

Quality Assurance Project Plan

Fourth Screening Investigation of Water and Sediment Quality in Creeks from Selected Washington Mining Districts

by
Robert L. Raforth

Washington State Department of Ecology
Water Quality Program
Central Regional Office
Yakima, Washington

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October 2005

303(d) listings addressed in this study: None

EIM User Study ID: MinesIV

Approvals

Approved by: _____ Tom Tebb, Section Manager, WQP, Central Regional Office	October 6, 2005 _____ Date
Approved by: _____ Bob Raforth, Project Lead, WQP, Central Regional Office	October 6, 2005 _____ Date
Approved by: _____ Rick Frye, Unit Supervisor, WQP, Central Regional Office	October 6, 2005 _____ Date
Approved by: _____ Stuart Magoon, Director, Manchester Environmental Laboratory	October 14, 2005 _____ Date
Approved by: _____ Pat Brommer, WQP, Assurance Coordinator	October 19, 2005 _____ Date

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Abstract

This screening-level study is designed to characterize water quality and sediments in streams near selected inactive or abandoned metals mines or mining districts. Drainage from a few selected mines may also be opportunistically sampled to compare to the adjacent stream chemistry. The study will be conducted by staff from the state Department of Ecology's Water Quality Program and the state Department of Natural Resource's Division of Geology and Earth Resources. This study is similar in design to previous studies conducted in 1997, 2000, and 2004.

Candidate mining districts were identified based on information in a database of inactive and abandoned mines created by the Department of Natural Resources and now administered by the Department of Ecology. Sample sites were selected based on the size of the mines or dominant mine in the district, variations in geologic host rock among districts, occurrence of tailings in or adjacent to a stream, and the primary and secondary minerals in the ore deposit.

The water quality emphasis for this study is the EPA ultra-clean sampling and low-level analysis methods for metals in surface water. General chemistry and field parameters will be obtained concurrently with the water and sediment samples. Water and sediment samples will be collected upstream and downstream of each mining district during the fall of 2005 to characterize low-flow conditions, and water samples will be collected during the spring of 2006 to characterize high-flow conditions. Results will be compared upstream to downstream, seasonally, and to state surface water quality standards and sediment quality guidelines.

Background

According to the Washington State Department of Natural Resources (DNR), there are nearly 4,000 inactive and abandoned metals mines in Washington State (Wolff et al., 2001). Discharges of water and sediment contaminated with metals from mine adits, waste rock, and tailings piles have adversely impacted streams and rivers that drain metals mining districts. The purpose of this study is to conduct screening-level sampling of water in streams in the vicinity of selected inactive or abandoned metals mines or mining districts. Drainage from a few selected mines may also be sampled to compare to the adjacent stream chemistry.

This project is an extension of three similar studies jointly conducted by staff from the Washington State Department of Ecology (Ecology) Central Regional Office (CRO) Water Quality Program (WQP), Ecology's Environmental Assessment Program, and DNR's Geology Division (Raforth et al., 2000; 2002; 2004). The previous studies identified sites that exceeded water quality standards and/or sediment quality guidelines and merit follow-up work.

Project Description

The results obtained from this study will help characterize mining districts, or parts of districts, not previously investigated using the ultra-clean sampling procedure for metals. Ten mining districts have been selected for study through review of information available in a database of inactive or abandoned mines prepared by DNR, as well as consultation with DNR staff (Table 1). Some of the selected sites may not be accessible for various reasons. Therefore, a few alternate sites will be selected as substitutes. Districts were selected primarily based on the size of the mines or dominant mine in the district (Figure 1). Consideration was also given to variations in geologic host rock among districts, presence of tailings in or adjacent to a drainage, and the primary and secondary minerals in the ore deposit.

Table 1. Sampling Locations

Mining District	Map ID	County
Northport	1	Stevens
Deep Creek	2	Stevens
Chewelah	3	Stevens
Lone Star	4	Stevens
Loon Lake	5	Stevens
Van Stone	6	Stevens
Kettle Falls	7	Stevens
Entiat	8	Chelan
Myers Creek	9	Okanogan
Squaw Creek	10	Okanogan

Sampling will be conducted upstream and downstream at each mining district during low flow in the fall of 2005 and high flow during the spring of 2006. Up to five individual mines that drain to surface water may be sampled to compare to stream water quality. Water quality results will be compared to state water quality standards for aquatic life (Chapter 173-201A WAC) and EPA national water quality criteria (EPA, 2002). Sediment quality results will be compared to guidelines for freshwater sediments (Michelson, 2003). This study will implement sampling recommendations from the previous work, including seasonality investigations and fingerprinting mine impacts through the use of the ratio of sulfate to total dissolved solids.

The emphasis for this study will be on the use of the EPA (1995) ultra-clean sampling procedure for metals in surface water. Metals to be analyzed in water are arsenic, cadmium, copper, lead, zinc, aluminum, iron, and mercury. General chemistry analyses for surface water samples will include hardness, sulfate, total suspended solids (TSS), total dissolved solids (TDS), and turbidity. Temperature, pH, and conductivity will be measured for each sampling event. Upstream and downstream sediment quality will be evaluated from samples obtained during the low-flow sampling. These samples will be analyzed for EPA priority pollutant metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, and Zn), iron, manganese, and aluminum. Fine-grained material will be preferentially sampled.

Organization and Schedule

Project Lead - Bob Raforth (509-457-7113)

Technical Assistance - Art Johnson (360-407-6766)

DNR Cooperator - Dave Norman (360-902-1439)

CRO Technical Unit Supervisor - Rick Frye (509-575-2821)

CRO WQP Section Manager - Tom Tebb (509-457-7107)

October 2005	Fall Sample Collection
April - May 2006	Spring Sample Collection
August 2006	Sample Analyses Completed and Data Reported
December 2006	Draft Project Report
March 2007	Final Project Report
March 2007	Data Entered Into the EIM Database

Quality Objectives

Table 2 shows the Washington State water quality standards and EPA national criteria for comparison to the metals data. The hardness-dependent standards for dissolved cadmium, copper, lead, and zinc are the lowest that might reasonably be encountered, based on results from previous studies (Raforth et al., 2000; 2002; 2004). Results from the temperature, pH, and turbidity measurements will also be compared to state standards (Table 3). Results from sediment sampling will be compared to recommended sediment quality guidelines (Michelson, 2003).

Table 2. Applicable Water Quality Standards and Criteria for Metals [dissolved standards calculated for a hardness of 10 mg/L]

Metal	Acute (ug/L)	Chronic (ug/L)
Washington State Surface Water Standards (Chapter 173-201A WAC)		
Arsenic - dissolved	360	190
Zinc - dissolved	16	15
Lead - dissolved	4.9	0.19
Copper - dissolved	1.9	1.6
Cadmium - dissolved	0.3	0.19
Mercury - total	no standard	0.012
Mercury - dissolved	2.1	no standard
EPA (1999) National Criteria		
Iron - total recoverable	no criterion	1,000
Aluminum - total recoverable*	750	

*at pH of 6.5 - 9.0

The state standards do not address TSS, except indirectly by way of the turbidity standard. The National Academy of Sciences (1973) considers the level of protection afforded aquatic communities to vary with TSS as follows:

- <25 mg/L - high
- 25 to 80 mg/L - moderate
- 80 to 400 mg/L - low
- >400 mg/L - very low

Table 3. Applicable State Water Quality Standards for Temperature, pH, and Turbidity (Chapter 173-201A WAC)

Parameter	Class AA (Extraordinary)	Class A (Excellent)
Temperature	Shall not exceed 16.0°C due to human activities. When natural conditions exceed 18°C, no temperature increase caused by human actions will be allowed which will raise the receiving water temperature by greater than 0.3°C.	Shall not exceed 18.0°C due to human activities. When natural conditions exceed 18.0°C, no temperature increase caused by human actions will be allowed which will raise the receiving water temperature by greater than 0.3°C.
pH	Shall be within the range of 6.5 - 8.5 with a human caused variation within the above range of less than 0.2 units	Shall be within the range of 6.5 - 8.5 with a human caused variation within the above range of less than 0.5 units
Turbidity	Shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.	Shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

EPA has classified impairment of aquatic habitats or organisms due to TSS as follows (Mills et al., 1985):

TSS Concentration	Aquatic Community Impairment
< 10 mg/L	Improbable
10 – 100 mg/L	Potential
> 100 mg/L	Probable

TSS - total suspended solids

Tables 4 (water) and 5 (sediment) list project targets for accuracy, precision, bias, and lowest concentrations of interest. Sources of error from sampling collection, transportation, and storage will be minimized by adherence to (1) EPA Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* (EPA, 1995) for water, and (2) Puget Sound Estuary Program Protocols (EPA, 1996) for sediment, and (3) Ecology Sediment Management Standards (Ecology, 1995a,b) for sediment.

Table 4. Measurement Quality Objectives - Water

Parameter	Accuracy (% deviation from true value)	Precision (RSD)	Bias (% of true value)	Required Reporting Limit
Aluminum	30%	10%	10%	20 ug/L
Iron	30%	10%	10%	50 ug/L
Arsenic	30%	10%	10%	0.1 ug/L
Zinc	30%	10%	10%	1 ug/L
Lead	30%	10%	10%	0.02 ug/L
Copper	30%	10%	10%	0.1 ug/L
Cadmium	30%	10%	10%	0.02 ug/L
Mercury	30%	10%	10%	0.002 ug/L
Hardness	15%	5%	5%	1 mg/L
TSS	15%	5%	5%	4 mg/L
TDS	15%	5%	5%	10 mg/L
Sulfate	15%	5%	5%	1 mg/L
Turbidity	15%	5%	5%	0.5 NTU

RSD – relative standard deviation

Table 5. Measurement Quality Objectives - Sediment

Parameter	Accuracy (% deviation from true value)	Precision (RSD)	Bias (% of true value)	Required Reporting Limit
Iron	50%	20%	10%	5 mg/Kg
Aluminum	50%	20%	10%	5 mg/Kg
Manganese	50%	20%	10%	5 mg/Kg
Zinc	50%	20%	10%	5 mg/Kg
Lead	50%	20%	10%	5 mg/Kg
Copper	50%	20%	10%	1 mg/Kg
Chromium	50%	20%	10%	1 mg/Kg
Nickel	50%	20%	10%	1 mg/Kg
Cadmium	50%	20%	10%	0.5 mg/Kg
Arsenic	50%	20%	10%	0.5 mg/Kg
Silver	50%	20%	10%	2 mg/Kg
Antimony	100%	40%	20%	5 mg/Kg
Mercury	50%	20%	10%	0.005 mg/Kg
Selenium	50%	20%	10%	0.5 mg/Kg
Beryllium	50%	20%	10%	0.5 mg/Kg
Thallium	100%	40%	20%	0.3 mg/Kg

RSD – relative standard deviation

The reporting limits are based on past performance by Ecology's Manchester Environmental Laboratory, using the methods selected for this project. To minimize the effect of measurement imprecision when comparing the data to environmental criteria, detection limits should be 10 times lower than the criteria in question (Cliff Kirchmer, personal communication, 2005). This rule of thumb is generally met by these reporting limits, with the exception of the limit for mercury, and silver and antimony, in sediment, which are the lowest currently available through Manchester.

Sampling Design

A conceptual water quality model for determining impacts to receiving waters from acid rock drainage (ARD) has been developed from interpreting the results of previous studies (Raforth et al., 2000; 2002; 2004). This model for streams draining metals mining districts is based on seasonal variations in water quality caused by flushing acid salts from mine workings, tailings, and waste rock during spring freshet.

This sampling program is designed to account for the anticipated seasonal effect of ARD. Water quality samples and field measurements will be obtained at each sample site twice during this study. The first samples and field data will be collected during low streamflow conditions expected in October 2005. The same sample sites will be resampled during high streamflow conditions in April or May 2006. Sediment quality samples will be collected only during low streamflow conditions.

The conceptual water quality model also predicts that the ratio of sulfate to total dissolved solids (TDS) is important for predicting impacts to receiving waters. This sampling program will continue to gather data toward confirming the utility of the ratio. Other parameters that will be analyzed in water and sediments were recommended from the previous studies. These parameters were considered to be indicators of ARD or other impacts from mining operations.

Table 6 shows the number of samples to be collected and the estimated cost of laboratory analysis.

Table 6. Number of Samples and Laboratory Cost Estimate

Sample Type	Analysis	No. of Samples*	Sampling Periods	Total Samples	Cost per Sample	Cost Subtotals
Water						
Field Samples	Diss. As, Cd, Cu, Pb, Zn	25	2	50	131	\$6550
"	Tot. Rec. Al, Fe	25	2	50	55	2750
"	Total Hg	25	2	50	70	3500
"	Hardness	25	2	50	20	1000
"	TDS	25	2	50	10	500
"	TSS	25	2	50	10	500
"	Sulfate	25	2	50	12	600
"	Turbidity	25	2	50	10	500
Replicate Samples	Diss. As, Cd, Cu, Pb, Zn	2	2	4	131	524
"	Tot. Rec. Al, Fe	2	2	4	55	220
"	Total Hg	2	2	4	70	280
"	Hardness	2	2	4	20	80
"	TDS	2	2	4	10	40
"	TSS	2	2	4	10	40
"	Sulfate	2	2	4	12	48
"	Turbidity	2	2	4	10	40
Filter Blanks	Diss. As, Cd, Cu, Pb, Zn	1	2	2	131	262
Bottle Blanks	Tot. Rec. Al, Fe	1	2	2	55	110
"	Total Hg	1	2	2	70	140
					+0.45 um filters @\$24 ea =	1296
					+500 mL Teflon bottles @\$16 ea =	1728
					+Teflon acid vials @ \$8 ea =	864
Sediment						
Field Samples	Priority Pollutant Metals	20	1	20	185	3700
"	Fe, Mn, Al	20	1	20	80	1600
Replicate Samples	Priority Pollutant Metals	2	1	2	185	370
"	Fe, Mn, Al	2	1	2	80	160
					Total Lab Cost** =	\$27402

* Water sampled fall 2005 and spring 2006; Sediment sampled fall 2005

** Costs include 50% price discount for Manchester Lab

Sampling Procedures

Recommended minimum sample sizes, containers, preservation procedures, and holding times for the parameters being analyzed in this study are shown in Table 7.

Table 7. Field Procedures

Parameter	Sample Size	Container	Preservation	Holding Time
Water				
Mercury	500 mL	500 mL Teflon bottle	HNO ₃ to pH<2, 4°C	28 days
Other metals	500 mL	500 mL Teflon bottle	HNO ₃ to pH<2, 4°C	6 months
Hardness	100 mL	125 mL poly bottle	HNO ₃ to pH<2, 4°C	6 months
TSS	1000 mL	1000 mL poly bottle	Cool to 4°C	7 days
TDS	250 mL	1000 mL poly bottle	Cool to 4°C	7 days
Sulfate	100 mL	1000 mL poly bottle	Cool to 4°C	28 days
Turbidity	100 mL	1000 mL poly bottle	Cool to 4°C	48 hours
Sediment				
Mercury	100 grams	8 oz. glass jar/Teflon lid	Cool to 4°C	28 days
Other metals	50 grams	8 oz. glass jar/Teflon lid	Cool to 4°C	6 months

Sampling methods for metals in water will follow the guidance in EPA Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels*. Sampling methods for sediment will be consistent with Puget Sound Estuary Program Protocols (EPA, 1996) and Ecology Sediment Management Standards (Ecology, 1995 a,b). Chain of custody will be maintained.

All water samples will be collected as simple grab samples. Water samples for metals analyses will be collected directly into pre-cleaned 500 mL Teflon bottles. Samples for dissolved metals will be vacuum-filtered in the field through a disposable 0.45 um cellulose nitrate filter (#450-0045, type S). Non-talc, disposable gloves will be worn during the filtering procedure. The filtrate will be transferred to a clean Teflon bottle and preserved to pH <2 with sub-boiled 1:1 nitric acid, carried in small 5 mL Teflon vials, one per sample. Unfiltered water samples for aluminum, iron, and mercury will be preserved in the same manner.

Teflon sample bottles will be supplied by Manchester Laboratory, cleaned as described in Kammin et al. (1995), and sealed in plastic bags. Each metals sample will be placed in double plastic bags, and all samples will be held on ice for transport to Manchester. Manchester will also supply 1-liter polyethylene bottles for general chemistry samples and 125 mL polyethylene bottles for hardness.

Sediment samples will be composites of multiple grabs taken with stainless steel scoops and homogenized in the field in stainless steel bowls. Sampling equipment will be cleaned by washing with Liquinox detergent and sequential rinses with tap water, dilute 5% nitric acid, and deionized (DI) water. The homogenate will be split into glass jars with Teflon lid liners and cleaned to EPA QA/QC specifications (EPA, 1990). Field observations will be recorded as to whether the sediment samples are predominantly gravel, sand, or silt.

Field measurements for pH, conductivity, and temperature will be obtained with a YSI Model 63 meter. The pH meter will be calibrated daily (YSI, 1999). Streamflow measurements will be made with a Marsh-McBirney flow meter and top-setting rod, or estimated using best professional judgment or alternative measurement methods. Station positions will be recorded from a hand-held GPS and topographic maps.

Measurement Procedures

Water sample analyses will be conducted by Manchester Laboratory following the laboratory procedures listed in Table 8. For sediments, laboratory procedures are listed in Table 9. Methods other than those listed may be employed after consulting with the project lead.

Table 8. Laboratory Procedures - Water

Analyte	Sample Matrix	Number of Samples	Expected Range of Results	Sample Prep Method	Analytical Method
Arsenic	filtered water	55	<0.1 - 50 ug/L	analyze directly	EPA 200.8
Zinc	filtered water	55	1 - 10,000 ug/L	analyze directly	EPA 200.8
Lead	filtered water	55	<0.02 - 5 ug/L	analyze directly	EPA 200.8
Copper	filtered water	55	<0.05 - 10 ug/L	analyze directly	EPA 200.8
Cadmium	filtered water	55	<0.02 - 5 ug/L	analyze directly	EPA 200.8
Aluminum	whole water	55	<20 - 10,000 ug/L	EPA 200.7 ^a	EPA 200.7 ^a
Iron	whole water	55	<20 - 10,000 ug/L	EPA 200.7 ^a	EPA 200.7 ^a
Mercury	whole water	55	<0.002 - 0.1 ug/L	EPA 245.7 ^b	EPA 245.7 ^b
Hardness	whole water	54	10 - 1,000 mg/L	N/A	SM 2340B
TSS	whole water	54	1 - 500 ug/L	N/A	SM 2540D
TDS	whole water	54	1 - 1,000 ug/L	N/A	SM 2540C
Sulfate	whole water	54	<0.5 - 1,000 mg/L	N/A	EPA 300.0
Turbidity	whole water	54	<1 - 100 NTU	N/A	SM 2130B

^aan ICP method modified by Manchester for ICP/MS

^ba CVAF method modified by Manchester for CVAA

Table 9. Laboratory Procedures - Sediment

Analyte	Sample Matrix	Number of Samples	Expected Range of Results	Sample Prep Method	Analytical Method
Mercury	sediment	22	<0.005 - 100 mg/Kg	EPA 245.5	EPA 245.5
Arsenic	sediment	22	<0.3 - 1,000 mg/Kg	EPA SW3050	EPA SW6020
Lead	sediment	22	<5 - 500 mg/Kg	EPA SW3050	EPA SW6020
Selenium	sediment	22	<0.3 - 5 mg/Kg	EPA SW3050	EPA SW6020
Thallium	sediment	22	<0.3 - 1 mg/kg	EPA SW3050	EPA SW6020
Iron	sediment	22	5,000 - 50,000 mg/Kg	EPA SW3050	EPA SW6010
Aluminum	sediment	22	5,000 - 50,000 mg/Kg	EPA SW3050	EPA SW6010
Manganese	sediment	22	100 - 5,000 mg/Kg	EPA SW3050	EPA SW6010
Zinc	sediment	22	10 - 5,000 mg/Kg	EPA SW3050	EPA SW6010
Copper	sediment	22	5 - 5,000 mg/Kg	EPA SW3050	EPA SW6010
Chromium	sediment	22	5 - 100 mg/Kg	EPA SW3050	EPA SW6010
Nickel	sediment	22	5 - 50 mg/Kg	EPA SW3050	EPA SW6010
Cadmium	sediment	22	<0.5 - 100 mg/Kg	EPA SW3050	EPA SW6010
Silver	sediment	22	<2 - 10 mg/Kg	EPA SW3050	EPA SW6010
Antimony	sediment	22	<5 - 10 mg/Kg	EPA SW3050	EPA SW6010
Beryllium	sediment	22	<0.5 - 5 mg/Kg	EPA SW3050	EPA SW6010

Quality Control

The quality control (QC) samples to be analyzed for this project are shown in Table 10. Up to 25 samples will be collected during each sampling event. These samples will be considered as a batch for QC purposes.

Table 10. QC Procedures

Matrix / Parameter	Field QC Samples			Laboratory QC Samples				
	Replicate	Bottle Blank	Filter Blank	LCS	Check Standards	Method Blanks	Analytical Duplicates	MS/MSD
Water								
Metals	4	2	2	1/batch	1/batch	1/batch	NA	1/batch
Hardness	4	NA	NA	1/batch	1/batch	1/batch	1/batch	NA
TSS	4	NA	NA	1/batch	1/batch	1/batch	1/batch	NA
TDS	4	NA	NA	1/batch	1/batch	1/batch	1/batch	NA
Sulfate	4	NA	NA	1/batch	1/batch	1/batch	1/batch	NA
Turbidity	4	NA	NA	1/batch	1/batch	1/batch	1/batch	NA
Sediment								
Metals	2	NA	NA	1/batch	1/batch	NA	1/batch	1/batch

LCS – laboratory control sample

MS/MSD – matrix spike/matrix spike duplicate

NA – not analyzed for

Field

Field QC samples for water will include bottle blanks, filter blanks, and replicate samples. Replicate samples will also be collected for sediments.

The blanks will be used to check for metals contamination arising from sample containers, preservative, or the filtration procedure. Bottle blanks will consist of 500 mL Teflon bottles cleaned and filled with DI water at Manchester, as previously described. Filter blanks will be prepared by filtering the contents of a DI-filled Teflon bottle. One pair of bottle and filter blanks each will be prepared for the low-flow and high-flow field work.

The total variability of the metals and conventional water quality data for this project (field + laboratory) will be assessed by collecting selected samples in replicate. The replicates will consist of separate sets of samples collected five-to-ten minutes apart. For the fall (low flow) field work, replicate water and replicate sediment samples will be collected at two of the 20 sampling sites for a total of four samples each for water and sediment. One contaminated site

and one upstream site will be sampled in replicate. This procedure will be followed for the spring (high-flow) sampling for water samples at different sites than the fall replicates.

Laboratory

Metals QC samples to be analyzed with each set of water samples will include a laboratory control sample (LCS), a matrix spike and spike duplicate, and a method blank.

Laboratory QC samples for metals in sediment will include a duplicate sample analysis (lab split), a matrix spike and spike duplicate, and a method blank.

Data Management Procedures

The field and laboratory data will be entered into Excel spreadsheets and into Ecology's Environmental Information Management (EIM) database. Hardness results will be used to calculate the water quality criteria corresponding to each sample, using Ecology spreadsheet tsdcalc.xls. Excursions from the criteria will be identified.

Audits and Reports

The project lead will prepare a draft report of the overall study by December 2006. The report will contain:

- A map of the sampling sites.
- Latitude/longitude and other location information for each sampling site.
- Descriptions of field and laboratory methods.
- A discussion of data quality, estimates of precision and bias, and the significance of any problems encountered in the analyses.
- Summary tables of the metals and ancillary data.
- An evaluation of significant findings with respect to exceedences of standards and guidelines, differences within and between mining districts, seasonality, sulfate:TDS ratios, and additional data interpretation as appropriate.
- Recommendations for follow-up work, if warranted.

A final report will be prepared after receiving review comments from CRO, DNR, and Environmental Assessment Program. The goal is to have the revised, final report completed on or before March 2007. The data will be entered into Ecology's EIM database by March 2007.

Data Verification and Validation

Manchester Laboratory will verify all laboratory data and case narratives before reporting the results to the project lead. Manchester will verify that methods and protocols specified in this Quality Assurance Project Plan were followed; that all calibrations, checks on quality control, and intermediate calculations were performed for all samples; and that the data are consistent, correct, and complete, with no errors or omissions. Evaluation criteria will include the acceptability of holding times, instrument calibration, procedural blanks, spike sample analyses, precisions data, laboratory control sample analyses, and appropriateness of data qualifiers assigned.

To determine if management quality objectives (MQOs) have been met, check sample, duplicate sample matrix spike, and spike duplicate results will be compared with the MQOs for this project.

To evaluate whether the targets for reporting limits have been met, the results will be examined for non-detects and to determine if any values exceed the lowest concentration of interest.

The project lead will verify the field data for correctness, completeness, and adherence to quality objectives. The project lead will validate the project data, which will include reviewing the laboratory data packages and data verification reports. The project lead will check the data and reports for completeness and reasonableness, and to assure the MQOs have been met.

Data Quality (Usability) Assessment

Data quality will be assessed to determine if the data can be used to meet the project objectives. If there are cases for which MQOs have not been met, these will be evaluated in terms of whether corresponding project objectives can still be met.

Due to the screening-level nature of this investigation, with only one upstream and one downstream sample being collected for each site, statistical testing for significant differences will not be possible. Identification of sites impacted by mining will be made by a simple comparison of upstream and downstream values, taking the estimates of field and laboratory variability from replicate and duplicate samples into account. If the difference between upstream and downstream samples is similar to or less than the difference in replicate/duplicate samples, the reader will be cautioned that the differences may not be significant.

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