentrations in milligrams per kilogram (mg/kg)

Sample ID	Arsenic Result	Arsenic Validated Changes	Cadmium Result	Cadmium Validated Changes	Lead Result	Lead Validated Changes	Mercury Result	Mercury Validated Changes
High Flow								
FQSE01	33.2		6.0		38.1		0.1 U	
FQSE02	39.3		5.1		38.3		0.1 U	
FQSE03	42.6		2.8	2.8+	36.5		0.1 U	
FQSE04	36.4		11.5		140		0.1 U	
FQSE05	32.4		0.25		12.2		0.1 U	
FQSE06	82.2		0.16 J	0.16 J-	28.1		0.05 J	0.05 J-
FQSE07	121		0.22 J		29.3		0.1 U	
FQSE08	125		0.44 J	0.44 J-	54.5		0.1 U	
FQSE09	204		0.32 J	0.32 J-	57.0		0.05 J	0.05 J-
FQSE10	87.5		0.64 J	0.64 J-	52.6		0.1 U	
FQSE11	36		0.37 J		59.1		0.03 J	0.03 J-
FQSE12	185		0.28 J		33.9		0.1 U	
FQSE13	24.2		0.12 J		20.1		0.1 U	
FQSE31	24.5		0.19 J	0.19 J-	37.6		0.04 J	0.04 J-
FQSO01	9.370		11.1		802		0.13	0.13 J-
FQSO02	3.510		0.28 J		380		0.2	0.2 J-
Low Flow								
FQSE01	82.7	82.7 J	9.3		366		0.08 J	
FQSE02	51.3	51.3 J	8.8		45.2		0.12 J	
FQSE03	57.6	57.6 J	3.8	3.8 J+	46.8		0.04 J	0.04 J-
FQSE04	34.9	34.9 J	8.8		121		0.04 J	0.04 J-
FQSE05	72.8	72.8 J	0.06 J		13.1		0.04 J	0.04 J-
FQSE06	72.9	72.9 J	0.07 J		22.1		0.07 J	0.07 J-
FQSE07	112	112 J	0.2 J	0.2 J+	33.4		0.04 J	0.04 J-
FQSE08	626	626 J	2.8		227		0.35	
FQSE09	145	145 J	0.29 J		46.6		0.18	
FQSE10	46.1	46.1 J	0.18 J		32.6		0.14 U	
FQSE11	27.2	27.2 J	0.19 J		25.7		0.05 J	
FQSE12	114	114 J	1.4	1.4 J+	27.5		0.08 J	
FQSE13	22.9	22.9 J	0.08 J		15.3		0.04 J	
FQSE31	51.2	51.2 J	0.32 J		34.2		0.06 J	0.06 J-

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[yellow box] Validation change