

QUALITY ASSURANCE PROJECT PLAN

Stormwater and Urban Runoff Storm Event Monitoring Drinking Water Source Protection Program



Eugene Water & Electric Board

September 2001

Revision 1

Table of Contents

1	Data Quality Objectives.....	3
2	Project Organization.....	3
2.1	Stormwater and Urban Runoff Project Manager	3
2.2	Project QA/QC Manager	3
2.3	Contract Laboratory Project Manager	3
3	Contract Laboratory Requirements.....	4
4	Quality Assurance Objectives.....	4
4.1	Precision	5
4.2	Accuracy	6
4.3	Representativeness.....	7
4.4	Comparability	7
4.5	Completeness	7
5	Quality Control Procedures	7
5.1	Field Quality Control Procedures	7
5.2	Sample Handling	8
5.3	Sample Custody Documentation	8
6	Laboratory Quality Control Procedures.....	8
6.1	Analytical Methods and Reporting Limits	8
6.2	Laboratory Quality Control Criteria	9
7	Data Review and Reporting.....	10
7.1	Minimum Data Reporting Requirements.....	11
7.2	Internal Quality Control Reporting.....	11
7.3	Independent Data Quality Review	12
8	Laboratory Audits and Corrective Actions	12
8.1	Laboratory and Field Performance Audits	12
8.2	Corrective Action Procedures	12

1 Data Quality Objectives

All data will be gathered and handled in accordance with EWEB's *Lower McKenzie Watershed, Stormwater and Urban Runoff Monitoring Plan (September 2001)*; the *Oregon Plan for Salmon and Watersheds "Water Quality Monitoring Guide Book"*; the *USGS National Field Manual for the Collection of Water-Quality Data*; and the *USGS Field Guide for Collecting and Processing Stream Water Samples for the National Water-Quality Assessment Program*. Sample collection protocol and analytical requirements are discussed in EWEB's stormwater and urban runoff monitoring plan (Section 5.0). The objectives for the stormwater and urban runoff monitoring program are discussed in Section 2.0 of the monitoring plan. The data collected as part of EWEB's stormwater and urban runoff monitoring program will be used to assess water quality trends, identify problem areas, calculate pollution loadings, and support overall water quality assessment in the McKenzie Watershed.

This Quality Assurance Project Plan (QAPP) describes the quality assurance and quality control (QA/QC) procedures that will be implemented as part of the stormwater and urban runoff monitoring program. The QAPP has been designed to ensure that the data generated are of sufficient quality to meet the study objectives. This QAPP has been prepared in accordance with the documents listed above and the Oregon Department of Environmental Quality 303(d) list minimum data requirements.

2 Project Organization

Personnel responsible for laboratory and data analysis are described below.

2.1 Stormwater and Urban Runoff Project Manager

Karl A. Morgenstern (EWEB, Eugene) is the Project Manager responsible for overall project coordination, including the production of all project deliverables, collection and submittal of environmental samples to the designated laboratories for the chemical and physical analyses specified in this QAPP. The Project Manager is responsible for coordinating these tasks with the other interested and involved parties associated with this monitoring effort (EWEB Hayden Bridge, City of Springfield, McKenzie Watershed Council, City of Eugene, Landowners, USGS, and others), and ensuring that the monitoring plan is implemented as specified.

2.2 Project QA/QC Manager

Mitch Postle or Water Quality Monitoring Designee (EWEB, Hayden Bridge Plant) will serve as the Project QA/QC Manager, responsible for coordinating with the analytical laboratories, ensuring conformance with data quality objectives, overseeing data validation, and managing project quality assurance and quality control.

2.3 Contract Laboratory Project Manager

To Be Determined. Selection of a contract laboratory(ies) has not been conducted to date. Once the appropriate laboratory is selected to analyze the water samples discussed in this monitoring plan, a representative of that laboratory will serve as the laboratory project

manager. The laboratory project manager will provide analytical support to this project and is responsible for ensuring that laboratory analyses are performed in accordance with the protocols, quality control criteria, and other specifications detailed in this QAPP.

3 *Contract Laboratory Requirements*

The contract laboratory is expected to meet the following minimum requirements:

1. Adhere to the methods outlined in the statement of work, including methods referenced for each analytical procedure;
2. Deliver fax, hard copy, and electronic data as specified;
3. Meet reporting requirements for deliverables;
4. Meet turnaround times for deliverables;
5. Implement QA/QC procedures, including the QAPP data quality requirements, laboratory analysis plan requirements, and performance evaluation testing requirements;
6. Allow laboratory and data audits to be performed, if deemed necessary; and
7. Follow documentation, chain of custody, and sample logbook procedures.

Changes in the laboratory procedures specified in the QAPP will not be permitted without written documentation of the intended change and the rationale. The Project QA/QC Manager must approve all changes in advance.

4 *Quality Assurance Objectives*

Surface water samples will be submitted for analysis of:

- ? Total Organic Carbon
- ? Chemical Oxygen Demand
- ? Total Suspended Solids
- ? Turbidity
- ? Nutrients
- ? Metals (total & dissolved)
- ? Bacteria (e.coli, fecal coliform, fecal streptococci, and enterococci)
- ? Petroleum Hydrocarbon Identification (HCID)
- ? Semi-Volatile Organics
- ? Pesticides/Herbicides (dissolved)
- ? Chlorinated Pesticides and PCBs

The quality assurance objectives for this project are to develop and implement procedures that will ensure the collection of representative physical and chemical data of known and acceptable quality. Table 4-1 summarizes the quality assurance objectives for each type

of water analysis in accordance with protocols for water analyses. The data quality parameters used to assess the acceptability of the data is precision, accuracy, representativeness, comparability, and completeness. These parameters are discussed below.

4.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Analytical precision is measured through matrix spike/matrix spike duplicate (MS/MSD)

**Table 4-1
Quality Assurance Objectives**

Analyte	Units	Precision	Accuracy	Completeness	EPA Method	Holding Times
Total and Dissolved Metals - Oregon Stormwater (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)	mg/L	± 20%	± 25%	90%	200 Series	6 Months
Semi-Volatile Organic Compounds	µg/L	± 20%	± 30%	90%	8270C	7 Days to Extract
Pesticides	µg/L	± 20%	± 30%	90%	USGS 2001	7 Days to Extract
Herbicides	µg/L	± 20%	± 30%	90%	USGS 2060	7 Days to Extract
Chlorinated Pesticides and PCBs	µg/L	± 20%	± 30%	90%	608	7 Days to Extract
Fecal Coliform and <i>E. Coli</i>	MPN	± 20%	± 40%	90%	SM 9222	30 Hours
Fecal Streptococcus and Enterococci	MPN	± 20%	± 40%	90%	SM 9230B	30 Hours
Nitrate + Nitrite	mg/L	± 20%	± 30%	90%	300	28 Days
Total Kjeldahl Nitrogen	mg/L	± 20%	± 30%	90%	351.3, 351.4	28 Days
Total Phosphorus	mg/L	± 20%	± 30%	90%	365.1, 365.3	28 Days
Chemical Oxygen Demand	mg/L	± 20%	± 30% ¹	90%	410.4	28 Days
Total Suspended Solids	mg/L	± 20%	± 30% ¹	90%	160.2	7 Days

¹ = For those analyses on which sample spiking cannot be performed, QC reference standards will be analyzed to determine accuracy.

samples for organic analysis and through laboratory duplicate samples for inorganic analyses. Analytical precision measurements will be carried on project specific samples at a minimum frequency of 1 per laboratory analysis group or 1 in 20 samples, whichever is more frequent, per matrix analyzed. Laboratory precision will be evaluated against quantitative relative percent difference (RPD) performance criteria presented in Table 4-1.

Field precision will be evaluated by the collection of blind field duplicates. One field duplicate per matrix will be collected. Currently, no performance criteria have been established for field duplicates. Field duplicate precision will therefore be screened against a RPD of 75 percent for water samples. However, no data will be qualified based solely on field duplicate precision. Precision measurements can be affected by the

nearness of a chemical concentration to the method detection limit, where the percent error (expressed as either %RSD or RPD) increases. The equations used to express precision are as follows:

$$RPD = \frac{(C_1 - C_2) \times 100\%}{(C_1 + C_2)/2}$$

Where:

RPD = relative percent difference
 C₁ = larger of the two observed values
 C₂ = smaller of the two observed values

$$\%RSD = (SD / D_{ave}) \times 100$$

Where: $SD = \sqrt{\frac{\sum(D - D_{ave})^2}{(n - 1)}}$
D = sample value
D_{ave} = average sample value
n = number of samples

4.2 Accuracy

Accuracy is an expression of the degree to which a measured or computed value represents the true value. Field accuracy is controlled by adherence to sample collection procedures outlined in the monitoring plan. To assess the potential for cross contamination in the field, one rinseate blank from the surface water sampling device will be collected.

Analytical accuracy may be assessed by analyzing “spiked” samples with known standards (surrogates, laboratory control samples, and/or matrix spike) and measuring the percent recovery. Accuracy measurements on matrix spike samples will be carried out at a minimum frequency of one in 20 samples per matrix analyzed. Surrogate recoveries will be determined for every sample analyzed for organics.

Laboratory accuracy will be evaluated against quantitative matrix spike and surrogate spike recovery performance criteria as presented in Table 4-1. Accuracy can be expressed as a percentage of the true or reference value, or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \times (S-U)/C_{sa}$$

Where:

%R = percent recovery
 S = measured concentration in the spiked aliquot
 U = measured concentration in the unspiked aliquot
 C_{sa} = actual concentration of spike added

4.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition. For this program, the selected analyte has been identified as a constituent of concern based on numerous studies indicating the typical pollutants associated with stormwater and urban runoff during storm events. Representative water quality data had previously been obtained from other stormwater and urban runoff studies conducted by the EPA and USGS.

4.4 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relation to another data set. For this monitoring program, comparability of data will be established through the use of standard analytical methodologies and reporting formats and of common National Institute of Standard and Technology or other traceable calibration and reference materials. Data will be used to evaluate trends over time and evaluate areas that appear to be contributing high pollution loads to receiving water bodies.

4.5 Completeness

Completeness is a measure of the amount of data that is determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{(\text{Number of acceptable data points}) \times 100}{(\text{Total number of data points})}$$

The data quality objective for completeness for all components of this project is 90 percent. Data that have been qualified as estimated because the quality control criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been qualified as rejected will not be considered valid for the purpose of assessing completeness.

5 *Quality Control Procedures*

Sampling procedures for this investigation are described in detail in the Sampling and Analysis Plan (Section 5.0) of EWEB's Stormwater and Urban Runoff Monitoring Plan. Section 5.1 discusses the field quality assurance samples (duplicate, rinseate blank, and MS/MSD sample) to be collected for water.

5.1 Field Quality Control Procedures

Field sampling procedures are detailed in Section 5.0 of the stormwater and urban runoff monitoring plan. To control the quality of field samples, one field duplicate and one rinseate blank will be analyzed. Although validation guidelines have not been established for field quality control samples, their analysis is useful in identifying possible problems resulting from sample collection or sample processing in the field. All field quality control samples will be documented in the field logbook. The field quality

control samples that will be collected as part of the stormwater and urban runoff monitoring program are discussed below.

Field Duplicates. For all water samples collected, one homogenized field duplicate will be collected and submitted for analysis. One field duplicate will be collected per 20 water samples.

Rinseate Blanks. Rinseate blanks are used to determine if cross contamination has occurred during sampling. For stormwater and urban runoff samples, one rinseate blank will be collected from DI water that has come in contact with the sampling device and will be submitted for analysis of organic and inorganic constituents being monitored during that given sampling event.

5.2 Sample Handling

Sample collection and handling procedures are detailed in the Sampling and Analysis Plan (Section 5.0) of EWEB’s Stormwater and Urban Runoff Monitoring Plan. To control the integrity of the samples during transit to the laboratory and during hold prior to analysis, established preservation and storage measures would be taken. Table 5-2 presents sample volume, container type, preservation, and maximum holding times for the various analyses of stormwater and urban runoff samples.

5.3 Sample Custody Documentation

Sample labeling and custody documentation will be performed as described in Section 5.4.3 of EWEB’s Stormwater and Urban Runoff Monitoring Plan.

6 Laboratory Quality Control Procedures

The Laboratory Standard Operating Procedures (SOP) provided by the contract analytical laboratory will describe in detail the chemical analytical procedures for this study. These SOPs will be kept in the project file at the analytical laboratory and will include written protocols for the analytical methods used.

6.1 Analytical Methods and Reporting Limits

The laboratory will calculate the method detection limit for each analyte in each matrix of interest and will establish an initial calibration curve for all analytes.

The methods of analysis, associated reporting limits, and screening levels for the water analyses are identified in Table 5-2. Reporting limits have been set at or below ambient water quality criteria for chronic exposure and maximum contaminant levels for drinking water.

**Table 5-2
Summary of Analytical Requirements**

Analyte	Vol. Req. (mL)	Container	Preservation	Filter	EPA Method	Holding Times
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Total Metals - Oregon Stormwater (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)	100	250 ml poly bottle	25 drops Nitric Acid (pH<2)	No	200 Series	6 Months
Dissolved Metals - Oregon Stormwater (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)	100	250 ml poly bottle	25 drops Nitric Acid (pH<2)	0.45 µm filter	200 Series	6 Months
Petroleum Hydrocarbons (NWTPH-HCID)	800	1000 mL amber jar	Ice	No	NWTPH-HCID	7 Days to Extract
Semi-Volatile Organic Compounds	800	1000 mL amber jar	Ice	No	8270C	7 Days to Extract
Pesticides	800	1000 mL amber jar	Ice	Glass fiber 0.7µm filter	USGS 2001	7 Days to Extract
Herbicides	800	1000 mL amber jar	Ice	Glass fiber 0.7µm filter	USGS 2060	7 Days to Extract
Chlorinated Pesticides and PCBs	1,000	1000 mL amber jar	Ice	No	608	7 Days to Extract
Fecal Coliform and <i>E. Coli</i>	75	150 ml poly bottle	Ice	No	SM 9222	30 Hours
Fecal Streptococcus and Enterococci	75	150 ml poly bottle	Ice	No	SM 9230B	30 Hours
Nitrate + Nitrite	100	500 ml poly bottle	12 drops Sulfuric Acid (pH<2)	No	300	28 Days
Total Kjeldahl Nitrogen	500	500 ml poly bottle	12 drops Sulfuric Acid (pH<2)	No	351.3, 351.4	28 Days
Total Phosphorus	50	250 ml poly bottle	6 drops Sulfuric Acid (pH<2)	No	365.1, 365.3	28 Days
Chemical Oxygen Demand	50	250 ml poly bottle	6 drops Sulfuric Acid (pH<2)	No	410.4	28 Days
Total Suspended Solids	200	500 ml Poly bottle	Ice	No	160.2	7 Days

6.2 Laboratory Quality Control Criteria

The analyst will review results of the quality control samples from each sample group immediately after a sample group has been analyzed. The quality control sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the Project Manager or Project QA Manager will be contacted immediately and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

All primary chemical standards and standard solutions used in this project will be traceable to the National Institute of Standards and Technology, Environmental Resource Associates, National Research Council of Canada, or other documented, reliable, commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

The following sections summarize the procedures that will be used to assess data quality throughout sample analysis.

Initial and Continuing Calibration. Multipoint initial calibration will be performed on each instrument at the start of the project, after each major interruption to the analytical

instrument, and when any ongoing calibration does not meet control criteria. Ongoing calibration will be performed daily for organic analyses and with every sample batch for conventional parameters (when applicable) to track instrument performance.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to continuing calibration verification at a frequency of 1 continuing calibration blank for every 10 samples analyzed at the instrument for inorganic analyses and every 21 hours for organic analyses. If the ongoing calibration is out of control, the analysis must come to a halt until the source of the control failure is eliminated or reduced to meet control specifications. All project samples analyzed while instrument calibration was out of control will be reanalyzed.

Matrix Replicates. Analytical replicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical replicates are subsamples of the original sample that are prepared and analyzed as a separate sample. A minimum of 1 replicate will be analyzed per sample group or for every 20 samples, whichever is more frequent. When matrix spikes are not available or appropriate, a matrix triplicate will be analyzed per sample group or for every 20 samples, whichever is more frequent.

Matrix Spikes and Matrix Spike Duplicates. Analysis of matrix spike samples provides information on the extraction efficiency of the method on the sample matrix. By performing duplicate matrix spike analyses, information on the precision of the method is also provided for organic analyses. A minimum of 1 matrix spike will be analyzed for every sample group or for every 20 samples, whichever is more frequent, when possible.

Surrogate Spikes. All project samples analyzed for organic compounds will be spiked with appropriate surrogate compounds as defined in the analytical methods. The laboratories will report surrogate recoveries; however, no sample result will be corrected for recovery using these values.

Method Blanks. Method blanks are analyzed to assess possible laboratory contamination at all stages of sample preparation and analysis. A minimum of 1 method blank will be analyzed for every extraction batch or for every 20 samples (10 samples for conventional parameters), whichever is more frequent.

7 Data Review and Reporting

All data will undergo two levels of QA/QC evaluation: one at the laboratory, and one by EWEB or a consultant working for EWEB.

Initial data reduction, evaluation, and reporting at the laboratory will be carried out as described in the appropriate analytical protocols and the laboratory's QA Manual. Quality control data resulting from methods and procedures described in this document will also be reported.

7.1 Minimum Data Reporting Requirements

The following describes the minimum data reporting requirements necessary for proper QA/QC evaluation of the analytical data.

Sample IDs. Records will be produced that clearly match all blind duplicate QA samples with laboratory sample IDs.

Sample Receipt. Chain of custody forms will be filled out for all sample shipments to document problems in sample packaging, custody, and sample preservation upon receipt at the laboratory.

Reporting. For each analytical method run, analytes will be reported as a detected concentration or as less than the specific reporting limit. The laboratories will also report dilution factors for each sample as well as date of extraction (if applicable) and date of analysis. Standard data packages will consist of a case narrative, sample results, QA sample results, and chain of custody forms.

7.2 Internal Quality Control Reporting

Internal quality control samples will be analyzed at the rates specified in the applicable analytical method.

- ? *Laboratory Blanks.* All analytes will be reported for each laboratory blank. All non-blank sample results shall be designated as corresponding to a particular laboratory blank in terms of analytical batch processing.
- ? *Surrogate Spike Samples.* Surrogate spike recoveries will be reported with all organic reports where appropriate. The report shall also specify the control limits for surrogate spike results. Any out of control recoveries (as defined in the specified method) will result in the sample being rerun or the data being qualified.
- ? *Matrix Spike Samples.* Matrix spike recoveries will be reported for all analyses. All general sample results will be designated as corresponding to a particular matrix spike sample. The report will indicate what sample was spiked. The report will also specify the control limits for matrix spike results for each method and matrix.
- ? *Laboratory Duplicates and/or Matrix Spike Duplicate Pairs.* Relative percent differences will be reported for all duplicate pairs as well as analyte/matrix specific control limits.
- ? *Laboratory Control Samples (LCS).* When run for internal quality control, LCS results will be reported with the corresponding sample data. Control limits for LCS will be reported as specified.

- ? *Blind Duplicates.* Blind duplicates will be reported as any other sample. Relative percent differences will be calculated for duplicate samples and evaluated as part of the data quality review.

7.3 Independent Data Quality Review

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

A qualified environmental chemist will perform a data quality review. The laboratories will deliver complete data packages for all chemical analyses. The data will be evaluated in accordance with the QAPP. All chemical data will be reviewed with regard to the following, as appropriate to the particular analysis:

- ? Holding times;
- ? Blanks;
- ? Detection limits;
- ? Surrogate recoveries;
- ? Matrix spike/matrix spike recoveries; and
- ? Laboratory and field duplicate relative percent differences.

The results of the data quality review will be summarized as part of the annual monitoring report. This report will be submitted to the project QA Manager for final review and confirmation of the validity of the data.

8 Laboratory Audits and Corrective Actions

Laboratory and field performance audits and corrective action procedures are described in this section.

8.1 Laboratory and Field Performance Audits

Laboratory and field performance audits consist of on-site reviews of quality assurance systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the Project QC Coordinator upon request. All laboratories are required to have written procedures addressing internal QA/QC; these procedures will be submitted and reviewed by the Project QA/QC Manager to ensure compliance with the QAPP. All laboratories must ensure that personnel engaged in sampling and analysis tasks have appropriate training.

8.2 Corrective Action Procedures

Corrective Action for Field Sampling

The Project Manager will be responsible for correcting equipment malfunctions during the field sampling effort and for resolving situations in the field that may result in noncompliance with the QAPP. All corrective measures will be immediately documented in the field logbook.

Corrective Action for Laboratory Analyses

All laboratories are required to submit and comply with their Standard Operating Procedures (SOPs). The Laboratory Project Manager will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Project Manager or QA/QC Manager will be notified immediately if any quality control sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. The Laboratory Project Manager will document the corrective action taken in a memorandum submitted to the QA/QC Manager within five days of the initial notification. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, reanalysis, re-extraction) will be submitted with the data package in the form of a cover letter.