Final

NEW WORLD MINING DISTRICT
RESPONSE AND RESTORATION PROJECT
OVERALL PROJECT WORK PLAN

Final

NEW WORLD MINING DISTRICT
RESPONSE AND RESTORATION PROJECT
OVERALL PROJECT WORK PLAN

Prepared for:

USDA Forest Service
Northern Region
Missoula, Montana

Prepared by:

Maxim Technologies, Inc.
303 Irene Street
P.O. Box 4699
Helena, Montana 59604

November 10, 1999

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

List of Tables

List of Figures

List of Appendices

LIST OF ACRONYMS AND ABBREVIATIONS

Agreement	Settlement Agreement
AIMSS	Abandoned and Inactive Mine Scoring System
ARARs	Applicable or Relevant and Appropriate Requirements
CBMI	Crown Butte Mines, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CECRA	Comprehensive Environmental Cleanup and Responsibility Act
cfs	cubic feet per second
CRP	Community Relations Plan
Decree	Consent Decree
District	New World Mining District
DNRC	Department of Natural Resources and Conservation
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Department of the Interior Environmental Protection Agency
FSP	Field Sampling Plan
HASP	Health and Safety Plan
HRS	Hazard Ranking System
MDEQ	Montana Department of Environmental Quality
Maxim	Maxim Technologies, Inc.
mg/L	milligrams per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
OUs	Operable Units
PRSC	Post Removal Site Control
QAPP	Quality Assurance Project Plan
RAOs	Removal Action Objectives
SAP	Sampling and Analysis Plan
UOS	URS Operating Services
USDA-FS	United States Department of Agriculture Forest Service

FOREWORD

The New World Mining District (District), which includes a mixture of National Forest Service and private lands, is a historic metals mining district located in the general vicinity of Cooke City, Montana in the Beartooth Mountains. This historic mining district, which is centered about four miles northeast of the northeast gate to Yellowstone National Park, contains hard rock mining wastes and acid discharges that impact the environment. Human health and environmental issues are related to elevated levels of heavy metals present in mine waste piles, open pits, acidic water discharging from mine openings, and stream sediments.

On August 12, 1996, the United States signed a Settlement Agreement (Agreement) with Crown Butte Mining, Inc. (CBMI) to purchase CBMI's interest in their District holdings. The resulting transfer of property to the U.S. government effectively ended CBMI's proposed mine development plans and provided $22.5 million to cleanup historic mining impacts to specific properties in the District. In June 1998, a Consent Decree (Decree) was signed by all interested parties and CBMI, and approved by the United States District Court, that finalized the terms of the Agreement and made available the funds that will be used for mine cleanup.

The Decree specifies that performance of response and restoration actions will initially address release or threats of release of hazardous substances, natural resources lost, and conditions affecting water quality and natural resources that are related to District Property. District Property is defined in the Decree to include all property or interests in property that CBMI relinquished to the United States. As specified in the Decree, monies available for cleanup will first be spent on "District Property". After District Property is cleaned up to the satisfaction of the United States, remaining funds will be used to cleanup other mining disturbances in the District. While cleanup will first target District Property, the assessment of impacts from historic mining will include all property within the District boundary as defined in the Decree, including impacts associated with the McLaren tailings (a large former tailings impoundment in Soda Butte Creek which is a non-District Property).

Between August and December of 1998, the U.S. Department of Agriculture Forest Service (USDA-FS), Environmental Protection Agency (EPA), U.S. Department of the Interior, and the State of Montana discussed and resolved issues pertinent to implementing the cleanup. The result of this interagency agreement was to designate the USDA-FS as the lead agency in charge of administering the project through its assigned authority prescribed by the Superfund law (Comprehensive Environmental Response, Compensation, and Liability Act, or CERCLA). The other federal and state agencies will be involved in the project in an advisory capacity.

The first order of business for the USDA-FS-led effort on the New World project was to assist CBMI in completing and submitting a support document and implementation plan to underpin a petition for temporary modification of water quality standards for Fisher and Daisy Creeks and a headwater segment of the Stillwater River. This document was submitted to the State of Montana Board of Environmental Review on January 22, 1999. The support document provides the necessary information required by the Montana Water Quality Act (75-5-201, et seq.), which allows adoption of temporary water quality standards for particular parameters on streams or stream segments that are not supporting the State's designated use. The Board of Environmental Review granted temporary standards for the petitioned stream segments in June 1999.

Following further interagency consultation and input, the USDA-FS has assembled an organization and guiding objectives to proceed with response and restoration activities associated with historic mining impacts in the New World Mining District. As set forth in the Decree, the USDA-FS will execute the response and restoration project by following guidance provided by the EPA for Non-Time-Critical Removal Actions. Non-Time-Critical Removal Actions are defined by CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as actions that are implemented by the lead agency to respond to "the cleanup or removal of released hazardous substances from the environment … as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment…" (EPA, 1993). It is the expectation of the parties involved in the Consent Decree and Settlement Agreement that the work performed under CERCLA will also satisfy the applicable substantive requirements of the Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA).

The primary goals of the New World response and restoration project are:

1. to assure the achievement of the highest and best water quality practicably attainable on District Property, considering the natural geology, hydrology and background conditions in the District (Agreement, Appendix C, 1), and,

2. to mitigate environmental impacts that are a result of historic mining, "… taking into consideration the desirability of preserving the existing undeveloped character of the District and the surrounding area." (Decree, Part II, F).

The USDA-FS, as outlined in the Agreement (Appendix C, 6), envisions that response and restoration work will initially focus on stabilizing the solid mine wastes to prevent or reduce erosion onto adjacent lands or into streams. Other expected response or restoration actions may include:

- Installing appropriate water management systems and, if necessary, operating a water treatment system during the construction phase of various response actions.
- Preparing repository sites to receive consolidated waste materials.
- Engineering appropriate capping systems to reduce potential infiltration through the waste materials to minimize further oxidation and acid production of mineralized materials.
- Closing adits and shafts.
- Revegetating mining-disturbed areas.
- Monitoring water quality.

It is the overall philosophy of the USDA-FS to achieve the goals stated above to the extent practicable and possible given the constraints of funding and the general desire to blend the response and restoration actions into the surrounding area. The USDA-FS anticipates many of the source areas at the site can be isolated from the environment and much of the erosion and sedimentation issues at the site can be mitigated. However, acid mine discharge issues at the site are technically challenging and total elimination of all threats associated with such discharges may be beyond the scope of this project. Such mitigation is further compounded by the presence of naturally occurring metals-impacted water and solids at the site. The USDA-FS will make every effort, however, to develop the best solutions to the various environmental problems at the New World Site and will work diligently in keeping the public informed and involved in the removal and restoration process.

1.0 INTRODUCTION

This work plan was developed by Maxim Technologies, Inc. (Maxim) for the United States Department of Agriculture Forest Service (USDA-FS). The purpose of this work plan is to describe the process and activities that are proposed by the USDA-FS to accomplish the goals and objectives set forth in this plan to respond to and restore natural resources affected by historic gold, silver, copper, and lead mining in the New World Mining District (District). This historic metals mining district is located in the general vicinity of Cooke City, Montana in the Beartooth Mountains (Figure 1). Many of the mining disturbed areas are situated on lands managed or controlled by the USDA-FS.

The primary environmental issues within the District are associated with impacts from historic and more recent mining activities (1953) that occurred over the years beginning with the prospecting of the area in about 1869. Human health and environmental issues are primarily related to elevated levels of heavy metals present in mine waste piles, open pits, acidic water discharging from mine openings, and streambed sediments.

This work plan will be used to guide project activities over the eight year period defined in the Support Document and Implementation Plan (Maxim, 1998). Modifications to this work plan will be made when necessary.

1.1 PROJECT BACKGROUND

The USDA-FS, as the lead agency responsible for implementing the cleanup of the District, has assembled an organization and guiding objectives to proceed with response actions and restoration of the historic mining impacts in the District. Under their Superfund authority, the USDA-FS will conduct the response and restoration project by following guidance provided by the EPA for Non-Time-Critical Removal Actions. Non-Time-Critical Removal Actions are defined by CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as actions that are implemented by the lead agency to respond to "the cleanup or removal of released hazardous substances from the environment … as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment…" (EPA, 1993).

Mitigation of historic mining wastes has been an on-going interest of numerous parties since the 1970s and much data is currently available on the nature and extent of contamination in the District. The USDA-FS plans to use as much of this existing data as possible to initiate and complete response actions.

Revegetation research has also been an important aspect of work conducted in the District. One of the first to investigate revegetation was the USDA-FS Intermountain Research Station (Brown, 1995; 1996). This research has focused on reclamation of high elevation mine disturbances including species selection, fertilization, planting season, organic amendments, acid soil amendments, and surface soil treatments. Larger scale reclamation efforts have also been conducted by numerous parties involved in reclamation of the McLaren Tailings near Cooke City (Figure 1). In 1969, the Bear Creek Mining Company covered the McLaren Tailings with soil and rerouted Soda Butte Creek. In 1989, the EPA constructed a dam at the lower end of the tailings to stabilize the banks of Soda Butte Creek (UOS, 1998). Other areas of the tailings have been recontoured and revegetated since that time.

Some reclamation work was completed by CBMI on District Property as part of their exploration and proposed mine development work. In 1993, CBMI began surface restoration work to reclaim the historic

McLaren open pit mine disturbance and areas disturbed by exploration activity in the Como Basin. Reclamation activities at the McLaren pit included recontouring, construction of runon control ditches, treating acid soils with a lime amendment, and fertilizing and seeding with native grasses. Similar reclamation work was completed in the Como Basin area although additional work was done in this area to construct runon controls to prevent water from entering a raise connected to the Glengarry adit. From 1993 to 1996, CBMI also reclaimed a number of exploration roads and drill pads.

In 1995, the EPA began a site investigation after the initial announcement of the property transfer from CBMI. The EPA investigation involved installing monitoring wells, surface water sampling, groundwater monitoring, and completing a groundwater tracer study. The results of this study were published in a technical report (URS Operating Services (UOS), 1998) which includes: a review of all previous surface water and groundwater data collection efforts by Montana Department of Natural Resources and Conservation (DNRC), USDA-FS, CBMI, EPA, and UOS; an evaluation of the data collected during the 1996, 1997 and 1998 field season; and, an overall evaluation of the complete data set with respect to restoration and reclamation of the historic abandoned mining operations. Other investigators of mining wastes in the District include the US Geological Survey, Montana State University, and Montana Department of Environmental Quality (MDEQ).

The USDA-FS assisted CBMI in October 1998 in completing a Support Document and Implementation Plan to support the petition for temporary modification of water quality standards. The Support Document and Implementation Plan (Maxim, 1998) was submitted to the State of Montana Board of Environmental Review on January 22, 1999. The Support Document provides the necessary information required by the Montana Water Quality Act (75-5-201, et seq.) for the consideration of adopting temporary water quality standards for particular parameters on streams or stream segments that are not supporting the State's designated use. The petition for temporary standards is necessary to temporarily modify the surface water quality standards for Daisy and Fisher Creeks and a headwater portion of the Stillwater River so that improvements to water quality may be achieved with the implementation of the response and restoration project. The Board of Environmental Review granted temporary standards for the petitioned stream segments in June 1999.

1.2 SITE LOCATION AND DESCRIPTION

The District falls within the boundaries of the Gallatin and the Custer National Forests, and abuts Yellowstone National Park's northeast corner (Figure 1). The Absaroka-Beartooth Wilderness Area bounds the District to the north and east. To the south of the District is the Montana-Wyoming state line and public lands administered by the Shoshone National Forest. The District lies entirely within Park County, Montana.

The communities of Cooke City and Silver Gate, Montana, are the only population centers within the District. The neighboring communities of Mammoth, Wyoming and Gardiner, Montana are located about 50 miles to the west. Red Lodge, Montana is about 65 miles to the northeast, via the Beartooth Highway, and Cody, Wyoming is located 60 miles to the southeast.

As the District is located at an elevation that ranges from about 7,380 feet to over 10,400 feet above sea level, the site is snow-covered for much of the year. Only two routes of travel are open on a year-round basis to the District: the Sunlight Basin road, which allows access to within a few miles of the District in the winter time; and the highway between Mammoth and Cooke City. The Beartooth Highway is closed during the winter as is Highway 212 from Cooke City to the Montana/Wyoming state line.

Figure 1 - Project Vicinity Map

Figure 1 - back page

The District covers an area of about 40 square miles. Historic mining disturbances affect about 50 acres according to recent measurements made by the USDA-FS Interagency Spatial Analysis Center. The McLaren Tailings, located outside of District Property, cover an additional 33 acres. The topography of the District is mountainous, with the dominant topographic features created by glaciation. The stream valleys are U-shaped and broad while the ridges are steep, rock covered, and narrow. Much of the District is located at or near tree line, especially in the Fisher Mountain area where the major mining disturbances are located.

The District is situated at the headwaters of three river systems which all eventually flow into the Yellowstone River. The three tributary rivers are the Clark's Fork of the Yellowstone, the Stillwater, and the Lamar. The Lamar River flows through Yellowstone Park. The major tributary streams in the District include Daisy, Miller, Fisher, Goose, Sheep, Lady of the Lake, Republic, Woody, and Soda Butte creeks (Figure 1).

1.3 MINING HISTORY

Mining exploration in the District began in 1864 when prospectors from the mining camp of Virginia City explored the area. The earliest placer and lode deposits were established in 1869, although prospecting was the only form of any mining development at that time. By 1876, a smelter was built in Cooke City for the reduction of silver-lead ore by the Eastern Montana Mining and Smelting Company. During these early years of development, the District was a part of the Crow Reservation. When the U.S. government withdrew this land from the reservation and put it into public ownership in 1882, interest in mining in the District heightened with the filing of 1,450 claims in that year (Wolle, 1963).

Mining activity fluctuated greatly between 1882 and the late 1920s, hampered primarily by the lack of a railroad to ship ore and supplies, and the long and severe winters. Numerous smelters were built and operated during this period, most only for a few years at a time. Gold was mined on Henderson Mountain beginning in 1888. During 1893 and 1894, gold was mined from underground workings and an open pit on Henderson Mountain (U.S. Bureau of Mines, 1950). A road over Sheep Mountain was built during 1905-1906 to reach a copper lode in the area of Goose Lake (UOS, 1996). The Glengarry Mining Company operated a floatation mill on the south side of Scotch Bonnet Mountain in the 1920s to process copper-gold ores from the Como ore body on Fisher Mountain (U.S. Bureau of Mines, 1950). By 1925, the estimated production of the District was $215,000 in gold, silver, copper and lead (Wolle, 1963).

In 1933, an open pit gold operation, the McLaren Mine, was developed on the west side of Fisher Mountain. Milling of the ore produced from the mine was done in Cooke City at the former Cooke City flotation mill. After the mill was destroyed by fire in 1953, no further mining was done in the McLaren pit, and mining in the District ceased. Exploration of the area continued until 1996, however, with CBMI as the last major company to hold an interest in mine development. CBMI executed their exploratory drilling program in the District from 1987 through 1993.

1.4 WORK PLAN ORGANIZATION

This work plan is organized into several sections. Following this introductory section is a description of the projects goals and objectives (Section 2.0). Section 3.0 describes the overall project organization, key personnel involved in the project, their roles, and responsibilities. Section 4.0 describes the existing environmental conditions in the District and presents a conceptual model of contaminant sources and pathways of contaminant movement. In Section 5.0, a discussion of the scope of work for the project is presented along with a description of the process that will be used to complete response and restoration activities. A proposed multi-year schedule is presented in Section 6.0 and a list of reports that will be prepared to detail the results of project activities is presented in Section 7.0. A list of references cited in this report concludes the work plan discussion.

Several documents are appended to this work plan. The Consent Decree and Settlement Agreement are attached in Appendix A. The Site-Wide Sampling and Analysis Plan is appended in Appendix B. The Community Relations Plan is included in Appendix C. Appendix D contains the Long-Term Surface Water Quality Monitoring Plan. The Long-Term Revegetation Monitoring Plan is included in Appendix E. Appendix F contains an example of the screening process that will be used to evaluate potential removal technologies and process options for solid mine waste media in annual Engineering Evaluation/Cost Analyses.

2.0 GOALS AND OBJECTIVES

The overall goals for this response and restoration project are: 1) assure the achievement of the highest and best water quality practicably attainable on the District Property, considering the natural geology, hydrology and background conditions in the District (Agreement, Appendix C, 1), and, 2) mitigate environmental impacts that are a result of historic mining. As the project progresses, goals are likely to be established for each of the watersheds that comprise the District.

The scope of the project is described in the Consent Decree (pp. 12-13, VII.7(a)) which directs the project work to address the following:

1. Releases or threats of release of hazardous substances, pollutants or contaminants that are related to District Property.

2. Natural resources lost as a result of, or injured or destroyed by, releases or threats of release of hazardous substances, pollutants or contaminants that are released to District Property.

3. Conditions affecting water quality and natural resources in Miller, Fisher, and Daisy Creeks, and their tributaries.

To achieve these project goals, numerous objectives have been established and are listed below. Objectives are listed in general order of importance. These objectives may be refined or modified as the project progresses with any changes incorporated into annual planning documents (further described in Section 5.0 of this document).

- Achieve the highest and best water quality practicably attainable considering the natural geology, hydrology, upstream mining impacts and natural background conditions.

- Prevent humans, wildlife and aquatic biota using the area from being exposed to the high concentrations of metals in waste rock and tailings materials.

- Prevent soluble metal contaminants or metals contaminated solid materials in the waste rock and tailings materials/sediments from migrating into adjacent surface waters to the extent practicable.

- Reduce or eliminate concentrated runoff and discharges that generate sediment and/or heavy metals contamination to adjacent surface waters and groundwater to the extent practicable.

- Prevent potential exposure through the food chain to metal contaminants from acid discharges, waste rock, and tailings materials to the extent practicable.

- Prevent or limit future releases and mitigate the environmental effect of past releases of hazardous substances, pollutants or contaminants.

- Identify, prioritize, and select response and restoration actions based on a comprehensive source assessment and streamlined risk analysis of District Property.

- Comply with site applicable or relevant and appropriate requirements (ARARs) to the extent practicable.

- Reduce or eliminate safety hazards associated with open shafts, pits, trenches, and adits.

- Restore injured natural resources to the extent practicable.

- Take into consideration the desirability of preserving the existing undeveloped character of the District and surrounding area when selecting response and restoration actions.

- Restore a functional balance to the ecosystem that corresponds to the management objectives of the Gallatin National Forest and Custer National Forest Management Plans.

As removal actions are proposed and evaluated each year, project objectives may be modified. Removal action objectives will also be developed for each of the specific projects completed annually. This process is discussed in greater detail in Section 5.0.

3.0 PROJECT ORGANIZATION

Numerous agencies and personnel have specific responsibilities and authority for this project. The federal agencies involved include the U.S. Department of Agriculture Forest Service, Environmental Protection Agency, U.S. Department of Agriculture Office of the General Council, and the U.S. Department of the Interior. The State of Montana is involved as a cooperating agency through the Department of Environmental Quality. There are also numerous other interested parties that will be involved in the project through the established public involvement process. Figure 2 shows the key personnel and their general responsibilities.

This page intentionally left blank

Figure 2 – Project Organization Chart

Figure 2 - back page

4.0 EXISTING CONDITIONS

This section of the work plan presents a brief summary of existing environmental conditions in the District using available data. While much remains to be learned about contaminant occurrence and movement at the site, the discussion presented herein endeavors to describe the existing environment relative to known sources and pathways of contaminants. The discussion in this section is organized by three environmental media: surface water, groundwater, and solid mine waste sources. At the end of the section, a conceptual model is presented that uses these data to describe the primary sources of contaminants of concern, the likely mechanisms that are involved in releasing contaminants into the environment, the exposure pathways that present risks to humans and the environment, and the fate of these contaminants. This model establishes the basis from which future studies and response actions will be designed. As new data are collected, this model will be refined to accommodate these findings

Information from the UOS (1998) report and the Support Document and Implementation Plan (Maxim, 1998) were widely used in summarizing existing conditions in the District. The reader is referred to these reports for data summary tables, a more complete description of groundwater and surface water chemistry, and other references to investigations that have previously been conducted in the District.

Because the discussion presented in this section is general in nature, specific impacts to humans or the environment that result from specific sources or pathways are not presented herein. More specific information will be presented in documents prepared in association with removal actions that are expected to be conducted annually through the life of the response and restoration project. The annual removal action process is described in Section 5.0 of this document.

4.1 SURFACE WATER

Surface water resources in the District are generally defined by three separate watersheds: Daisy Creek, Fisher Creek and Miller Creek (Figure 1). The flow and water quality characteristics of these drainages are presented below.

4.1.1 DISCHARGE

The Daisy Creek drainage basin collects water from the north side of Daisy Pass, the north flank of Crown Butte, the west flank of Fisher Mountain, the east flank of Mt. Abundance, Wolverine Pass, the north end of Miller Mountain, and from the historic McLaren open pit mining operation. Daisy Creek flows northward from its origin below Daisy Pass approximately two miles to its confluence with the Stillwater River, which continues generally northward through the Absaroka-Beartooth Wilderness Area. Measured flows in Daisy Creek range from 0.078 cubic feet per second (cfs) on November 19, 1974 to 57 cfs on June 27, 1990. Daisy Creek is impacted by a combination of natural acid rock drainage and acid mine drainage from the McLaren mine workings (UOS, 1998).

Fisher Creek drains the southeast side of Lulu Pass, the northeast flanks of Fisher and Henderson Mountains, and the southwest flanks of Scotch Bonnet and Sheep Mountains. Fisher Creek flows generally to the southeast for approximately 3.5 miles to its confluence with the Clarks Fork of the Yellowstone River. The Clarks Fork enters the Yellowstone River near Laurel, Montana. The Glengarry adit is situated between the confluence of the two main headwater (first order) tributaries of Fisher Creek. Discharge from the Glengarry adit provides a sustained flow to Fisher Creek throughout the year, whereas the headwater tributaries may go dry during some fall and winter months. Measured discharge from the adit ranges from 0.04 cfs on June 18, 1975 and on June 13, 1995 to 0.5 cfs on June 5, 1991. High flow measurements in Fisher Creek were 91.6 cfs, taken on June 5, 1991 just upstream from Fisher Creek's confluence with the Clarks Fork River and 112.4 cfs, taken on June 26, 1990 where the Lulu Pass road crosses Fisher Creek. Water in Fisher Creek has been moderately to severely impacted by a combination of natural acid rock drainage, acid mine drainage from the Glengarry adit and from smaller discharging adits on Henderson and Scotch Bonnet Mountains, and seasonal discharge from the disturbed area near Lulu Pass (UOS, 1998).

Miller Creek drains the south side of Daisy Pass, south flank of Crown Butte, west flank of Henderson Mountain, and east flank of Miller Mountain. Miller Creek flows southeastward for approximately two miles to its confluence with Soda Butte Creek, which in turn flows west into Yellowstone National Park where it enters the Lamar River. Immediately above Miller Creek's confluence with Soda Butte Creek a measured low flow of 0.44 cfs was recorded on September 25, 1997. The measured high flow at this location was 55.5 cfs on July 2, 1990. Although several minor historic mine disturbances are present in the Miller Creek drainage basin, Miller Creek water is largely unimpacted by potentially acid generating rock or acid mine drainage (UOS, 1998).

Surface water discharge in the area is quite variable and seasonally dependent. All three watersheds show rapid flow response to snowmelt and summer precipitation events. Significant diurnal variations occur particularly during the peak snowmelt periods. The three drainage basins are geomorphically similar and relatively small in areal extent. Although a substantial number of summer and fall flow measurements have been made of streamflow in these drainages, winter and spring flow measurements have largely been restricted to those made at selected locations on Daisy Creek, Fisher Creek and Soda Butte Creek during the 1974-75 hydrograph year and a few late spring measurements made in 1995 on Daisy and Fisher Creek (UOS, 1998).

4.1.2 Water Quality

As indicated previously, water quality in the three primary drainages at the site is impacted by various metals associated with the mineralized host rock and mine-related disturbances. Mean concentrations of selected parameters for the 1989-1998 time period for sample sites on Daisy Creek and Fisher Creek located below most mining disturbance are summarized in Table 1. The data in Table 1 only represent average concentrations. A wide fluctuation in metals concentrations are evident seasonally, primarily during spring high flow (snow melt) and summer storm events. Detailed information on water quality fluctuations can be found in the UOS report (1998).

Several of these parameters exceed Montana's water quality standards (Montana Circular WQB-7) as well as both the acute and chronic aquatic life standards. A comparison of more recent water quality data to that collected during the 1970s suggests constituent loading in Daisy Creek has declined, possibly due to surface restoration work completed by CBMI near the McLaren open cut mine area. Similar work was undertaken in the Como disturbed area but no readily identifiable water quality improvements in Fisher Creek can be attributed to this work.

The single most significant source of contaminants to Fisher Creek is the Glengarry adit (Figure 1). Surface restoration and drainage ditches constructed at the site by CBMI did result in an apparent 40% reduction in water discharging from the adit. This did not, however, translate into apparent improved water quality in Fisher Creek (UOS, 1998).

TABLE 1
MEAN SURFACE WATER CONCENTRATIONS OF SELECTED PARAMETERS
Overall Project Work Plan
New World Mining District – Response and Restoration Project

Location	*TR Al[1]*	*TR Cd*	*TR Cu*	*TR Fe*	*TR Mn*	*TR Zn*	*pH*
Daisy Creek near Mouth	4.37	0.001	1.598	4.195	0.653	0.237	6.5
Fisher Creek near Mouth	0.30	0.001	0.093	0.486	0.035	0.082	6.8
MDEQ WQB-7 Standards[2]	0.087	0.0014	0.0052	1.000	---	0.067	---

Notes: (1) TR = Total Recoverable; all values in mg/L (pH in standard units); Data Source - Maxim, 1998

(2) Circular WQB-7 Numeric Water Quality Standards, MDEQ, November 1998; standards are for chronic aquatic life adjusted for a hardness of 50 mg/L except for aluminum and iron where no hardness adjustment is required; aluminum standard is for dissolved analysis rather than total recoverable; --- indicates a standard does not apply.

Available data also indicate substantial metals loading entering both Fisher and Daisy creeks from undisturbed natural sources. An example of naturally derived metals loading is evident in water quality data from surface water station FCT-12. This station monitors water quality in an unmined tributary above the Glengarry adit. Amacher (1998) reports that 14% of the copper load in Fisher Creek can be attributed to this drainage. This tributary drainage is underlain by the Fisher Mountain intrusive.

Other area springs, discharging from undisturbed areas, were also documented as having elevated metal concentrations (UOS, 1998). This may be attributed to pervasive, sub-economic to economic, sulfide mineralization in the intrusive complexes and sedimentary units occurring throughout the District. Data also indicate that flushing of metal ions and particulate matter from mining waste, natural soils, and regolith accompanies summer storm events; this flushing may also occur at the onset of snow melt. Quantifying the contributions of metals and other contaminants from natural sources would be a difficult task due to the complex geology of the District and the widespread nature of both mine wastes and sulfide containing native materials.

4.2 GROUNDWATER

Groundwater occurs within two general hydrostratigraphic units in the area: unconsolidated sediments and consolidated bedrock. Unconsolidated sediments in the area are thin relative to bedrock units and are primarily composed of colluvium, alluvium, and glacial deposits, and minor amounts of mine waste rock. Groundwater flow through unconsolidated material is diffuse, and the rate and direction of flow is usually more predictable than groundwater flow through bedrock units. The permeability and storage capacity of unconsolidated sediments in the area are relatively very high compared to bedrock units.

Primary porosity and permeability within bedrock in the area is very low, and as a result, groundwater flow in bedrock is primarily controlled by secondary permeability developed along fractures and joints. In isolated areas, groundwater flow is also affected by enhanced permeability attributable to open underground mine workings and improperly abandoned exploratory borings. Bedrock permeability in the area is low as evidenced by low sustained base flow from adits and springs, and low yields to wells and borings drilled at the site. Throughout the area, groundwater typically flows from mountain ridges to valley bottoms, but flow can be locally controlled by fracture orientations, geologic structures, and mine workings.

Springs and seeps occur where the water table or potentiometric surface intersects the topographic surface, and are often localized near the surface expression of fractures and/or geologic structures. Discharge rates from seeps and springs are variable and exhibit large seasonal variations.

Groundwater samples were collected from various monitoring wells in the McLaren Pit and Como Basin area during October 1996 and May and July 1997. The samples were analyzed for field parameters and a suite of metals to evaluate the quality, quantity, and source of groundwater discharging from the McLaren Pit area and Glengarry Adit. The data were also collected to document seasonal variability of groundwater quality.

Dissolved concentrations of aluminum, copper, iron and zinc were consistently elevated in water samples collected during all three sampling events. Dissolved concentrations of all four metals exceeded Montana Human Health and Aquatic Life Standards during all sampling events in all monitoring wells in the McLaren Pit area and on Fisher Mountain, north of the McLaren Pit. Concentrations of dissolved metals generally decrease and pH values increase with depth in the McLaren Pit area. With few exceptions, dissolved metals concentrations were highest during the July 1997 sampling event, when groundwater levels were measured at their seasonal high. In contrast, metals concentrations in surface water were lowest during the July event as a result of surface water dilution from snow melt runoff.

Water level data indicate regional groundwater flow from Fisher Mountain toward the McLaren Pit area does not contact waste rock piles. Instead, metals appear to leach from waste rock as snowmelt infiltrates vertically through the waste rock. Data from recent groundwater dye tracer tests support this theory, as dye injected above the pit wall was recovered in deeper wells in the McLaren Pit area, but dye was not recovered in wells completed in waste rock. During periods of high groundwater, there is the potential for regional groundwater flow from Fisher Mountain to contact waste rock in the McLaren Pit. However, the occurrence of peak groundwater levels coincides with snowmelt, which could effectively increase the head within waste rock material, preventing upward migration of groundwater into waste rock.

Groundwater quality and water level data collected in the Como Basin indicate groundwater flow is controlled primarily by near vertical fractures, joints, and faults. Interconnectedness between fractures and joints appears moderate to minimal. As was the case in the McLaren Pit area, dissolved metals concentrations in groundwater appear to be highest in Como Basin wells during July, when groundwater levels are at their seasonal peak. However, in the Como Basin area, water quality trends with respect to well depth and formation completion are not evident.

Dissolved metals concentrations in groundwater samples collected in Como Basin wells are generally lower than those measured in McLaren Pit wells. Two wells located on Scotch Bonnet Mountain north of Como Basin (wells EPA-12 and Tracer 6) intercept groundwater of relatively good quality where, with the exception of dissolved iron, all other metals concentrations are below Montana Human Health Standards. The poorest water quality is intercepted by wells located near the Glengarry adit underground workings (wells MW-1, EPA-11 and EPA-12).

Groundwater intercepted by most monitoring wells located downstream of the Glengarry, Como, and McLaren areas appears, for the most part, to be relatively unaffected by acid rock drainage.

4.3 MINE WASTE SOURCE AREAS

The main sources of metals and acidity from mine wastes in the District have been identified as being the McLaren Pit area, the Como Basin area, discharges from the Glengarry adit, the McLaren tailings, and the Great Republic Smelter (Figure 1). These three source areas represent the majority of metal and acid loading identified in Daisy and Fisher creeks and downstream water. Numerous other small mines and adits, improperly abandoned exploratory borings, prospect pits, waste rock piles, small tailings impoundments, and mill sites may also contribute to water quality degradation. Although most of these disturbances have been identified and located, many have not been completely characterized, and the potential of these features to contribute metals and/or acid to area water has not been documented or confirmed.

The Implementation Plan (Maxim, 1998) lists the following known mine waste source areas:

- McLaren Pit
- Spalding Tunnels
- Gold Dust Adit
- Fisher Creek
- Sheep Mountain
- Miller Creek
- Alice E Mine and Mill Site
- Republic Mill Site
- Glengarry Adit/Shafts
- Como Basin
- New Chicago Mill Site
- East Henderson Mountain
- Other Reeb Property
- Rommel Tailings Impoundment
- McLaren Mill Site
- McLaren Tailings

4.4 CONTAMINANTS OF CONCERN

The primary contaminants of concern in the District are metals (particularly zinc, copper, cadmium, iron, aluminum, manganese, and iron) and sulfate. Previous investigators (UOS, 1998) suggest these contaminants are present at relatively high concentrations in mine waste dumps on the property and are present in oxidized environments in underground mine workings. These metals are made soluble as oxidation products of sulfide minerals, are leached from sources, and are transported via water to receiving streams and to the area's groundwater system. Because of metals released from the relicts of mining activity, and possibly through natural mechanisms, certain local streams do not currently support a fishery.

The contaminants of concern described above affect the water quality in Daisy Creek, the upper Stillwater River, and Fisher Creek to point where these streams do not meet the beneficial use requirements and surface water quality standards of the Montana B-1 stream classification. Daisy Creek exceeds either the aquatic life criteria or human health standards for pH, aluminum, cadmium, copper, iron, lead, manganese and zinc. The other streams have similar exceedance issues.

Abundant data are available demonstrating that these streams have at least a 30-year history of water quality impairment. In addition, biological studies of Fisher Creek, Daisy Creek , and the Stillwater River were conducted by Montana Fish and Game during 1973 through 1975 (DNRC, 1977). These studies indicated that these streams were moderately to severely impaired in the 1970s in their ability to support aquatic life, primarily by the metals listed above.

4.5 SOURCE-PATHWAY CONCEPTUAL MODEL

A source-pathway conceptual model is shown in Figure 3. This model was developed to aid in identifying potential sources of metals and potential pathways of movement of these metals from source materials into surrounding soils, groundwater, surface water, sediments, and other affected environmental media. Potential receptors of impacted soils, sediments, and water, which are not shown on the model, include humans, aquatic life, plants, birds, fish, and animals.

The source-pathway conceptual model illustrates that the major sources of contaminants are acidic, metal-laden mine waste dumps located at mine openings and massive sulfide ore deposits underground that are exposed to the atmosphere by either mine workings or natural fracturing and faulting. The primary mechanisms of movement of metal-laden mine wastes include the following:

- Erosion into surface water courses
- Dissolution of contaminants in runoff
- Infiltration of dissolved metals into soil and groundwater
- Movement of impacted water through open underground mine workings and improperly abandoned exploratory borings
- Groundwater discharge into surface water
- Contaminated surface water flow to groundwater.

The blue arrows on the diagram (Figure 3) indicate the flow of unimpacted surface water and groundwater while the red arrows indicate surface and groundwater flow paths that have become impacted with contaminants of concern. Black arrows indicate the movement of sediments from roads and mine dumps into surface water. The site conceptual model will evolve as more information is gathered and as knowledge of the interaction between contaminants and the environment is gained.

Figure 3 – Site Conceptual Model

Figure 3 - back page

5.0 SCOPE OF WORK

The New World Response and Restoration Project will address the release or threats of release of hazardous substances, and mitigate, repair, or restore natural resources injured by the release of hazardous substances. As described in the previous section, the hazardous substances present in the District are elevated levels of heavy metals present in mine wastes and acid discharges. As presented in Section 2.0, the Consent Decree and Settlement Agreement framed the scope of work for this project under the regulatory authority of CERCLA (Superfund). The work completed during this project is also expected to satisfy the substantive requirements of CECRA

To accomplish the broad scope of work outlined in the Consent Decree and Settlement, the goals and objectives for the project (Section 2.0) focus removal activities on controlling or eliminating the release of heavy metals into the environment. Restoration activities at the site would follow or be a part of removal actions as specific areas of the District are cleaned up.

The National Contingency Plan (NCP) establishes procedures and standards for responding to releases of hazardous substances and effectuates the responsibilities and powers created by CERCLA. As set forth in the Consent Decree, the NCP process will be used to implement response and restoration actions. This section of the project work plan describes the elements of the NCP process and the scope of work that will be completed in the District under NCP guidance.

5.1 THE NCP PROCESS

The NCP outlines two different actions to mitigate releases or threats of release of hazardous substances. These two actions are removal and remedial. Removal actions are undertaken at any release, regardless of whether the site is included on the National Priorities List (NPL), where the lead agency makes the determination, based on certain factors, that there is a threat to public health or welfare or the environment. For removal actions, the lead agency may take any appropriate removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of release. Removal actions should contribute to the efficient performance of any anticipated long-term remedial action.

The Consent Decree set forth the non-time-critical removal action process, as described in the NCP, as the process that will be used to guide cleanup of mine wastes in the District. Non-time-critical removal actions may be interim or final actions and may be the first and only action at a site, or one of a series of planned response actions. Removal actions in the District will be prioritized by considering the following factors that are pertinent to site features (NCP, 300.415(2)):

- Actual or potential exposure to nearby human populations, animals, or the food chain from contaminants.
- Actual or potential contamination of drinking water supplies or sensitive ecosystems.
- High levels of contaminants in soils largely at or near the surface that may migrate.
- Weather conditions that may cause contaminants to migrate or be released.
- Other situations or factors that may pose threats to public health or welfare or the environment.

Removal actions will be prioritized using a process, developed by the Montana Mine Waste Cleanup Bureau in cooperation with the USDA-FS, called the Abandoned Inactive Mine Scoring System (AIMSS). This process is modeled after the EPA Hazard Ranking System (HRS) and modified for abandoned mine sites (Pioneer et al, 1994). This modified HRS essentially ranks the relative risk of individual contaminant sources and pathways. The USDA-FS anticipates that sufficient mine waste source data will be available in the fall of 1999 to begin this prioritization for the Year 2000 removal action. The 1999 removal action will be determined in lieu of this scoring system but will be based on site data and available information that indicates potential source areas with high concentrations of contaminants that may migrate.

Figure 4 illustrates the non-time-critical process for the New World Mining District cleanup. This flow diagram is divided into three parts. The first part shows the overall planning process that will be used to guide the project for the next eight years. The second part shows the annual planning cycle that will be used to develop reclamation and restoration plans. The third part of the diagram shows the annual design and construction cycle that will be used to implement the reclamation plans.

Substantial emphasis will be placed on annual planning. While the Overall Project Work Plan defines the umbrella of activities that will occur over the 8-year implementation period, the annual plans will detail the specifics of the actual removals. The logic in using this annual planning process is threefold: 1) Allow a certain degree of flexibility in developing annual response actions, recognizing that new information will be developed each year to further the understanding of the nature and extent of mining impacts; 2) Promote public involvement by maintaining a process open to public input and comment; and, 3) Recognize the short construction season during which response actions can be implemented.

A brief description of the elements of the non-time-critical removal process, as represented in Figure 4, is presented in the following text.

5.2 PROJECT STARTUP

During the period from November 1998 to March 1999, several meetings were held with cooperating agencies and other interested groups to scope out the project, identify project goals, priorities, and objectives, and to discuss the general philosophy of removal actions and project cleanup. One of the first actions was to prepare and submit the Support Document and Implementation Plan to the Board of Environmental Review (Maxim, 1998). As described in Section 1.1, the petition for temporary standards was submitted to the Board of Environmental Review to temporarily modify surface water quality standards so that improvements to water quality may be achieved through the implementation of response and restoration activities.

The Implementation Plan divided the District into Operable Units (OUs). An OU is defined under EPA guidance as a discrete action that comprises an incremental step toward a final remedy. OU boundaries may be drawn along geographic lines, such as mine wastes in the Fisher Creek drainage, or may be defined by environmental media actions, such as solid mine wastes or acid mine discharges. After further consideration and as a result of meetings between cooperating agencies, the OUs presented in the Implementation Plan will be redefined as "Source Areas" and OUs will be redefined as the two administrative boundaries identified in the Consent Decree and Settlement Agreement (Figure 1). These are:

- District Property
- New World Mining District

Figure 4 – Project Flow Chart

Figure 4 - back page

These two operable units will be primarily used to prioritize removal actions as well as used to define the results of the removal action. Results of the cleanup will be measured in terms of acreage of disturbances reclaimed and the change in metals loading to surface water and groundwater.

A total of 18 source areas have been identified in the District. A list of these source areas, including a summary of the general activities that will be conducted, is presented below. A more comprehensive list of activities for each source area over the project term is provided in the Implementation Plan (Maxim, 1998). Source areas are listed in the order presented in the Implementation Plan and, as such, this listing is not a prioritized order of source area cleanups.

- District Property — Includes all property or interest relinquished by CBMI. Activities will include: surveying the District for additional sources; characterize chemistry, thickness, and quantity of sources (waste rock dumps or tailings) through borehole drilling; identify and investigate potential waste rock disposal sites; identify potential borrow sources; survey cultural resources; and monitor surface and ground water resources.

- McLaren Pit — Complete the hydrologic evaluation and determine necessary controls for reducing pit inflows; determine pit holding capacity; characterize waste rock dumps; evaluate source control and water treatment options; install and maintain stormwater sediment control; monitor and maintain revegetated areas; establish whether all underground mine workings are identified; insure that all capped boreholes are secure; and monitor water diversion system, erosion control practices, and water quality.

- Glengarry Adit/Shafts — Complete the hydrologic evaluation of the mine workings; determine control options for reducing adit inflows; rehabilitate adit as necessary to evaluate source control measures; characterize waste rock dumps; evaluate source control and water treatment options; install and maintain stormwater sediment control; insure that all capped boreholes are secure; monitor and maintain revegetated areas; and monitor water diversion system and erosion control measures.

- Spalding Tunnels — Includes the underground workings north of the Como Basin (also know as the upper Glengarry workings) and associated waste rock material. Activities will include: completion of the hydrologic evaluation of the mine workings; evaluate source control options, water treatment and adit closure options; rehabilitate adits as necessary to evaluate source control measures; characterize waste rock dumps; install and maintain stormwater sediment control; monitor and maintain revegetated areas; and monitor water diversion system and erosion control measures.

- Como Basin — Includes the disturbed areas and waste rock material in and around the topographic depression at the headwaters of Fisher

Creek. Likely activities include: insuring that all underground workings are identified; evaluate source control measures and water treatment options including evaluating installation of caps over certain areas and shafts; install and maintain stormwater sediment control; monitor and maintain revegetated areas; insure that all capped boreholes are secure; and monitor water diversion system and erosion control measures.

- Gold Dust Adit — Includes the underground workings and associated waste rock material and surface disturbances comprising the Gold Dust mine. Activities are likely to include the following: complete the hydrologic evaluation of the mine workings; insuring that all underground workings are identified; rehabilitate adits if necessary to evaluate source control options; evaluate source control, water treatment and adit closure options; characterize waste rock dumps; install and maintain stormwater sediment control; install erosion control measures; monitor and maintain revegetated areas; and monitor water diversion system and erosion control measures.

- New Chicago Mill Site — Includes the surface disturbances and mill waste in and around the historic White smelter site near the Fisher Creek road crossing. Disturbances and mine waste at this site will be characterized to determine necessary removal actions.

- Fisher Creek — Encompasses the general area defined by the Fisher Creek drainage basin and includes miscellaneous waste rock piles and prospects. Disturbances and mine waste in this source area will be characterized to determine necessary removal actions.

- East Henderson Mountain — Encompasses the general area of the east and northeast slopes of Henderson Mountain and includes miscellaneous adits, shafts, waste rock piles, and prospects. Disturbances and mine waste in this source area will be characterized to determine necessary removal actions.

- Sheep Mountain - FCT-12 — Encompasses the west and south west slopes of Sheep Mountain including the Tredennic adit and waste rock piles and miscellaneous short adits and prospect pits. Disturbances and mine waste in this source area will be characterized to determine necessary removal actions.

- "Other" Reeb Property — Includes other property owned or controlled by Margrete Reeb including the silver claims adit, prospects and waste rock above goose creek, miscellaneous short adits and waste rock piles on Henderson Mountain. Disturbances and mine waste in this source area will be characterized to determine necessary removal actions.

• Road Systems	Roads within or accessing District Property will be evaluated to determine which roads should be closed and which roads will be used during removal actions.
• Wetland, Stream Bank and Transported Sources	Includes contaminated material deposited along stream thalwegs and bog material with elevated metal concentrations. Disturbances in this source area will be characterized to determine necessary removal actions.
• Miller Creek	Comprises the Miller Creek drainage basin including the southwest flank of Henderson Mountain, the southeast flank of Crown Butte and the northeast flanks of Miller Mountain. Disturbances and mine waste in this source area will be characterized to determine necessary removal actions.
• Rommel Tailings Impoundment	This site on District Property is an historic mill tailings impoundment near the headwaters of Soda Butte Creek that contains several thousand cubic yards of waste material. Disturbances and mine waste in this source area will be characterized to determine necessary removal actions.
• Alice E Mine and Mill Site	This site is not on District Property. It includes the mine, mill, and waste rock material on the south side of Henderson Mountain. Assessment of sources present at this site will be done along with assessment of District Property wastes. Cleanup work on this source area will be deferred until cleanup of District Property is complete.
• McLaren Mill and Tailings Site	This site is not on District Property. It includes the area encompassing the historic McLaren mill tailings near the confluence of Miller and Soda Butte creeks. Assessment of sources present will be done along with assessment of District Property wastes. Cleanup work on this source area will be deferred until cleanup of District Property is complete.
• Great Republic Smelter	This site is not on District Property. It includes the area encompassing the historic smelter near the confluence of Republic and Soda Butte creeks. Assessment and cleanup of this site is being handled by MDEQ as a separate project. Cleanup work is expected to begin in 2000.

5.3 OVERALL PROJECT WORK PLAN

The overall project work plan (this plan) serves to outline background information on the project and to present the scope of work and process that will be used to guide response and restoration activities. This plan will be considered the master planning document. As this plan does not contain specific details on actual investigation or cleanup activities, it will be supported by annual work plans that will be prepared to direct the planning and implementation of annual removal actions.

5.4 SUPPLEMENTAL PLANNING DOCUMENTS

Several other long-term planning documents will be used to support project implementation. These documents are the following:

- Site-wide Sampling and Analysis Plan
- Community Relations Plan
- Long-Term Surface Water Quality Monitoring Plan
- Long-Term Revegetation Monitoring Plan
- Health and Safety Plan

The following subsections describe the elements of each of these other plans.

5.4.1 SITE-WIDE SAMPLING AND ANALYSIS PLAN

The Site-Wide Sampling and Analysis Plan (SAP) is a standard Superfund document that describes the objectives, field methods, analytical methods, data quality objectives, quality control procedures, and standard operating procedures used to guide collection and analysis of environmental data for the project. The SAP is comprised of two parts, a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). The FSP presents a detailed description of field investigation activities. The QAPP describes quality parameters and procedures to ensure that all data collection efforts produce data of known quality.

The FSP will be used by field personnel as a step-by-step guide to environmental sampling and will stipulate the laboratory analytical procedure that will be used for sample analysis. The primary information covered in the FSP will be focused on five environmental media: mine waste, surface water, sediment, groundwater, and soil. Detailed descriptions of sample designation, sampling methods, field note taking, completing field forms, sample packaging, and sample shipment will be included in the FSP. A discussion of data quality objectives will also be presented. Determining data quality objectives is one of the first steps in determining the appropriate analytes, analytical methods, and detection limits needed for the sampling program.

The QAPP will be used by field personnel to monitor and control data quality. The QAPP will identify the number and type of quality control samples collected, instrument calibration procedures, preventative maintenance procedures, data reduction and validation procedures, and corrective actions. Guidance in the QAPP will enable field personnel to address quality issues in the field so that the majority of data collected meet the established data quality objectives

The site-wide SAP will likely cover only data acquisition methods that will commonly be used during the life of the project. These standard methods include measurement of field parameters (pH, conductivity, temperature); surface water sampling; flow measurements; gauge installation and maintenance; monitoring well installation; well development; groundwater sampling; aquifer testing; and, soil and mine waste sampling (manual, backhoe, and drilling). As actual sampling locations will not be identified in the site-wide FSP, the SAP will be supplemented each year by an annual FSP which will detail sampling locations, frequency of sampling, and any specific methods or data collection needs that were not identified in the Site-Wide SAP.

Table 2 shows the typical types of data that are expected to be collected during each field season. The table lists the types of samples, typical analytical parameters, and data uses. The Site-Wide SAP, which presents the standard methods and procedures for data collection, is appended to this Overall Work Plan in Appendix B.

TABLE 2
DATA COLLECTION TYPE, DATA PARAMETERS, AND DATA USES
Overall Project Work Plan
New World Mining District - Response and Restoration Project

Sample Type	Typical Data Parameters	Data Uses
Mine Waste	Total metals, acid base account, pH, conductivity, coarse fragment content, saturation percent	Contaminant identification, lime requirement, volume, compactability, moisture content
Potential Cover Soil	Texture, pH, conductivity, coarse fragment content, total metals, organic matter content, fertility	Suitability, volume, fertilizer prescription
Surface Water	Total recoverable metals, dissolved metals, acidity, cations, anions, pH, conductivity, temperature, flow	Contaminant concentrations, loading, source areas, water pathways, water movement, exceedance of water quality standards
Groundwater	Dissolved metals, acidity, cations, anions, pH, conductivity, temperature, water level, aquifer characteristics	Contaminant concentrations, loading, source areas, water pathways, water movement, exceedance of water quality standards
Sediment	Total metals	Contaminant identification, volume, exceedance of standards
Vegetation (reclaimed areas)	Cover, species composition, species density, species frequency, total metals	Erosion resistance, maintenance needs (reseeding), species distribution, metals uptake
Macroinvertebrates	Species diversity, number, and density, total metals	Trends in abundance and diversity, metals uptake
GPS Survey	Feature location	Latitude and longitude
Engineering Survey	Elevation, topography, material volumes, location	Engineering evaluation/cost analysis, construction design

5.4.2 COMMUNITY RELATIONS PLAN

The Community Relations Plan (CRP) is an integral part of the Settlement Agreement and the removal action process. The plan formalizes the extent of public involvement and the tools that will be used by the lead agency to keep the public informed. Using interviews with the public as the basis for the plan, community involvement is tailored to the level of interest.

A preliminary draft of the CRP is attached in Appendix C. As currently written, some of the features of the plan include: designating a community relations spokesperson; scheduling public meetings; announcement of pertinent project events in area newspapers; accepting public comment on project scoping and analysis documents (including this plan); and, a wide range of information access to the public including: establishing information repositories; providing project information via the internet; and establishing a project mailing list for occasional mailings.

5.4.3 Long-Term Surface Water Quality Monitoring Plan

The long-term surface water quality monitoring plan describes surface water monitoring activities in the District that will be carried out over the eight-year project period. Surface water quality monitoring will be done to carry out the monitoring requirements associated with the proposed rule to adopt temporary water quality standards for segments of Daisy Creek, the Stillwater River, and Fisher Creek. Details included in the monitoring plan are sampling station locations, frequency of sampling, sampling methods, analytical parameters, analytical methods, and quality control procedures. A copy of the plan is included in Appendix D.

5.4.4 Long-Term Revegetation Monitoring Plan

Appendix E contains a copy of the long-term revegetation monitoring plan. The purpose of the revegetation monitoring plan is to outline the procedures, methods, and schedule for monitoring revegetated areas. The areas monitored will include the areas recently reclaimed by CBMI, and new areas that will be reclaimed each year as a result of the response actions.

Revegetation monitoring data will be used to aid in the design and implementation of revegetation efforts as well as to determine if maintenance is needed on previously revegetated areas. Field measurements will be taken each year at selected sites to quantify cover, species types, frequency, and diversity. Monitoring will be conducted annually, primarily during the month of August.

5.4.5 Health and Safety Plan

The health and safety plan (HASP) will be used to inform personnel working in the District of the physical and chemical hazards present, the level of personal protection needed to do work, and the work practices that will be followed to prevent exposure or injury while at the site. The health and safety plan will identify personnel that can be contacted in the event of an emergency, such as the Park County sheriff and medical evacuation services, and will show the route from the District to the nearest medical facility.

5.5 PREPARE ANNUAL WORK PLANS

The previous section describes plans that will be used to guide project activities through the anticipated eight-year project life. Annual work plans will be also be prepared to detail the work that will be done to implement the yearly removal action and to plan for the removal action that will be done in the following year. While the tasks for the annual work plans will vary from year to year, the content will generally follow the elements of the non-time-critical removal process. The following subsections describe in general each of these annual work plan elements.

5.5.1 Identify Removal Action Objectives

Removal action objectives (RAOs) are specific objectives adopted for each of the yearly removal actions. Removal action objectives (RAOs) generally consist of environmental medium-specific goals for protecting human health and the environment. These RAOs may be a subset of the objectives identified for the overall project (Section 2.0) or may be somewhat more specific and developed to complement the overall project objectives. Since the scope of the annual removal actions will be likely be broken into logical segments that can be completed in a single construction season, RAOs will take this into consideration by limiting the scope of the objective, if necessary, to fit the scope of the removal action.

RAOs will be considered, discussed, and identified each year by the cooperating agencies. The RAOs will be used in the engineering evaluation/cost analysis (EE/CA) (see Section 5.5.3) to ensure the removal action alternatives developed in the EE/CA address the defined objectives and that the preferred alternative selected meets the defined RAOs.

5.5.2 Site Investigation

A site investigation will be conducted each year to support the engineering evaluation. The site investigation will primarily consist of obtaining new environmental and survey data to fill data gaps identified during preliminary engineering analyses completed for the subsequent year's removal project. Data needed to characterize the nature and extent of contamination will be limited to those data needed to support the specific objectives of the non-time-critical removal action, supplementing existing data as appropriate.

The site investigation is composed of the following parts: preparation of an annual FSP; collecting and analyzing environmental and survey data; evaluating data; and, preparing a technical report. These components are described below.

<u>Field Sampling Plan</u>

A Field Sampling Plan (FSP) will be written to guide field activities and will likely be included as a section in the annual work plan. The FSP will rely heavily on the Site-Wide SAP, Water Quality Monitoring Plan, and Revegetation Monitoring Plan that were prepared for the overall project. Since standard field procedures, chemical parameters, and analytical methods are already described in these overall plans, the annual FSP will focus on identifying specific sample locations, types of samples to be collected, and sampling frequency. The FSP will also be used to describe any non-standard field or analytical methods that were identified to fill specific data gaps.

<u>Collect and Analyze Environmental and Survey Data</u>

Data collection will occur during the field season, beginning as early as late April for certain water quality monitoring tasks, and continuing through the summer into October. Field crews will use the planning documents to guide field activities and all data will be collected in accordance with data quality objectives and standard operating procedures. Samples will be shipped to the appropriate laboratories for analysis.

Evaluate Data

As data are received from the laboratories, the data will be entered into the project data management system, validated to ensure that data quality objectives have been met, and appropriately flagged for any problems or limitations. These data will then become available to the project team for analysis.

Data will be used for the project primarily to support the preparation of the removal action EE/CA and the petition for temporary water standards. Data will also be used to update the site conceptual model that describes the sources and pathways of contaminant movement. As the conceptual model is updated and more is known about the movement of contaminants, data will be used to indicate if a reduction in contaminant loading occurs following the completion of annual construction projects.

Prepare Technical Report

A technical data report will be prepared each year to present and summarize the results of the field sampling. This report will likely be included as a section of the EE/CA report, which is discussed below. Included in the contents of the report will be a brief description of field activities, any deviations from the FSP, a summary of the data, tables, and figures. Raw data reports, field notes, chain of custody, and other pertinent information will be included as appendices to the report.

5.5.3 ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)

The EE/CA is the centerpiece of the work that will be completed each year. The EE/CA is a flexible document that is tailored to the scope, goals, and objectives of the non-time-critical removal action that will be selected each year by the cooperating agencies. The EE/CA presents the site investigation data, an engineering analysis of the data, and an estimate of costs that are needed to support the selection of a response alternative.

The EE/CA is written to include an explanation of the RAOs, a summary of pertinent site data that show the nature and extent of contamination relevant to the removal action, a streamlined risk evaluation, identification of applicable reclamation technologies and process options, development and screening of alternatives, and the selection of a preferred alternative. These later components are described in some detail in the following subsections.

Streamlined Risk Evaluation

A streamlined risk evaluation will be performed for each removal action. A streamlined risk evaluation is intermediate in scope between a limited risk evaluation and a conventional baseline risk assessment that is completed for a remedial action. The streamlined risk evaluation will be based on site data to determine if contaminant levels in soil and water media pose a potential risk if no cleanup is done. The streamlined evaluation assists the responsible agencies in determining whether a cleanup action is warranted, what exposures need to be addressed, and what appropriate cleanup levels may be.

The streamlined risk evaluation focuses on the specific problem that the removal action is intended to address. The site conceptual model is used in the evaluation to examine the sources of contaminants and the potential for movement of the contaminants to human and environmental receptors. An important element of the risk evaluation is determining the degree of exposure and the exceedance of either risk-based cleanup goals or water quality criteria.

For human health risk, risk-based guidelines were developed for abandoned mine sites under a recreational use scenario developed by Tetra Tech (1996) for the Montana Mine Waste Cleanup Bureau. The USDA-FS was a cooperating agency in the development of the Tetra Tech document. The recreational use scenario assumed a moderate to high level of four different types of recreational populations: fishermen, hunters, gold panners/rockhounds, and ATV/motorcycle riders. Evaluated exposure pathways included soil and water ingestion; dermal contact; dust inhalation; and fish consumption. Exposure point concentrations and potential contaminant intakes were estimated using median contaminant concentrations calculated from the Montana Mine Waste Cleanup Bureau's AIMSS database. The database contains soil and surface water data from over 270 mine sites. The types of activities, exposure pathways, and use levels considered in the recreational scenario are consistent with current recreational uses in the District. Contaminant concentrations used by Tetra Tech are similar to those in the District.

For ecological risk, contaminant concentrations in sediment, soil, and water will be compared to known indicators of impairment. The two populations that risk will primarily be evaluated are aquatic life and terrestrial plants. Since substantially more data would be needed to assess specific risks to birds and mammals, only a qualitative or semi-quantitative assessment of risk to these populations will be done.

Identify and Screen Applicable Removal Technologies and Process Options

The conceptual model that portrays contaminant sources, release mechanisms, and exposure pathways and the RAOs and goals developed for each removal action will provide the basis for the identification of applicable reclamation technologies and process options. General response actions and process options are applied to the mitigation of contaminants identified in the removal action. General categories of response actions include no action, institutional controls, engineering controls, treatment, removal, and disposal. Removal technologies for surface water may include:

- Containment
- Biological Treatment
- Chemical Treatment
- Physical Treatment
- Diversion

Removal technologies for groundwater may include the following:

- Vertical Barriers
- Gradient Control
- Extraction
- Injection or Infiltration
- Surface Water Discharge
- Biological Treatment
- Chemical Treatment
- Physical Treatment

Removal technologies for solid mine wastes may include:

- Surface Controls
- Soil Covers
- Capping
- Physical Treatment
- Biological Treatment
- Chemical Treatment
- Excavation
- Transport
- Disposal

The purpose of identifying and screening technology types and process options is to eliminate those technologies that are obviously unfeasible, while retaining potentially effective options. Appendix F contains a table showing an example of the logic and reasoning behind the screening of technologies or process options that will be used to consider solid mine wastes in the District. Technologies and options that are likely to be retained for removal action alternative development are shaded in the example table.

Develop and Evaluate Removal Alternatives

Removal alternatives will be evaluated in the EE/CA using the technologies and process options that passed the screening phase. A limited number of removal alternatives will be developed by combining reclamation technologies and process options that passed the initial screening. The no-action alternative will also be included as an alternative and used as a baseline against which the other alternatives can be compared. Assembling the alternatives will be done by combining process options so that each alternative either offers a distinct benefit over another alternative or provides a different approach to meeting RAOs and goals. The alternatives will be developed so that a reasonable range of costs is also represented in the evaluation.

Removal alternatives will be evaluated in detail using three criteria: effectiveness, implementability, and cost. According to the Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA (EPA, 1993), the effectiveness of an alternative should be evaluated by the following criteria: overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and, short-term effectiveness. How well each alternative meets RAOs will also be considered under effectiveness.

Implementability addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. Technical feasibility considerations include the applicability of the alternative to the waste source, availability of the required equipment and expertise to implement the alternative, and overall reliability of the alternative. Implementability also considers appropriate combinations of alternatives based on site-specific conditions. Administrative feasibility evaluates logistical and scheduling constraints.

Evaluation of alternative costs consists of developing conservative cost estimates based on the description of work items developed for each alternative. These costs do not necessarily represent the cost that may be incurred during construction of the alternative because many design details may be preliminary. Unit costs will be developed by analyzing data available from USDA-FS and nationally published cost estimating guides. Where possible, cost data will incorporate actual operating costs and unit costs that have been realized during similar reclamation projects in the District. Unit costs will be based on assessments of materials handling and procurement, site conditions, administrative and engineering costs, and contingency.

In addition to the capital costs discussed above, post-removal site control (PRSC) costs are estimated for each alternative. PRSC costs will be estimated using reasonable assumptions for potential maintenance of each of the alternatives. Because it is difficult to determine the actual maintenance that will be needed to ensure that an alternative is successful, PRSC requirements tend to be based on the relative difference in perceived maintenance between alternatives. The present worth of average annual PRSC costs are estimated for a 30-year period using an interest rate factor of 4.9% (OMB, 1995). The total project cost for each alternative is the sum of the capital cost and the present worth PRSC cost.

Compliance With ARARs

A list of applicable or relevant and appropriate requirements (ARARs) will be presented in each EE/CA. Compliance with ARARs for each of the alternatives will be evaluated using available data and professional judgement. In some respects, this is a subjective evaluation since the results of a removal action are not completely predictable in terms of reduction of contaminant concentrations or environmental risk. While not based solely on this criterion, practicability of achieving ARARs will be included in the justification for the selection of the preferred alternative.

Identify Preferred Alternative

A preferred alternative will be selected in the EE/CA by the USDA-FS, in consultation with participating parties, and a justification for selection of the preferred alternative will be presented. The preferred alternative will be open to public comment and evaluation.

Response to Significant Comments

The EE/CA will be released to the public for review and comment for a 30-day comment period. All comments received during that period will be reviewed by the USDA-FS and a response will be prepared for those significant comments that may affect the response action scope or outcome. Based on the significant comments received, the preferred alternative could be accepted without modification, accepted with modification, or rejected.

5.5.4 ACTION MEMORANDUM

The action memorandum will be the decision document for the annual removal action. The action memorandum will be prepared by the USDA-FS and will generally summarize relevant parts of the EE/CA, the response to significant comments, and the justification for selection of the removal action. It will state the purpose of the removal action, background information, the threats to public health or welfare or the environment that will be addressed by the removal action, and a description of the proposed action and associated costs.

5.5.5 ANNUAL REMOVAL DESIGN AND CONSTRUCTION

Once the action memorandum has been issued, the design and construction of the removal action will be initiated. This section describes how the preferred alternative will be implemented, including a discussion of the design and bidding process and the actual construction phase.

Engineering Design

A final design for the selected removal action alternative will be prepared. Removal design will consist of developing construction drawings and technical specifications needed to bid and construct the project. The design process will include two intermediate submittals to the USDA-FS prior to a final design.

Construction drawings will include site plans, cross-sections, and details. The construction drawings will show the areas included in the project, construction limits, access, staging areas, borrow areas, sediment control measures, and temporary water treatment locations. Technical specifications will be prepared using the USDA, Forest Service publication "*Forest Service Specifications for Construction of Roads and Bridges"* published in August 1996. The technical specifications will describe the work involved with each bid item, the materials required, construction requirements, and measurement and payment.

Prepare Bid Document and Select Construction Contractor

Depending on the size and complexity of the project, a bid document will be assembled and advertised for bidding. The USDA-FS will receive, open, and evaluate bids. Bids will be awarded to the low bidder who submits a complete bid in accordance with the bid requirements on some projects while on other projects a combination of qualifications, costs, and proposed approach will be used to select the successful contractor.

Project Construction

Removal action construction is expected to be done each year to implement the removal action selected in the EE/CA process. The construction season will generally be between the months of June through October, depending on snow and weather conditions. Removal actions will generally be designed to be completed in one construction season, although some multi-year actions may be attempted for certain aspects of the project. Whether a project is designed to be multi-year or whether a winter shut down is needed for an annual project, temporary erosion control methods will be implemented on any construction disturbances that have not been seeded by the close of the season. Temporary erosion control methods (designed to survive winter conditions and spring runoff) may include surface water diversions, sediment control (straw bale filters, silt fences, and sediment basins), heavy mulch applications, or rock covers.

5.5.6 POST-REMOVAL SITE CONTROL

Post-removal site control will be performed on all reclaimed areas. These activities are likely to include soil and vegetation monitoring, erosion monitoring, maintenance of reclaimed areas, and other operations and maintenance required to ensure removal actions meet project objectives and ARARs. The plans prepared for yearly construction monitoring, water quality monitoring, and revegetation monitoring will be the primary vehicles to insure post-removal site control addresses problems with reclaimed areas as these problems are identified. A summary of likely post-removal site control monitoring is presented in Table 3.

TABLE 3
POST-REMOVAL SITE CONTROL MONITORING
Overall Project Work Plan
New World Mining District – Response and Restoration Project

Monitoring Type	Parameters	Monitoring Schedule
Revegetation	Cover, Species Composition, Species Density, Species Frequency	Annually – August and September
Water Quality – Surface Water	Total recoverable metals, acidity, cations, anions, pH, conductivity, temperature, flow	Three events per year timed to seasonality
Water Quality – Groundwater	Dissolved metals, acidity, cations, anions, pH, conductivity, temperature, flow	One event per year
Construction	Turbidity, pH, conductivity, and field determined ions and metals	Pre, during, and post construction
Soil	pH, texture, sulfur fractionation, neutralization potential	As needed to complement revegetation monitoring in problem areas

This page intentionally left blank

6.0 SCHEDULE

As previously discussed, this overall work plan covers response and restoration work for the years 1999 through 2007. As the various components of the project are put into place in 1999, a regular schedule will be maintained for each of the elements described in Section 5.0 of this plan. Because 1999 is the first year that project activities have been initiated, the schedule has been compressed somewhat to accommodate all the planning and public involvement activities necessary to implement a response action for the 1999 construction season. Therefore the schedule for 1999 is somewhat atypical. A Gantt chart showing the eight year schedule for project activities is shown in Figure 5.

This page intentionally left blank

Figure 5 – Gantt Chart Schedule

Figure 5 - back page

7.0 REPORTS

Numerous reports will be produced to support this work plan. Most of these reports have been described in previous sections of this plan but are summarized in Table 4 to provide a concise list of the report, report contents, and anticipated delivery schedule.

TABLE 4
LIST OF REPORTS
Overall Project Work Plan
New World Mining District - Response and Restoration Project

Report Title	Contents	Delivery Schedule
Project Work Plan	This Document – 8-year plan	Draft – May 1999 Final – Nov 1999
Site-Wide Sampling and Analysis Plan	Field sampling methods, analytical parameters and methods, quality assurance protocols	Draft – June 1999 Final – Nov 1999
Community Relations Plan	Public involvement protocols	Draft – April 1999 Final – Nov 1999
Long-Term Surface Water Quality Monitoring Plan	8-year plan for consistent sampling of selected surface water stations; follows methods and procedures in Site-Wide SAP	Draft – April 1999 Final – Nov 1999
Revegetation Monitoring Plan	8-year plan for consistent monitoring of vegetation field parameters in existing and newly revegetated areas	Draft – May 1999 Final – Nov 1999
Health and Safety Plan	Health and Safety protocols for site workers	April 1999
1999 Work Plan	1999-specific work activities	Draft – April 1999 Final – Nov 1999
1999 EE/CA	Evaluation of alternatives for 1999 response action	Draft – June 1999 Final – Dec 1999
1999 Response to Significant Comments	Response to significant comments on 1999 EE/CA	December 1999
1999 Action Memorandum	Decision document for 1999 response action	December 1999
1999 Annual Water Quality Monitoring Report	Results of long-term surface water quality monitoring	Draft – Dec 1999 Final – Feb 2000
1999 Annual Revegetation Monitoring Report	Results of annual revegetation monitoring	Draft – Nov 1999 Final – Jan 2000
1999 Design Package	Engineering Design Drawings, Technical Specifications, and Bid Package	Draft – July 1999 Final – August 1999
2000 – 2006 Work Plans	Work plans detailing specific work activities to support annual response actions	Draft – November Final – December
2000 – 2006 EE/CAs	Engineering evaluation of alternatives developed for annual response actions	Draft – February Final – March
2000 – 2006 Response to Significant Comments	Response to significant comments on annual EE/CA	April
2000 – 2006 Action Memorandums	Decision Documents for annual response actions	April
2000 – 2006 Annual Water Quality Monitoring Reports	Results of annual surface water and groundwater quality monitoring	February
2000 –2006 Annual Revegetation Monitoring Reports	Results of annual revegetation monitoring	January
2000 – 2006 Design Packages	Engineering Design Drawings, Technical Specifications, and Bid Package	Draft – April Final – May

REFERENCES

Amacher, Michael C., 1998. Metal Loadings and Metals in Sediments and Wetland Soils in the Fisher and Daisy Creek Catchments in the New World Mining District, Montana. A Draft Assessment Report Prepared for USDA-FS Region 1 and the USEPA. USDA Forest Service, Rocky Mountain Research Station, Forestry Sciences Laboratory, Logan Utah. January.

Brown, Ray W., M.C. Amacher, B.D Williams, W.F. Mueggler, and J. Kotuby-Amacher, 1996. Reclamation Research in the New World: 1995 Report of Research. USDA Forest Service, Intermountain Research Station, Forestry Sciences Laboratory, Logan Utah. Prepared for Crown Butte Mines, Inc., May.

Brown, Ray W., M.C. Amacher, B.D Williams, and J. Kotuby-Amacher, 1995. Reclamation Research in the New World District: 1994 Report of Research. USDA Forest Service, Intermountain Research Station, Forestry Sciences Laboratory, Logan Utah. Prepared for Crown Butte Mines, Inc., June 1.

EPA, 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. EPA/540-R-93-057. Publication 9360.0-32. Office of Emergency and Remedial Response. Washington D.C. August.

Montana Department of Natural Resources and Conservation (DNRC), 1977. Mine Drainage Control from Metal Mines in a Subalpine Environment, A Feasibility Study. U.S. Department of Commerce, National Technical Information Service PB-277089. 167 p.

Maxim Technologies, Inc., 1998. Support Document and Implementation Plan. Submitted by Crown Butte Mines, Inc. in Support of Its Petition for Temporary Modification of Water Quality Standards for Selected Parameters for Fisher and Daisy Creeks and a Headwater Segment of the Stillwater River, Park County, Montana.

Tetra-Tech, 1996. Risk-Based Cleanup Guidelines for Abandoned Mine Sites. Prepared for the Department of Environmental Quality, Abandoned Mine Reclamation Bureau, December.

United States of America, June 25, 1998. Consent Decree and Settlement Agreement. United States of America and State of Montana, Plaintiffs, v. Crown Butte Mines, Inc. A Montana Corporation, and Crown Butte Resources Ltd., a Canadian Corporation, Defendants, et. al. In the United States District Court for the District of Montana, Billings Division.

URS Operating Services, Inc. 1998. Site Assessment Summary and Sampling Activities Report, New World Mine, Cooke City, Montana. Prepared for U.S. EPA, Contract No. 68-W5-0031. Superfund Technical Assessment and Response Team (START) – Region VIII. September 11.

____1996. Analytical Results Report – Henderson Mountain, Cooke City, Montana. Prepared for U.S. EPA, Contract No. 68-W5-0031. Superfund Technical Assessment and Response Team (START) – Region VIII. April 19.

U.S. Bureau of Mines, 1950. Mines and Mineral Deposits (Except Fuels) - Park County, Montana. Information Circular 7546. prepared by Glenn C. Reed.

Wolle, Muriel Sibell. 1963. Montana Pay Dirt, A Guide to the Mining Camps of the Treasure State. Sage/Swallow Press Books, Ohio University Press, Athens, Ohio. 436 pp.