

Final

**LONG-TERM SURFACE WATER QUALITY
MONITORING PLAN**
New World Mining District
Response And Restoration Project

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Prepared for:

**USDA Forest Service
Northern Region
Missoula, Montana**

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November 10, 1999

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1.0 INTRODUCTION

This Long-Term Surface Water Quality Monitoring Plan for the New World Mining District was developed by Maxim Technologies, Inc. (Maxim) for the United States Department of Agriculture Forest Service (USDA-FS). The USDA-FS is undertaking a non-time-critical response action in the New World Mining District (District) to respond to and restore natural resources affected by historic gold, silver, copper, and lead mining. The historic District is located in a 40 square mile area in the vicinity of Cooke City, Montana (Figure 1).

This monitoring plan is one of several project plans and is directly supported by the Site-Wide Sampling and Analysis Plan (Site-Wide SAP). The Site-Wide SAP contains the methods and procedures for all surface water sampling and analysis. The Site-Wide SAP is the overall guidance document for all environmental data collection procedures in the District. The Site-Wide SAP will be referenced for those procedures involving quality assurance, quality control, and documentation. For clarity, field and analytical methods are described in this plan. Relevant standard operating procedures (SOPs) are also referenced; the SOPs are appended to the Site-Wide SAP.

1.1 BACKGROUND

In August 1998, Crown Butte Mines, Inc.(CBMI) entered into a consent decree with the United States Government, the State of Montana and several non-profit organizations which provided funding for, and guidance on, response and restoration actions to be implemented on historic mine related disturbances in the New World Mining District (District). At this time the USDA-FS became the lead agency in the clean up effort. The work, among other aspects, is to include addressing water quality problems created by historic mining within the District. As a condition of the consent decree, CBMI, with the assistance of the USDA-FS, petitioned the State of Montana to adopt temporary water quality standards for specific stream segments within the District. This petition was submitted to Montana Board of Environmental Review (Board) on January 22, 1999 along with an Implementation Plan in support of the petition that provides for water quality monitoring along the specified stream segments (Maxim, 1998). A rule implementing the temporary standards was approved by the Board in June 1999.

This monitoring plan is consistent with the provisions and requirements of the petition for temporary water quality standards. In addition, it recognizes the need to monitor water quality in stream segments not specifically named in the petition, but which may also be affected by response and restoration actions.

1.2 SITE LOCATION AND DESCRIPTION

The New World Mining District (District) is located in Park County in south-central Montana. The District is bounded on the south by the Montana-Wyoming state line, on the west by Yellowstone National Park and on the north and east by the Absaroka-Beartooth Wilderness area boundary (Figure 1). The District is characteristic of subalpine regions of the northern Rocky Mountains with elevations that range from approximately 7,000 feet to over 10,000 feet. Accumulated snow pack in the higher elevations range from 10 feet to over 20 feet deep where drifting occurs. The ground is generally snow covered from late October through mid May at the lower elevations and from early October through late July at the higher elevations. Perennial and semi-perennial snow fields occupy the north facing slopes of the highest mountain peaks.

Area streams are high energy, first and second order tributaries of the Yellowstone River system. These streams occupy glacially carved valleys and are fed largely by melting snow pack. Peak streamflow is characteristically reached by mid June or early July and may be several orders of magnitude higher than baseflow conditions, which typically occur in late winter or early spring. Three drainage basins have been identified as potentially being impacted by the proposed response and restoration actions: 1) Fisher Creek and the Clarks Fork of the Yellowstone River; 2) Daisy Creek and the Stillwater River drainage basin; and, 3) Miller Creek and Soda Butte Creek drainage basin.

District streams have been slightly to severely impacted by acid rock drainage. Since the early 1970's, numerous water quality studies have been undertaken by various entities, both private and governmental. These studies have amassed a large body of data documenting water quality in the District. This data has been compiled and evaluated (URS, 1998) and will be used as a baseline with which to compare future changes in water quality.

2.0PURPOSE AND OBJECTIVES

Long-term surface water quality monitoring will be conducted in the District in order to: 1) Comply with the requirements of the rule to adopt temporary water quality standards for segments of Daisy Creek, the Stillwater River, and Fisher Creek in accordance with the Montana Water Quality Act (MCA 75-5-312); and 2) Monitor the effects on surface water quality and flow resulting from remediation and removal actions being conducted on mine related disturbances in watersheds within the District.

3.0SURFACE WATER SAMPLING

Surface water data collection will include measuring flow, measuring certain field parameters, and collecting samples for water quality analysis. This section describes the sampling stations, frequency of sampling, and timing of surface water sampling events. Also described are the sampling methods and analytical parameters

3.1 SAMPLING STATIONS AND FREQUENCY

Surface water sampling will be conducted three times each year during the period that temporary water quality standards are in effect. These events will be conducted at pre-established monitoring stations along the three stream reaches identified in the rule for temporary standards, as well as along stream reaches not identified in the rule but which may be affected by removal actions in the District. Site locations for each of the three watershed basins are identified in Table 1 and shown on Figure 2. Sampling will occur at or near low flow conditions (April/May), at or near high flow conditions (July), and at the end of the construction season (September/October).

3.2 FIELD NOTES

Detailed field notes will be taken at each sample site and will include sampling station number, field sample number, date, time, weather, field parameters, water color, field conditions, and other observations as necessary. Notes will be kept in a project dedicated field notebook in accordance with SOP-12 (Sample Documentation).

Figure 1 - Project Vicinity Map

Figure 1 - back page

Figure 2 - Long-Term Surface Water Quality Monitoring Station Locations

Figure 2 – back page

TABLE 1
SURFACE WATER QUALITY SAMPLE SITES
 Long-Term Surface Water Quality Monitoring Plan
 New World Mining District – Response and Restoration Project

Site Name	Location	Drainage Basin
SW-3	Fisher Creek at DNRC Gauging Station (DNRC-207)	Fisher Creek
SW-4	Fisher Creek at Lulu Road Crossing	Fisher Creek
CFY-2	Fisher Creek Above Confluence with Clarks Fork Y. R.	Fisher Creek
SW-6	Clarks Fork Yellowstone River at Saw Mill Road Crossing	Clarks Fork Yellowstone
DC-2	Daisy Creek Below Confluence of McLaren Tributaries	Daisy Creek
DC-5	Daisy Creek Above Confluence with Stillwater River (DNRC-127)	Daisy Creek
SW-7	Stillwater River at Stillwater Trail Crossing	Stillwater River
SW-2	Miller Creek below Miller Mountain Road crossing	Miller Creek
SBC-1	Soda Butte Creek above confluence with Miller Creek	Soda Butte Creek
SBC-2	Soda Butte Creek below McLaren Tailings	Soda Butte Creek
RR-SBSW-102	Soda Butte Creek below confluence with Republic Creek	Soda Butte Creek
SBC-4	Soda Butte Creek at Yellowstone Park Boundary	Soda Butte Creek

3.3 SAMPLE DESIGNATION

Sample designations will consist of a series of letters and numbers to indicate the project and sample station identifier. The project prefix will consist of the letters RR for the project name (Response and Restoration). An example of the sample designation follows:

RR-SBC-4

Field quality control samples will be submitted blind to the laboratory. Field quality control samples will include deionized water blanks, rinsate blanks, and field duplicates. The sample designation for blind field duplicates will be the same number and letter designation as the station where the duplicate sample is taken. The quality control sample will be differentiated from the natural sample by adding the following codes at the end of the sample designation number:

Deionized Water Blank	'B'
Rinsate Blank	'R'
Field Duplicate	'X'

An example of a quality control sample designation follows:

RR-SBC-4X

3.4 FLOW MEASUREMENTS

Flow measurements will be taken in accordance with SOP-01 (Streamflow Measurement; Wading Technique) and will consist of one or more of the following methods: 1) Area-velocity method; 2) Portable flume method; or 3) Timed volumetric method. At high flow periods some downstream sites may be unsafe to wade. In such cases, flows will be estimated by measuring stream stage. If not already in place, stream stage gauges will be installed at appropriate sample sites in accordance with the manufacturer's recommendations and SOP-21 (Gauging Station Operation).

3.5 SURFACE WATER SAMPLING

Field parameters are shown in Table 2 and will be measured according to Maxim SOPs. Field parameters will be measured using suitable, calibrated, handheld, analytical instruments in accordance with procedures in the Site-Wide SAP.

TABLE 2 FIELD PARAMETERS Long-Term Surface Water Quality Monitoring Plan New World Mining District – Response and Restoration Project			
Parameter	SOP Number ⁽¹⁾	3.5.1....	SOP Title
Specific Conductance	SOP-05		Field Measurement of Specific Conductance
pH	SOP-06		Field Measurement of pH
Water Temperature	SOP-07		Field Measurement of Water Temperature
Flow	SOP-01		Streamflow Measurement; Wading Technique

1. Maxim Standard Operating Procedures

Surface water samples will be collected according to SOP-03 (Surface Water Quality Sampling). Samples will be collected in clean laboratory supplied bottles of appropriate size and composition and, as necessary, passed through a 0.45 micron disposable filter and/or acidified to an appropriate pH level for preservation. Non-disposable sampling equipment will be decontaminated between sampling stations according to SOP-11 (Equipment Decontamination). Appropriate field forms will be filled out in accordance with SOP-10 (Field Forms).

3.6 QUALITY ASSURANCE/QUALITY CONTROL

The New World Mining District QA/QC elements will include:

- Long-Term Surface Water Quality Monitoring Plan
- Field documentation of sampling procedures

- Properly prepared chain of custody records
- Instrument calibration and documentation
- Quality control blanks, duplicates and splits
- Proper identification of analytes
- Quantification of analytes within acceptable error limits
- Matrix spike recoveries and documentation
- Total measurement error and statistical evaluation of the data

Quality control (QC) samples will be collected in accordance with the Site-Wide SAP and SOP-13 (QC Samples). The following QC samples will be collected for surface water sampling:

- *Blanks (DI water)* - 1 per sampling event or 5% of the total number of samples.
- *Equipment rinsate blanks* - 1 per day for each procedure requiring equipment decontamination (disposable equipment will be used where possible).
- *Field duplicates* - 1 per sampling event or 5% of total # of samples.

Chain-of-custody forms will accompany each cooler to the laboratory. Chain-of Custody forms will be filled out to include the project name, samplers name, sample number, date and time of sampling, number and type of bottles, and analytical parameter and method list.

3.7 SAMPLE SHIPPING

Samples will be stored and shipped, in accordance with SOP-09 (Sample Packaging and Shipping). Samples will be chilled to 4° C in ice filled coolers and secured with a chain of custody seal. Samples will be shipped at the end of the sampling event, or sooner if required to meet seven day holding time requirements, for overnight delivery to the analytical laboratory.

3.8 ANALYTICAL METHODS

Samples will be shipped to Northern Analytical Laboratories in Billings, Montana. Constituents identified as exceeding Montana water quality standards for a class B-1 stream have been identified in the Implementation Plan as the basis for the analytical parameters list. Montana water quality standards for metals are defined as total recoverable (TRC) metals. Considerable previous sampling data exists to establish the relationship between TRC and total dissolved metals (TDM). As such, metals will be analyzed as TRC metals. Table 3 summarizes laboratory analytical parameters, holding times, EPA analytical method number, required detection limits, and sample preservation.

Quality assurance (QA) requirements will be assured by adhering to EPA approved analytical reference methods and determining total measurement error. These QA procedures are described in the Site-Wide SAP.

TABLE 3
SUMMARY OF SURFACE WATER ANALYTICAL REQUIREMENTS
 Long-Term Surface Water Quality Monitoring Plan
 New World Mining District – Response and Restoration Project

Parameter	PQL (mg/l) ⁽¹⁾	EPA Method No.	Max. Holding Time	Preservatives
Physicochemical				
Specific Conductivity	None	120.1	7 days	None
pH	None	150.1	Upon arrival at lab	None
Total Dissolved Solids	None	160.1	7 days	None
Total Suspended Solids	None	160.2	7 days	None
Hardness	None	200.7	14 days	None
Acidity	None	305.1	14 days	None
Temperature	Field analyze	-----	-----	-----
Flow	Field analyze	-----	-----	-----
Metals				
Aluminum	0.1	200.7/202.1	6 months	HNO ₃ , pH<2
Cadmium	0.0001	200.7/213.2	6 months	HNO ₃ , pH<2
Copper	0.001	200.7/220.2	6 months	HNO ₃ , pH<2
Iron	0.01	200.7/236.1	6 months	HNO ₃ , pH<2
Lead	0.001	200.7/239.2	6 months	HNO ₃ , pH<2
Manganese	0.003	200.7/243.1	6 months	HNO ₃ , pH<2
Zinc	0.01	200.7/289.1	6 months	HNO ₃ , pH<2
Common Cations				
Calcium	1.0	200.7/215.1	6 months	None
Magnesium	1.0	200.7/242.1	6 months	None
Potassium	1.0	200.7/258.1	6 months	None
Sodium	1.0	200.7	6 months	None
Common Anions				
Sulfate	None	300.0/375.0	28 Days	None
Bicarbonate	None	310.1	14 Days	None
Carbonate	None	310.1	14 Days	None
Chloride	None	325/300.0	28 Days	None

1. PQL = Practical Quantitation Limit
 mg/L = milligrams per liter

4.0REPORTING

A succinct report will be prepared each year following completion of all monitoring activities. The annual report will contain a discussion and summary of monitoring activities, any deviations in either methods or procedures from this long-term monitoring plan, and sufficient text, tables and figures to provide the reader with an understanding of the methods used and the resultant data. A PARC (precision, accuracy, representativeness, and completeness) statement will be made in accordance with the Quality Assurance Project Plan along with a brief discussion of data validation results. Both these elements are described in detail in the Site-Wide SAP. Appendices will include field data sheets, a database printout, and a copy of laboratory analytical reports.

5.0 REFERENCES

URS Operating Services, 1998. Site Assessment Summary and Sampling Activities Report, New World Mine. September 11, 1998.

CBMI, 1999. Petition Before the Board of Environmental Review of the State of Montana. January 22, 1999.

Maxim Technologies, Inc., 1999. Support Document and Implementation Plan Submitted by Crown Butte Mines, Inc. in Support of Temporary Modification of Water Quality Standards for Selected Parameters for Fisher and Daisy Creeks and Headwater Segments of the Stillwater and Clarks Fork of the Yellowstone Rivers - Park County

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Montana Department of Health and Environmental Sciences - Water Quality Bureau, 1976. Water Quality Inventory and Management Plan - Upper Yellowstone River Basin. February 1976.