

Appendix E
Quality Assurance/Quality Control Documentation

Data Quality

(.1 Overview

This appendix summarizes the quality assurance/quality control (QA/QC) procedures that were implemented in the laboratory and field to ensure that the data collected during the 2011-2012 Truckee River Water Quality Monitoring Program for the Town of Truckee and Placer County. The purpose of the data review was to evaluate the data to ensure they were of known quality and met the project objectives. A general description of the laboratory and field QA/QC procedures is discussed in Section E.2. Upon receipt from the laboratory, a complete data quality evaluation was performed on all data generated during this program to ensure that the reported data accurately represent the concentrations of constituents present in the water samples. The process results of the data quality evaluation are discussed in Section E.3.

(.2 Laboratory Quality Assurance/Quality Control Procedures

Quality assurance is defined as the integrated program designed for assuring reliability of monitoring and measurement of data. Quality control is defined as the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measuring process. This section presents quality control procedures that were conducted by the laboratory to ensure analytical data quality. A description of the general practices required of the laboratory is summarized below.

(.2.1 Standard Operating Procedures (SOPs)

Western Environmental Testing Laboratory (Wet Lab) and High Sierra performed all analyses and QA/QC procedures in accordance with published analytical methods and internal SOPs. The internal SOPs provide step-by-step instructions for performing analytical methods. Utilizing SOPs is a method to ensure uniformity and compliance in the measurement process.

(.2.2 Purity of Standards, Solvents and Reagents

The purity/quality of reagents, solvents and standards used in the analytical process is a critical component in the generation of high quality data. All reagents used were of reagent-grade (equivalent) or higher grade quality whenever obtainable. Where applicable, reference standard solutions were traceable to the National Institute of Standards Technology (NIST), the American Association for Laboratory Accreditation (AALA), or to an equivalent source. Each new lot of reagent-grade chemicals was tested for quality of performance, and laboratory records were kept to document the results of lot tests.

(.2.3 Calibration

Instrument calibration is performed to ensure that the instrument is capable of producing acceptable qualitative and quantitative data for target compounds. Calibration procedures vary by analytical method. In general, each instrument is calibrated initially using certified standards, followed by periodic (i.e., daily) calibration verifications to confirm that the initial calibration is valid.

(.2.4 Method Blank

A method blank (MB) is a QC sample that consists of all reagents specific to the method and is carried through every aspect of the procedure, including preparation, cleanup and analysis. The MB is used to identify any interferences or contamination of the analytical system that may lead to the reporting of elevated analyte concentrations or false positive data. Potential sources of contamination include solvent, reagents, glassware, or the laboratory environment. The MB is prepared with each group of samples processed. One batch of samples is generally defined as a group of 20 samples or less of the same sample matrix that are processed using the same procedures, reagents and standards within the same time period.

(.2.5 Laboratory Control Sample

A laboratory control sample (LCS) is a laboratory-generated clean matrix sample that is fortified with known concentrations of target analytes. The LCS is then carried along with the environmental samples through the entire sample preparation/analysis sequence. Review of the LCS recovery data is used to monitor the performance of the analytical methods. The results of the LCS, used in conjunction with the matrix spike samples, can provide evidence that the laboratory performed the method correctly or the sample matrix affected the results.

(.2.6 Matrix Spike Sample

Matrix spikes (MS) and matrix spike duplicates (MSDs) are analyzed to evaluate the effect of the sample matrix on the accuracy of the analytical procedures. A matrix spike is an environmental sample that has been spiked with known concentrations of target analytes. The matrix-spiked sample is then carried through the entire analytical sequence like all other samples. The analyte concentrations detected during the analysis are compared to the known spike concentrations to obtain a percent recovery for each spiked analyte. The recoveries are compared to acceptance limits and the results are used to evaluate accuracy and the presence of matrix interferences.

The difference between the MS and the MSD analyses is expressed as the relative percent difference (RPD). RPDs are used to evaluate analytical precision and can also be a measure of relative sample heterogeneity.

(.3 Data Quality Evaluation

Upon receipt from the laboratory, each analytical report was thoroughly reviewed and the data evaluated to determine if the data met the project objectives. Data

reviewed included storm water samples. Initially, the data were screened for the following major items:

- A 100 percent check between electronic data provided by the laboratory and the hard copy reports;
- Conformity check between the chain-of-custody forms, compositing protocol, and laboratory reports;
- A check for laboratory data report completeness; and,
- A check for typographical errors on the laboratory reports.

After performing the aforementioned data screening, the laboratory was notified of any deficiencies, if any, by way of a telephone call detailing the problems encountered during the initial screening process.

Following the initial screening, a more complete QA/QC review was performed, which included an evaluation of method holding times, method blank contamination, and accuracy and precision. Accuracy was evaluated by reviewing MS, MSD and LCS recoveries; precision was evaluated by reviewing field duplicate, spike duplicate and laboratory sample duplicate RPDs.

A total of 607 constituents were measured among 107 samples (including field QC samples). Data quality assessment was based upon review of holding times, laboratory blanks, laboratory control samples, laboratory duplicates, matrix spikes and matrix spike duplicates, reporting limits, and field duplicates. Based on the data review, none of the constituent results were rejected. The following sections describe specific items that were evaluated during the QA/QC review process and data that were qualified as estimated due to laboratory QC exceedances.

(3.1 Holding Times

A sample holding time is defined as the maximum allowable time a sample can be stored after sample collection and preservation until analysis. During the data review process, it was determined that there were 12 holding time exceedances. The exceedances occurred on all samples collected on January 20, 2012 (Sites DSC-TC1, DSC-TT1 and its field duplicate and triplicate samples, DSC-MC1, and DSC-MC2), and were caused by a laboratory instrument error that led to the analysis of nitrate (six results) and nitrite (six results) outside of the EPA recommended 48 hour hold time. The error was resolved and no further hold time exceedances occurred.

(.3.2 Blank Evaluation

As mentioned previously, analytical results from laboratory method blanks were evaluated during the QA/QC review process. Blanks can be used to identify the presence and potential source of sample contamination. If no contamination is present in the blanks, then no further action is required. Laboratory method blanks were analyzed with every batch of samples for most analyses.

In the 2011-2012 dataset, no analytes were detected in the laboratory method blanks at concentrations greater than their respective reporting limits. Therefore, none of the data were qualified as a result of laboratory or field contamination.

(.3.3 Accuracy and Precision

Accuracy is the degree of agreement between a measurement and the true or expected value or between the average of a number of measurements and the true or expected value. Systematic errors affect accuracy. For chemical properties, accuracy is expressed as percent recovery (%R), which is calculated as follows:

$$\%R = [(C_s - C)/S] * 100$$

where:

%R	=	percent recovery
C _s	=	spiked sample concentration
C	=	background sample concentration
S	=	concentration equivalent of spike added

MS, MSD and LCS results were checked to assess the accuracy of the analytical process. MS and MSD results provided an evaluation of accuracy in environmental sample matrices; whereas, LCS results provided a measure of accuracy throughout the entire recovery process.

Precision is an estimate of variability. In other words, precision is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. Precision can be calculated as the relative percent difference (RPD) as follows:

$$RPD = 2 * [(S - D)/(S + D)] * 100$$

where:

RPD	=	relative percent difference
S	=	concentration measured in original sample
D	=	concentration measured in duplicate sample

Duplicate sample results (field splits and laboratory duplicates) were checked to assess the variability and precision between samples. Depending on the analytical method, various types of laboratory duplicate results were compared to assess precision. For example, some methods require the analysis of an MS and an MSD sample pair, whereas other methods are not as specific. When MS/MSD analyses are not specified, the laboratory calculated precision using a sample and a duplicate of the same sample.

Control limits for spike recoveries and RPDs are shown on Table D-1. These are the acceptance limits used to evaluate the usability of the project data.

**Table E-1
Accuracy and Precision Control Limits**

Analyte	% Recovery (Accuracy)	RPD (Precision)
Ammonia	80 - 120	20
Nitrate/Nitrite (as N)	80 - 120	20
Orthophosphate	80 - 120	20
Phosphorus (total)	80 - 120	20
Phosphorus (dissolved)	80 - 120	20
TKN	80 - 120	20
TSS	80 - 120	20
Turbidity --		20

The following sections discuss the results of accuracy and precision measurements.

Laboratory Duplicates

In the 2011-2012 dataset, no results were qualified as estimated due to a laboratory duplicate exceedances.

Field Duplicates

There are no specific regulatory criteria available to evaluate field duplicate results. However, because field duplicates are more susceptible than laboratory duplicates to concentration variability, an RPD criterion of 50 percent was used during the data evaluation.

In the 2011-2012 dataset, three triplicate samples were collected and analyzed for 18 total constituents to assess field precision. The field precision in the samples collected from DSC-TT1 on January 20, 2012 exceeded the criteria of 50 percent for total phosphorus and total suspended solids. Therefore, these six results were qualified with "Js" to indicate estimated concentrations as a result of field precision issues.

Laboratory Control Samples

In the 2011-2012 dataset, no results were qualified due to out-of-range LCS recoveries.

Matrix Spike/Matrix Spike Duplicate Samples (MS/MSDs)

In the 2011-2012 dataset, no results were qualified due to out-of-range MS or MSD recoveries.

Overall Summary

All results were evaluated against Truckee River Water Quality Monitoring Program specified quality control criteria. In total, 12 results were qualified with "Js" due to holding time exceedances and 6 results were qualified as estimated due to field precision issues. The QA/QC review of analytical results found all the data to be of acceptable quality and usable for the intended purposes, including sample data qualified as estimated due to holding time or precision issues.