Metals Monitoring in Quilceda and Allen Creeks, Snohomish County

---

Quality Assurance Project Plan

by
Art Johnson
June 23, 2000

Washington State Department of Ecology
Environmental Assessment Program
Watershed Ecology Section

Approvals:

Robert Wright_____
Client, Northwest Regional Office

John Glynn_____
Section Manager, Northwest Regional Office

Kathy Thornburgh_____
Snohomish County, Surface Water Management

Stuart Magoon_____
Director, Manchester Laboratory

Cliff Kirchmer_____
Quality Assurance Officer

Will Kendra_____
Section Manager, Watershed Ecology Section

Dale Norton_____
Unit Supervisor, Contaminant Studies Unit

Art Johnson_____
Project Lead, Contaminant Studies Unit

Project Description

Quilceda and Allen Creeks near Marysville in Snohomish County were considered for the 1998 303(d) list for exceeding state aquatic life standards for chronic exposure to lead, copper, and zinc. It was subsequently determined that the data in question (Thornburgh, 1996) were for total recoverable metals, so could not be compared to the state standards, which are for dissolved metals.

The Washington State Department of Ecology (Ecology) Northwest Regional Office (NWRO) remains concerned about the potential for adverse metals impacts to Quilceda and Allen Creeks due to stormwater runoff and other sources. They have requested that the Environmental Assessment Program (EAP) monitor these creeks to determine if they meet standards. Thornburgh (1996) reported elevated total recoverable metals concentrations at the stations listed in Table 1, based on routine monitoring done by Snohomish County (see Figure 1).

Table 1. Snohomish County Monitoring Stations with Elevated Metals Concentrations

Station	Snohomish Co. ID	Lead	Copper	Zinc
Upper Quilceda Creek	QCLU	x	x	x
Lower Quilceda Creek	QCLD	x		
Upper Allen Creek	ACLU	x		
Lower Allen Creek	ACLD	x	x	

Water sampling procedures will follow *Sampling Ambient Water for Trace Metals at EPA Water Quality Levels* (EPA, 1995). Analysis will be by Inductively Coupled Plasma -- Mass Spectrometry (ICP-MS). The objective will be to collect accurate dissolved metals data at sufficiently low detection limits to determine compliance with state water quality standards (WAC 173-201A).

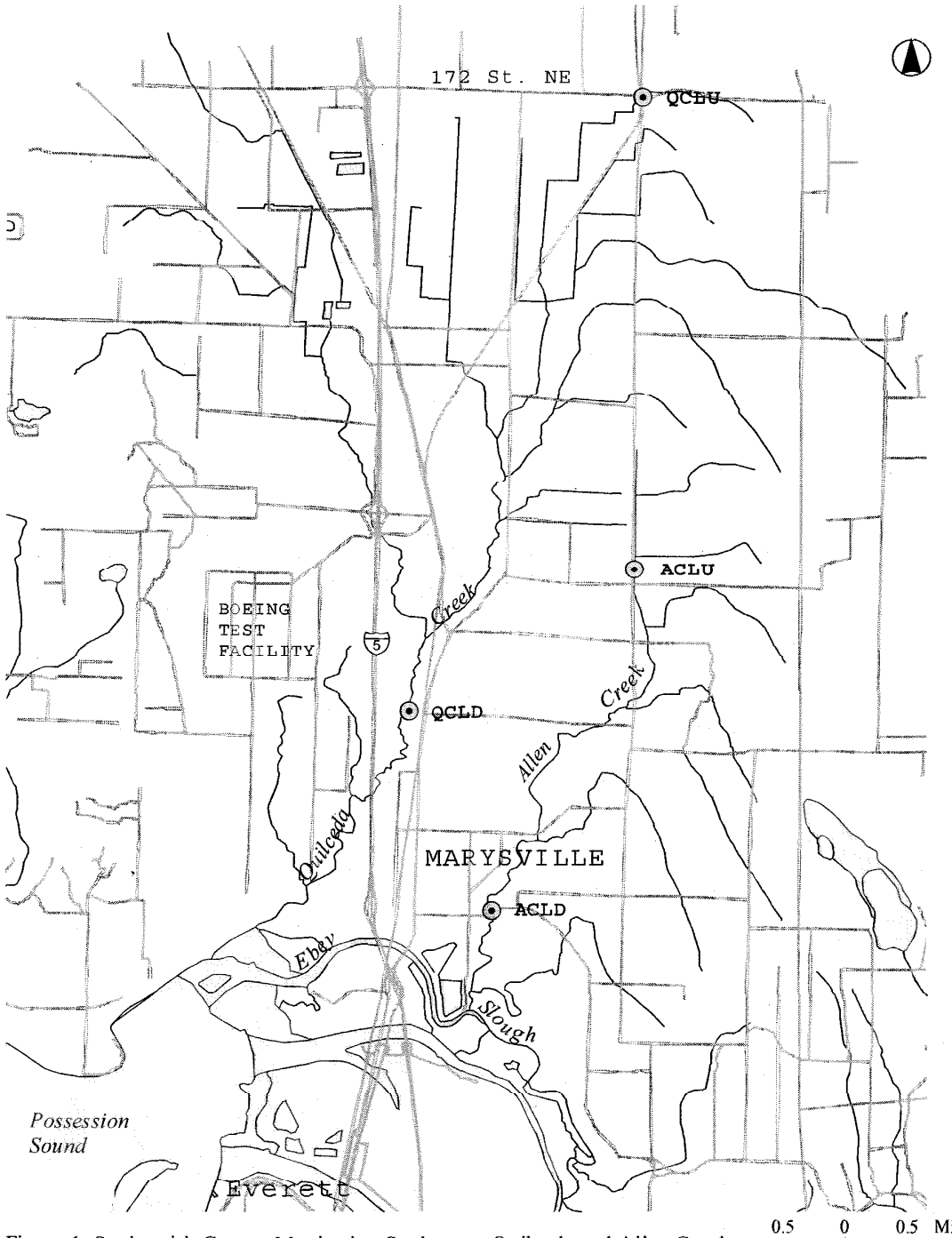

Figure 1. Snohomish County Monitoring Stations on Quilceda and Allen Creeks

EAP will collect the initial dissolved metals samples in June at the same time routine monitoring for total recoverable metals is done by Snohomish County. EAP will demonstrate their clean sampling technique for metals and provide sampling equipment for Snohomish County to collect dissolved metals samples for the remaining four sampling events.

The EAP dissolved sample and the Snohomish County total recoverable sample will be splits from the same grab. Snohomish County will also monitor temperature, D.O., conductivity, pH, and turbidity. EAP will analyze hardness. Snohomish County will measure the flow at the upper station on each creek (method yet to be determined). Channel configuration at the lower creek stations makes flow determination difficult.

The dissolved metals samples will be analyzed at the Ecology Manchester Environmental Laboratory. North Creek Analytical in Bothell analyses Snohomish County's metals samples. North Creek provides appropriately cleaned sample containers to Snohomish County.

Manchester's reporting limits for the metals of interest are shown in Table 2 and compared to the chronic water quality standards for the lowest hardness value reported for these creeks by Snohomish County (28 mg/L).

Table 2. Manchester Reporting Limits Compared to Water Quality Standards (ug/L)

Metal	Reporting Limit	Chronic Standard
Lead	0.02	0.61
Copper	0.05	3.8
Zinc	0.5	36

Table 3. Number of Samples and Laboratory Cost Estimate for Analyzing Metals in Quilceda/Allen Creeks

Sample Type	Analysis	Stations or Samples	Sampling Events	Total Samples	Cost per Sample	Cost Subtotals
Field Samples	Diss. Pb, Cu, Zn	4	5	20	102	2040
"	Hardness	4	5	20	12	240
"	TSS	4	5	20	10	200
"	Conductivity	4	5	20	7	140
Replicate Samples	Diss. Pb, Cu, Zn	1	5	5	102	510
"	Hardness	1	5	5	12	60
"	TSS	1	5	5	10	50
"	Conductivity	1	5	5	7	35
Filter Blanks	Diss. Pb, Cu, Zn	1	2	2	102	204
Bottle Blanks	Diss. Pb, Cu, Zn	1	2	2	102	204
Matrix Spikes	Pb, Cu, Zn	2	5	10	no charge	0
Std. Ref. Material	Pb, Cu, Zn	1	5	5	no charge	0
Lab Control Sample	Pb, Cu, Zn	1	5	5	no charge	0
Method Blank	Pb, Cu, Zn	1	5	5	no charge	0
					+0.45 micron filters @ $21 ea =	567
					+500 mL teflon bottles @ $14 ea =	406
					+acid preservative @ $7 ea =	203
					TOTAL LAB COST =	4859

Schedule

(exact dates to be determined)

June 13, 2000.....First Sample Collection
August 2000.....Second Sample Collection
November 2000.....Third Sample Collection
February 2001.....Fourth Sample Collection
April 2001.....Fifth Sample Collection
May 2001.....Laboratory Analyses Completed
June 2001.....Draft Report to NWRO and Snohomish Co.
August 2001.....Final Report
November 2001.....Data Entered into EIM

Project Organization

Project Lead - Art Johnson, EAP (360/407-6766)
Snohomish County - Kathleen Thornburg and Ellen Stewart (425/388-3464 ext. 4542)
Watershed Ecology Section Manager - Will Kendra (360/407-6698)
Contaminant Studies Unit Supervisor – Dale Norton (360/407-6765)
Manchester Laboratory Director - Stuart Magoon (360/871-8813)
Manchester Inorganics Unit Leader - Jim Ross (360/871-8808)
Quality Assurance Officer - Cliff Kirchmer (360/407-6455)
Client, NWRO - Robert Wright (425/649-7060)
Section Manager, NWRO - John Glynn (425/649-7033)

[Note: The remainder of this QAPP pertains to dissolved metals, except as noted.]

Data Quality Objectives

Precision and Bias

Data quality objectives for precision and bias will be +/- 20%. Table 4 shows Manchester's recent results on a certified freshwater reference material for the metals being analyzed in the present study. Due to the difficulty of eliminating low-level contamination from zinc, the dissolved zinc data for this project may be biased high.

Table 4. Manchester Results on Standard Reference Material[a] (ug/L)

Analysis Date	Zinc	Copper	Lead
April 1999	3.56	1.44	0.070
June 1999	1.67	1.41	0.065
July 1999	1.30	1.38	0.065
November 1999	1.20	1.41	0.066
certified value =	1.04	1.35	0.068

[a]SLRS-3 (River Water Reference Material for Trace Metals, Nat. Res. Council Canada)

Sources of bias from sampling procedures and sample handling will be minimized by adherence to EPA Method 1669.

Representativeness

Each station will be sampled on five separate occasions covering a range of runoff conditions in an effort to obtain representative data. The total variability in the data (field + laboratory) will be assessed by doing replicate sampling. Replicates will be collected in upper Quilceda Creek where elevated metals concentrations were most frequently reported by Snohomish County.

Completeness

The amount of useable data obtained will be maximized by careful planning of field work, packaging and transport of samples, and by following EPA Method 1669 sampling guidance. The laboratory will be asked to save excess sample until the data can be reviewed by the project lead.

Comparability

Sampling, quality assurance, and analytical methods are consistent with other low-levels metals work done by EAP.

Sampling Methods

Sampling methods will follow the guidance in EPA Method 1669.

Metals samples will be simple grabs collected by hand into pre-cleaned 1.0 liter Teflon bottles. The samples will be taken away from the bank by wading into the stream or with the Teflon bottle on the end of a plastic pole. After collection, the sample will be split 50:50 with Snohomish County.

The EAP dissolved metals sample will be filtered in the field through a pre-cleaned 0.45 µm Nalgene filter unit (#450-0045, type S). The filtrate will be transferred to a pre-cleaned 0.5 liter Teflon bottle and preserved to pH <2 with sub-boiled 1:1 nitric acid, carried in small teflon vials, one per sample. Teflon sample bottles, Nalgene filters, and Teflon acid vials will be obtained from Manchester, cleaned as described in Kammin et al. (1995), and sealed in plastic bags.

Non-talc nitrile gloves will be worn by personnel filtering the samples. Filtering will be done in a glove box constructed of a PVC frame and polyethylene cover. Each dissolved metals sample will be placed in double polyethylene bags and held on ice for transport to Manchester Laboratory (June samples) or for pick up by Ecology at Snohomish County (other samples).

Analytical Methods

Dissolved metals will be analyzed at Manchester Laboratory by ICP-MS, following EPA Method 200.8. Hardness will be analyzed by Standard Methods 2340B.

Quality Control Procedures

Field QC samples will include filter blanks, bottle blanks, and field replicates, at the frequency indicated in Table 3. Field replicates will consist of two separate sets of samples collected within approximately 15 minutes of each other.

Laboratory QC samples to be analyzed with each sample set will include: matrix spikes, matrix spike duplicates, a standard reference material certified for low metals concentrations in river water (SLRS-3 or equivalent), a laboratory control sample, and a method blank.

Data Assessment Procedures and Reporting

Manchester's SOP for data reduction, review, and reporting will meet the needs of this project Each laboratory unit assembles data packages consisting of raw data from the analyses of the samples, copies of the pertinent logbook sheets, QA/QC data, and final reports of data entered into LIMS. These data packages are subjected to a data verification and quality assurance review by another analyst familiar with the procedure. Reviewers use *Laboratory Data Validation National Functional Guidelines for Evaluating Inorganic Analyses, USEPA, July, 1988.*

The following additional information will be reported for metals: 1) the name, source, and certified values for SRMs and LCSs analyzed; 2) the metals concentrations measured in the SRM (in addition to percent recovery); and 3) the spiking levels used in matrix spikes.

The data from each sample collection will be provided to NWRO and Snohomish County in a timely manner. Any exceedances of water quality standards will be noted. A t-test will be performed to determine if there is a statistically significant difference between the results obtained and the standards for each metal.

A draft report of the study results will be provided to NWRO and Snohomish County in June 2001. The report will contain:

- a map of the study area showing 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 exceedances of standards, differences within and between sampling sites, comparisons to Snohomish County data, and additional data interpretation as appropriate
- recommendations for follow-up work if warranted.

A final report will be prepared after receiving review comments from NWRO, Snohomish County, and internal comments from EAP. The goal is to have the revised final report completed in August 2001. The data will be entered into Ecology's Environmental Information Management (EIM) system.

References

EPA. 1995. Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Levels. EPA 821-R-95-034.

Kammin, W.R., S. Cull, R. Knox, J. Ross, M. McIntosh, and D. Thompson. 1995. Labware Cleaning Protocols for the Determination of Low-level Metals by ICP-MS. American Environmental Laboratory 7(9).

Thornburgh, K. 1996. Snohomish County Ambient Water Quality Monitoring – Summary Report for 1992-1995. Snohomish County Public Works, Everett, WA.