**Sampling Analysis Plan (SAP) for Water Quality Monitoring in the Upper Animas River**

**Long-Term Monitoring Plan**
**2016-2017**
*** Revised October 12, 2016 ***

Colorado Department of Public Health and Environment
Water Quality Control Division
4300 Cherry Creek Drive South
Denver, CO 80246

## 1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) describes the sampling and analysis methods that will be affiliated with the collection of water quality samples during the long term monitoring of the Upper Animas River watershed. Water quality will be monitored in response to public health and environmental concerns related to the Gold King Mine spill.

The Water Quality Control Division's (Division) Quality Management Plan (QMP) states that a quality assurance and quality control program will be implemented through the mandatory use of smaller sampling and analysis plans. In accordance with this directive, this SAP will be considered supplemental to the Division's SAP for routine River and Stream Water Quality Monitoring prepared for State fiscal year 2016.

## 2.0 BACKGROUND

On August 5, 2015 approximately 3 million gallons of accumulated acid mine drainage was accidently released into Cement Creek in the Upper Animas River basin. The plume consisted of elevated concentrations of heavy metals, including but not limited to arsenic, zinc, cadmium and copper.

The spill initially began in Cement Creek and then flowed south towards the Town of Silverton where it flowed into the Animas River. The plume continued southward along the Animas River towards the State line with New Mexico depositing colloidal metal particles in slow flowing portions of the Animas River. It is anticipated that the turbulent high flows attributable to spring snowmelt will release these deposited particles, thus converting total metals into the more toxic dissolved fraction.

The Division's overarching objectives are to collect, assess, and report data regarding the chemical, physical and biological integrity of the State's surface waters. In support of these objectives, the Environmental Data Unit maintains a network of statewide monitoring sites, including trend and synoptic study sites, for collecting chemical, physical, and biological data. It is the Division's intention to sample monitoring stations

already in its network of sites as well as points of entry at private water systems along both Cement Creek and the Animas River beginning April 1, 2016 and continuing to mid-July of 2017. Consequently, the implementation of this SAP will span three State fiscal years.

## 3.0 TECHNICAL APPROACH

Under this supplemental SAP, water quality monitoring activities will be focused on Cement Creek, Mineral Creek, and the Animas River and private domestic water systems in order to support decision-making related to the current status of water quality on those two waterbodies.

Water quality data will consist of water chemistry and sediment grab samples collected from six stations as well as field measurements monitored in real-time at five U.S. Geological Survey gage locations. Fish tissue data will be analyzed for total metals and mercury. Data will be used to monitor current status and rates of recovery in water quality in the Upper Animas River basin.

Data will also be used to develop and verify if and when public alert notifications are issued as a means to protect downstream water supply, agriculture and recreation users.

### 3.1 SAMPLING GOALS AND OBJECTIVES

The goals and objectives specific to this supplemental SAP are as follows:

- Collect water quality data, including ambient water chemistry and sediment, at four sites on Cement Creek, Mineral Creek and the Animas River to inform decisions related to water quality conditions.

- Collect water quality data at approximately 100 private domestic water systems along the Animas River basin to inform decisions related to protecting public health.

- Collect fish and analyze tissue for metals accumulation to inform decisions related to protecting public health and the environment.

- Contract with U.S. Geological Survey to purchase five, 4-parameter continuous monitors and provide operation and maintenance of equipment for a period of time not to exceed August 31, 2018. Monitors will generate real-time field measurements that will be used to develop correlations between pH, turbidity, specific conductance, and total or dissolved metals.

## 4.0 RESPONSIBLE AGENCY AND CONTACTS

The Environmental Data Unit will be primarily responsible for the coordination and implementation of targeted, site-specific monitoring. The Environmental Data Unit will provide field support by collecting water quality samples and will provide inclusive oversight of the Quality Assurance/Quality Control (QA/QC) affiliated with this SAP.

San Juan Basin Health Department (SJBHD) will provide field support by collecting weekly water chemistry and sediment samples and verification[1] samples at four stations. SJBDH will provide additional field support by collecting water quality samples from upwards to 100 private domestic water systems.

Colorado Parks and Wildlife will be responsible for the collection of whole body fish and shipment to Laboratory Services Division (LSD). The Division will be responsible for submitting fish tissue samples to LSD for analysis.

It is anticipated that other Division units will assist with planning, coordination and implementation, as needed throughout the execution of this SAP.

## 4.1 PROJECT COORDINATOR AND CONTACTS

Chris Theel
Colorado Department of Public Health and Environment
Water Quality Control Division
Environmental Data Unit – Monitoring and Data Workgroup Lead
303-692-3558; christopher.theel@state.co.us

CDPHE Water Quality Control Division

Jean Aldrich – 303-692-3396, jean.aldrich@state.co.us
Arne Sjodin – 303-692-3522, arne.sjodin@state.co.us

San Juan Basin Health Department

Brian Devine – 970-335-2030, BDevine@sjbhd.org

U.S. Geological Survey

Steven Anders, Western Colorado Data Section Chief – 970-628-7140,
spanders@usgs.gov

Mr. Anders will be the point of contact for tasks related to installation, operation and maintenance of continuous monitors at USGS gages.

[1] Verification visit is to confirm threshold exceedences of real-time field parameters with handheld probes

## 5.0 DATA QUALITY OBJECTIVES

The Data Quality Objective (DQO) process is used to establish performance or acceptance criteria for data collection activities. These criteria in turn serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support goals of the Division's monitoring plan. The DQO process is systematic and begins by defining the problem and identifying the goals and objectives of the SAP. Subsequent steps identify feedback participation and measurement performance criteria. Data collection methods and the analytical approach are designed to satisfy plan goals and objectives of the SAP.

## 5.1 MEASUREMENT PERFORMANCE CRITERIA

A central aspect of DQO process is the documentation of the data quality indicators which specify the performance criteria and acceptance criteria for the quality of the data collected for the plan and for existing data to be included in a project.

### 5.1.1 PRECISION

Precision is a measure of reproducibility of test results. A series of measurements on the same sample for the same parameter is compared to the average value. Precision is estimated by means of duplicate/replicate analyses. Precision is best expressed in terms of the standard deviation or the relative percent difference (RPD) between field duplicate measurements as show below.

$$RPD = [(x_1 - x_2) / \{(x_1 + x_2)/2\}] \times 100$$

RPD = relative percent difference (%)

$x_1$ and $x_2$ = duplicate measurements of the same parameter

The smaller the RPD, the more precise are the measurements. The usability of duplicate measurements is assessed during data validation.

The Colorado Department of Public Health and Environment's Laboratory Service Division is responsible for establishing measurement criteria for precision of the analytical procedures used in projects where water quality data are collected. Data for these Quality Control procedures are obtained by analyses of replicate, split and spiked samples, and blanks.

### 5.1.2 ACCURACY

Accuracy is the degree of agreement of a measurement with an acceptable reference or true value. This is accomplished by comparing a measured value to an accepted reference value in a sample of known concentration or by determining the recovery of a known concentration spiked into a sample.

$\%R = \{100 (x_s - x_u) / K$
$\%R$ = percent recovery
$x_s$ = measured value for spiked sample
$x_u$ = measured value for unspiked sample
K = known value of the spike in the sample

LSD is responsible for establishing measurement criteria for accuracy of the analytical procedures used in projects where water quality data are collected. Data for these Quality Control procedures are obtained by analyses of replicate, split and spiked samples, and blanks.

### 5.1.3 COMPLETENESS

Completeness is the percentage of valid measurements or data points obtained, as a proportion of the number of measurements or data points planned for the project. Completeness is affected by such factors as sample bottle breakage and acceptance/non-acceptance of analytical results. A target of 90% completeness will be considered acceptable. To be considered complete, the data set must contain all Quality Control check analyses verifying precision and accuracy for the analytical protocol. Completeness is then determined by the following:

% Completeness = (Number of Valid Measurements / Total Number of Measurements Planned) x 100

## 6.0 FIELD EQUIPMENT

The following sections detail the field equipment that will be necessary to execute this SAP and calibration of equipment, as applicable, to ensure collection of defensible data.

### 6.1 EQUIPMENT LIST

The following field equipment is needed to complete the sampling and analysis program:

- Multi-parameter sonde and handheld device
- Calibration standards
- 47 mm filter holder
- 47 mm and 0.45 µM pore size cellulose acetate membrane filters
- 47 mm and #28 pore size glass fiber “roughing” pre-filters
- Sterile plastic syringe
- Disposable forceps
- Air pump with diffuser stone
- Calibration cups (“cal cups”)

- Latex or nitrile gloves
- Indelible markers or pencils
- De-ionized water (DI)
- Field notebooks or electronic forms stored on handhelds
- Chain-of-custody forms
- Coolers and ice preservative
- Bucket/rope

## 6.2 FIELD INSTRUMENT CALIBRATION

All monitoring equipment used in the field will be maintained according to the manufacturer's recommendations. The calibration frequency, procedures, and scheduled maintenance for field instruments are found in the Division's Standard Operating Procedures (SOP), and equipment instruction manuals. Meters should be calibrated before use each day, and per instructions in the operations manual. Division personnel using field instruments are expected to read and be thoroughly familiar with all procedures detailed in SOPs and instruction manuals for all field instruments.

These methods are aligned with the protocols detailed in the Division's *Standard Operating Procedures for Water Quality Monitoring Activities* (March 2010).

## 7.0 SURFACE WATER SAMPLE COLLECTION

Stream samples are collected as "grab" samples. The grab sample is collected by filling each sample bottle directly from the stream. Alternatively, a sampling container may be used to collect a large enough volume of the water to fill all sample bottles. The grab sample should be collected from the main channel thalweg (the line of fastest flow in the stream channel and often the deepest), just below the water surface. If stream conditions are unsafe for the sampler to wade into the thalweg, the grab sample may be made from the stream bank where active flow occurs or where stream flow is directed along the bank, or from a bridge using a rinsed bucket.

These methods are aligned with the protocols detailed in the Division's *Standard Operating Procedures for the Collection of Water Chemistry Samples* (April 2016).

Sediment samples will be collected in concert with water chemistry samples using protocols detailed in EPA's *Technical Standard Operating Procedure for Sediment Sampling* (April 2014)

## 7.1 SURFACE WATER FIELD MEASUREMENTS

Field measurements for pH, temperature, turbidity, and specific conductance will be made at the same time when water chemistry samples are collected. These measurements can be made *in situ* (directly from the stream), or from a discrete sample collected in a container (bucket). These measurements shall be recorded using the field

equipment identified in Section 6.1 of this SAP. The field measurements should follow the Division's *Standard Operating Procedures for the Collection of Water Chemistry Samples* (April 2016). Same day field measurements will be collected complimentary to the real-time field measurements captured by the fixed, continuous monitors at each USGS gage location.

## 8.0 SAMPLE CONTAINERS AND PRESERVATION

The Division's Environmental Data Unit collects routine stream water samples to be analyzed for nutrients, total recoverable and dissolved metals, neutrals (for parameters needing no preservative, or other special bottle prep) , and microbiological. Analytical panels are shown in Appendix C.

Routine, weekly grab or verification samples shall include dissolved metals (filtered), total metals, a 50 ml centrifuge BD bottle, and a sediment jar.

Private domestic well samples shall include a nutrient (acid preserved), a neutral (unpreserved, non-metal), dissolved metals (filtered), total metals, a 50 ml centrifuge BD bottle and an *E. coli* microbiological container.

Fish tissue samples will be placed in 50 ml centrifuge BD bottles at LSD.

1. Nutrient – 250 ml. Container identified as "Nutrient".

   Fill with grab sample. This bottle contains acid for preserving the sample and should be handled with care. Do not rinse, and do not over-fill. Leave approximately ½ inch headspace to allow for mixing and expansion.

2. Neutral – 250 ml. Container identified as "Neutral".

   Fill with grab sample. Rinse with sample source water three times before collecting sample.

3. Dissolved metals (filtered) - 250 ml. Container identified as "Filtered Metals".

   Metals bottles have been acid washed, and do not need to be rinsed with sample before filling. Samples are to be filtered through a 0.45 µM cellulose acetate filter. Pre-filters can be used. Filters and pre-filters will be wetted with D.I. water and the first 30-50 ml of sample filtered to waste before final sample is collected. Leave ½ inch headspace to allow for mixing and expansion.

4. Total Metals (unfiltered) – 250 ml. Container identified as "Metals"

This sample is a grab sample. Metals bottles have been acid washed, and do not need to be rinsed with sample before filling.

5. BD Centrifuge tube – 50 ml. Container identified as "BD Falcon".

   Fill with grab sample to ¾ mark. Rinse with sample source water three times before collecting sample. Sample is frozen upon receipt by LSD. This sample serves as a backup.

6. Sediment jar – 100 ml.

   This is a grab sample. Rinse jar with sample source water three times before collecting sample. Fill jar to ½ mark with stream sediment.

7. *E. coli* – 100 ml. Container identified as "Microbiological".

   These samples are grab samples. The microbiological sample bottles have been washed and sterilized, so no rinsing with sample is necessary. Fill the bottle to just below the shoulder to the "fill line".

Samples should be placed in a cooler and stored on ice immediately after collection for transport to LSD or other sub-contracted laboratories.

## 9.0 SAMPLE DOCUMENTATION AND HANDLING

The following sections describe the documentation of field activities and documentation and handling of samples detailed in the Division's *Standard Operating Procedures for Water Quality Monitoring Activities* (March 2010).

### 9.1 FIELD DOCUMENTATION

Field notebooks, including daily field forms and photographs will be used to document field activities.

#### 9.1.1 FIELD LOG NOTEBOOKS AND FIELD FORMS

All staff shall document all monitoring activities using standard field log notebooks, which contain pre-printed field forms on Rite-in-the-Rain waterproof paper. Each sampling event will have its own log entry, with all pertinent data requested on the field form provided. Each log entry will include at least the following; sample date and sample customer ID number, site number and description, sample collector's name, site latitude and longitude and associated GPS documenting data, start/sample/end times, how and where the sample was collected, whether samples were collected directly into the sample container or poured out of a bucket, all field measurements and how the

measurements were taken (e.g. directly out of the stream, out of a bucket), sample filtering information, observations and comments, and summary of QA activity, if any.

All documentation will be done at the time of sampling using the Division's preprinted and formatted "Monitoring Field Log" notebooks (see Appendix A). Only field team members may be in custody of the notebooks during field activities. Field log entries must be dated, legible, preferably made in black indelible ink, and contain accurate documentation. Corrections to erroneous data will be made by crossing through the entry and entering the correct information. The person making the correction must initial and date where the error occurred.

Optionally, staff may record all the same important "sampling metadata" on Microsoft Excel field forms that are only presently installed on Trimble Yuma 2 handhelds and will be available beginning July 1, 2015. The data will be downloaded upon completion of each field week. Corrections may be made to the downloaded files and will follow the same protocol as discussed above.

### 9.1.2 PHOTOGRAPHS

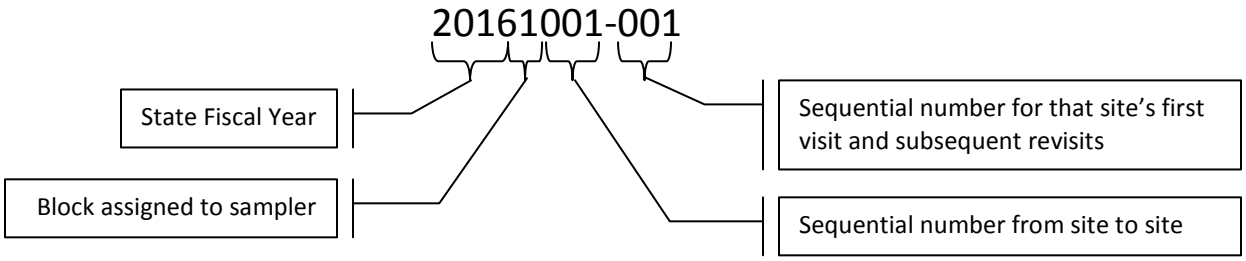
Photographs shall be taken at each new site and include an upstream, downstream and benchmark snapshot. Photographs shall be downloaded, re-titled to identify the station identification, waterbody and snapshot location (e.g. upstream); and stored in the Photos folder on the Division's common "Assessment" drive.

## 9.2 SAMPLE LABELING

Every sample will have a unique barcode identification number. Each sample shall have a barcode generated, printed on weatherproof address labels, and affixed to the exterior of each bottle set prior to a given sample trip. Each "set" shares the same barcode.

This unique barcode identification number is an eleven digit number that is bracketed by (*) asterisks. The * character is the start and stop reading character for the barcode reader. The first four numbers of the barcode are the four digit fiscal year. The fifth number denotes the block assigned to the sampler or specific program. For the duration of this project, the block assigned will be 9, which denotes a special study. The remaining six numbers in the bar code are sequential numbers based on sites and site revisits within the duration of this project. Each sampler shall be responsible for making sure that each number used in their block is unique. See example below for further details.

**Example:**




## 9.3 CHAIN OF CUSTODY

All samples will be submitted with a completed LSD "Request for Analytical Services" form for each sample set (see Appendix B). This form shall be considered the Division's official Chain-of-Custody. The form shall be completed per instructions for completing the form. All requested information shall be provided. Samples are to be immediately placed in a cooler, preserved with wet ice, and delivered to LSD or other sub-contracted laboratories. Sample holding times shall be accounted for when a schedule is projected, and samples delivered to meet all holding times. If samples will be delivered on a Friday, samples should be to the lab no later than 2 p.m. to ensure proper relinquishing of samples to laboratory staff.

The "Request for Analytical Services" form shall include an affixed unique barcode identification number, station identification, waterbody and description, date and time of sample collection, number and type of sample containers, sample media, analyses requested, sampler(s) name and affiliation, name and signature of relinquishing and receiving personnel, as well as the date and time of each custody transfer. The temperature shall be taken from a "temperature blank" within the cooler, or some other comparable means, and may be recorded on the form by Accessioning staff at LSD.

## 10.0 ANALYTICAL METHODS

Samples will be analyzed for the parameters and by the methods specified in Appendix C.

All methods of sample collection, preservation and analysis used in determining water quality will be in accordance with the test procedures identified in Section 31.16(2) of WQCC Regulation No. 31 *The Basic Standards and Methodologies for Surface Waters*.

## 11.0 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance is a set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality. This will

ensure that the accuracy of the data can be stated with a high level of confidence. Assuring the quality of surface water data is accomplished by following standard operating procedures (e.g. observing proper sample collection techniques, proper maintenance and calibration of field meters), collecting QC samples, reviewing and analyzing QA/QC data, and making appropriate adjustments to surface water quality data collection procedures on the basis of the results of QA/QC procedures.

QA/QC procedures for the Division may be divided into three categories:

- Field procedures quality control
- Data quality control
- Laboratory quality control

## 11.1 FIELD QUALITY CONTROL

Standard operating procedures will be utilized as a primary tool to ensure field procedure quality control (See Appendix D for a list of SOPs). Staff performing field activities for the Program will receive the training necessary to ensure that all SOPs are fully and properly used when completing field-monitoring activity. Each project-specific SAP will describe and or reference all specific quality assurance/quality control methods to be followed. At a minimum, the following water chemistry quality control samples will be taken:

- Field duplicates
- Field blanks (also referred to as “Trip blanks”)

### 11.1.1 FIELD DUPLICATES

Field duplicates will be field sample replicates and will be used to determine field precision. Duplicate samples, including duplicate field measurements, are a set of similar samples collected from the same site, at about the same time, and analyzed in the same manner. Duplicate samples may be equated to “fraternal twins” in that they originate from one source but each sample may contain a slightly different chemical composition. Duplicate sample results must be compared to assure reasonable agreement. In general, the acceptable results from duplicates are a 10% difference for cations, anions, and nutrients. For total and dissolved metals, particularly when concentrations are near detection levels, a difference of 10% to 50% may be allowed, based on best professional judgment by the Division’s QA/QC Officer identified in Section 13.0 of this SAP.

Duplicate samples shall be taken and analyzed from a minimum of 10% of the total number of samples collected during the implementation of this SAP.

### 11.1.2 FIELD BLANKS

Field blanks help to ensure that sampling equipment, sampling containers, and de-ionized rinse water is effectively cleaned and/or free from contaminants that may be introduced into a sample via the equipment or rinse water. Field or Trip blanks, also referred to as equipment blanks, are blank solutions (solutions of DI water) that are processed through the equipment used for collecting and processing an environmental sample. Four types of surface water quality sampling equipment have blank samples taken from them:

- DI water container
- Sample container
- Filter apparatus
- Sample collection device (bucket)

All results from equipment blank samples shall be at or near the minimum reporting level (or non-detect level). Any detection of contaminants in equipment blanks shall be addressed by the Division's QA/QC Officer and may entail modified cleaning or decontamination procedures.

Field blanks shall be collected one per "sample trip" or one per week if you are out for entire week or several days at a time.

## 11.2 DATA QUALITY CONTROL

Data quality control procedures and measures are grouped into four categories to be reviewed:

- Steps for measuring compliance with WQCD procedures
- LSD issues
- Bias and errors
- Additional considerations

Due to the length and complexity of this section, reference may be made to the Division's *Quality Assurance Project Plan for Surface Water Monitoring and Assessment* (May 2015), which is on file with the Project Coordinator listed in Section 4.1 of this SAP. All QC data will be reviewed following completion of this SAP. If all data-acceptance criteria in the SAP are met, then the analytical data are acceptable.

## 11.3 LABORATORY QUALITY CONTROL

The Division will utilize LSD as the primary source of analytical services for water and sediment samples during the implementation of this SAP. The following items will be reviewed, at a minimum, to verify laboratory QA/QC:

- Verifying QA/QC with LSD personnel
- Method Detection Limits and Reporting Limits
- PQL issues
- Duplicates and blanks
- Contamination issues
- Post-sample submittal preservation

If analytical services are provided by a laboratory other than LSD, the same steps will be taken, as outlined above, to verify acceptable laboratory quality control.

## 12.0 DATABASE MANAGEMENT

The Division's Project Leader listed under Section 4.1 will be responsible for accumulating all relevant laboratory and field data and tracking completion of all samples collected under this SAP.

The Division uses EQuIS[2] ("Environmental Quality Information System") as the primary database for water quality data. Data management objectives and data quality objectives are discussed in the Division's QMP and program or project specific QAPPs and other SAPs.

Water chemistry samples are collected along with field data and visual observations per instructions in Sections 7.1 and 9.1, respectively. Field measurements are recorded by a YSI EXO Handheld reader or Trimble Yuma 2 handheld and downloaded to a desktop PC upon completion of the sample trip.

Sample sets are delivered to LSD for laboratory analysis. When samples are collected in remote locations, occasionally microbiological samples are delivered to sub-contracted laboratories to facilitate quicker analysis. Field data and observations are downloaded into an Excel® spreadsheet by the individual field technicians. The LSD returns chemical data via monthly Excel® spreadsheets known collectively as "laboratory extracts" or may be obtained later through a CDPHE SQL[3] based server known as the Integrated Data Report (IDR). These data as well as off-site microbiological data are returned in an electronic format to the Division's Environmental Data Unit.

Field data and observations along with microbiological data received from off-site laboratories are transferred into a format to be joined with the water chemistry data by the EQUIS database manager and support staff. Field, chemistry, and microbiological data coalesce and are analyzed for quality control before data is uploaded to EPA's WQX. Once in the WQX, the data will be available to all interested parties through the EPA's Water Quality Warehouse STORET.

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[2] Developed by Earthsoft

[3] A special-purpose programming language designed for managing data held in a relational database management system

## 13.0 PERSONNEL

The following key personnel from the Division and SJBHD will complete the tasks described in this SAP:

Chris Theel (WQCD Denver office)
Jean Aldrich (WQCD Denver office)
Adam Taubman (WQCD Denver office)
Lorie Petersen (WQCD Denver office)
Arne Sjodin (WQCD Denver office)
Brian Devine (San Juan Basin Health Department)

Other Division or SJBDH staff not listed above may occasionally participate in field activities or database management on an as-needed basis.

## 14.0 SCHEDULE

The tentative schedule listed in Appendix D is developed for this SAP and shall be implemented between April 1, 2016 and mid-July of 2017. A map illustrating the statewide distribution of these scheduled sites may be found in Appendix E.

## 15.0 REFERENCES

*Quality Assurance Project Plan for Surface Water Monitoring and Assessment.* Colorado Department of Public Health and Environment, Water Quality Control Division. May 2015.

*Quality Management Plan for the Collection and Utilization of Environmental Data*. Colorado Department of Public Health and Environment, Water Quality Control Division. March 2011.

*Standard Operating Procedures for the Collection of Water Chemistry Samples* Colorado Department of Public Health and Environment, Water Quality Control Division. April 2016.

*Standard Operating Procedures for Water Quality Monitoring Activities*. Colorado Department of Public Health and Environment, Water Quality Control Division. March 2010.

*Technical Standard Operating Procedure. Sediment Sampling Methods.* SOP No. FLDM-104 Revision 1.0. U.S. Environmental Protection Agency, Region 8 Laboratory. April 2014.

*The Basic Standards and Methodologies for Surface Waters, Regulation No. 31* (5CCR1002-31). Colorado Department of Public Health and Environment, Water Quality Control Commission. December 2010.

## 16.0 APPROVAL

Nicole Rowan
Clean Water Program Manager

10-17-16
Date

Aimee Konowal
Watershed Section Manager

10-18-16
Date

Chris Theel
Monitoring and Data Work Group Lead and QA/QC Officer

10-12-2016
Date

## APPENDIX A – FIELD FORM

# Upper Animas River Basin Post-Spill Response - Field Form

COLORADO Department of Public Health & Environment
4300 Cherry Creek Drive South
Denver, Colorado 80246

SAN • JUAN • BASIN HEALTH DEPARTMENT
281 Sawyer Drive
Durango, Colorado 81303

Sample barcode here

### Station Information

Station: ☐ CEM49 ☐ 82 ☐ 81 ☐ 9423A
Station or DW Identifier: _____
Stream or Well Name: _____
Description: _____
Latitude: _____ (dd.ddd)
Longitude: _____ (-dd.ddd)
GPS Datum: ☐ NAD83 ☐ NAD27 ☐ WGS84

### Sample (Grab) Collection Information

Sampling Location: ☐ Bridge ☐ Instream ☐ Other
Instream Location: ☐ Left bank ☐ Right bank ☐ Thalweg ☐ Other
Collection Methods: ☐ Bridge w/ bucket ☐ Instream direct ☐ Instream w/ bucket
Filtering Equipment: ☐ GeoTech Pump ☐ Syringe ☐ Other
Filtering Holder: ☐ 142 mm GeoTech ☐ 47 mm Swinnex ☐ Other
Filter Paper Type: ☐ 142 mm GeoTech ☐ 47 mm Swinnex ☐ Other
Filtering Method: ☐ Bucket ☐ Instream direct ☐ Sample container
Filter Count (used): _____

### QA/QC

QA/QC Collected: ☐ Duplicate ☐ Blank (affix QC barcodes to form)
Deionized Water Source: ☐ LSD ☐ San Juan Basin Health ☐ Other
Deionized Water Date: M M - D D - Y Y

### Bottles and Preservation

Preservation: ☐ Chemical ☐ Ice ☐ Other _____
Chemistry Recv Lab: ☐ LSD ☐ San Juan Basin Health ☐ Other
Microbiological Recv Lab: ☐ LSD ☐ San Juan Basin Health ☐ Other

Test Panel(s):
☐ **Surface Water and Sediment Package**
☐ 250 ml metals ☐ 250 ml filtered metals
☐ 120 ml (4 oz.) sediment ☐ 50 ml BD tube
☐ **Drinking Water Well Package**
☐ 250 ml metals ☐ 250 ml filtered metals
☐ 250 ml nutrients ☐ 250 ml neutrals
☐ 100 ml *E coli* ☐ 50 ml BD tube

### Other Field Activity

☐ Macroinvertebrates ☐ Periphyton ☐ Pebble Counts
☐ Habitat ☐ Discharge/Flow

### Sample Information

Sample Date: M M - D D - Y Y
Sample Time: _____ : _____ ☐ a.m. ☐ p.m.
Samplers Initials: _____
Sample(s) Collected: ☐ Surface Water ☐ Sediment ☐ Drinking Water Well ☐ Other _____
Sample Type: ☐ Routine ☐ Verification ☐ Other emergency

### Field Measurements

Instrument Used: ☐ YSI ☐ In-Situ ☐ Other
Calibration (on site): ☐ Yes ☐ No
Measure Method: ☐ Bridge w/ bucket ☐ Instream ☐ Instream w/ bucket
Stream Temp: _____ °C
Spec. Conductance: _____ uS/cm
pH: _____ su @
Diss. Oxygen: _____ mg/l
Air Temp: _____ °C
Field Comments: _____

Duplicate barcode here

Blank barcode here

Form Version 1.0 - 04/07/2016

## APPENDIX B – REQUEST FOR ANALYTICAL SERVICES FORMS

Laboratory Services Division
8100 Lowry Boulevard, Denver, CO 80230-6928
Phone: (303) 692-3090
Fax (303) 344-9989

Sample barcode here

### REQUEST FOR ANALYTICAL SERVICES

Note: This form to be used from 7/1/15-6/30/16

**CUSTOMER**

Customer ID: 00000372
Name: CDPHE – WQCD – [Unit name here]

Address: 4300 Cherry Creek Drive South
City/State/Zip: Denver, CO 80246
Contact Name: [your name here]
Contact Phone: [your phone # here]
Contact Email: [your email address here]

**SPECIMEN INFORMATION**

Collected: ☐☐-☐☐-☐☐ M-D-Y
Military Time: ☐☐ ☐☐ ☐ a.m. ☐ p.m.
Collected by: ☐
Matrix: ☐

**SAMPLE SITE**

Station ID: ☐
Stream Name: _____
Description: _____
☐ Check if new station

**BOTTLE INFORMATION**

Check each box that applies

| BOTTLE | M | FM | Neut | Nut | TN* | MOC | SVOC | EC | SiO | HG | Number |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 250 ml | ☐ | ☐ | ☐ | ☐ | | | | | | | |
| 500 ml | ☐ | ☐ | ☐ | ☐ | | | | | | ☐ | ☐ |
| 125 ml | ☐ | ☐ | ☐ | ☐ | ☐ | | | | | | |
| 50 ml BD | ☐ | ☐ | ☐ | ☐ | | ☐ | | | ☐ | | |
| 1 Liter Amber | ☐ | ☐ | ☐ | ☐ | | | ☐ | | | | |
| Micro | ☐ | ☐ | ☐ | ☐ | | | | ☐ | | | |
| Other | _____ | | | | | | | | | | _____ |

**TEST ORDER** (Check appropriate box)

**METALS**

| TRC | DISS | TOTAL | |
|---|---|---|---|
| ☐ | ☐ | ☐ | Aluminum |
| ☐ | ☐ | ☐ | Antimony |
| ☐ | ☐ | ☐ | Arsenic |
| ☐ | ☐ | ☐ | Cadmium |
| ☐ | ☐ | ☐ | Chromium |
| ☐ | ☐ | ☐ | Copper |
| | ☐ | | Hardness, Total |
| ☐ | ☐ | ☐ | Iron |
| ☐ | ☐ | ☐ | Lead |
| ☐ | ☐ | ☐ | Magnesium |
| ☐ | ☐ | ☐ | Manganese |
| | ☐ | ☐ | Mercury |
| ☐ | ☐ | ☐ | Nickel |
| ☐ | ☐ | ☐ | Potassium |
| ☐ | ☐ | ☐ | Selenium |
| ☐ | ☐ | ☐ | Silver |
| ☐ | ☐ | ☐ | Uranium |
| ☐ | ☐ | ☐ | Zinc |

**NUTRIENTS**

- ☐ Nitrate/Nitrite
- ☐ Nitrogen, Ammonia
- ☐ Nitrogen, Kjeldahl
- ☐ Nitrogen, Total
- ☐ Phosphorus, Total

**NEUTRALS**

- ☐ Alkalinity, Total
- ☐ BOD/COD (wwtp)
- ☐ Chloride
- ☐ Conductivity
- ☐ Fluoride
- ☐ Nitriteor Nitrate (wwtp)
- ☐ Phosphate, Ortho
- ☐ Solids, Dissolved
- ☐ Solids, Total Suspended
- ☐ Solids, Total
- ☐ Sulfate
- ☐ _____

**OTHER**

- ☐ DOC
- ☐ TOC
- ☐ Cyanide, Direct
- ☐ Sulfide
- ☐ UV @ 254
- ☐ Nonylphenol
- ☐ _____

**RADIOCHEMISTRY**

- ☐ Radium 226
- ☐ Radium 228
- ☐ _____

**MICROBIOLOGY**

- ☐ Total Coliform, PA
- ☐ Fecal Coliform, MT
- ☐ E. coli, MPN
- ☐ _____

☒

**TEST PANELS**

- ☐ WQCD Routine Panel
- ☐ WQCD Trend Panel
- ☐ CPW Panel
- ☐ WQCD - Mine Impact Surface Water Pkg*
- ☐ WQCD - Mine Impact Sediment Pkg*
- ☐ WQCD - Mine Impact DW Wells Pkg*
- ☐ WQCD - Mine Impact Fish Pkg*
- ☐ Mining - Metals & Minerals
- ☐ Mining - Nutrients
- ☐ Additional Parameters

**DEPOSITION** — **CHAIN OF CUSTODY**

| RELINQUISHED BY: | DATE/TIME: | RECV BY: | DATE/TIME: |
|---|---|---|---|
| RELINQUISHED BY: | DATE/TIME: | RECV BY: | DATE/TIME: |
| RELINQUISHED BY: | DATE/TIME: | RECV BY: | DATE/TIME: |

TEMPERATURE AT RECEIPT: * C

LSD Internet Address: http://www.cdphe.state.co.us/lr/ Form #251 - Revised: 03/16/2016

## APPENDIX C – PARAMETERS, METHODS, HOLDING TIMES AND UNITS

| Analysis | Methodology | Holding Time | Turn-Around | Units |
|---|---|---|---|---|
| **METALS PANEL:** | | | | |
| ALUMINUM | EPA 200.7 | 6 MONTHS | 30 DAY | ug/L |
| ARSENIC | EPA 200.8 | 6 MONTHS | 30 DAY | ug/L |
| CADMIUM | EPA 200.8 | 6 MONTHS | 30 DAY | ug/L |
| COBALT | EPA 200.7 | 6 MONTHS | 30 DAY | ug/L |
| COPPER | EPA 200.7 | 6 MONTHS | 30 DAY | ug/L |
| IRON | EPA 200.7 | 6 MONTHS | 30 DAY | ug/L |
| LEAD | EPA 200.8 | 6 MONTHS | 30 DAY | ug/L |
| MANGANESE | EPA 200.8 | 6 MONTHS | 30 DAY | ug/L |
| NICKEL | EPA 200.7 | 6 MONTHS | 30 DAY | ug/L |
| SELENIUM | EPA 200.8 | 6 MONTHS | 30 DAY | ug/L |
| URANIUM | EPA 200.8 | 6 MONTHS | 30 DAY | ug/L |
| ZINC | EPA 200.7 | 6 MONTHS | 30 DAY | ug/L |
| **NUTRIENTS:** | | | | |
| N-NITRATE/NITRITE | EPA 353.2 | 28 DAYS | 30 DAY | mg/L |
| **FISH TISSUE:** | | | | |
| MERCURY IN FISH | EPA 7473 | IF FROZEN, UNLIMITED | 30 DAY | mg/kg |
| **OTHER:** | | | | |
| HARDNESS, TOTAL | CALCULATION | 6 MONTHS | 30 DAY | mg/L |
| CHLORIDE | EPA 300.0 | 28 DAYS | 30 DAY | mg/L |
| FLUORIDE | EPA 300.0 | 28 DAYS | 30 DAY | mg/L |
| E. COLI | STD METHODS (IDEXX MPN) | 8 HRS | 30 DAY | PER 100 ML |

Metals are both dissolved and total unless otherwise noted

Laboratory Services Division analytical panels are shown below. *E. coli* will be analyzed at San Juan Basin Health Department.

**Routine Panel (Tot & Diss.)**

| Form | Parameters |
|---|---|
| Inorganic Chemistry | Aluminum |
| Inorganic Chemistry | Arsenic |
| Inorganic Chemistry | Cadmium |
| Inorganic Chemistry | Cobalt |
| Inorganic Chemistry | Copper |
| Inorganic Chemistry | Iron |
| Inorganic Chemistry | Lead |
| Inorganic Chemistry | Manganese |
| Inorganic Chemistry | Nickel |
| Inorganic Chemistry | Selenium |
| Inorganic Chemistry | Uranium |
| Inorganic Chemistry | Zinc |

**Sediment Panel (Total only)**

| Form | Parameters |
|---|---|
| Inorganic Chemistry | Aluminum |
| Inorganic Chemistry | Arsenic |
| Inorganic Chemistry | Cadmium |
| Inorganic Chemistry | Cobalt |
| Inorganic Chemistry | Copper |
| Inorganic Chemistry | Iron |
| Inorganic Chemistry | Lead |
| Inorganic Chemistry | Manganese |
| Inorganic Chemistry | Nickel |
| Inorganic Chemistry | Selenium |
| Inorganic Chemistry | Uranium |
| Inorganic Chemistry | Zinc |

**Drinking Water Panel (Tot & Diss.)**

| Form | Parameters |
|---|---|
| Inorganic Chemistry | Aluminum |
| Inorganic Chemistry | Arsenic |
| Inorganic Chemistry | Cadmium |
| Inorganic Chemistry | Cobalt |
| Inorganic Chemistry | Copper |
| Inorganic Chemistry | Iron |
| Inorganic Chemistry | Lead |
| Inorganic Chemistry | Manganese |
| Inorganic Chemistry | Nickel |
| Inorganic Chemistry | Selenium |
| Inorganic Chemistry | Uranium |
| Inorganic Chemistry | Zinc |
| Inorganic Chemistry | Nitrate/Nitrite |
| Inorganic Chemistry | Fluoride |
| Inorganic Chemistry | Chloride |
| Inorganic Chemistry | Hardness |
| Microbiological* | *E. coli* |

**Fish Tissue (Total only)**

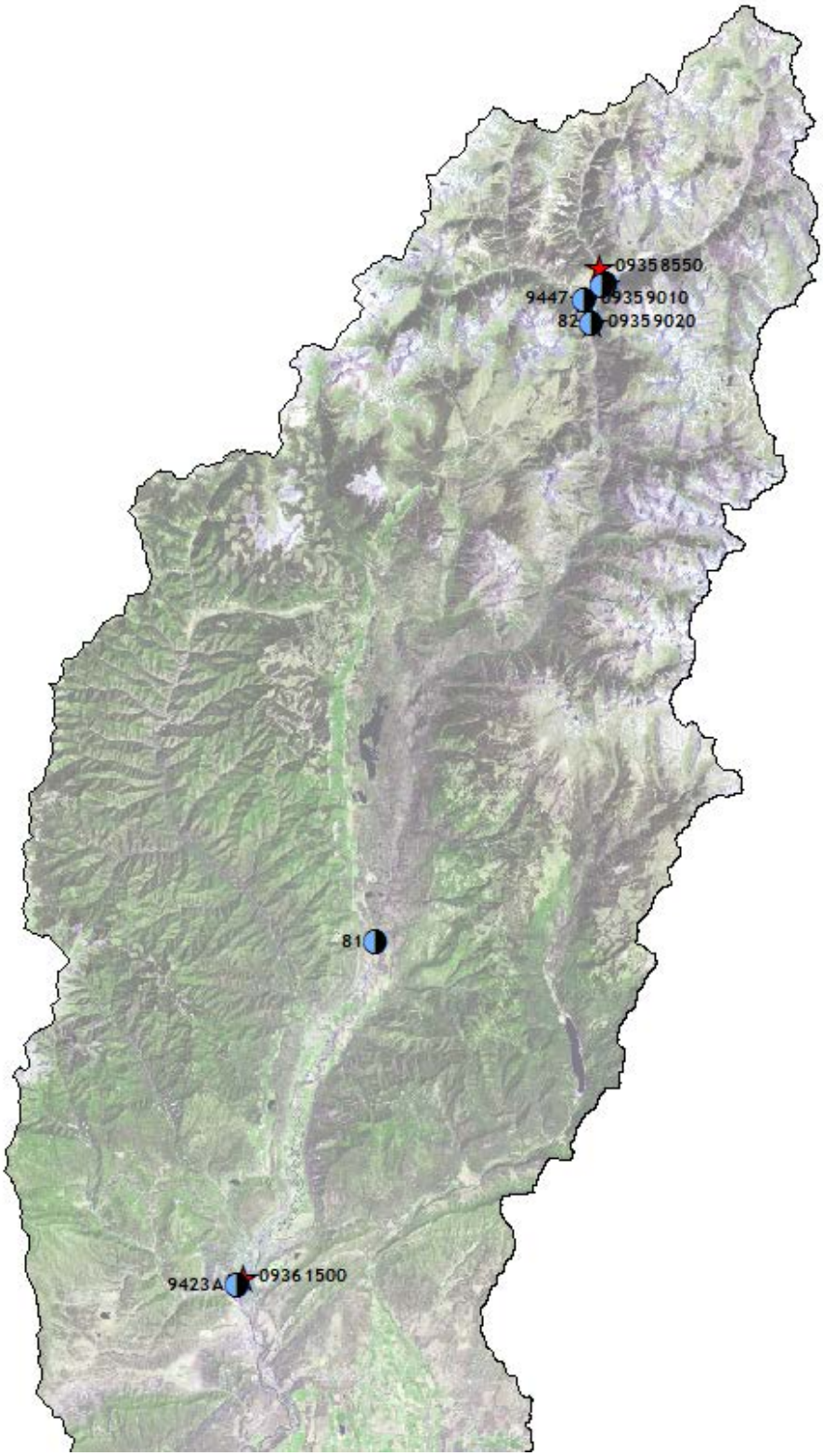
| Form | Parameters |
|---|---|
| Inorganic Chemistry | Aluminum |
| Inorganic Chemistry | Arsenic |
| Inorganic Chemistry | Cadmium |
| Inorganic Chemistry | Cobalt |
| Inorganic Chemistry | Copper |
| Inorganic Chemistry | Iron |
| Inorganic Chemistry | Lead |
| Inorganic Chemistry | Manganese |
| Inorganic Chemistry | Nickel |
| Inorganic Chemistry | Selenium |
| Inorganic Chemistry | Uranium |
| Inorganic Chemistry | Zinc |
| Inorganic Chemistry | Mercury - Fish |

## APPENDIX D – SCHEDULE (MONITORING PLAN)

| Station ID | Waterbody and Description | Sampling Period | Routine Visits | Verification Visits | Latitude | Longitude |
|---|---|---|---|---|---|---|
| **2016 SPRING RUNOFF (WEEKLY)** | | | | | | |
| CEM49 | CEMENT CREEK AT MOUTH | Apr-Jul 2016 | 15 | 20 | 37.81000 | -107.66056 |
| 82 | ANIMAS RIVER NEAR SILVERTON | Apr-Jul 2016 | 15 | | 37.7902 | -107.6676 |
| 81 | ANIMAS RIVER ABOVE DURANGO (BAKERS BRIDGE) | Apr-Jul 2016 | 15 | | 37.45871 | -107.79915 |
| 9423A | ANIMAS RIVER AT DURANGO - 9TH ST BRIDGE | Apr-Jul 2016 | 15 | | 37.27456 | -107.88427 |
| **2016-17 BASE FLOW (EVERY OTHER MONTH)** | | | | | | |
| 9488 | ANIMAS RIVER ABOVE CEMENT CREEK | Oct '16-Feb '17 | 3 | 10 | 37.81116 | -107.659 |
| CEM49 | CEMENT CREEK AT MOUTH | Aug '16-Feb '17 | 4 | | 37.81000 | -107.66056 |
| 9447 | MINERAL CREEK ABOVE ANIMAS RIVER | Oct '16-Feb '17 | 3 | | 37.80282 | -107.673 |
| 82 | ANIMAS RIVER NEAR SILVERTON | Aug '16-Feb '17 | 4 | | 37.7902 | -107.6676 |
| 81 | ANIMAS RIVER ABOVE DURANGO (BAKERS BRIDGE) | Aug '16-Feb '17 | 4 | | 37.45871 | -107.79915 |
| 9423A | ANIMAS RIVER AT DURANGO - 9TH ST BRIDGE | Aug '16-Feb '17 | 4 | | 37.27456 | -107.88427 |
| **2017 SPRING RUNOFF (WEEKLY)** | | | | | | |
| 9488 | ANIMAS RIVER ABOVE CEMENT CREEK | Apr-Jul 2017 | 13 | 20 | 37.81116 | -107.659 |
| CEM49 | CEMENT CREEK AT MOUTH | Apr-Jul 2017 | 15 | | 37.81000 | -107.66056 |
| 9447 | MINERAL CREEK ABOVE ANIMAS RIVER | Apr-Jul 2017 | 13 | | 37.80282 | -107.673 |
| 82 | ANIMAS RIVER NEAR SILVERTON | Apr-Jul 2017 | 15 | | 37.7902 | -107.6676 |
| 81 | ANIMAS RIVER ABOVE DURANGO (BAKERS BRIDGE) | Apr-Jul 2017 | 15 | | 37.45871 | -107.79915 |
| 9423A | ANIMAS RIVER AT DURANGO - 9TH ST BRIDGE | Apr-Jul 2017 | 15 | | 37.27456 | -107.88427 |

The following table demonstrates which WQCD stations correspond with USGS gaging stations. A map showing exact locations of each site is shown in Appendix E.

| Station ID | Waterbody and Description | USGS Station ID | USGS Waterbody Description |
|---|---|---|---|
| 9488 | ANIMAS RIVER ABOVE CEMENT CREEK | 09358000 | ANIMAS RIVER AT SILVERTON, CO |
| CEM49 | CEMENT CREEK AT MOUTH | 09358550 | CEMENT CREEK AT SILVERTON, CO |
| 9447 | MINERAL CREEK ABOVE ANIMAS RIVER | 09359010 | MINERAL CREEK AT SILVERTON, CO |
| 82 | ANIMAS RIVER NEAR SILVERTON | 09359020 | ANIMAS RIVER BELOW SILVERTON, CO |
| 81 | ANIMAS RIVER ABOVE DURANGO (BAKERS BRIDGE) | | |
| 9423A | ANIMAS RIVER AT DURANGO - 9TH ST BRIDGE | 09361500 | ANIMAS RIVER AT DURANGO, CO |

Point of entry locations at private domestic water systems will be sampled, as necessary, during the term of monitoring expected to occur. Exact locations will be determined by SJBHD.

## APPENDIX E – MAP OF SCHEDULED SITES ON CEMENT CREEK, MINERAL CREEK, AND ANIMAS RIVER