

11 Quality Control

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Victor Stokmanis¹



Grassland Bypass Project

¹ Quality Assurance Specialist, Bureau of Reclamation (MP-157), 2800 Cottage Way, Sacramento, California 95825
(926) 978-5285, vstokmanis@mp.usbr.gov

Data Quality Objectives

The Data Collection and Reporting Team (DCRT) uses the laboratory data from this project to support the determination of whether Selenium (Se) levels in the Grassland Bypass exceed regulatory compliance levels. Because individuals use the data generated by this program for regulatory compliance and baseline monitoring purposes, the data must be of the highest degree of reliability. Sample collection from different environmental media and analytical methods performed by the laboratories must adhere to the guidelines established in the quality assurance project plan (QAPP).

Quality Assurance Project Plan

The use and operation of the Grassland Bypass Project (GBP) was originally intended to extend over a five year time period (October 1, 1996 through September 30, 2001). However, on May 31, 2001, the U.S. Bureau of Reclamation (Reclamation) and the San Luis & Delta-Mendota Water Authority (Authority) completed an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) on Phase II of the GBP. Phase II proposed extending the GBP to December 31, 2009. The EIS/EIR was needed to ensure that the continued use of the Project would be consistent with long-term drainage options and to ensure compliance with water quality objectives. On September 7, 2001, the California Regional Water Quality Control Board, Central Valley Region, adopted a Waste Discharge Requirement (WDR) for Phase II of the GBP that sets the terms and conditions for the use and operation of GBP through 2009. The WDR includes a schedule of monthly and annual selenium and salt loads that the GBP may discharge into Mud Slough (North) and the San Joaquin River, and specifies chronic toxicity testing. It also describes a program to monitor storm water releases from the Grassland Drainage Area (GDA) into the Grassland wetlands. On September 28, 2001, the Phase II Use Agreement (UA II), allowing the Authority to use the San Luis Drain from October 1, 2001 through December 31, 2009, was executed. The UA II established the terms and conditions for using the SLD and operating the GBP. The UA II required an extensive monitoring program to assess project accomplishments based on the WDR. As a result, the DCRT put in place a new Compliance Monitoring Program (CMP II) to monitor the environmental effects of the GBP. CMP II is based on the monitoring plan for the first Use Agreement that established the site locations, sampling frequency, parameters, and data reporting of project findings. The U.S. Bureau of Reclamation's Environmental Monitoring Branch was assigned the lead role to update the QAPP for Phase II of the Grassland Bypass Project.

On August 22, 2002, Reclamation and the DCRT completed and released the QAPP for Phase II of the use and operation of the Grassland Bypass Project. The QAPP provides the protocols for documenting the Quality Assurance/Quality Control (QA/QC) activities carried out by the agencies responsible for the separate components of CMP II. The QAPP describes the organization and membership of the project participants and defines the data quality objectives (DQOs) for CMP II. This plan describes the QA/QC activities associated with each agency's monitoring program, provides the QA/QC protocol of each laboratory participating in the program, provides acceptance criteria for data validation procedures, and describes corrective actions to be taken when the data fails to meet such criteria. The QAPP addresses both

quantitative goals, including precision, accuracy, and completeness, and qualitative goals, including representativeness and comparability.

The updated QAPP follows the format described in the May 1994 Guidelines for Preparing Quality Assurance Project Plans, published by the State of California Department of Water Resources. The QAPP includes all the requirements identified in the August 1994 Draft Interim Final, US EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5.

Quality Assurance Oversight

QA/QC oversight for CMP II is the responsibility of a QA/QC manager (QAQCOM) working for Reclamation. The QAQCOM oversees the implementation of commitments, guidelines, practices, and protocols outlined in the QAPP in compliance with the goals and objectives of the project. The QAQCOM uses guidelines, protocols, and criteria established in the QAPP to monitor and validate data collected by Reclamation personnel and to assess the data collection and validation processes used by the other participating agencies. When the QAQCOM identifies a noncompliance issue, the appropriate QA Officer is notified, and the agency implements corrective actions to resolve the problem. The QAQCOM brings any unresolved issues between the QAQCOM and a participating agency's QA Officer to the attention of the DCRT for resolution. Reclamation personnel conduct audits of all participating analytical laboratories and review the data collection activities of the participating agencies for adherence to protocol. Agencies participating in CMP II also conduct field audits on other participating agencies by reviewing sampling methods in the field.

Quality Assurance Accomplishments

Laboratory Performance and System Audits

Table 1 is a list of laboratories that have been audited by Reclamation for the Project.

During 2002, Reclamation audited Twining Laboratories, Inc. and Frontier Geosciences, Inc. The audit process involves an initial demonstration of performance using external quality assurance samples (performance audit) followed by a review of the latest version of the laboratory's QA Manual, the laboratory's performance study results for the past three years, and the laboratory's most recent internal or external audit report with corrective actions. Once the laboratory has demonstrated acceptable performance and passed the initial document review process, Reclamation conducts an on-site system audit of the laboratory facility. During the on-site system audit, Reclamation reviews all of the detailed aspects of the quality system to ensure laboratory personnel understand and adhere to the protocols cited in the laboratory QA manual and that they follow the procedures outlined in the analytical methods. The auditors then send a report addressing all of the deficiencies identified during the system audit to the laboratory with a recommended time frame for the laboratory to respond to the findings and implement and document the corrective actions. The following tables are examples of how Reclamation summarized and documented performance sample results for Twining Laboratories, Inc. and Frontier Geosciences, Inc. in 2002 (Table 2 and 3).

The two laboratories audited by Reclamation in 2002 performed well on the performance and system audits. Where deficiencies were observed, the laboratories have incorporated the recommendations or are in the process of implementing them.

Sample Collection System Audits

Reclamation conducted a sample collection system audit on the San Luis & Delta Mendota Water Authority on April 24, 2002. The Authority collects water samples three times a month for Block Environmental Services (BES) at five different project sites for toxicity testing and selenium analysis. On June 12, 2002, the California Department of Fish and Game (CDFG) performed a sample collection system audit on the U.S. Fish and Wildlife Service (USFWS) at site I2. USFWS conducted a sample collection system audit on CDFG at site H on June 13, 2002. After completing the audits, USFWS and CDFG debriefed each other on their findings. For the GBP, USFWS and CDFG collect tissue samples for selenium, boron, and mercury analyses. The sample collection system audits focused on the quality of the environmental samples collected by the field samplers and the ability of field personnel to adequately support and document the sample collection process. The purpose of the sample collection system audits was to identify and prevent problems in the field that could compromise sample integrity. Even though the sample collection system audits found some deficiencies and deviations from stated protocols, overall the audits found Authority, CDFG, and USFWS field personnel to be very knowledgeable and skilled in collecting environmental samples for the Grassland Bypass Project. CDFG and USFWS personnel have remedied all deficiencies or deviations found during these field audits.

Data Review and Validation Activities

The routine data review and validation activities performed in 2002 to ensure data reliability as stated in the QAPP are listed in Table 4.

Data Validation Methods

The QAQC is responsible for ensuring the participating agencies properly validate their analytical results, identify problems with their analytical data, and contact their respective laboratories to initiate corrective actions. To accomplish these tasks, Reclamation routinely reviews and validates the data produced by the participating agencies.

Reclamation assesses the validity of the analytical results by comparing QC results to acceptance criteria identified in Table 7 of the QAPP. The guidelines address both internal and external QC sample results. The QAPP defines internal QC samples as those check samples incorporated by the laboratories performing the work and defines external QC samples as those check samples submitted to the laboratories by the contracting agency. Reclamation verifies that agencies are incorporating the correct numbers and types of external QC samples into batches of field samples during the data validation process and addresses any nonconformance issues with the agencies directly. Another assessment activity performed by Reclamation is to ensure participating agencies spike their external QC check samples or incorporate reference samples at concentrations near historical levels as a means of ensuring better sample accuracy.

Reclamation brings laboratory QC summary report problems to the attention of the each agency's QA Officer. The QA Officers then address these problems with the laboratories. For example, QA Officers may request laboratories take proper corrective actions on internal QC check sample results outside of established control limits. Reclamation checks data packages to ensure laboratories document details of their corrective actions in the case narrative section or as footnotes in the QC summary section. Reclamation also checks laboratory data packages to ensure the laboratories analyze project samples within required holding times.

Reviewing data packages to identify possible outliers is another part of the validation process. Once Reclamation staff identifies a data point as a possible outlier, they request the laboratory re-analyze the sample. Reclamation identified the selenium result of 1.2 ug/L for the BES water sample collected at Site B on February 20, 2002 as a potential outlier. From August 2001 through February 2002, selenium results from this site varied as follows: 32, 33, 32, 53, 56, 29, 53, 51, 30, 44, 47, 49, 55, 45, 47, 61, 56, 66, 61, 1.2, and 70 ug/L (Table 5). Upon re-analyzing the sample demonstrating the 1.2 ug/L selenium result, the laboratory confirmed the original result (Table 5). As a result, Reclamation concluded a sample switch had not occurred within the laboratory. Upon further investigation, Reclamation determined a water sample with a selenium concentration of 65 ug/L collected on February 20, 2002 demonstrated a historically high selenium value for the ambient site. The sample with the historically high 65 ug/L selenium result was also re-analyzed and the result confirmed. Reclamation concluded that sample bottles were incorrectly labeled in the field and the 1.2 ug/L selenium result was from the ambient site, and the 65 ug/L selenium result came from site B.

To assess both laboratory performance and field sampling homogenization techniques, Reclamation collected one duplicate sediment sample from Mud Slough and four duplicate sediment samples from the San Luis Drain and submitted them to the U.S. Geological Survey, Denver Laboratory for selenium analyses. These duplicate sample results (Table 6) provided information on both laboratory performance (precision) and field homogenization techniques. The values in Table 6 demonstrate acceptable analytical precision and sample homogenization techniques.

Reclamation also reviewed all field calibration sheets from each agency performing field sampling for documentation of routine instrument calibrations to ensure reliable field measurements.

QA Issues of Concern

To determine whether all deficiencies and deviations from stated protocols were corrected, Reclamation requires a corrective action report from BES responding to the findings in Reclamation's sample collection system audit report of the Authority on April 24, 2002.

On January 30th, 2004, the QAQCOM met with Staff of the Central Valley Regional Water Quality Control Board (CVRWQCB) to review the nutrient data collected and validated for sites C, G, and N from October 2001 to December 2002. During the review, a portion of the data was noted not to meet the GBP QAPP's quality assurance standards or the recovery criteria specified in the WDRs for Phase II of the GBP. Therefore, the QAQCOM concurred with the CVRWQCB's decision not to release that portion of the data.

On March 1, 2004, the QAQCOM called Randy Dahlgren of the University of California, Davis - Land Air and Water Resources Department Laboratory (UCD Laboratory) to request a review of the raw nutrient data his laboratory generated for sites B and D. However, the laboratory had destroyed all the raw nutrient data from October 2001 to December 2002. This review was necessary to determine if the UCD Laboratory collected and analyzed the nutrient samples following criteria established in the project's QAPP. Due to the UCD Laboratory's inability to provide the raw nutrient data, the QAQCOM determined that the nutrient data for sites B and D cannot be verified to determine if it meets the QAPP's quality assurance standards. As a result, none of the nutrient data for Sites B and D can be used for assessment purposes related to the Grassland Bypass Project.

The QAQCOM has instructed the laboratory currently analyzing the nutrient samples to retain raw data for a minimum of five years. As a result, the QAQCOM is confident nutrient data released in the future for the Grassland Bypass Project will meet the project's acceptance criteria as specified in the QAPP.

Uncertainty Associated with Environmental Measurements

As with all quantitative measurements, there is a degree of uncertainty associated with the values provided. This is especially true for environmental data where measurement error may be introduced in the sample collection phase as well as in the laboratory service phase. Program participants and the public need to understand that values presented in laboratory reports are not absolute, but rather represent values with associated precision and accuracy uncertainties as defined in Table 7 of the QAPP. In addition, as the concentration of the parameter approaches the limit of detection for the particular analytical method, the level of uncertainty of the result increases significantly as shown in Figure 4 of the QAPP. The data user needs to understand the degree of uncertainty or the confidence limits associated with the data.

Summary

During year 2002, the participating agencies in the Compliance Monitoring Program complied with all protocols outlined in the QAPP. Adherence to the QAPP ensured the reliability of the data collected and provided the necessary documentation to support the validity of the measurements. Where exceptions did occur, Reclamation was able to identify and address the issues, thereby ensuring the reliability of the project's data.

Reclamation took the lead role in 2002 updating the QAPP for Phase II of the use and operation of the GBP. During 2002, Reclamation conducted audits of two project laboratories and a sample collection system audit on the Authority for BES. CDFG performed a system audit of USFWS's sampling group and vice versa in 2002. Reclamation reviewed and validated the data collected throughout the year. In order to perform QA oversight duties, Reclamation requires full cooperation from the participating agencies. When using the data to make decisions, individuals need to understand the analytical uncertainty associated with the data. In performing QA oversight, Reclamation serves to remind agencies of the need to adhere to protocols established in the QAPP.

Table 1. Summary of Laboratory Audits Conducted by US Bureau of Reclamation

Laboratory	Location	Date(s)	Analysis Type
Trace Substance Laboratory	Rolla, Missouri	April 30 & May 1, 1996	Tissue Analysis
Severn Trent Services Laboratory	West Sacramento, California	October 10, 1996; July 10 & 11, 2001	Water Analysis
Frontier Geosciences Inc.	Seattle, Washington	February 2 & 3, 1998; September 4 & 5, 2002	Tissue Analysis
U.S. Geological Survey Geological Division Laboratory	Denver, Colorado	December 2 & 3, 1998 July 17 & 18, 2001	Sediment Analysis
Twining Laboratory	Fresno, California	June 22 & 23, 1999;	Water Analysis
South Dakota State University Olsen Laboratory	Brookings, South Dakota	September 23, 1999	Water Analysis
Water Pollution Control Laboratory	Rancho Cordova, California	January 13 & 14, 2000	Tissue Analysis
Weck Laboratories	City of Industry, California	August 10 & 11, 2000	Water Analysis
Block Environmental Laboratory	Pleasant Hill, California	September 28, 2000	Toxicity Analysis

Table 2. Twining Laboratories Performance Study

Sample ID	Parameter	Result mg/L	True Value mg/L	% Recovery	Acceptance Limit
QA475	Nitrate as N	2.6	2.8	93%	80 - 120
QA475	Ammonia as N	1.6	1.7	94%	80 - 120
QA475	Total Phosphorus	2	2.5	80%	80 - 120
QA476	Boron	0.27	0.28	96%	80 - 120
QA478	Total Suspended Solids	76	65.2	117%	80 - 120

Notes: Date completed: 05/07/02
Matrix = Water

Table 3. Frontier Geosciences, Inc. Performance Study

Sample ID	Parameter	Result mg/kg	True Value mg/kg	% Recovery	Acceptance Limit
QA481	Boron	40	37.6	106%	80 - 120

Notes: Date Completed: 06/19/02
Matrix = Vegetation

Table 4. Data review and validation activities

Type of data & field logbooks	Review and Validation Group
Sediment data from Reclamation	Reclamation
Water data from CVRWQCB	Reclamation and CVRWQCB
Biota data from USFWS and CDFG	Reclamation and USFWS
Toxicity data from BES	Reclamation
Field logbooks from Reclamation's sampling group	Reclamation

Table 5. Block Environmental Site B Monitoring

SELENIUM LEVELS (ug/L) AT SITE B					
	Result	Re-analyzed	Relative %	Difference	Confirmation
	ug/L	Result	Difference		Acceptance Level
		ug/L			
8/13/2001	32	-	-	-	-
8/15/2001	33	-	-	-	-
8/17/2001	32	-	-	-	-
9/10/2001	53	-	-	-	-
9/12/2001	56	-	-	-	-
9/14/2001	29	-	-	-	-
10/22/2001	53	-	-	-	-
10/24/2001	51	-	-	-	-
10/26/2001	30	-	-	-	-
11/26/2001	44	-	-	-	-
11/28/2001	47	-	-	-	-
11/30/2001	49	-	-	-	-
12/10/2001	55	-	-	-	-
12/12/2001	45	-	-	-	-
12/14/2001	47	-	-	-	-
1/28/2002	61	-	-	-	-
1/30/2002	56	-	-	-	-
2/1/2002	66	-	-	-	-
2/18/2002	61	-	-	-	-
2/20/2002	1.2	0.9	-	0.3	+ RL
2/22/2002	70	-	-	-	-

Table 6. Quality Assurance Results, Sediment Monitoring

Location	Selenium Level Regular Sample (ug/g)	Selenium Level Duplicate Sample (ug/g)	Relative Percent Difference (RPD) or Difference	Duplicate Acceptance Criteria
Site I ₂ (whole core)	6.2	5.5	13%	≤ 35%
Site B (whole core)	16.0	18.0	11%	≤ 35%
Site 1-2C (whole core)	16.0	18.0	11%	≤ 35%
Check #13 (whole core)	4.5	4.6	2.2%	≤ 35%
Check #15C (whole core)	4.7	4.8	2.1%	≤ 35%

Notes: CONDUCTED JUNE 18, 19, 24, 25, 2002
 DUPLICATES TO MEASURE LABORATORY PRECISION