



Stantec

**SAMPLING AND MONITORING PLAN
FOR THE**

COAL CREEK WATERSHED

Crested Butte, CO

Prepared For:

Town of Crested Butte, CO
Coal Creek Watershed Coalition (CCWC)

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1.0 Background

1.1 INTRODUCTION

Several different governmental and non-governmental groups have conducted water quality monitoring for the Coal Creek watershed over the past 40 years. The monitoring efforts have utilized certified state and federal laboratories for primary conduct of analyses and for QA/QC. These data sets were subject to a rigorous external review by Stantec Consultants as part of a comprehensive watershed plan for Coal Creek. Individual data sets were validated if they met established criteria, such as whether a formal laboratory QA/QC program was followed. From these validated data sets, Stantec constructed a project database that queried sample locations, sample dates, and corresponding results. From these queries, the framework for a watershed sampling and monitoring plan was established.

The purpose of this water quality sampling and monitoring plan is to establish standard sampling locations, parameters to monitor, and sampling frequency so that trends in water quality can be assessed. The Coal Creek Watershed Coalition (CCWC) will operator as manager of this plan and coordinate all efforts identified herein.

1.2 OBJECTIVES

The water quality monitoring program is designed to obtain samples and analytical results that give representative indications of the quality of Coal Creek and its tributaries. The information obtained from the monitoring program may also be used to assess the effectiveness of mitigation measures that are implemented to reduce or eliminate impacts from the Standard Mine and other human activity in the watershed. The major objectives covered by this water quality monitoring plan include:

- Evaluate surface water quality in Coal Creek and drainages to Coal Creek;
- Measure stream flows in Coal Creek and associated drainages;
- Assess the quantity and quality of drainage from the Standard Mine site;
- Identify the quantity and quality of drainage from waste rock in areas other than Standard Mine;
- Evaluate the biological health of Coal Creek below the Standard Mine drainage;

Monitoring enables the CCWC to identify changes in water quality throughout the watershed and institute management practices so that applicable water quality standards are achieved.

2.0 Watershed Sampling and Monitoring Plan

This section describes the Standard Operating Procedures for the collection and analysis of surface samples and for aquatic biological monitoring in the Coal Creek Watershed.

2.1 SAMPLING STATION LOCATIONS

Water monitoring sampling station locations are shown on the inset map with this document (Figure 2.1 on pg. 15).

2.1.1 Surface Water Sampling Station Descriptions

Surface water sampling stations on Coal Creek have been selected based on historical monitoring and to assess the direct and indirect impacts of watershed activities. Table 2.1 provides a list of the surface water monitoring locations including rationale for sampling.

To ensure consistent sampling locations through the monitoring period, CCWC members should stake these sites in the field. The stakes are to be easily identifiable and noted with the appropriate station ID listed in Table 2.1. For further information, reference site descriptions in Table 2.3 (pg. 14) that include global positioning system (GPS) coordinates to identify specific positions for sampling and monitoring.

2.1.2 General Sampling Procedures – Surface Water

The CCWC's water quality monitoring plan objectives are to establish background water quality for Coal Creek; monitor upstream and downstream of known pollutant source areas (e.g. mining activity) to detect water quality impacts; and identify water quality impacts from other activities in the watershed.

The schedule for most surface water stations will be developed based on seasonal access and the parameters monitored at each station. Some of the stations must be sampled at least once during each of the following four defined base flow periods: spring low flow (April), spring high flow (June), summer low flow (August), and fall low flow (October). A preliminary sampling schedule is reflected in Table 2.2.

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Watershed Sampling and Monitoring Plan

March 16, 2005

Table 2.1 Surface Water Sampling Locations

Segment	Sample ID	Location	Rationale
9	CC-SW-01	Drainage from Robinson Basin before Lake Irwin	To assess the impacts of mining and recreation activity in subwatershed S8
9	CC-SW-02	Outlet from Lake Irwin	To determine background water quality for Coal Creek from Lake Irwin
9	CC-SW-03	Coal Creek Independence Basin	To assess the impacts from mining activity near Irwin including the Forest Queen Mine
9	CC-SW-04	Coal Creek Below Kebler Pass	To assess the impacts from mining activity in subwatershed N7 and sediment transport from logging along Coal Creek in N7 and S5
9	CC-SW-05	Coal Creek Above Elk Creek	To assess the impacts of mining activity in the Little Frank Area, the drainage from Splains Gulch, and to establish water quality at the end of segment 9
9	WC-SW-01	Wildcat Creek Above Coal Creek (at diversion)	To assess the impacts from activities in the Wildcat Creek subwatershed (N6)
11	CC-SW-06	Coal Creek Below Elk Creek	To assess the impacts from activities in the Elk Creek subwatershed (N6) including the Standard Mine
11	CC-SW-07	Coal Creek Above the Iron Fen	To assess the impacts from activities in the Little Elk Creek drainage
11	CC-SW-08	Coal Creek Below the Iron Fen	To assess the impacts from the Iron Fen
11	CC-SW-09	Coal Creek at the CB Intake (20 ft above intake)	To assess the impacts from mining and recreational activity in subwatersheds N5 and S4 and to establish water quality at the end of segment 11
11	EC-SW-01	Elk Creek Background	To determine background water quality for Elk Creek
11	EC-SW-02	Elk Creek below the upper adits	To assess the impacts from mining activity in the upper adits
11	EC-SW-03	Drainage from the Main (Level 1) adit	To assess the impacts from the main adit
11	EC-SW-04	Elk Creek Below the Standard Mine	To assess the impacts from the entire Standard Mine site
11	EC-SW-05	Elk Creek Above Coal Creek	To assess the impacts from activities in the Elk Creek subwatershed (N6) including the Standard Mine
11	Fen-SW-01	Drainage from the Iron Fen	To assess the impacts from the Iron Fen
12	CC-SW-10	Coal Creek Below the Mt. Emmons/Keystone Outfall	To assess the impacts from the outfall and drainage from subwatershed N4
12	CC-SW-11	Coal Creek Below Wildcat Creek	To assess the impacts from mining and recreational activities in the Wildcat Creek watershed (S2) and septic systems in subwatersheds N2, N3, S4
12	CC-SW-12	Coal Creek Above the Slate River (400 ft below Butte Ave bridge)	To assess the impacts from the Town of Crested Butte and to establish water quality at the end of segment 12
12	Key-SW-01	Below the Mt. Emmons / Keystone Outfall (below CR 12)	To assess the impacts from the Mine discharge and activities in subwatershed N4

SAMPLING AND MONITORING PLAN FOR THE COAL CREEK WATERSHED

Watershed Sampling and Monitoring Plan

March 16, 2005

Table 2.2 Sampling Station Frequency

Segment	Water Body	Sample ID	Year 1 Sampling Frequency				Years 2 through 5 Sampling Frequency			
			Low Flow Spring (April)	High Flow Spring (June)	Low Flow Summer (August)	Low Flow Fall (October)	Low Flow Spring (April)	High Flow Spring (June)	Low Flow Summer (August)	Low Flow Fall (October)
9	Coal Creek	CC-SW-01		P,C	P,C					
9	Coal Creek	CC-SW-02	P,C	P,C	P,C	P,C				
9	Coal Creek	CC-SW-03	P,C	P,C	P,C	P,C				
9	Coal Creek	CC-SW-04		P,C	P,C					
9	Coal Creek	CC-SW-05	P,C	P,C	P,C	P,C,B	P,C	P,C	P,C	P,C,B
9	Wildcat Creek	WC-SW-01		P,C	P,C					
11	Coal Creek	CC-SW-06	P,C	P,C	P,C	P,C,B	P,C	P,C	P,C	P,C,B
11	Coal Creek	CC-SW-07	P,C	P,C	P,C	P,C				
11	Coal Creek	CC-SW-08	P,C	P,C	P,C	P,C				
11	Coal Creek	CC-SW-09	P,C	P,C	P,C	P,C,B	P,C	P,C	P,C	P,C,B
11	Elk Creek	EC-SW-01		P,C	P,C					
11	Elk Creek	EC-SW-02		P,C	P,C					
11	Elk Creek	EC-SW-03		P,C	P,C					
11	Elk Creek	EC-SW-04	**	P,C	P,C	P,C,B	**	P,C	P,C	P,C,B
11	Elk Creek	EC-SW-05	P,C	P,C	P,C	P,C,B	P,C	P,C	P,C	P,C,B
11	Iron Fen	Fen-SW-01		P,C	P,C					
12	Coal Creek	CC-SW-10	P,C	P,C	P,C	P,C,B	P,C	P,C	P,C	P,C,B
12	Coal Creek	CC-SW-11		P,C	P,C					
12	Coal Creek	CC-SW-12	P,C	P,C	P,C	P,C,B	P,C	P,C	P,C	P,C,B
12	Keystone Discharge	Key-SW-01		P,C	P,C					
P	PHYSICAL	pH, Flow, Turbidity, Specific Conductance, Air Temperature, Water Temperature, Dissolved Oxygen								
C	CHEMICAL	Dissolved Cadmium, Copper, Lead, and Zinc; Hardness								
B	BIOLOGICAL	Macroinvertebrate Survey								
**	ACCESS LIMITED	Sample site could be sampled although it may not be safely accessed due to snowpack								

In general, the water quality program is a program of surveillance for impacts to surface water. The water quality monitoring program for Coal Creek should be dynamic and responsive. The Monitoring Plan proposed after the first year (Table 2.2) may be modified to reflect results from the first year of sampling and/or regulatory changes as they arise.

2.2 SURFACE WATER SAMPLING PROTOCOL

The water quality monitoring program requires specific analyses for each monitoring site, which may include one or more of the following parameters: conductivity, pH, temperature, turbidity, dissolved oxygen, hardness, cadmium, copper, lead, and zinc. This section describes the protocol and methodology for determining these parameters in the field and for collecting and preserving samples, which will undergo laboratory analysis to determine concentrations of the target chemical constituents.

The following water quality parameters are measured in the field.

- pH
- Turbidity
- Conductivity (specific conductance)
- Air temperature
- Water Temperature
- Dissolved Oxygen

Conductivity, water temperature and DO are always measured in-stream. Air temperature is measured at the time of sample collection.

Measurements of pH, conductivity, and dissolved oxygen (DO) should be sampled in the field. Turbidity reading should be made in the field unless portable equipment is not available. In this case, measurements should be made as soon as possible after sample collection, to obtain accurate results. The Town of Crested Butte has a water treatment and wastewater treatment facility that are equipped with a bench-top turbidimeter to measure turbidity, if needed.

The following materials and equipment are used in sample collection.

- Sample containers with labels
- Data forms and field notebook
- Distilled/deionized water (reagent grade)
- Clean, decontaminated cooler(s) and ice packs or cubes
- Waterproof pen/pencil
- Thermometer
- Portable pH/Conductivity/Dissolved Oxygen Meter
- Portable turbidimeter
- Calibration standards

2.2.1 Conductivity, Dissolved Oxygen, Air and Water Temperatures

These parameters should be measured in the field using a portable meter with a pH/conductivity probe and DO probe. The conductivity meter probe, which also measures temperature, should be inserted directly into the deepest part of the stream channel near the bank. Once the reading stabilizes, the conductivity value is read and recorded on the sample data sheet. The

meter is switched to read temperature, allowed to stabilize, and the temperature is read and the value recorded in the appropriate space on the sample data sheet.

The same procedure is followed for DO measurements with the probe inserted into the deepest part of the stream channel. The probe must be inserted deep enough to cover the thermistor. The probe must also have sufficient flow across the membrane tip to stabilize; if the sample area is stagnant, create sufficient flow across the probe tip by pulling on the cable to move the probe up and down. When the reading on the meter stabilizes any air bubbles trapped on the probe tip are dislodged, the value is recorded or stored in the meter memory.

The ambient air temperature (not in direct sunlight) is measured using a hand held thermometer.

2.2.2 Turbidity and pH

Turbidity and pH measurements should be made in the field using the portable turbidimeter and the multiple-parameter pH meter. These measurements are not made in-stream but rather from a grab sample. The sample container is thoroughly rinsed using stream water downstream from the sampling site. After rinsing, a water sample is collected from the sample site for turbidity and pH analysis. The pH meter probe is inserted into the container and the meter is allowed to stabilize. The value is then read and recorded on the sample data sheet. The sample is then vigorously shaken and a turbidity reading taken and recorded on the sample data sheet.

2.2.3 QA/QC for Field Measurements

Field meters are maintained in good working condition and cleaned between sampling events. Batteries are routinely replaced and fresh spare batteries are always on-hand in the field. The portable multi-parameter meter (pH, conductivity, temperature and DO) is fully standardized prior to each sampling event. The meter should be calibrated using standards provided by the manufacturer. Calibrations are recorded in a logbook kept on file. The turbidimeter is calibrated to a known standard prior to each sampling event. During sampling events, the meters should be tested for accuracy with known standards. Recalibrate the DO probe every two hours for maximum accuracy.

Field measurements are taken from the same locations in the stream profile and at the same depths. Changes in sampling locations, due to dynamic changes in stream morphology are noted on the sample data sheets. Care will be taken to ensure that water-sampling procedures for temperature and specific conductance do not disturb bottom sediments.

2.2.4 Analytical Sampling Protocol

Sampling procedures outlined in this section were designed following a review of methods recommended in publications by the EPA and the USGS. These sampling procedures require that the sampling team follow specific QA/QC measures to avoid introducing sources of trace element contamination.

Surface water samples are collected at each station according to the schedule identified in Table 2.2. Two water samples are collected at each monitoring station. One water sample will be analyzed to determine the dissolved fraction of the constituents of concern; the other will be used for field measurement of pH and turbidity. Sample containers are labeled at the time of collection as follows:

- Location:
- Sample Name:
- Date:
- Time:
- Preservative (if used):
- Comments:

Surface water sampling follows the following general procedures:

1. Estimate stream flow (if appropriate) using velocity and stream geometry method, flow meter, or gaging devices (e.g. stream gage, Parshall Flume)
2. Check battery test switch on all field instruments before use and make sure they are properly calibrated.
3. Measure in-stream conductivity, temperature, and DO readings by inserting probe directly into the stream.
4. Fill sample containers, after proper labeling, by the grab sampling method, taking care to avoid contamination of bottles.
5. Take an air temperature reading making sure the thermometer is not in direct sunlight.
6. Measure pH and turbidity, by vigorously shaking the unpreserved stream sample bottle and taking a 40-ml sub-sample.
7. Record all information (station, date, time), measurements, and observations on the appropriate field data form and sign form.

2.2.5 Equipment Selection

Trace metals and inorganic compounds are the constituents of concern in surface waters downstream of the mining operation. Accurate analysis of these elements at the low expected concentrations requires that sampling equipment be free of organic and inorganic contamination. Polyethylene, Fluoropolymer, or glass sampling containers are used to collect and store samples depending on the specific requirements of the methods for the target analytes.

2.2.6 Equipment Preparation

The CCWC's should contact the contract laboratory to secure sample bottles (metals 250 mL) and Teflon preservative ampoules (if needed) for each sample to be taken, in order to avoid field cleaning and possible cross-contamination. Sampling personnel wear non-powdered vinyl gloves for all procedures, and avoid breathing on or otherwise contacting samples.

2.2.7 Personnel

Field technician(s) conduct field and analytical water sampling. The field technicians follow the QA/QC procedures that are described in this water quality monitoring plan and in the Quality Assurance Project Plan in Appendix A.

2.2.8 Sample Types

Each sampling station has a specific set of sampling procedures that are determined by the analytes to be measured. Some stations require collection of two samples for analyses. One sample is collected for dissolved metals, including cadmium, copper, lead, and zinc at the minimum, and hardness (laboratory); one sample is analyzed for pH and turbidity (field). Each sample collected is treated (ex. preserved or iced) according to the requirements target analyte(s) and recommended preservation methods. Grab samples are collected for all water quality parameters.

2.2.9 Sample Collection

Surface water samples are collected from moving water in the stream channel by approaching from downstream. Care is taken not to disturb bottom sediments in the sampling location. Sampling proceeds from areas of lowest potential contamination to areas of highest potential contamination. Sampling events are timed to avoid turbulent weather conditions such as high winds and precipitation. If high or gusty winds occur during the sampling event measures are taken to protect samples from wind-born contamination.

2.3 QUALITY ASSURANCE/QUALITY CONTROL

The CCWC should collect field blanks and duplicate samples during each sampling event. One field blank and one duplicate sample should be collected for every 10 field samples collected. Blank and duplicate samples, handled in the same manner as the as the other samples, are used as controls to monitor for possible sources of contamination. CCWC uses the QA/QC protocols outlined in the following Sections and in the Quality Assurance Project Plan in Appendix A, to ensure reliability of the field and analytical data.

2.3.1 Field Blanks

Field technicians collect one field blank for every sampling event. The field blank is prepared prior to field sampling from a large container filled with reagent grade distilled water provided by the laboratory. The field blank is carried to the site during the sampling event.

2.3.2 Field Duplicates

One field duplicate is collected for every 10 analytical water samples. The field duplicate is collected either by splitting a larger sample into two aliquots or by taking two samples in rapid succession.

2.3.3 Shipping and Handling

Samples, that are to be analyzed by a third-party analytical laboratory, are placed on ice in clean coolers and sealed using strapping tape. The coolers are clearly labeled to indicate the destination of the samples. The coolers, samples and chain-of-custody forms, are shipped by over-night carrier to the analytical laboratory. Samples are shipped over-night to ensure that the holding-times for chemical analyses are not compromised.

2.3.4 Record Keeping and Training

The CCWC has been selected to maintain records of all sampling events, QA/QC protocols, and analytical results. The Project Manager should retain copies of the field data forms and the chain-of-custody forms. The laboratory should also retain copies of analytical reports for their records. CCWC should provide regular training and practice for field technicians to ensure that sampling procedures are executed in accordance with the most current water quality monitoring plan. CCWC should also conduct an annual review of current published QA/QC and sampling procedures and update the monitoring plan as needed.

2.3.5 Data Validation

The Project Manager should review the water quality monitoring field and laboratory data as described in the QAPP in Appendix A.

2.4 AQUATIC BIOLOGY METHODS

Aquatic biological surveys are to be conducted in late September-early October to determine the status of macroinvertebrate species that occur in Coal Creek. Coal Creek and Elk Creek are the main drainages in which the surveys are to be conducted. The following section outlines the methods and procedures used to conduct the biological surveys.

2.4.1 Sample Sites

Seven sampling sites are located on Coal Creek and Elk Creek as part of the long term monitoring program. Sample site CC-SW-05 is located upstream of the confluence of Elk Creek with Coal Creek and serves as an upstream reference to monitor natural variation in the aquatic community at the end of Segment 9. This site is unaffected by the Standard Mine's activities. Sample site CC-SW-06 is located downstream of the confluence of Elk Creek on Coal Creek. CC-SW-06 is located to monitor potential effects of drainage from the Standard Mine on macroinvertebrate populations in Coal Creek.

Two sampling sites are located on Elk Creek. The upstream reference site, EC-SW-04, is located downstream of the inactive Standard Mine. The downstream site, EC-SW-05, is located 2.4 km downstream of site EC-SW-04 at the mouth of Elk Creek. Both sites serve to monitor potential effects of mining activities on macroinvertebrate populations in Elk Creek.

Sample site CC-SW-09 is located at the Crested Butte municipal water intake at the downstream end of Segment 11. This site serves as a downstream reference to monitor macroinvertebrate populations in Coal Creek and is 5 km downstream of the Standard Mine's activities. Site CC-SW-09 is upstream of the Mt. Emmons/Keystone Mine outfall and serves as an upstream reference to monitor aquatic health before the outfall. Sample site CC-SW-10 is located downstream of the Mt. Emmons/Keystone Mine outfall. This site serves to monitor the potential effects of drainage from the Mt. Emmons/Keystone Mine activities (including the treated discharge) on macroinvertebrate populations in Coal Creek. Site CC-SW-12 is located at the Butte Avenue bridge in Crested Butte and is 7.5 km below the Standard Mine site, 2.5 km below the Mt. Emmons/Keystone Mine outfall. This site monitors macroinvertebrate populations in Coal Creek before confluence with the Slate River at the downstream end of Segment 12.

2.4.2 Macroinvertebrates

Macroinvertebrate assemblages are good indicators of localized conditions. Because many benthic macroinvertebrates have limited migration patterns or a sessile mode of life, they are particularly well suited for assessing site-specific impacts (upstream-downstream studies). The Rapid Bioassessment Protocols (RBP) provide an effective means of evaluating and documenting macroinvertebrate habitat and health for each station on Coal Creek and Elk Creek.

2.4.3 RBP Field Sampling Procedures for Single Habitat

1. A 100 m reach representative of the characteristics of the stream should be selected. Whenever possible, the area should be at least 100 meters upstream from any road or bridge crossing to minimize its effect on stream velocity, depth, and overall habitat quality. There should be no major tributaries discharging to the stream in the study area.
2. Before sampling, document the site description, weather conditions, and land use. After sampling, review this information for accuracy and completeness.
3. Draw a map of the sampling reach. This map should include in-stream attributes (e.g., riffles, falls, fallen trees, pools, bends, etc.) and important structures, plants, and attributes of the bank and near stream areas. Use an arrow to indicate the direction of flow. Indicate the areas that were sampled for macroinvertebrates on the map. Estimate "river mile" for sampling reach for probable use in data management of the water resource agency. If available, use hand-held Global Positioning System (GPS) for latitude and longitude determination taken at the furthest downstream point of the sampling reach.
4. All riffle and run areas within the 100-meter (m) reach are candidates for sampling macroinvertebrates. A composite sample is taken from individual sampling spots in the riffles and runs representing different velocities. Generally, a minimum of 2 m² composited area is sampled for RBP efforts.
 - Sampling begins at the downstream end of the reach and proceeds upstream. Using a 1 m kick net, 2 or 3 kicks are sampled at various velocities in the riffle or series of riffles. A *kick* is a stationary sampling accomplished by positioning the net and disturbing one square meter upstream of the net. Using the toe or heel of the boot, dislodge the upper layer of cobble or gravel and scrape the underlying bed. Larger substrate particles should be picked up and rubbed by hand to remove attached organisms.
 - The jabs or kicks collected from different locations in the cobble substrate will be composited to obtain a single homogeneous sample. After every kick, wash the collected material by running clean stream water through the net 2 to 3 times. If clogging does occur, discard the material in the net and redo that portion of the sample in a different location. Remove large debris after rinsing and inspecting it for organisms; place any organisms found into the sample container. Do not spend time inspecting small debris in the field.
 - Transfer the sample from the net to sample container(s) and preserve in enough 95 percent ethanol to cover the sample. Forceps may be needed to remove organisms from the dip net. Place a label indicating the sample identification code or lot number, date, stream name, sampling location, and collector name into the sample container. The outside of the container should include the same information and the words "preservative: 95% ethanol". If more than one container is needed for a sample, each container label should contain all the

information for the sample and should be numbered (e.g., 1 of 2, 2 of 2, etc.). This information will be recorded in Field Sample Log.

- Record the percentage of each habitat type in the reach. Note the sampling gear used, and comment on conditions of the sampling, e.g., high flows, treacherous rocks, difficult access to stream, or anything that would indicate adverse sampling conditions.
- Document observations of aquatic flora and fauna. Make qualitative estimates of macroinvertebrate composition and relative abundance as a cursory estimate of ecosystem health and to check adequacy of sampling.
- Perform habitat assessment after sampling has been completed; walking the reach helps ensure a more accurate assessment. Conduct the habitat assessment with another team member, if possible.
- Return samples to laboratory.

2.4.4 Quality Control in the Field

1. Sample labels must be properly completed, including the sample identification code, date, stream name, sampling location, and collector's name, and placed into the sample container. The outside of the container should be labeled with the same information. Chain-of-custody forms, if needed, must include the same information as the sample container labels.
2. After sampling has been completed at a given site, all nets, pans, etc. that have come in contact with the sample should be rinsed thoroughly, examined carefully, and picked free of organisms or debris. Any additional organisms found should be placed into the sample containers. The equipment should be examined again prior to use at the next sampling site.

2.4.5 2.4.5 Macroinvertebrate Analysis

For RBP, macroinvertebrates are identified to the family, subfamily, or genus taxonomic level. This analysis provides lists and estimates of density ($\#/m^2$). Community relationships and affect of mining, if any, are discussed in the analysis section of an annual aquatic biology report. Trend analysis is conducted on the compiled data to monitor for significant changes in macroinvertebrate populations and species diversity over time and between sites.

A copy of the most current USGS report on area stream flows is provided to the aquatic biologist conducting the analysis of the biota, so that flow variability can be considered in the evaluation of annual results.

2.4.6 Macroinvertebrate Reporting

An annual aquatic biology report is to be prepared presenting the data and analysis of macroinvertebrate studies. This report is presented to the interagency task force annually for review.

2.5 LABORATORY ANALYTICAL PROCEDURES

Physical and chemical analyses are conducted by an EPA-approved and state certified analytical laboratory, using analytical methods and procedures described in Standard Methods for the Examination of Water and Wastewater, 20th edition, American Public Health Association, 1999. See Appendix C for a list of methods used for parameters identified in this sampling and

monitoring plan. The laboratory complies with record keeping and quality assurance procedures as described in the following section.

2.6 QUALITY ASSURANCE PROGRAM

In order to produce valid water quality data from the project area, basic quality control elements are incorporated in both field and laboratory aspects of the monitoring program. These control elements are outlined in the following sections.

2.6.1 Basic Elements Ensuring QA/QC

Basic elements ensuring QA/QC consist of the following:

- Calibration of field instruments.
- Proper collection and preservation of samples.
- Time-sensitive samples are delivered as soon as possible for analysis by the lab within specified holding times (Appendix C).
- Transfer of custody and shipment - the field sampler is responsible for proper collection, preservation, labeling, packaging and dispatching samples to the laboratory with proper sample collection and chain-of-custody forms.
- United Parcel Service slips are retained for verification of shipment of samples. In the case of air delivery, CCWC personnel obtain telephone verification.
- Custody is transferred to the laboratory upon delivery of samples. The laboratory is then responsible for receiving, adequately storing, and proper handling of samples.
- Copies of the Chain-of-Custody forms are returned to CCWC for verification and record keeping.

2.6.2 Quality Assurance Sampling

During the course of the Water Monitoring Program, additional (standard and duplicate) samples are collected and analyzed to determine precision and accuracy of the method used in the laboratory according to the following schedule:

- Each quarter, duplicate samples are taken from one of the water quality stations being monitored. These duplicates are identified and the results are reported with the associated water quality data.
- EPA Quality Control samples are procured by the analytical laboratory on a continual basis and analyzed as a check for accuracy.
- As an intra-laboratory check, samples are split on a regular basis.
- Quality assurance procedures and data are fully documented and retained for future reference. Field and laboratory personnel keep complete and permanent records of sampling and testing to satisfy legal requirements for potential enforcement or judicial proceedings.

2.6.3 Quality Assurance Project Plan (QAPP)

A copy of the QAPP for the Coal Creek Watershed is provided as Appendix A. The QAPP describes the steps that are followed to assure the quality and integrity of data obtained from the surface and groundwater sampling outlined in this Water Quality Monitoring Plan.

Table 2.3 Surface Water Sampling Locations

Segment	Water Body	Sample ID	Location	Coordinates (DMS)	
				Latitude	Longitude
9	Coal Creek	CC-SW-01	Drainage from Robinson Basin before Lake Irwin	38 53 07.11140	107 06 26.77216
9	Coal Creek	CC-SW-02	Outlet from Lake Irwin	38 52 29.92234	107 05 58.76544
9	Coal Creek	CC-SW-03	Coal Creek Independence Basin	38 52 11.16522	107 05 36.52922
9	Coal Creek	CC-SW-04	Coal Creek Below Kebler Pass	38 51 13.21631	107 05 01.97086
9	Coal Creek	CC-SW-05	Coal Creek Above Elk Creek	38 51 20.49784	107 03 43.84736
9	Wildcat Creek	WC-SW-01	Wildcat Creek Above Coal Creek (at diversion)	38 52 05.57545	107 00 32.26805
11	Coal Creek	CC-SW-06	Coal Creek Below Elk Creek	38 51 24.82144	107 03 21.50566
11	Coal Creek	CC-SW-07	Coal Creek Above the Iron Fen	38 51 43.38818	107 02 32.31821
11	Coal Creek	CC-SW-08	Coal Creek Below the Iron Fen	38 51 44.58368	107 02 12.68601
11	Coal Creek	CC-SW-09	Coal Creek at the CB Intake (20 ft above intake)	38 52 00.99537	107 01 23.33907
11	Elk Creek	EC-SW-01	Elk Creek Background	38 53 01.00401	107 04 06.28899
11	Elk Creek	EC-SW-02	Elk Creek below the upper adits	38 52 51.81447	107 04 24.57811
11	Elk Creek	EC-SW-03	Drainage from the Main (Level 1) adit	38 52 48.03283	107 04 24.49936
11	Elk Creek	EC-SW-04	Elk Creek Below the Standard Mine	38 52 40.75576	107 04 28.23268
11	Elk Creek	EC-SW-05	Elk Creek Above Coal Creek	38 51 29.43171	107 03 41.88833
11	Iron Fen	Fen-SW-01	Drainage from the Iron Fen	38 51 48.1320	107 02 36.9380
12	Coal Creek	CC-SW-10	Coal Creek Below the Mt. Emmons/Keystone Outfall	38 52 07.79926	107 01 06.10533
12	Coal Creek	CC-SW-11	Coal Creek Below Wildcat Creek	38 52 08.22420	107 00 17.58803
12	Coal Creek	CC-SW-12	Coal Creek Above the Slate River (400 ft below Butte Ave bridge)	38 52 36.25095	106 58 39.47293
12	Keystone Discharge	Key-SW-01	Below the Mt. Emmons / Keystone Outfall (below CR 12)	38 52 07.08989	107 01 16.33428

Figure 2.1 Sample Location Map

Figure 2.1 is enclosed in the pocket following this page.

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**SAMPLING AND MONITORING PLAN FOR THE COAL CREEK WATERSHED
APPENDIX A**

APPENDIX A QUALITY ASSURANCE PROJECT PLAN

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**SAMPLING AND MONITORING PLAN FOR THE COAL CREEK WATERSHED
APPENDIX B**

APPENDIX B WATER QUALITY DATA FORM

**COAL CREEK WATER QUALITY
SAMPLE DATA SHEET**

Station: _____

Date Collected: _____

Time: _____

Weather: _____

Air Temperature: _____ °C

Conductivity: _____ umhos/cm at 25°C

Sample Temp: _____ °C

pH: _____ S.U.

Turbidity: _____ NTU

Staff Gauge: _____

Flow: _____ cfs

Person(s) Conducting
Sampling: _____

Signed: _____

FIELD NOTES AND OBSERVATIONS

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**SAMPLING AND MONITORING PLAN FOR THE COAL CREEK WATERSHED
APPENDIX C**

**APPENDIX C HOLDING TIMES AND ANALYTICAL METHODS FOR
WATER QUALITY TESTING**

Recommendations for Preserving Samples

PARAMETER	VOLUME REQUIRED (mL)	CONTAINER PLASTIC OR GLASS	PRESERVATIVE	HOLDING TIME (3)
Alkalinity	100	p,g	Cool, 4°C	24 Hrs.
Arsenic	100	p,g	HN0 ₃ to pH 2	6 Mos.
BOD	1000	p,g	Cool, 4°C	6 Hrs. (1)
COD	50	p,g	H ₂ S0 ₄ to pH 2	7 Days
Chloride	50	p,g	None Required	7 Days
Conductivity	50	p,g	Determine On site	No Holding
Cyanides	500	p,g	Cool, 4°C NaOH to pH 12	24 Hrs. 14 Days
Dissolved Oxygen	300	g only	Determine on site	No Holding
Hardness	100	p,g	Cool, 4°C HNO ₃ to pH 2	7 Days
Metals				
Dissolved	200	p,g	Cool, 4°C HN0 ₃ to pH 2	24 Hrs. 6 Mos.
Total	100	p,g	HN0 ₃ to pH 2	6 Mos.
Mercury				
Dissolved	100	p,g	Filter HN0 ₃ to pH 2	38 Days (Glass) 13 Days (Hard Plastic)
Total	100	p,g	HN0 ₃ to pH 2	38 Days (Glass) 13 Days (Hard Plastic)

Stantec**SAMPLING AND MONITORING PLAN FOR THE COAL CREEK WATERSHED****APPENDIX C**

PARAMETER	VOLUME REQUIRED (mL)	CONTAINER PLASTIC OR GLASS	PRESERVATIVE	HOLDING TIME (3)
Nitrogen				
Ammonia	400	p,g	Cool, 4°C H ₂ SO ₄ to pH 2	28 Days
Kjeldahl (total)	500	p,g	Cool, 4°C H ₂ SO ₄ to pH 2	7 Days
Nitrate/Nitrite	100	p,g	Cool, 4°C H ₂ SO ₄ to pH 2	24 Hrs. ⁽²⁾
Oil & Grease	1000	g only	Cool, 4°C H ₂ SO ₄ or HCl to pH 2	24 Hrs.
Organic	25	p,g	Cool, 4°C	24 Hrs.
pH	25	p,g	Determine on site	6 Hrs. ⁽¹⁾
Phenolics (carbon)	500	g only	Cool, 4°C H ₂ P0 ₄ to pH 4 1.0 g CuSO ₄ /l	24 Hrs.
Phosphorous				
Ortho- Total	50	p,g	Cool, 4°C	7 Days
Selenium	50	p,g	HN0 ₂ to pH 2	6 Mos.
Sulfate	50	p,g	Cool, 4°C	7 Days
Sulfide	100	p,g	Cool, 4°C	14 Days
Temperature	1000	p,g	Determine on site	No Holding
Turbidity	100	p,g	Determine on site	No Holding

PARAMETER	VOLUME REQUIRED (mL)	CONTAINER PLASTIC OR GLASS	PRESERVATIVE	HOLDING TIME (3)
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(1) If samples cannot be returned to the laboratory in less than 6 hours and holding time exceeds this limit, the final reported data should indicate the actual holding time.

(2) Mercuric chloride may be used as an alternate preservative at a concentration of 40 mg/l, especially if a longer holding time is required. However, the use of mercuric chloride is discouraged whenever possible.

(3) It has been shown that samples properly preserved may be held for extended periods beyond the recommended holding time.

METHODS USED FOR WATER ANALYSES BY CODE

From: Environmental Protection Agency

<u>PARAMETER</u>	<u>METHOD NUMBER</u>	<u>PARAMETER</u>	<u>METHOD NUMBER</u>
Acidity	305.1	Molybdenum	200.8 / 200.7
Alkalinity	310.1	Cobalt	200.8 / 200.7
Aluminum	200.8 / 200.7	Nickel	200.8 / 200.7
Arsenic	200.8 / 200.7	Nitrogen-Ammonia	350.1
Barium	200.8 / 200.7	Nitrogen—Total Kjeldahl	351.3
Cadmium	200.8 / 200.7	Nitrogen—Nitrate	352.6
Calcium	200.8 / 200.7	Nitrogen—Nitrate	352.6
Chloride	300.0	Nitrogen—Organic	calculation
Chromium	200.8 / 200.7	Orthophosphate	365.1
Copper	200.8 / 200.7	Total Phosphate	365.1
Fluoride	304.2	Potassium	200.8 / 200.7
Hardness	200.8 / SM2340B	Selenium	200.8 / 200.7
Hex Chromium	7196A	Silica	200.7
Hydrogen	427D	Silver	200.8 / 200.7
Iron	200.8 / 200.7	Sodium	200.8 / 200.7
Lead	200.8 / 200.7	Solids—Total	160.1
Magnesium	200.8 / 200.7	Solids—Volatile	160.4
Manganese	200.8 / 200.7	Solids—Suspended	160.2
Mercury	200.8 / 200.7	Solids—Settleable	160.5
Zinc	200.8 / 200.7	Sulfate	300
Bicarbonate	310.1	Sulfide	376.2
TOC	415.2		
Carbonate	310.1		
Oil and Grease	413		