R4
335341
7219
SF FILE NUMBER
FILE PLAN
2.0

ANALYTICAL RESULTS REPORT
RICHARDSON FLAT TAILINGS
SUMMIT COUNTY, UTAH

TDD R8-8508-07

EPA REGIONAL SITE PROJECT OFFICER: ERIC JOHNSON

E&E PROJECT OFFICER: SUSAN KENNEDY
REVIEWED BY KARL FORD

SUBMITTED TO: KEITH SCHWAB, FIT-DPO
WILLIAM GEISE, REM-FIT COORDINATOR

DATE SUBMITTED: OCTOBER 25, 1985

Rev. 13

LIST OF FIGURES

FIGURE 1 GENERAL SITE LOCATION, RICHARDSON FLAT TAILINGS, UTAH

FIGURE 2 SITE MAP AND SAMPLE LOCATIONS, RICHARDSON FLAT TAILINGS, UTAH

LIST OF TABLES

TABLE 1 ANALYTICAL DATA FOR UNFILTERED GROUND WATER SAMPLES (TOTAL METALS)

TABLE 2 ANALYTICAL DATA FOR FILTERED GROUND WATER SAMPLES (DISSOLVED METALS)

TABLE 3 ANALYTICAL DATA FOR SURFACE WATER SAMPLES

TABLE 4 ANALYTICAL DATA FOR SURFACE SOIL AND TAILINGS SAMPLES

TABLE 5 ANALYTICAL DATA FOR SUBSURFACE SOIL AND TAILINGS SAMPLES

Ref. 13

TABLE OF CONTENTS

PAGE

LISTS OF TABLES AND FIGURES i

I. INTRODUCTION. 1

II. QUALITY ASSURANCE REVIEW. 2

III. ANALYTICAL RESULTS AND CONCLUSIONS. 2

A. GROUND WATER SAMPLES. 2

B. SURFACE WATER SAMPLES 3

C. SOIL AND TAILINGS SAMPLES 5

IV. SUMMARY 6

V. RECOMMENDATIONS 6

REFERENCES. 7

APPENDICES

A. SITE INSPECTION REPORT

B. RICHARDSON FLAT TAILINGS RAW DATA

Ref 13

ANALYTICAL RESULTS REPORT
RICHARDSON FLAT TAILINGS
SUMMIT COUNTY, UTAH

I. INTRODUCTION

This report was prepared to satisfy the requirements of Technical Directive Document (TDD) R8-8508-07, issued to Ecology and Environment, Inc., Field Investigation Team (E&E FIT) by the Region VIII Environmental Protection Agency (EPA).

The samples discussed in this report were collected by the FIT on June 19 and 20, and July 30 through August 2, 1985 from Richardson Flat Tailings near Park City, Utah (Figure 1). Two previous reports, the Report of Sampling Activities (R8-8505-27) and the Sampling Plan (R8-8504-23), present discussions regarding project objectives, site description, sampling procedures, quality control, sample documentation and field observations.

The sampling results discussed in this report consist of three ground water, six surface water, one surface soil, four surface tailings, two subsurface soil and four subsurface tailings samples collected during this investigation.

Richardson Flat Tailings is located in Summit County, Utah, approximately 3.5 miles northeast of Park City. The tailings cover approximately 160 acres in the NW 1/4, Section 1, Township 2 South, Range 4 East, and were piped from the Keetley Ontario Mine Shaft south of Park City. An ephemeral pond overlies the northeastern portion of the tailings, and is contained by a dam at the northwestern end. The site is currently owned by United Park City Mines Company (UPCM) who maintains six monitoring wells located near the base of the dam.

Ref. 3

II. QUALITY ASSURANCE REVIEW

All samples collected at Richardson Flat Tailings were low hazard, and were analyzed for Task 1 and 2 metals. In addition, surface water samples were analyzed for sulfate, and ground water samples were analyzed for sulfate and cyanide. Subsurface tailings samples were also analyzed for cyanide.

A triple volume surface water sample was collected at station RT-SW-6 for laboratory quality assurance. A duplicate ground water sample (RF-GW-4) was collected from station RF-GW-3 to check laboratory procedures, accuracy and precision.

A review of spike recovery and duplicate sample data was performed at EPA Region VIII Lab, and indicated the analytical procedures used were acceptable. Soil cyanide data were reviewed by E&E FIT chemists and were judged acceptable.

III. ANALYTICAL RESULTS

Analytical results for the 1985 sampling effort at Richardson Flat Tailings have been compiled in Tables 1, 2, 3, 4 and 5. Corresponding sample locations are illustrated in Figure 2. The raw data are attached as Appendix B.

A review of the analytical data allows the following observations and conclusions.

A. GROUND WATER SAMPLES

Upgradient ground water sample RF-GW-1 was collected from the newly installed monitoring well south of the tailings. Samples RF-GW-2 and RF-GW-3 were collected from UPCM monitoring wells located near the base of the dam. RF-GW-4 is a duplicate of sample RF-GW-3.

Ref 13

The ground water samples were analyzed for total metals, cyanide and sulfate, and dissolved metals. Ground water samples are generally analyzed for dissolved metals rather than total metals, but for purposes of comparison, both analyses were performed.

Total metals analyses of downgradient ground water samples (RF-GW-2, RF-GW-3 and RF-GW-4 averaged) revealed ten-fold increases in aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, silver, vanadium and zinc over the background ground water sample RF-GW-1. In contrast, dissolved metals analyses revealed elevated levels of arsenic, cobalt, iron, manganese and zinc using the same comparison. Only manganese, however, is present in higher concentrations than allowed by National Interim Primary drinking water standards (Table 1).

Total cyanide was found at a concentration of 200 ppb in downgradient sample RF-GW-2 as compared to non-detectable levels in the background sample RF-GW-1. However, a notation on the data sheet states the largest part of the RF-GW-2 value is due to an interference.

Based on these findings, an observed release of contaminants to the ground water can be scored according to the Mitre Model for Hazardous Waste Site Ranking using dissolved metals data. A drinking water well, used as a back-up source for Park City residents, is located two and a half miles from the contaminated wells at Richardson Flat Tailings. Hydrologic continuity between the drinking water well and the contaminated wells is unlikely, however, due to the prevailing direction of ground water movement through the unconsolidated deposits (Reference G).

B. SURFACE WATER SAMPLES

Surface water samples RT-SW-1, RT-SW-2 and RT-SW-3 were collected from the east bank of Silver Creek, and RT-SW-4, RT-SW-5 and RT-SW-6 were collected from the intermittent stream which flows through the tailings.

Pg. 13

A comparison of the upgradient Silver Creek sample RT-SW-1 to downgradient samples RT-SW-2 and RT-SW-3 reveals concentrations of aluminum, antimony, arsenic, calcium, copper, iron, lead, manganese, mercury, and zinc are higher in the background sample (RT-SW-1) than the midstream sample (RT-SW-2). This is likely attributed to the Prospector Square Tailings which lie alongside Silver Creek less than two miles upstream of Richardson Flat.

Concentrations of the above constituents are relatively high in the background sample RT-SW-1 collected approximately one mile downstream of Prospector Square Tailings. Concentrations are lowest in sample RT-SW-2 collected one and a half miles downstream of Prospector Square Tailings and upgradient of Richardson Flat Tailings. Highest concentrations, however, are found in sample RT-SW-3, immediately downstream of Richardson Flat Tailings.

In spite of relatively high levels of Task 1 and 2 metals in the background sample RT-SW-1, a ten-fold increased concentration of lead was found in downgradient sample RT-SW-3 when compared with the background sample. In addition, a four fold increase of arsenic levels was found in RT-SW-3. Thus, the surface water data can be used as direct evidence of an observed release, as stipulated by HRS scoring guidelines.

Surface water from Silver Creek is diverted approximately 1,000 feet downstream of Richardson Flat Tailings, and is used to irrigate pasture land and hay fields. Silver Creek is not used as a drinking water source for human populations.

Analyses of surface water samples RT-SW-4, RT-SW-5 and RT-SW-6 collected from the intermittent on-site diversion ditch revealed elevated levels of aluminum, antimony, arsenic, barium, calcium lead, magnesium and sodium. Water in the diversion ditch flows to a marshy area located just west of the dam, and into Silver Creek directly upstream of RT-SW-3.

Ref. 13

C. SOIL AND TAILINGS SAMPLES

Analytical data for surface tailings samples (RT-SO-4, RT-SO-5, RT-SO-6 and RT-SO-7) reveal elevated concentrations of arsenic, cadmium, calcium, copper, lead, magnesium, mercury, silver, sodium and zinc, as compared to the off-site background soil sample (RT-SO-1). Elevated levels of the above constituents are typical in metal mine tailings, however, the off-site background soil sample contains substantially higher levels of arsenic, cadmium, lead, mercury and zinc as compared to mean concentrations for the Western United States (Table 4). Wind-blown tailings material is probably the primary source of contamination to nearby off-site surface soil. This idea is substantiated by comparison of the background surface soil sample data (RT-SO-1) to subsurface soil data (RF-SS-1, RF-SS-2). Most of the elemental constituents are elevated in the surface soil, but are greatly reduced in subsurface soil samples.

Data from subsurface tailings samples RF-SS-3, RF-SS-4 and RF-SS-5 indicate downward migration of antimony, arsenic, cadmium, copper, lead, magnesium, mercury, silver, sodium and zinc. As a result, soil beneath the tailings (RF-SS-6) contains elevated concentrations of all of the above constituents. Subsurface tailings data are presented in Table 5.

IV. SUMMARY

Although other upstream tailings or mining operations may be contributing inorganic contaminants to Silver Creek, a significant increase in surface water lead concentrations can be attributed to Richardson Flat Tailings. Water from Silver Creek is used for local irrigation.

A significant release of arsenic, cobalt, iron, manganese and zinc to downgradient ground water was demonstrated. However, hydrologic continuity between the contaminated aquifer and current

Rev 13

drinking water sources is unlikely. Any expansion of the Park City water supply should be thoroughly evaluated based on these findings.

Surface and subsurface tailings material contain high concentrations of heavy metals and arsenic. Subsurface tailings sample data indicate downward movement of contaminants in the solid matrix.

Elevated levels of metals and arsenic in nearby off-site soil may be attributed to wind-blown tailings from Richardson Flat.

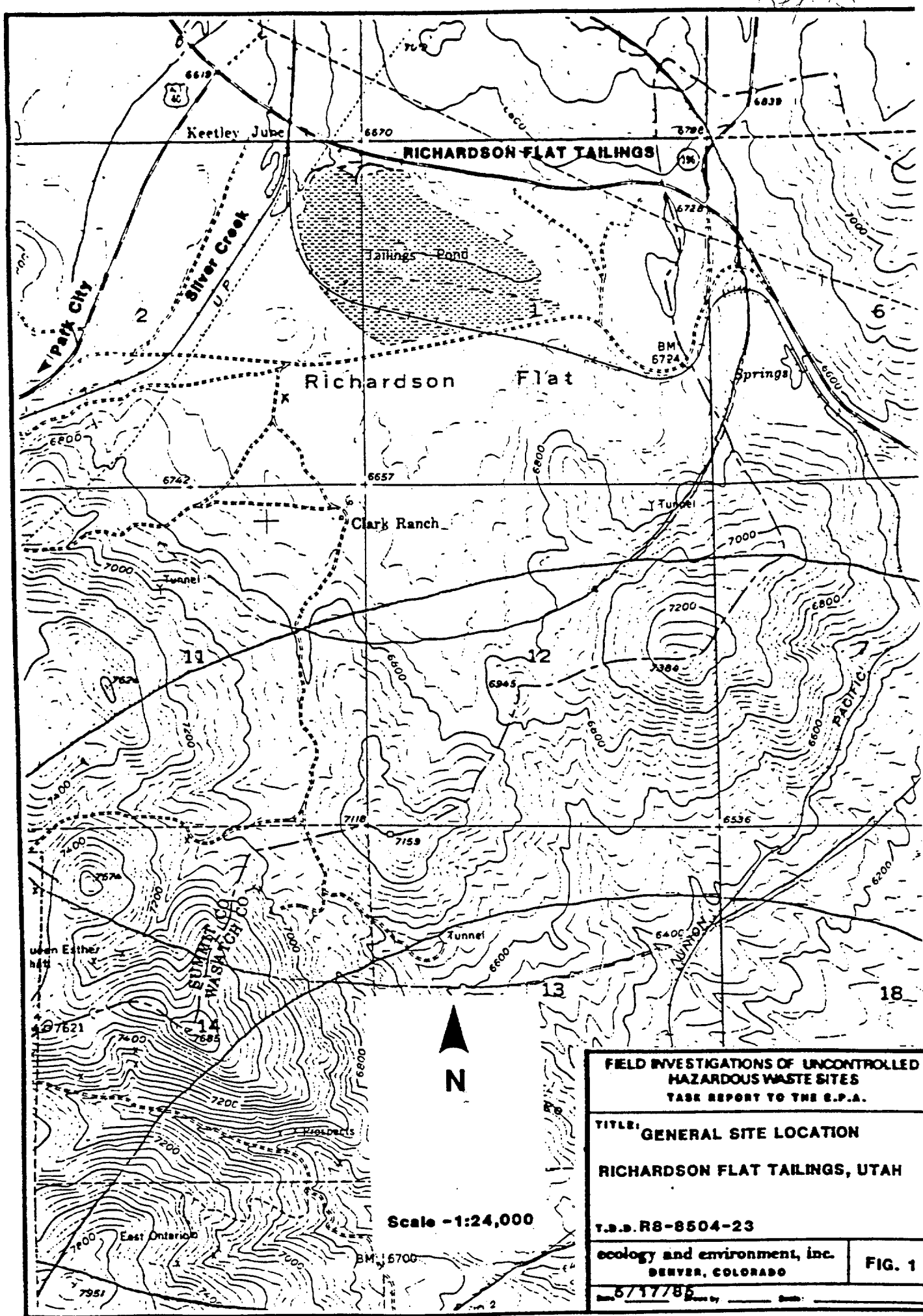
V. RECOMMENDATIONS

1. An observed release of contaminants to the air route was scored based on photo-documentation of air-borne tailings material during collection of surface tailings sample (RT-SO-7). It is recommended that high-volume air sampling be conducted at the site to further substantiate and complete the HRS package.

2. Because the tailings material contains high concentrations of metals and arsenic, the area should be fenced to prevent on-site grazing by domestic sheep and cattle, and to keep people off the site.

3. Further surface water and sediment sampling is recommended to fully assess the hazard associated with irrigating area pasture land with water diverted directly downstream from Richardson Flat.

Ref. 13



FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.

TITLE: GENERAL SITE LOCATION

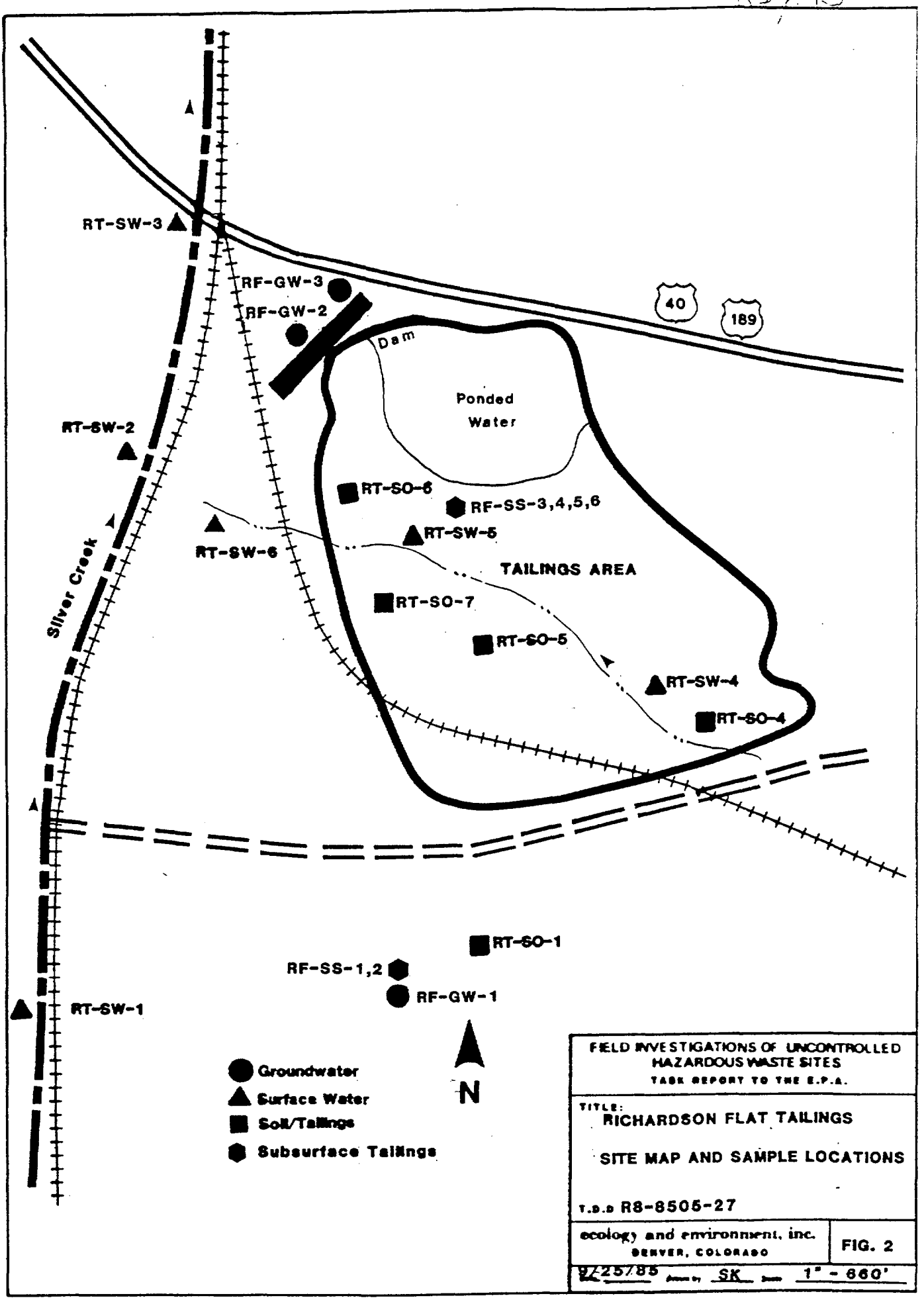
RICHARDSON FLAT TAILINGS, UTAH

T.D.D. R8-8504-23

ecology and environment, inc.
DENVER, COLORADO

FIG. 1

6/17/85


RT-SW-3
RF-GW-3
RF-GW-2
40
189
Dam
Ponded Water
RT-SW-2
RT-SO-6
RF-SS-3,4,5,6
RT-SW-5
RT-SW-6
TAILINGS AREA
Silver Creek
RT-SO-7
RT-SO-5
RT-SW-4
RT-SO-4
RT-SO-1
RF-SS-1,2
RF-GW-1
RT-SW-1
N
Groundwater
Surface Water
Soil/Tailings
Subsurface Tailings
FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES
TASK REPORT TO THE E.P.A.
TITLE:
RICHARDSON FLAT TAILINGS
SITE MAP AND SAMPLE LOCATIONS
T.D.# R8-8505-27
ecology and environment, inc.
DENVER, COLORADO
FIG. 2
9/25/85
SK
1" - 660'

Ref. 13

TABLE 1. ANALYTICAL DATA FOR UNFILTERED GROUND WATER SAMPLES COLLECTED AT RICHARDSON FLAT TAILINGS, UTAH.
(Results in ug/l, ppb)

Parameter	Hole #1 RF-GW-1 Totals	UPCM #2 RF-GW-2 Totals	UPCM #1 RF-GW-3 Totals	UPCM #1 RF-GW-4 Totals	Drinking Water Criteria
TASK 1&2 METALS					
Aluminum	1,040	4,920	80,700	83,400	5,000(c)
Antimony	<5	63sc	<5	<5	146(b)
Arsenic	<5	349sc	78	70	50(a)
Barium	83	2,665sc	1,534	1,354	1,000(a)
Beryllium	<10	<10	<10	<10	0.037(b)
Cadmium	<5	16	42	48	10(a)
Calcium*	45	314	352	332	
Chromium	<5	42	98	104	50(a)
Cobalt	<5	80	46	48	
Copper	<5	190	1,583	1,350	1,000(b)
Iron	958	26,300	126,000	130,000	700(d)
Lead	<30	1,080	588	527	50(a)
Magnesium*	9.9	72	88	85	
Manganese	20	10,400	2,230	2,070	50(a)
Mercury	<0.1	0.1	0.70	0.60	2.0(a)
Nickel	<30	30	88	82	13.4(b)
Potassium					
Selenium	<5	<5	<5	<5	10(a)
Silver	<5	17	<5	<5	50(a)
Sodium*	16	54	44	44	
Thallium	<100	<100	<100	<100	13(b)
Tin					
Vanadium	<10	17	262	266	
Zinc	<5	2,790	650	569	5,000(b)
TASK 3 METAL					
Cyanide	<10	200	<10	<10	200(c)
SPECIAL ANION					
Sulfate*	35	775	625	1,025	250,000(c)

*mg/l or ppm

Ref. 13

TABLE 2. ANALYTICAL DATA FOR FILTERED GROUND WATER SAMPLES COLLECTED AT RICHARDSON FLAT TAILINGS, UTAH.
(Results in ug/l, ppb)

Parameter	Hole #1 RF-GW-1 Dissolved	UPCM #2 RF-GW-2 Dissolved	UPCM #1 RF-GW-3 Dissolved	UPCM #1 RF-GW-4 Dissolved
TASK 1&2 METALS				
Aluminum	<30	<30	<30	<30
Antimony	<5	<5	<5	<5
Arsenic	<5	9	<5	9
Barium	78	99	104	104
Beryllium	<10	<10	<10	<10
Cadmium	<5	<5	<5	<5
Calcium*	47	307	254	254
Chromium	<5	<5	<5	<5
Cobalt	<5	67	10	10
Copper	<5	<5	<5	<5
Iron	<10	14,800	376	300
Lead	<30	<30	<30	<30
Magnesium*	9.8	70	56	56
Manganese	11	9,990	924	903
Mercury	<0.1	<0.1	<0.1	<0.1
Nickel	<30	<30	<30	<30
Potassium				
Selenium	<5	<5	<5	<5
Silver	<5	<5	<5	<5
Sodium*	16	52	42	44
Thallium	<100	<100	<100	<100
Tin				
Vanadium	<10	<10	<10	<10
Zinc	6	144	<5	<5
TASK 3 METAL				
Cyanide				

*mg/l or ppm

Rev 13

TABLE 3. ANALYTICAL DATA FOR SURFACE WATER COLLECTED AT RICHARDSON FLAT TAILINGS, UTAH.
(Results in ug/l, ppb)

Parameter	Upstream SC RT-SW-1	Midstream SC RT-SW-2	Downstream SC RT-SW-3	Southeast IS RT-SW-4	Mid IS RT-SW-5	West IS RT-SW-6
TASK 1&2 METALS	Total	Total	Total	Total	Total	Total
Aluminum	172	77	370	450	<30	35
Antimony	21	15	35	19	13	7
Arsenic	14	11	65	33	27	12
Barium	36	41	53	119	26	27
Beryllium	<10	<10	<10	<10	<10	<10
Cadmium	<5	<5	<5	<5	<5	<5
Calcium	137,000	119,000	124,000	128,000	252,000	287,000
Chromium	<5	<5	<5	<5	<5	<5
Cobalt	<5	<5	<5	<5	<5	<5
Copper	12	9	60	18	<5	<5
Iron	725	389	2,290	1,570	507	215
Lead	147	93	1,985	237	42	<30
Magnesium	22,200	24,000	26,000	35,400	55,400	59,200
Manganese	764	434	727	602	1,654	2,566
Mercury	0.2	0.1	0.57	0.1	<0.1	<0.1
Nickel	<30	<30	<30	<30	<30	<30
Potassium						
Selenium	<5	<5	<5	<5	<5	<5
Silver	<5	<5	<5	<5	<5	<5
Sodium	31,700	25,600	25,200	36,500	29,000	37,300
Thallium	<100	<100	<100	<100	<100	<100
Tin						
Vanadium	<10	<10	<10	<10	<10	<10
Zinc	2,690	1,650	2,730	350	1,410	812
SPECIAL ANION						
Sulfate	284	222	210	218	963	909
Chloride	47	27	28	50	40	33
pH	7.33	7.54	7.47	7.26	7.40	7.40
Conductivity**	600	600	550	700	1,200	1,400
Temperature °C	21	21	19	20	21	21

SC - Silver Creek
IS - Intermittent Stream
** - umhos/cm

Ref. B

TABLE 4. ANALYTICAL DATA FOR SURFACE SOIL AND TAILINGS SAMPLES COLLECTED AT RICHARDSON FLAT TAILINGS, UTAH.
(Results in ug/g, ppm)

Parameter	Background Soil RT-SO-1	Southeast Tailings RT-SO-4	Middle Tailings RT-SO-5	Northwest Tailings RT-SO-6	North Tailings RT-SO-7	Mean for Western US*
TASK 1&2 METALS						
Aluminum	14,400	3,440	863	794	1,340	58,000
Antimony	39	<200	<200	<400	<300	0.47
Arsenic	58	3,600	1,500	900	600	5.5
Barium	178	105	58	6.2	27	580
Beryllium	<1.6	<1.9	<1.4	<1.8	<1.5	0.68
Cadmium	17	47	40	80	58	0.2
Calcium	8,200	45,600	49,500	16,900	75,200	
Chromium	24	60	15	7.8	19	41
Cobalt	11	6.9	2.3	<0.9	1.5	7.1
Copper	94	227	181	371	961	21
Iron	24,000	30,700	19,900	154,000	106,000	21,000
Lead	1,110	3,320	2,650	7,010	8,530	17
Magnesium	4,990	14,600	15,300	3,960	13,100	
Manganese	879	1,650	1,810	510	5,150	380
Mercury	0.59	1.70	2.61	0.14	0.50	0.05
Nickel	12	59	5.2	9.6	16	15
Potassium						
Selenium	<16	<20	<300	<400	<300	0.23
Silver	6.7	20	19	24	22	0.2
Sodium	1,020	3,470	2,960	3,280	2,280	
Thallium	<16	<19	<14	<18	<15	0.2
Tin						
Vanadium	37	9.1	3.5	4.8	6.5	70
Zinc	1,570	6,360	5,400	5,870	3,780	55
% Solids	97.4	95.8	96.9	90.6	93.7	

* Reference f

Ref 13

TABLE 5. ANALYTICAL DATA FOR SUBSURFACE SOIL AND TAILINGS SAMPLES COLLECTED AT RICHARDSON FLAT TAILINGS, UTAH.
(Results in ug/g, ppm)

Parameter	Soil 5-7' RF-SS-1	Soil 10-12' RF-SS-2	Oxidized Tailing RF-SS-3	Reduced Tailings RF-SS-4	Tailings/ Soil Contact RF-SS-5	Soil beneath Tailings RF-SS-6
TASK 1&2 METALS						
Aluminum	16,900	16,700	844	484	1410	12,400
Antimony	<1	<1	31	49	171	14
Arsenic	6.5	6.3	311	328	218	34
Barium	125	147	31	86	64	235
Beryllium	<2	<2	<2	<2	<2	<2
Cadmium	6.8	7.4	53	169	61	15
Calcium	6,190	5,020	81,600	117,000	54,200	9,200
Chromium	19	19	6.3	16	14	15
Cobalt	8.7	9.5	<1	<1	4.5	16
Copper	14	17	225	225	335	105
Iron	18,500	19,700	80,800	68,000	22,600	15,100
Lead	37	37	2,770	4,720	4,920	1,090
Magnesium	6,240	7,620	11,100	12,900	13,300	4,530
Manganese	471	625	5,990	5,880	1,630	1,220
Mercury	<.05	<.05	0.94	1.97	2.26	0.40
Nickel	21	22	7	<6	<6	16
Potassium						
Selenium	<1	<1	1.0	<1	9.4	1.3
Silver	<1	<1	7.9	13	26	6.9
Sodium	308	279	2,230	11,300	6,100	1,010
Thallium	<20	<20	<20	<20	<20	<20
Tin						
Vanadium	31	28	3.1	<2	5.4	30
Zinc	70	44	3,980	23,200	12,700	1,510
% Solids	79.2	77.4	86.4	88.3	88.9	79.1
Task 3 Metal						
Cyanide	<0.4	<0.4	<0.4	5.2	<0.3	--

REFERENCES

(a) National Interim Primary Drinking Water Regulations. (EPA-570/9-76-003.) U.S. Environmental Protection Agency, Office of Drinking Water, 1976.

(b) U.S. EPA Water Quality Criteria. 1980. Federal Register 45 (231): 203-220.

(c) Safe Drinking Water Committee, 1982, Drinking Water and Health, National Academy Press, 4:166.

(d) U.S. EPA, 1976, Quality Criteria for Water.

(e) Clean Water Act, Code of Federal Regulations (Vol. 40, Parts 100 to 149), July 1, 1982.

(f) Shacklette, J.T., and Boerngen, J.G.; 1984: Elemental Concentrations in Soil and Other Surficial Materials of the Conterminous United States. U.S. Geological Survey Professional Paper 1270. 105pp.

(g) Baker, C.H., Jr.; 1970: Water Resources of the Heber-Kamas-Park City Area, North-Central Utah. U.S. Geological Survey Technical Publication No. 27. 79pp.

REFERENCE 14

RECORD OF COMMUNICATION

[X] PHONE CALL [ ] DISCUSSION [ ] FIELD TRIP [ ] CONFERENCE

[ ] OTHER (SPECIFY) (801) 649-9321

(Record of item checked above)

TO:	FROM:	DATE
Jennifer Harrington Park City - Planning Div.	Susan Kennedy, (E&E)	9/4/85
		TIME 0930

SUBJECT Resident Population of Park City During Winter Months.

SUMMARY OF COMMUNICATION

Ms. Harrington provided the following information:

- The permanent year-round population of Park City is 4500.
- Although as many as 10,000 (permanent population plus number of guest beds) people may stay in town during five to ten days of the peak winter season, this additional population is transient.
- No information is available of the average winter population including permanent and transient.

When asked if the winter population is higher than summer population due to support workers at restaurants, hotels, etc., Ms. Harrington stated the change is insignificant because an equal number of summer residents spend the winter months elsewhere.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

For HRS purposes, the population of Park City is 4500 which includes transient workers, but excludes travelers passing through the area.

INFORMATION COPIES TO:

EPA Form 1300-6 (7-72) REPLACES EPA HQ FORM 6300-3 WHICH MAY BE USED UNTIL SUPPLY IS EXHAUSTED.

Reference 15

RECORD OF COMMUNICATION	☐ PHONE CALL ☒ DISCUSSION ☐ FIELD TRIP ☐ CONFERENCE ☐ OTHER (SPECIFY) (Record of Item checked above)	
TO: File	FROM: Annette L. Sackman Annette Sackman, E & E	DATE 09-02-87 TIME 1300

SUBJECT

Number of homes within one mile of Richardson Flat Tailings

SUMMARY OF COMMUNICATION

During recent field investigation activities in the Park City area, I have noted three homes within a one mile radius of Richardson Flat Tailings.

CONCLUSIONS, ACTION TAKEN OR REQUIRED

INFORMATION COPIES TO:

EPA Form 1300-6 (7-72) REPLACES EPA HQ FORM 8200-9 WHICH MAY BE USED UNTIL SUPPLY IS EXHAUSTED.