RIMINI ROAD IMPROVEMENT PROJECT

RESTORATION OF ABANDONED MINE SITES PROJECT

DRAFT REPORT

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Omaha, Nebraska

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1 Introduction

The U.S. Army Corps of Engineers (USACE) has been provided authority for Restoration of Abandoned Mine Sites (RAMS) by Section 560 of the 1999 Water Resource Development Act. The RAMS program is a regionally focused and stakeholder responsive program for the restoration of abandoned and inactive non-coal mines where water resources (ecosystem/habitat) have been degraded by past mining practices. This authority is intended to allow the USACE to provide support to agencies that manage lands impacted by past mining. The USACE coordinated in advance to obtain stakeholder buy-in on all work proposed to be performed by Corps Districts to ensure that the proposed work is supportive of the stakeholders' efforts in the area.

The USACE Omaha District is working in coordination with the Western Federal Lands Highway Division (WFLHD) of the Federal Highway Administration, in cooperation with the U.S. Forest Service (USFS), the Montana Department of Transportation (MDOT), and Lewis and Clark County. The WFLHD identified the data needs for the Rimini Road Improvement Project. USACE Omaha District personnel performed the fieldwork from June 15 through 17, 2004.

The purpose of this report is to submit documentation of the field activities and analytical results obtained from this fieldwork and provide recommendations to the WFLHD. This report includes the methods and procedures used for collecting soil samples, preparing analytical results, and the data quality evaluation. The scope of work for this project includes a general interpretation of these results with respect to the road improvement project; however, the data is predominantly being provided to the stakeholders for their interpretation.

2 Project Information

2.1 Site Description

The Rimini Road Improvement Project is located within the Upper Tenmile Creek Mining Area National Priority List site which consists of abandoned and inactive hard rock mines producing gold, lead, zinc, and copper. The Upper Tenmile Creek Mining Area is located primarily within Lewis and Clark County southwest of Helena, Montana. The Tenmile Creek basin is the primary watershed within the mining area. Rimini Road is located adjacent to Tenmile Creek which flows predominantly north at this location. Extensive mining within the watershed has resulted in widespread metals contamination. Exposed waste rock and tailings piles are located throughout the Tenmile Creek Mining Area. Through the process of surface water runoff, these wastes have contributed heavy metals to Tenmile Creek and its tributaries. Because Rimini Road is located along Tenmile Creek, heavy metals contamination is a concern within drainage areas due to surface water runoff. In addition, Rimini Road may be located directly on tailings piles and/or tailings piles may have been used to grade the road.

2.2 Project Goals

WFLHD requested USACE sample the roadbed fill in preparation for widening and paving Rimini Road. Rimini Road is a gravel road, which is narrow and winding in places. The concern with the roadbed fill is that contaminated spoil from mining and milling might have been used to construct the roadbed, requiring removal prior to paving. Of particular concern is the possibility of mercury contamination in the soil. Other possible contaminants include other heavy metals, strongly acidic soil conditions, and residual cyanide.

3 Field Investigation

3.1 Field Investigation Activities

All twenty-five locations proposed in the Site Specific Addendum (SSA) to the Final RAMS Work Plan were sampled. The soil borings were drilled and sampled by the USACE Omaha District, Core Drill Unit. The boring locations were spread evenly along the extent of the Rimini Road Project every 500 meters to coordinate with existing station numbers. In addition, a boring was located near each drainage area passing under the road. A handheld global positioning system (GPS) was used to record the boring locations. Boring locations are outlined on **Figure 1.** **Table 1** summarizes soil boring location information.

Table 1 Soil Boring Locations

Soil Boring Point ID	Approximate Station	North Latitude (WGS 84)	West Longitude (WGS 84)
MT-RR-SB01	1+050	46° 34’ 21.0”	112° 13’ 05.5”
MT-RR-SB02	1+500	46° 34’ 08.6”	112° 13’ 06.7”
MT-RR-SB03	2+000	46° 33’ 59.8”	112° 13’ 28.4”
MT-RR-SB04	2+500	46° 33’ 49.5”	112° 13’ 39.4”
MT-RR-SB05	2+700	46° 33’ 46.7”	112° 13’ 48.1”
MT-RR-SB06	3+000	46° 33’ 43.9”	112° 14’ 02.8”
MT-RR-SB07	3+500	46° 33’ 37.8”	112° 14’ 23.0”
MT-RR-SB08	4+000	46° 33’ 20.8”	112° 14’ 34.1”
MT-RR-SB09	4+500	46° 33’ 06.5”	112° 14’ 38.9”
MT-RR-SB10	4+850	46° 32’ 56.2”	112° 14’ 39.9”
MT-RR-SB11	5+000	46° 32’ 49.5”	112° 14’ 41.1”
MT-RR-SB12	5+500	46° 32’ 32.1”	112° 14’ 43.1”
MT-RR-SB13	6+000	46° 32’ 20.7”	112° 14’ 46.8”
MT-RR-SB14	6+250	46° 32’ 12.1”	112° 14’ 51.6”

Soil Boring Point ID	Approximate Station	North Latitude (WGS 84)	West Longitude (WGS 84)
MT-RR-SB15	6+500	46° 31’ 49.7”	112° 15’ 05.4”
MT-RR-SB16	7+000	46° 31’ 48.5”	112° 15’ 05.1”
MT-RR-SB17	7+500	46° 31’ 36.1”	112° 15’ 14.3”
MT-RR-SB18	7+875	46° 31’ 24.4”	112° 15’ 23.4”
MT-RR-SB19	8+000	46° 31’ 20.2”	112° 15’ 25.8”
MT-RR-SB20	8+500	46° 31’ 06.8”	112° 15’ 36.2”
MT-RR-SB21	9+000	46° 30’ 50.9”	112° 15’ 41.7”
MT-RR-SB22	9+500	46° 30’ 32.8”	112° 15’ 41.2”
MT-RR-SB23	10+000	46° 30’ 17.3”	112° 15’ 31.7”
MT-RR-SB24	10+500	46° 30’ 04.6”	112° 15’ 23.1”
MT-RR-SB25	10+925	46° 29’ 52.0”	112° 15’ 14.8”

Drilling and sampling were accomplished with the use of a Gus Pech 1300C Drill Rig equipped with 4.25-inch inside-diameter (ID) hollow-stem augers and a 5-foot continuous sampler. The borings were sampled continuously from the road surface to a maximum depth of ten feet below ground surface (bgs) or bedrock refusal. Bedrock refusal was encountered prior to 10 feet bgs in all borings. One composite sample for chemical analysis was collected from each boring by taking equal sub-samples from the continuous sampler and homogenizing the sub-samples. After sampling, borings were backfilled with tamped drill cuttings and native soil. The drill logs are attached.

Twenty-five composite analytical samples (one composite sample from each boring) were collected for analysis of metals (Ag, As, Ba, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, & Zn), pH, total cyanide, and acid-base accounting (ABA). ABA samples were sent to Energy Laboratory in Billings, Montana for analysis. Samples for all other analysis were sent to the USACE Environmental Chemistry Branch Laboratory in Omaha, Nebraska. Two field duplicate samples were collected in addition to the twenty-five primary samples. **Table 2** summarizes soil boring and sampling information.

Table 2 Soil Boring and Sampling Summary

Soil Boring Point ID	Sampled Interval (ft bgs)	Soil Recovered (ft)	Bedrock Refusal (ft bgs)	Analysis
MT-RR-SB01	0.5-3.5	3.5	3.5	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB02	0.5-3.4	3.4	3.4	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB03	0.5-2.8	2.8	2.8	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB04	0.5-1.2	1.2	1.2	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB05	0.5-2.3	2.3	2.3	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB06	0.5-2.4	2.4	2.4	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB07	0.5-1.9	1.9	1.9	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB08	0.5-2.3	2.3	2.3	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB09	0.5-3.8	3.8	3.8	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB10	0.5-1.7	1.7	1.7	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB11	0.5-4.7	4.7	4.7	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB12	0.5-3.2	3.2	3.2	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB13	0.5-2.8	2.8	2.8	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB14	0.5-5.6	4.1	5.6	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB15	0.5-3.7	3.7	3.7	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB16	0.5-2.0	2.0	2.0	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB17	0.5-3.4	3.4	3.4	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB18	0.5-2.1	2.1	2.1	Metals, pH, Total Cyanide, Acid-Base Accounting, TCLP Metals
MT-RR-SB19	0.5-2.9	2.9	2.9	Metals, pH, Total Cyanide, Acid-Base Accounting, TCLP Metals
MT-RR-SB20	0.5-3.9	3.9	3.9	Metals, pH, Total Cyanide, Acid-Base Accounting, TCLP Metals

Soil Boring Point ID	Sampled Interval (ft bgs)	Soil Recovered (ft)	Bedrock Refusal (ft bgs)	Analysis
MT-RR-SB21	0.5-3.4	3.4	3.4	Metals, pH, Total Cyanide, Acid-Base Accounting, TCLP Metals
MT-RR-SB22	0.5-3.5	3.5	3.5	Metals, pH, Total Cyanide, Acid-Base Accounting, TCLP Metals
MT-RR-SB23	0.5-9.0	6.1	9.0	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB24	0.5-6.0	4.0	6.0	Metals, pH, Total Cyanide, Acid-Base Accounting
MT-RR-SB25	0.5-7.1	5.9	7.1	Metals, pH, Total Cyanide, Acid-Base Accounting, TCLP Metals

4 Sample Results

4.1 Data Quality Objectives

The data quality objectives are those in the Final RAMS Work Plan. The analytical results provide information about presence and extent of mine-related contamination. The criteria in order to attain these goals are given in the Final RAMS Work Plan and this section. Method detection limit (MDL), method reporting limit (MRL), and Quality Control (QC) criteria that will meet the data objectives for metals are given in Table 6-6 of the Final RAMS Work Plan. The MDL, MRL, and QC criteria for sulfate are given in Table 6-7 of the Final RAMS Work Plan.

4.2

4.3 Analytical Results

Composite soil samples were collected for analysis of metals (Ag, As, Ba, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Sb, & Zn), pH, total cyanide, and acid-base accounting (ABA). ABA samples were sent to Energy Laboratory in Billings, Montana for analysis. Samples for all other analysis were sent to the USACE Environmental Chemistry Branch Laboratory in Omaha, Nebraska. **Table 3** identifies the methods the laboratories used for each chemical.

Table 3 Chemical Analyses and Methods

Target Constituent	Analytical Method
Metals	
Antimony	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Arsenic	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Barium	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Cadmium	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Chromium	EPA SW-846 6010B Inductively Coupled Plasma – Trace

Target Constituent	Analytical Method
Copper	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Iron	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Mercury	EPA SW-846 7470 Cold Vapor Atomic Absorption
Manganese	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Nickel	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Lead	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Silver	EPA SW-846 6010B Inductively Coupled Plasma – Trace
Zinc	EPA SW-846 6010B Inductively Coupled Plasma – Trace
pH	EPA M325.2 Colorimetry
Total Cyanide	EPA M375.3 Colorimetry
Acid Base Accounting	EPA M310.2 Titrimetry

Results from the laboratory analysis are presented in **Table 4** by sample point location. Every analysis has a result listed, although some chemicals were not detected. The non-detected results are indicated in **Table 4** with a less than symbol (<) and the MDL. Some laboratory results are qualified with a "J". The J indicates the chemical is definitely identified but its concentration is estimated between the MDL and the MRL. The Chemical Data Quality Assessment Report is attached to this report and contains more information about data qualifiers.

Table 4 Analytical Results

Sample Point	units	Reporting Limit	Detection Limit	MT-RR-SB01	MT-RR-SB02	MT-RR-SB03	MT-RR-SB04	MT-RR-SB05
Date Collected				06/17/04	06/17/04	06/17/04	06/17/04	06/17/04
Metals (mg/kg)								
Antimony	mg/kg	4.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	mg/kg	3.0	0.6	14.0	**34.4**	**37.3**	20.0	**61.3**
Barium	mg/kg	0.5	0.1	118.0	75.6	90.6	65.3	94.3
Cadmium	mg/kg	0.5	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	2.0	0.4	9.4	12.0	14.0	8.7	14.0
Copper	mg/kg	2.0	0.4	20.0	19.0	35.7	18.0	47.6
Iron	mg/kg	24.0	8.0	16700	16700	**56300**	20900	**42100**
Lead	mg/kg	2.0	0.4	16.0	29.7	6.0	16.0	12.0
Manganese	mg/kg	0.8	0.2	382.0	361.0	967	429.0	677.0
Mercury	mg/kg	0.005	0.001	0.016	0.012	0.004 J	0.0056	0.0066
Nickel	mg/kg	2.0	0.6	11.0	8.2	32.4	11.0	25.5
Silver	mg/kg	1.0	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	mg/kg	2.0	0.6	49.2	64.5	64.0	41.1	70.1
pH	pH units	NA	NA	8.70	7.66	8.47	8.61	7.67
Cyanide	mg/kg	0.4	NA	ND	ND	ND	ND	ND
Acid Base Accounting								
Neutralization Potential	t/kt	1	NA	64	10	12	36	17
Acid Potential	t/kt	1	NA	<1	<1	<1	<1	<1
Acid/Base Potential	t/kt	NA	NA	64	10	12	36	17
Sulfur, Total	%	0.01	NA	<0.01	<0.01	0.01	<0.01	0.02
Sulfur, Hot Water Extractable	%	0.01	NA	<0.01	<0.01	0.01	<0.01	0.01
Sulfur, HCl Extractable	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfur, HNO3 Extractable	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	0.01
Sulfer Residual	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01

mg/kg = milligrams/kilogram
t/kt = tons/kiloton = parts per thousand
NA = Not Applicable
ND = Not detected above the MRL

Results in bold are above residential PRGs
Results shaded are above industrial PRGs

Sample Point	units	Reporting Limit	Detection Limit	MT-RR-SB06	MT-RR-SB07	MT-RR-SB08	MT-RR-SB09	MT-RR-SB10
Date Collected				06/17/04	6/16/04	6/16/04	6/16/04	6/16/04
Metals (mg/kg)								
Antimony	mg/kg	4.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	mg/kg	3.0	0.6	**33.3**	8.8	**39.7**	**39.4**	5.8
Barium	mg/kg	0.5	0.1	150.0	119.0	77.8	44.4	45.3
Cadmium	mg/kg	0.5	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium	mg/kg	2.0	0.4	14.0	18.0	10.0	8.6	3.7
Copper	mg/kg	2.0	0.4	19.0	43.3	23.4	16.0	16.0
Iron	mg/kg	24.0	8.0	18200	**30000**	**25500**	12500	14800
Lead	mg/kg	2.0	0.4	50.6	14.0	37.2	43.8	13.0
Manganese	mg/kg	0.8	0.2	602.0	648.0	513	262.0	713.0
Mercury	mg/kg	0.005	0.001	0.045	0.018	0.015	0.015	0.005 J
Nickel	mg/kg	2.0	0.6	6.4	12.0	14.0	4.8	2.1
Silver	mg/kg	1.0	0.2	<0.2	<0.2	<0.2	0.2 J	<0.2
Zinc	mg/kg	2.0	0.6	88.1	69.9	72.2	69.2	44.6
pH	pH units	NA	NA	6.40	8.37	8.32	7.56	7.93
Cyanide	mg/kg	0.4	NA	ND	ND	ND	ND	ND
Acid Base Accounting								
Neutralization Potential	t/kt	1	NA	6	38	25	8	19
Acid Potential	t/kt	1	NA	<1	<1	<1	<1	<1
Acid/Base Potential	t/kt	NA	NA	6	38	25	8	19
Sulfur, Total	%	0.01	NA	0.01	<0.01	0.02	<0.01	<0.01
Sulfur, Hot Water Extractable	%	0.01	NA	0.01	<0.01	0.02	<0.01	<0.01
Sulfur, HCl Extractable	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfur, HNO3 Extractable	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfer Residual	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01

mg/kg = milligrams/kilogram
t/kt = tons/kiloton = parts per thousand
NA = Not Applicable
ND = Not detected above the MRL

Results in bold are above residential PRGs
Results shaded are above industrial PRGs

Sample Point	units	Reporting Limit	Detection Limit	MT-RR-SB11	MT-RR-SB12	MT-RR-SB13	MT-RR-SB14	MT-RR-SB15
Date Collected				6/16/04	6/16/04	6/16/04	6/16/04	6/16/04
Metals (mg/kg)								
Antimony	mg/kg	4.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic	mg/kg	3.0	0.6	**70.8**	22.0	20.0	**46.0**	**59.2**
Barium	mg/kg	0.5	0.1	56.0	115.0	147.0	135.0	71.2
Cadmium	mg/kg	0.5	0.1	<0.1	11.0	<0.1	<0.1	<0.1
Chromium	mg/kg	2.0	0.4	9.9	7.5	11.0	14.0	11.0
Copper	mg/kg	2.0	0.4	18.0	18.0	17.0	22.8	13.0
Iron	mg/kg	24.0	8.0	14500	16900	17800	**23100**	16900
Lead	mg/kg	2.0	0.4	60.4	41.3	42.0	47.4	80.6
Manganese	mg/kg	0.8	0.2	356.0	453.0	601.0	608.0	355.0
Mercury	mg/kg	0.005	0.001	0.034	0.014	0.016	0.029	0.0089
Nickel	mg/kg	2.0	0.6	4.3	6.4	7.0	10.0	5.5
Silver	mg/kg	1.0	0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	mg/kg	2.0	0.6	101.0	140.0	98.2	111.0	95.6
pH	pH units	NA	NA	7.05	7.78	7.45	7.84	6.38
Cyanide	mg/kg	0.4	NA	ND	ND	ND	ND	ND
Acid Base Accounting								
Neutralization Potential	t/kt	1	NA	11	10	10	20	6
Acid Potential	t/kt	1	NA	<1	<1	<1	<1	<1
Acid/Base Potential	t/kt	NA	NA	11	10	10	19	6
Sulfur, Total	%	0.01	NA	0.01	<0.01	<0.01	<0.01	<0.01
Sulfur, Hot Water Extractable	%	0.01	NA	0.01	<0.01	<0.01	<0.01	<0.01
Sulfur, HCl Extractable	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfur, HNO3 Extractable	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01
Sulfer Residual	%	0.01	NA	<0.01	<0.01	<0.01	<0.01	<0.01

mg/kg = milligrams/kilogram
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Results shaded are above industrial PRGs

Sample Point	units	Reporting Limit	Detection Limit	MT-RR-SB16	MT-RR-SB17	MT-RR-SB18	MT-RR-SB19	MT-RR-SB20
Date Collected				6/16/04	6/16/04	6/16/04	6/15/04	6/15/04
Metals								
Antimony	mg/kg	4.0	1.0	<1.0	<1.0	<1.0	2 J	<1.0
Arsenic	mg/kg	3.0	0.6	**54.5**	8.4	**62.3**	**2490**	**67.9**
Barium	mg/kg	0.5	0.1	61.5	122.0	75.5	66.5	124.0
Cadmium	mg/kg	0.5	0.1	<0.1	<0.1	<0.1	<0.1	0.5 J
Chromium	mg/kg	2.0	0.4	11.0	20.1	9.7	8.5	17.0
Copper	mg/kg	2.0	0.4	20.0	16.0	25.1	42.6	38.6
Iron	mg/kg	24.0	8.0	17400	21000	20700	**26600**	20000
Lead	mg/kg	2.0	0.4	47.9	13.0	37.2	**884.0**	92.9
Manganese	mg/kg	0.8	0.2	400.0	444.0	541.0	323.0	527
Mercury	mg/kg	0.005	0.001	0.021	0.0066	0.012	0.130	0.0075
Nickel	mg/kg	2.0	0.6	9.4	7.7	12.0	3.0	9.1
Silver	mg/kg	1.0	0.2	<0.2	<0.2	<0.2	3.8	<0.2
Zinc	mg/kg	2.0	0.6	72.2	74.9	72.4	95.6	114
pH	pH units	NA	NA	7.85	5.97	8.00	4.21	7.15
Cyanide	mg/kg	0.4	NA	ND	ND	ND	ND	ND
Acid Base Accounting								
Neutralization Potential	t/kt	1	NA	22	8	18	4	13
Acid Potential	t/kt	1	NA	<1	<1	<1	5	<1
Acid/Base Potential	t/kt	NA	NA	22	8	18	-1	12
Sulfur, Total	%	0.01	NA	0.02	0.02	0.02	0.24	0.03
Sulfur, Hot Water Extractable	%	0.01	NA	<0.01	<0.01	<0.01	0.09	0.03
Sulfur, HCl Extractable	%	0.01	NA	<0.01	<0.01	<0.01	0.04	<0.01
Sulfur, HNO3 Extractable	%	0.01	NA	0.01	<0.01	<0.01	0.07	<0.01
Sulfer Residual	%	0.01	NA	<0.01	<0.01	<0.01	0.04	<0.01

mg/kg = milligrams/kilogram
t/kt = tons/kiloton = parts per thousand
NA = Not Applicable
ND = Not detected above the MRL

Results in bold are above residential PRGs
Results shaded are above industrial PRGs

Sample Point	units	Reporting Limit	Detection Limit	MT-RR-SB21	MT-RR-SB22	MT-RR-SB23	MT-RR-SB24	MT-RR-SB25
Date Collected				6/15/04	6/15/04	6/15/04	6/15/04	6/15/04
Metals								
Antimony	mg/kg	4.0	1.0	<1.0	<1.0	<1.0	2.0 J	<1.0
Arsenic	mg/kg	3.0	0.6	16.0	15.0	**134**	**2000**	**69.2**
Barium	mg/kg	0.5	0.1	107.0	109.0	61.4	77.7	39.2
Cadmium	mg/kg	0.5	0.1	0.2 J	<0.1	0.85	11.1	0.5 J
Chromium	mg/kg	2.0	0.4	12.0	33.8	14.0	26.2	9.9
Copper	mg/kg	2.0	0.4	20.8	83.7	22.4	115	13.0
Iron	mg/kg	24.0	8.0	16500	21300	15400	**24800**	9960
Lead	mg/kg	2.0	0.4	25.1	22.6	108.0	**1490**	74.7
Manganese	mg/kg	0.8	0.2	377.0	377.0	334.0	490	187.0
Mercury	mg/kg	0.005	0.001	0.016	0.004 J	0.034	0.213	0.040
Nickel	mg/kg	2.0	0.6	9.4	19.0	7.1	14.0	5.5
Silver	mg/kg	1.0	0.2	<0.2	<0.2	0.6 J	5.1	0.3 J
Zinc	mg/kg	2.0	0.6	67.7	63.0	118.0	1250	102.0
pH	pH units	NA	NA	8.53	8.78	7.03	7.33	7.69
Cyanide	mg/kg	0.4	NA	ND	ND	ND	ND	ND
Acid Base Accounting								
Neutralization Potential	ppt	1	NA	53	24	10	24	10
Acid Potential	ppt	1	NA	<1	<1	<1	10	<1
Acid/Base Potential	ppt	NA	NA	53	24	10	14	10
Sulfur, Total	%	0.01	NA	<0.01	<0.01	0.01	0.51	0.01
Sulfur, Hot Water Extractable	%	0.01	NA	<0.01	<0.01	0.01	0.18	0.01
Sulfur, HCl Extractable	%	0.01	NA	<0.01	<0.01	<0.01	0.01	<0.01
Sulfur, HNO3 Extractable	%	0.01	NA	<0.01	<0.01	<0.01	0.26	<0.01
Sulfer Residual	%	0.01	NA	<0.01	<0.01	<0.01	0.06	<0.01

mg/kg = milligrams/kilogram
t/kt = tons/kiloton = parts per thousand
NA = Not Applicable
ND = Not detected above the MRL

Results in bold are above residential PRGs
Results shaded are above industrial PRGs

5 Quality Control Review

Quality control review consists of an evaluation of the field procedures and analytical procedures and a review of the data to ensure appropriate QC compliance were met.

5.1 Field Quality Control

The USACE project team reviewed all field documents including logbooks for completeness. A review of the placement or coordinates of the sample was performed to ensure that this correlates to sample nomenclature. Placement and frequency of the quality control samples were reviewed to ensure compliance to set criteria. Location coordinates were reviewed for completeness and accuracy by the project technical team.

5.2 Laboratory Quality Control

The analytical program for this project conformed to the Final RAMS Work Plan prepared by the U.S. Army Corps of Engineers, July 2002 and the Rimini Road Improvement Project SSA to the Final RAMS Work Plan, 26 May 2004. ECB Laboratory and Energy Laboratory performed sample analyses in accordance with the procedures prescribed in the Final RAMS Work Plan using definitive quality control and quality assurance procedures.

5.3 Data Evaluation

The reviewed data are usable and are suitable for addressing the overall objective of this investigation. The detailed Chemical Data Quality Assessment Report (CDQAR) identifies the procedures used to ensure definitive quality data was obtained from the soil samples. The CDQAR is attached.

6 Conclusions and Recommendations

6.1 Metals Comparison to Preliminary Remedial Goals

The analytical results for metals were compared to Environmental Protection Agency (EPA) Region 9's Preliminary Remedial Goals (PRGs) for direct contact exposure to residential and industrial soil. This comparison has been summarized in **Table 4**. Analytical results for metals above residential PRGs are in bold italic and analytical results for metals above industrial PRGs are shaded gray. The PRGs should be viewed as Agency guidelines and are not legally enforceable standards. In this case, the PRGs are being used as conservative cleanup standards for the Rimini Road Project. **Table 5** lists the applicable PRGs.

Table 5 PRGs for Residential and Industrial Soil

Contaminant	Residential Soil (mg/kg)	Industrial Soil (mg/kg)
Antimony	31	410
Arsenic	22	260
Barium	5400	67000
Cadmium	37	450
Chromium	210	450
Copper	3100	41000
Iron	23000	100000
Lead	400	750
Manganese	1800	19000
Mercury	23	310
Nickel	1600	20000
Silver	390	5100
Zinc	23000	100000

A comparison between the analytical results for metals and residential soil PRGs indicates soils are above PRGs for the following:

- Arsenic at sample points MT-RR-SB02, MT-RR-SB06, MT-RR-SB11, MT-RR-SB12, MT-RR-SB15, MT-RR-SB16, MT-RR-SB18, MT-RR-SB20, MT-RR-SB23, and MT-RR-SB25;
- Iron at sample point MT-RR-SB07;
- Arsenic and iron at sample points MT-RR-SB03, MT-RR-SB05, MT-RR-SB08, and MT-RR-SB14; and
- Arsenic, iron, and lead at sample points MT-RR-SB19 and MT-RR-SB24.

A comparison between the analytical results for metals and industrial soil PRGs indicates soils are above PRGs for the following:

- Arsenic and Lead at sample points MT-RR-SB19 and MT-RR-SB24.

6.2 Acid Base Accounting

ABA is a static procedure that can be used to predict if a sample mine overburden material will be an acid producer or a neutralizer. The acid producing potential in a rock is tied directly to the amount of sulfides bound up in the rock in various forms. When these sulfides minerals are exposed to water and air, the sulfur is oxidized to form more soluble oxygen containing anions resulting in the release of metallic ions and acids. The lower pH can then result in additional metals release. ABA is an analytical test that can determine the potential of the sample to produce acid and release metallic ions. Acid neutralization and acid production are represented in **Table 4** by neutralization potential (NP) and acid potential (AP), respectively.

The ability of a sample to produce acid is determined by calculating the acid/base potential (ABP) and the neutralization potential ratio (NPR). These values are calculated as follows:

Neutralization Potential	NP
Acid Potential	AP
Acid/Base Potential	ABP = NP - AP
Neutralization Potential Ratio	NPR = NP ÷ AP

The criteria used for interpretation are as follows:

ABP > 20	non-acid producing
ABP <-20	acid producing
ABP -20 to 20	variable
NPR > 3	non-acid producing
NPR < 1	acid producing

The analytical results presented in **Table 4** show All ABP values are positive, with the exception of sample MT-RR-SB19. Even though many positive values fall into the ABP variable range (-20 to 20), using the NPR values it is seen that all values are > 3 with the exception of MT-RR-SB19 and MT-RR-SB24. From these analyses it is reasonable to assume that all samples would be non-acid producing with the exception of MT-RR-SB19 and possibly MT-RR-SB24.

6.3 Recommendations

The results of ABA show the samples of the Rimini Road fill material are not acid producers with the exception of samples MT-RR-SB-19 and MT-RR-SB-24. The metals analyses show high concentrations of arsenic and lead in the same two samples (MT-RR-SB-19 and MT-RR-SB-24) when compared to EPA Region 9's PRGs for industrial soils. A comparison to EPA Region 9's PRGs for residential soils is considered too conservative considering the project area is in a location dominated by igneous and metamorphic rocks that tend to produce soils with high concentrations of naturally occurring metals.

The ABA and metals analyses indicate that contaminated spoil from mining and milling (tailings) were most likely used as fill material beneath Rimini Road near sample point locations MT-RR-SB-19 and MT-RR-SB-24. These tailings are most likely a contaminant source because they have the potential to produce acid and release metallic ions; therefore, it is recommended that fill material near sample point locations MT-RR-SB-19 and MT-RR-SB-24 be removed prior to re-grading and re-paving Rimini Road.

7 Summary

Samples of soil were collected from the Rimini Road Project area in June 2004 and analyzed for chemical concentrations of several metals, total cyanide, pH, and ABA. The sampling was conducted as part of the Rimini Road Project to determine if roadbed fill contaminated from spoil from mining and milling was used to construct the roadbed.

Soil samples were collected from twenty-five locations within the Rimini Road Project area. Results indicate spoils from mining and milling operations were likely used as roadbed fill in two locations (MT-RR-SB-19 and MT-RR-SB-24). It is recommended that the contaminated fill be removed from these two areas prior to re-grading and re-paving Rimini Road.

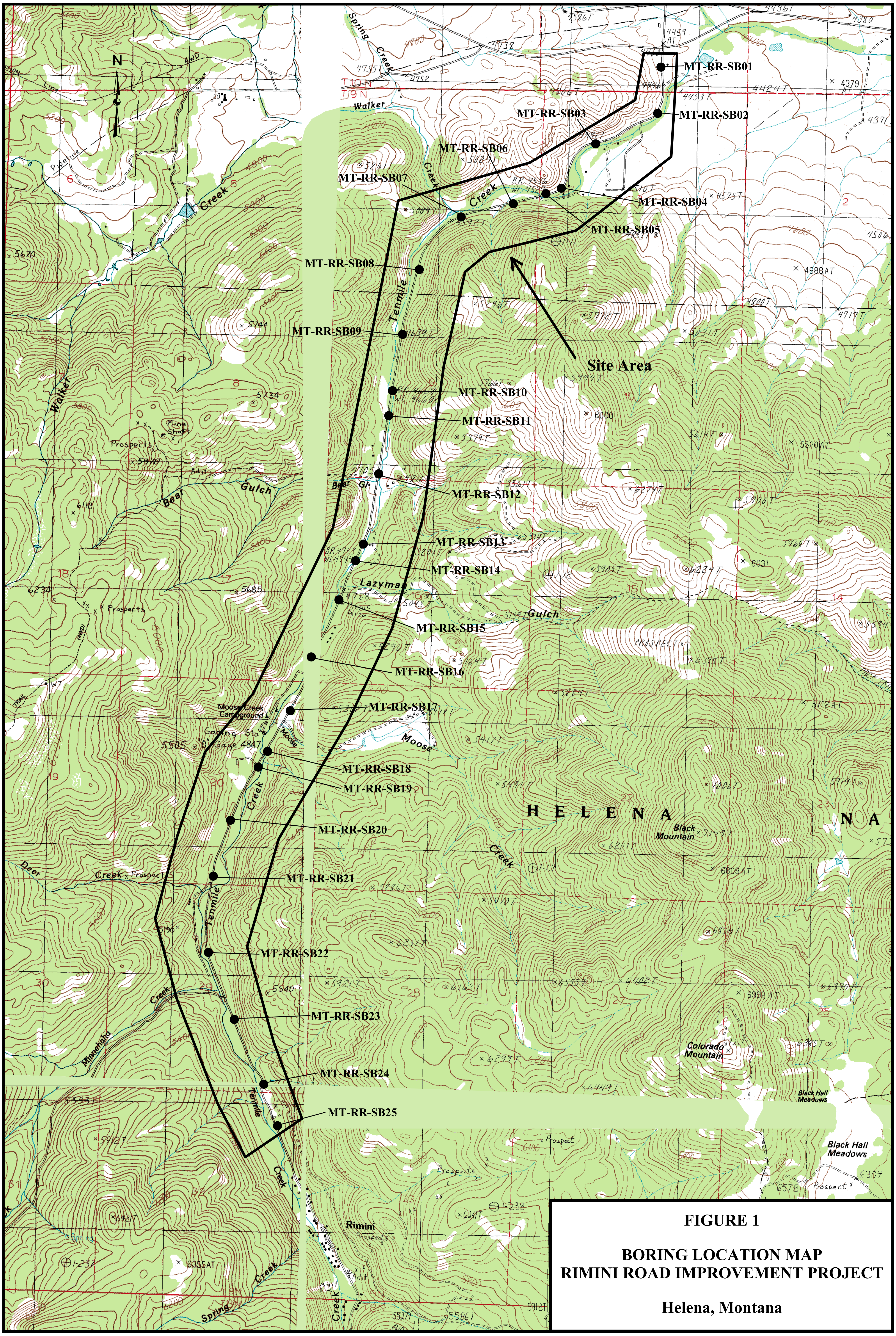

FIGURE 1

BORING LOCATION MAP
RIMINI ROAD IMPROVEMENT PROJECT

Helena, Montana