SITE-SPECIFIC ADDENDUM TO
RESTORATION OF ABANDONED MINES SITE WORK PLAN
SOUTH MOSQUITO CREEK AND BUCKSKIN CREEK
24 July 2002

1 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) has been provided authority for Restoration of Abandoned Mine Sites (RAMS) through the Water Resource Development Act (WRDA) 1999 Section 560. This 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.

This document is prepared as the Site-Specific Addendum (SSA) to the Restoration of Abandoned Mine Sites Work Plan, dated July 2002. The RAMS Work Plan was written to encompass all investigative activities to be accomplished by various districts of the USACE under the RAMS program. The purpose of this SSA is to present methods and procedures for conducting a site characterization of the South Mosquito and Buckskin Creek drainages involving limited surface water sampling and flow rate measurements. Fieldwork will be performed by individuals from the USACE Omaha District and United States Forest Service. Additional stakeholders providing input or exhibiting interest in this project include, but are not limited to, Colorado Division of Minerals and Geology and the Bureau of Land Management.

This SSA describes the media, locations, analyses, frequencies, and techniques associated with the major field tasks outlined above and will be used in conjunction with the RAMS Work Plan. The RAMS Work Plan contains a more complete discussion of the RAMS program, along with a thorough discussion of the following: sampling requirements; field quality control; chemical data quality objectives; project organization and quality control responsibility; laboratory analytical and preparation procedures; sample collection, handling and documentation procedures; preventative maintenance procedures; calibration procedures and frequency; corrective action; and data reduction. This document references the RAMS Work Plan for the current field activities and contains site-specific information not included in the RAMS Work Plan.

2 PROJECT INFORMATION

South Mosquito Creek is located in Park County, approximately 4 miles west of the town of Alma. South Mosquito Creek is a tributary to Mosquito Creek, which then joins with the North Fork of the South Platte River near Alma.

The London Mine is the only major mine on South Mosquito Creek; however, there are several different levels of the London Mine and mine wastes from different periods of

mining that affect the water quality of South Mosquito Creek. These include the drainage from the London Extension Tunnel, drainage from the Water Tunnel, the London Extension mine waste pile, the Water Tunnel mine waste pile, the Butte Mill tailings pile, the Butte Mine waste pile, the American Shaft waste pile, historic tailings piles, and a relatively recent tailings embankment.

Currently, a mine drainage treatment system has been constructed to treat the London Extension mine drainage. In addition, there is a current National Pollutant Discharge Elimination System (NPDES) permit on the discharge from the Water Tunnel. A Total Maximum Daily Load (TMDL) developed by the Colorado Department of Public Health & Environment concluded that even if all the metals from the two mine drainages were removed, South Mosquito Creek would still not meet stream standards.

Buckskin Creek is the next creek to the north of South Mosquito Creek and is also located in Park County west of the town of Alma. Buckskin Creek joins with the North Fork of the South Platte River near Alma. Numerous abandoned mines exist on federal lands in the Buckskin Creek drainage.

3 FIELD INVESTIGATION ACTIVITIES

The primary objective of this field investigation is to determine metal loading from various mine sites to the South Mosquito Creek and Buckskin Creek drainage basins. A single round of surface water sampling and flow rate measurements will be collected in accordance with this SSA. Proposed sampling locations are shown on Figure 1. The sampling locations were selected in consultation with project stakeholders and reflect locations upgradient and downgradient from potentially contaminated areas. The locations are designed to determine whether or not stream degradation is occurring as a result of these areas.

The following Standard Operating Procedures (SOPs), located in Appendix A of the RAMS Work Plan, will be adhered to during the course of this field investigation: A7 (Investigative Derived Waste Procedures); A11 (Surface Water and Sediment Sampling Equipment and Procedures); A12 (Equipment Decontamination Procedures); A13 (Sample Handling, Documentation, and Tracking Procedures); and A14 (Field Documentation). The following paragraphs provide site-specific information not found in the RAMS Work Plan/SOPs or changes to these documents.

3.1 Surface Water Sampling Equipment and Procedures

Sampling location coordinates obtained from a hand-held Global Positioning Satellite (GPS) device will be recorded in the field logbook in longitude and latitude. The device has an approximate accuracy of plus-or-minus 20 feet. Field measurements of pH, specific conductance, temperature, and turbidity will be obtained with a Horiba U-10 water quality checker. Probes for all of these specified parameters are housed in a single unit, making this equipment ideal for sampling sites where it is anticipated that access will be by foot.

Surface water samples will be collected directly into the sample container, or, if flow rate is too low for this method, the samples will be collected with a disposable plastic cup and poured into the sample container. All excess water will be disposed of by pouring gently out on the stream bank adjacent to the sampling location.

The sample ID scheme presented in SOP A13 will use the following designations:

UU = Project designation will be replaced with CO (for Colorado RAMS)
VVVV = Designation of sampling area location will be replaced with SMC for South Mosquito Creek and BC for Buckskin Creek.

An example of a surface water sample collected on South Mosquito Creek is:

CO-MSC-SW01-01

The Quality Control (QC) duplicate sample would have the sample designation of:

CO-MSC-SW01-02

3.2 Stream Discharge Equipment and Procedures

Flow rate measurements will be obtained using an FP201 Global Flow Probe hand-held flow meter with a 5- to 15-foot expandable handle. The flow meter has a 2-inch propeller sensor that rotates freely on a bearing shaft with no mechanical interconnections. Magnetic material in the propeller passes a pickup coil in the housing, thereby producing electrical impulses. The electrical impulses are then carried by wire to a readout display located on top of the handle, which amplifies and converts the signal into velocity readings measured in feet per second. Instantaneous, average and maximum velocity readings are displayed. The range of the flow meter is 0 to 25 feet per second, with accuracies of plus-or-minus 0.1 feet per second for instantaneous velocity, and plus-or-minus 0.01 feet per second for average and maximum velocity.

At each surface water sampling location, the stream channel will be subdivided into 1 to 5 segments of equal length depending on the width of the stream channel. Ideally, each segment will range from 3 to 5 feet across. The depth of the stream will be measured in the middle of each segment. These measurements will be recorded by drawing a diagram on graph paper with a scale of 1 square foot per graph paper square, assuming the measured depth is consistent across each stream segment. The cross-sectional area of each stream channel segment will be calculated by counting the number of squares in the stream segment, and will be recorded in the field logbook.

After calculating the cross-sectional areas, velocity measurements will be obtained from each stream segment. The flow meter handle will be extended to the appropriate length and the flow probe placed in the middle of each stream segment for a minimum of 1 minute. The flow probe will be moved slowly back and forth from top to bottom during the 1-minute timeframe in order to obtain a vertical flow profile. The average and

maximum flow velocities for each stream segment will be recorded in the field logbook. For each stream segment, the average velocity will then be multiplied by the cross-sectional area in order to determine the flow for that segment. Once the flow for each segment is obtained, all of the segment flows will be added together to obtain a total stream flow. The date, time, and GPS coordinates in longitude and latitude for each sampling location will be recorded in the field logbook.

4 CHEMISTRY REQUIREMENTS

Sample analytical and handling requirements are given in this section of the SSA for South Mosquito Creek and Buckskin Creek in Colorado. Reference to the Restoration of Abandoned Mine Sites Final Work Plan, July 2002, is provided.

4.1 Project and Data Quality Objectives

4.1.1 Project Objectives

Samples of surface water from selected areas of South Mosquito and Buckskin Creeks will be obtained for chemical analysis. For this project, 23 surface water samples along with required QC samples will be obtained. See Figure 1 for the sampling locations.

4.1.2 Data Quality Objectives

The data quality objectives are based on those given in the RAMS Work Plan, July 2002. The analytical results will be used to gain information about the extent of metals loading from various mine sites into the associated creeks. The criteria in order to attain these goals are given in the RAMS Work Plan, July 2002, and/or given in this section. The Method Detection Limit (MDL), Method Reporting Limit (MRL), and QC criteria that will meet the data objectives for metals are given in Tables 6-5 and 6-6 of the RAMS Work Plan, July 2002. The MDL, MRL, and QC criteria that will meet the data objectives for alkalinity, chloride and sulfate are given in Table 6-7 of the RAMS Work Plan, July 2002.

4.2 Sample Requirements

A total of 23 surface water samples will be obtained from South Mosquito Creek and Buckskin Creek for chemical analysis. The surface water samples will be analyzed by a laboratory for total and dissolved metals, and total chloride, sulfate, and alkalinity. Field analysis will be performed for pH, specific conductance, temperature, and turbidity. Sample requirements are given in the following table:

SAMPLE REQUIREMENTS

Parameter	Field	Quality Control Duplicate	MS/MSD*	Total
Metals Total**	23	2		25
Metals Dissolved**	23	2		25
Chloride	23	2		25
Alkalinity	23	2		25
Sulfate	23	2		25

* Required MS/MSD can be obtained from samples above.

** Metals include Al, As, Ca, Cd, Cr, Cu, Fe, Pb, Mg, Mn, K, Ag, Zn.

NOTES:

- Each bottle and the COC must include the **LIMS # 6692 .**
- Keep all samples in the cooler on ice.

Total metals and dissolved metals each require one 500 ml plastic container. Total metals may be place into pre-acidified containers or sent to the lab unacidified. If sent to the lab unacidified it must be marked on the bottle label and chain-of-custody form that this sample is for total metals and will need nitric acid added by the lab.

Dissolved metals will be sent to the lab unacidified. It must be marked on the bottle label and chain-of-custody form that the lab must filter and acidify upon receiving.

4.3 Preservation, Holding Time, and Shipment

Requirements are given in the following tables:

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIMES FOR WATER SAMPLES

Parameter	Container	Preservation	Maximum Holding Times:	
			Extraction	Analysis
Dissolved Metals	500 ml Plastic	Preservative added after filtering by ECB Lab; Ice to 4^0C	NA	6 months (Mercury - 28 days)
Total Metals	500 ml Plastic	HNO_3 to pH <2 or send to ECB for acid; Ice to 4^0C	NA	6 months (Mercury - 28 days)
Alkalinity	500 ml Plastic	Ice to 4^0C	NA	14 days
Sulfate			NA	28 days
Chloride			NA	28 days

1 One 500 ml container is sufficient for Sulfate, Chloride, and Alkalinity analysis.

2 NA = Not Applicable

4.4 Labeling and Shipment Procedures

The filled sample bottles will be labeled as specified in the RAMS Work Plan, July 2002. The Laboratory Identification Management System (LIMS) number is **LIMS # 6692**.

The labeled bottles will be placed in the cooler with the appropriate chain-of-custody form. Samples may be accumulated for up to 5 working days and will be shipped weekly to the laboratory in a batch. The cooler will be shipped by FedEx or UPS overnight mail or carried directly to the laboratory:

US Army Corps of Engineers
Environmental Chemistry Branch (ECB) Laboratory
ATTN: WES-EE-Q (Sample Custodian)
420 South 18th Street
Omaha NE 68102
Telephone: (402) 444-4314.

4.5 Sample Analysis

The following analytical methods will be used for the field samples and appropriate required quality control samples for this site:

Parameter	Method	Matrix
Metals	EPA Method 3005/6010B	water
Alkalinity	EPA Method 310.2	water
Chloride	EPA Method 325.2	water
Sulfate	EAP Method 375.2	water

5 SAFETY REQUIREMENTS

General health and safety requirements are identified in the RAMS Site Safety and Health Plan (SSHP), July 2002. Relevant sections for this field effort are identified in the Site-Specific Job Hazard Assessments in Section 12. Personnel working on site must read relevant sections of the SSHP and comply with the requirements they contain. Personnel must sign the acknowledgement form on page viii before the Site Safety and Health office will permit work on site. The Site Safety and Health Officer must ensure Tailgate Safety Meetings are performed regularly and documented on the form in Section 12 of the SSHP. For this field effort, person protective equipment is Modified Level D, consisting of steel-toed, steel-shank safety boots or appropriate hiking boots if additional traction is required for the terrain, and latex or nitrile gloves during sample collection.

6 QUALITY CONTROL REVIEW

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

6.1 Field Quality Control

All documentation found in the field logbook will be reviewed by the project team for completeness. A review of the placement or coordinates of the sample will be performed

to ensure that this correlates to sample nomenclature. Placement and frequency of the quality control samples will be reviewed to ensure compliance to set criteria. Location coordinates, flow rate measurements, cross-sectional area calculations, and discharge calculations will be reviewed for completeness and accuracy by the project technical team.

6.2 Laboratory Quality Control

Upon completion of analysis, the analyst will calculate the final sample results and associated QC results from the raw data. The analyst will review all raw data for any peaks that appear suspect or will have any effect on the data. The analyst will review all analytical instrument parameters such as internal standards, retention times, and controls to ensure compliance. The analyst will also review accuracy of equations including units and quality control results for the analytical batch. When the analyst has completed the analysis of the samples, a second level of data and instrument review will be performed by another laboratory person. This will give a check on instrument performance, interpretation, and calculation of the data results. Before the data package is released, a third level of review will be performed by the Quality Control Officer of the lab to ensure complete data accuracy and compliance. The sample temperature upon receiving the samples, holding times, and a complete case narrative of the quality control will be submitted along with each data package. The three levels of laboratory review of the data package will be performed on 100 % of the data.

6.3 Data Evaluation

The project chemist will make a separate review of a portion of the data package obtained from the laboratory. This will include a review of the case narrative that is included in the data package. If no noted deficiencies are encountered, it can be assumed that the data package as obtained from the laboratory is of sufficient quality that batch validation can be performed. The batch data evaluation will be performed on 100 % of the data package obtained from the laboratory. In performing this, the evaluator will use the National Functional Guidelines as a guide. The parameters and QC results that are used in the validation are:

- Holding times,
- Sample temperatures during shipment and before analysis,
- Blanks (trip and method),
- Laboratory Control Samples,
- Matrix Spike/Matrix Spike Duplicates, and
- Surrogates.

Data evaluation consists of comparing the above six items along with other checks as given in Section 5.7 of the RAMS Work Plan, July 2002 to set project criteria and flagging the data values accordingly. The evaluation should show how the holding times and shipment/holding temperatures are met, any noncompliances, along with how the

analytical batch blanks and spikes samples meet set criteria. Data tables will be produced for all analytical data along with the resulting data qualification flags.

7 REPORT REQUIREMENTS

The report for this field effort will consist of:

- a brief summary of field activities,
- a map of final sampling locations,
- a table of sampling location coordinates in longitude and latitude, flow rate velocities, stream channel cross-sectional area, and calculated discharge rate,
- a table of analytical results for all parameters and comparison to state surface water standards, if any,
- a brief summary of data quality based on data evaluation, and
- recommendations for future investigation, if any, in the drainage.