

Comprehensive Everglades Restoration Plan

2007 Annual Quality Assessment Report

for

May 2006 – April 2007

Quality Assurance Oversight Team

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ACRONYMS AND ABBREVIATIONS

AEL	Advanced Environmental Laboratories, Inc.
ASR	Aquifer storage and recovery
AT	Assessment Team
BOD	biochemical oxygen demand
CAS	Columbia Analytical Services
CERP	Comprehensive Everglades Restoration Plan
CGM	CERP Guidance Memorandum
DBLB	DB Environmental Laboratory
DCT	Design Coordination Team
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved oxygen
DQO	Data Quality Objective
ENP	Everglades National Park
EPJV	Everglades Partnership Joint Venture
EVER	Everglades Laboratory
FDEP	Florida Department of Environmental Protection
FGCU	Florida Gulf Coast University
FIU	Florida International University
FWEC	Foster Wheeler Energy Corporation
KSA	KSA Environmental Laboratory, Inc.
LCS	laboratory control sample
MAP	Monitoring and Assessment Plan
MDL	Method Detection Limit
MS	matrix spike
MSD	matrix spike duplicate
N	nitrogen
NA	Not applicable
NCER	National Conference on Ecosystem Restoration
NELAC	National Environmental Laboratory Accreditation Conference
NOB	no bottle
NRS	No requirement stated
ORP	Oxidation Reduction Potential
P	phosphorous
PCBs	polychlorinated biphenyls
PDT	Project Delivery Team
PE	Performance Evaluation

PI	Principal Investigator
PIR	Project Implementation Report
PMP	Project Management Plan
PMR	Project Manager Remark
QA	quality assurance
QAOT	Quality Assurance Oversight Team
QA/QC	Quality Assurance/Quality Control
QAR	Quality Assessment Report
QASR	Quality Assurance Systems Requirements
QC	quality control
RECOVER	Restoration Coordination and Verification
RPD	relative percent difference
SOP	Standard Operating Procedure
SOW	Scope of Work
SFWMD	South Florida Water Management District
TKN	Total Kjeldahl Nitrogen
TOC	total organic carbon
TTECI	TetraTech EC, Inc.
USACE	US Army Corps of Engineers
USBS	U.S. Biosystems, Inc.
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WRDA	Water Resource Development Act

EXECUTIVE SUMMARY

Since passage of the Water Resource Development Act (WRDA) in 2000, the mission of the Comprehensive Everglades Restoration Plan (CERP) has been to restore, protect and preserve the water resources of central and southern Florida, including the Everglades. The collection of high-quality, scientifically defensible data is the cornerstone of this mission. The Quality Assurance Oversight Team (QAOT) was established by CERP Guidance Memorandum (CGM) 41 to *provide guidance on monitoring procedures, quality assurance/quality control (QA/QC) and data validation for CERP projects and to be the forum to develop consistency among the various entities involved with environmental monitoring, data quality and QA/QC processes*. CGM 41 specifies that the lead QAOT agencies will *compile individual QA CERP reports and produce an integrated QA report on CERP projects to CERP management*. This Quality Assessment Report (QAR) has been prepared by the QAOT to fulfill this mandate.

The scope of the QAR is to describe the state of data quality generated for CERP during the time period between May 1, 2006 and April 30, 2007. The term CERP is an umbrella term for many different activities. These include Restoration Coordination and Verification (RECOVER) system-wide monitoring efforts (i.e., Monitoring and Assessment Plan [MAP]), project monitoring, and permit-driven regulatory monitoring. Throughout this report, the terms “system-wide monitoring” will be used to designate RECOVER activities, “project monitoring” to denote CERP and Advanced Construction Projects monitoring, and “permit monitoring” to denote permit-driven regulatory monitoring.

The QAOT employed a variety of methods to understand the QA/QC procedures being implemented for CERP that could impact data quality. Assessment of CERP data quality was accomplished by conducting interviews with agency QA staff, project managers¹ and principal investigators (PIs), and reviewing monitoring plans. Assessment of CERP project and permit data quality was accomplished through the review of field and laboratory quality control (QC) data, the results of laboratory performance evaluation (PE) samples, and the results of field and laboratory audits. For this report, no attempt was made to assess the QC results of CERP system-wide monitoring data. Overall, this report presents an opportunistic “snapshot” of CERP data quality. The results are not necessarily representative due to the small number of assessments performed in each category and cannot be extrapolated to CERP as a whole. This is a major limitation of this report, and one of the biggest challenges for the QAOT in the future.

An inventory of current CERP monitoring activities was conducted by the QAOT in March 2007 by distributing a questionnaire to CERP project managers and CERP system-wide PIs. The purpose of the QAOT inventory was to identify environmental monitoring activities and to determine what was being monitored and by whom. Essentially 100% of the questionnaires were completed, meaning that the QAOT inventory accurately represented the current and proposed environmental monitoring activities. Based on the inventory, seven CERP projects (13%) and 48 CERP system-wide monitoring efforts (87%) are currently collecting environmental data. The complete QAOT inventory contains 571 rows and 14 columns of data. It is posted in the CERPZone within the QAOT Project Team cabinet in a folder entitled QAOT Documents.

During the report period, nine interviews were conducted to determine if the quality systems being implemented for CERP were compliant with the 2006 QA Systems Requirements (QASR) manual. Three interviews conducted with agency representatives assessed organizational policies and procedures. Six interviews were conducted with selected CERP project managers and CERP system-wide PIs to assess

¹ The term “project manager” in this report denotes management of both CERP project and permit-related monitoring.

implementation of QASR requirements for specific monitoring efforts. Eleven (11) quality system elements were assessed for each interview. Responses were coded to indicate whether the QASR requirement was fully met (**Excellent**); partially met (**Adequate**); or not met (**Limited**). The results of the interviews confirmed that compliance with QASR requirements was excellent. At the monitoring level, four of the six monitoring activities received an “excellent” rating and the remaining two received “adequate” ratings based on the project manager and PI interviews. In general, average compliance for each quality system element was excellent for all but two categories (lack of a QA Officer or QA program in the field and lack of a QA Officer or QA program in the laboratory). The need for QA outreach to CERP project managers and system-wide PIs is recognized by the QAOT; therefore, the assignment of USACE and South Florida Water Management District (SFWMD) staff to act as QA officers for CERP is being implemented. The six monitoring activity interviews represent approximately 10% of the environmental monitoring currently being conducted for CERP. However, the preponderance of current monitoring efforts are biological or ecological and the two biological interviews conducted represent less than 1% of those activities. Thus, the QAOT interviews did not adequately assess the state of biological/ecological monitoring compliance with the QASR. Further, it is recognized that the monitoring activity interviews represent the practices of individuals and cannot be extrapolated to represent QA/QC activities overall. Based on the snapshot represented by these interviews it appears that project managers and PIs are implementing the quality systems of their organizations. In general, it appears that the QASR requirements are codified at the agency level and implemented at the monitoring level. The technical reviews and assessments performed indicate that the data can be used with confidence.

The QAOT reviewed two monitoring plans during the report period. The purposes of the reviews were to assess the usability of the Monitoring Plan Checklist outlined in the CERP Guidance Memorandum (CGM) 40.01 as well as to assess the completeness of the monitoring plans versus the content requirements defined in CGM 40. The two monitoring plans, prepared in 2004 and 2007, respectively, described a biological monitoring activity and a water quality aquifer storage and recovery (ASR) area pilot project. The monitoring plan reviews provide an extremely limited snapshot of monitoring plan contents, but initiated a process that the QAOT is committed to continue. For these two monitoring plans it was noted that: both monitoring plans fully or partially addressed over 75% of the monitoring plan elements defined in CGM 40.01; technical elements of the monitoring plans were adequately or partially addressed; field procedures and documentation requirements were not adequately addressed in the ASR plan; and QA/QC requirements in the plans did not adequately define requirements for QC samples, QA audits, data verification and validation, and data and records management procedures. Overall, the adequacy of monitoring plans being prepared for CERP could not be fully evaluated based on the two reviews conducted and summarized in this report because the small number reviewed is not adequate for generalizations. The adequacy of monitoring plans is critical to data quality and monitoring plan review is a critical aspect of QAOT responsibilities. Therefore, improvements in communication, process, and procedures are needed. The QAOT recognizes the need to review monitoring plans and is developing a process to ensure that reviews occur.

The CERP QASR manual defines the quality system for CERP. It defines the protocols and procedures that must be implemented for CERP data collection activities to ensure that data are accurate, defensible, and comparable. During the report period, the QASR review initiated during 2006 to identify errors, inconsistencies, and technical updates was finished. With the exception of Chapter 8 *Biological Monitoring and Assessment Procedures*, the revised chapters were posted on the QAOT website on October 17, 2007 for public comment. Chapter 8 will be distributed for public comment after an internal review by the RECOVER PIs. It is anticipated that revised chapters will be posted on the QAOT webpage during 2008.

Of the approximately 55 monitoring efforts currently underway, over 85% are collecting biological and ecological data. In order to assess the QA/QC procedures currently implemented for biological and ecological monitoring, a questionnaire focused on CERP system-wide monitoring was developed by the QAOT and the Assessment Team (AT) Co-chairs. The objective of the questionnaire was to “help identify areas where assistance in developing or improving processes can be focused... and to develop focused sessions at upcoming Biological workshops.” The stated goal was “to identify and resolve real problems while continuing to assure high data quality.” The completed questionnaires were received in 2007 and the data will be compiled in 2008. The results will be reported in the 2008 QAR and will be used by the AT Co-chairs and QAOT to identify the QA/QC procedures currently being implemented for CERP system-wide monitoring and to determine compliance with the QASR. Based on the results of these questionnaires, the QAOT will work with the AT Co-chairs to develop effective outreach mechanisms, including teleconferences or focused workshops, to address substantive issues and QA/QC gaps. These activities will be summarized as part of the 2008 QAR.

Field assessments are critical to the generation of quality data because the sample collection and handling procedures will profoundly impact sample integrity and thus, data quality (Claycomb, 2000). Based on the QAOT inventory and interviews with SFWMD staff, 28 organizations are currently collecting field samples or data for CERP. During the report period, field data quality was assessed through the results of three field audits and field QC data for six CERP-related water quality monitoring activities. The field audit results and field QC data presented in this report are “opportunistic” and are based on available information. The report input represents a small fraction of current CERP field activities and is not representative. The QAOT continues to develop a systematic approach to target field audits towards critical activities, but this was not fully implemented in 2007. Nineteen (19) quality issues in two major categories were identified in the three field audits: analytical issues (68%) and documentation issues (32%). Analytical issues included improper rinsing procedures (38%) and sampling method procedures (54%). Documentation issues included incomplete header sheets and inconsistencies between the field notes and the custody forms. This limited snapshot none-the-less demonstrates the importance of field audits; approximately two-thirds of the field audit findings (i.e., deficiencies) could result in inaccurate or incomparable analytical data that would not be possible to identify by reviewing the analytical results. No biological or ecological field assessments were performed by the QAOT during the report period.

The results of field QC samples are an important indicator of data quality. Field measurement data in DBHYDRO for six water quality monitoring locations that will contribute data to CERP were used to assess the quality of a snap shot of field data. The data set contained 3530 data points for eight field parameters (depth, dissolved oxygen, oxidation reduction potential, pH, salinity, Secchi disk depth, specific conductivity, and temperature). The QAOT acknowledges that this data set is miniscule relative to the amount of field-measured water quality data currently collected for CERP; it is opportunistic rather than representative because it reflects data collected for one organization (SFWMD) operating under a field program with a highly developed quality system and a centralized database that facilitated data analysis. Given that the “snapshot” is small, the results are excellent. Ninety-seven percent (97%) of the 3530 field measurements in the snapshot were not qualified in any way, indicating that instrument calibration, sample handling, and associated QC samples were acceptable. Only 3% of the data were qualified.

There are 32 chemistry and biology laboratories identified in the QAOT inventory as currently analyzing samples in support of CERP system-wide, project, and permit monitoring. During 2007 the QAOT assessed data quality for laboratories performing chemical analysis for CERP in several ways. Laboratory audits were conducted for six laboratories (19%), the results of PE samples were reviewed for 17 (53%) laboratories, and a limited set of QC data were examined for six (19%) laboratories. As previously noted, laboratory audit results and laboratory QC data presented in this report are

“opportunistic” and represent information that was available during 2007. The QAOT continues to develop a systematic approach to target laboratory audits towards critical activities, but this was not yet fully implemented in 2007. CERP system-wide data quality was not assessed during the report period and is not discussed in this report.

Six laboratory audits were conducted by the QAOT during the report period (Table 7-1). The 69 laboratory related findings or deficiencies for these six audits were spread evenly among four categories: Analytical Issues (30%), Documentation (26%), Instrument and Equipment (16%), and Quality Systems (28%). Overall, standard operating procedure (SOP)-related issues represented the single largest category (16%), followed by labeling and temperature monitoring issues (12% each) and method deviations (9%). These results demonstrate the importance of laboratory audits; approximately half of the laboratory audit findings could result in inaccurate or incomparable analytical data that would not be possible to identify by reviewing the analytical results.

The QAOT inventory and QAOT members identified 17 laboratories that are currently or potentially contracted to analyze chemistry samples for CERP. The results of 32 PE studies, including two sponsored by the QAOT, were reviewed and analyzed for failures and trends. Of the 108 failures reported for the 32 PE studies, most were single failures associated with volatile or semivolatile compounds. Few trends were noted. Only alkalinity, ammonia as nitrogen (N), total Kjeldahl nitrogen (TKN), and total hardness were identified with multiple failures by more than two laboratories. These parameters are critical for CERP and the results of PE samples can be used to identify potential laboratory and data issues.

Data for seven SFWMD water quality monitoring activities in DBHYDRO were identified as CERP-related (Section 7.3). The data set contained 10,138 values for 171 laboratory parameters representing eight parameter classes. These data represent a small, opportunistic snapshot of the only CERP laboratory data available in a central repository, DBHYDRO. Based on data qualifiers assigned to authentic samples 97% of the data were of high quality, requiring no data qualifiers. A total of 293 sample values (~3%) were qualified with laboratory data quality flags; no data were rejected. The most heavily qualified parameter classes were polychlorinated biphenyls (PCBs) (14%), pesticides (13%), and isotopes (9%). These parameter classes represent a relatively small percentage of the overall data set.

The 2006 QAOT QAR (QAOT, 2006) identified four specific action items for improvement. Some progress was made in addressing each during 2007:

- Progress has been made in communicating QASR requirements to the monitoring community although more communication is needed. The QAOT has been represented at AT meetings, and has communicated requirements indirectly through the quality systems questionnaires.
- Progress has also been made in communicating CERP QA/QC requirements to project managers. The QAOT members continue to communicate QASR requirements during routine interaction with project managers and PIs within their organizations. This is an on-going activity. The review of monitoring plans provides an opportunity to ensure and communicate the inclusion of QASR requirements.
- The QAOT has made significant progress in designating personnel to perform QA functions for CERP. During 2007 qualified personnel were identified to perform this function for water quality monitoring, biological/ecological monitoring, hydrology and hydrodynamics monitoring, and organic and inorganic laboratory analysis. A QAOT subteam has been identified to define the responsibilities of the QA Officers. These responsibilities will be finalized in 2008 and training will be conducted.

- The need to identify appropriate, quantifiable QC procedures for biological parameters was not achieved during 2007. However, the QAOT/AT questionnaire was designed to identify those needs. The QAOT and AT Co-chairs will use the results to develop training and identify QA/QC gaps.

As demonstrated by this report, the QAOT has made significant advancements in initiating procedures and tools that will be used to assess the quality of CERP data. However, much remains to be done. Eight specific recommendations for improvement are identified throughout this report. These are summarized below.

1. Establish a systematic water quality data review process

The QAOT should assess the quality of all water quality data being generated for CERP. A process to receive, review, and assess water quality QA/QC results is needed.

2. Consistent, comprehensive, and readily accessible water quality data formats. The formats of water quality data and meta data are not consistent between organizations and laboratories. This needs to be addressed. The QASR requirement for the use of ADaPT was intended to address this issue, however ADaPT is not used by many organizations generated chemistry data for CERP. The QAOT recognizes that the use of ADaPT is an ongoing issue and is working on additional training of CERP staff in each agency.

3. Outreach/training and workshops. The need for outreach to project managers and PIs is a continued need to ensure that the requirements of the QASR are understood and implemented. The QAOT is in the process of working with the AT Co-chairs to develop effective outreach mechanisms, including teleconferences or focused workshops, to address QA/QC gaps.

4. Focused laboratory and field audits

The audit program must be expanded to include water quality, biological, ecological, hydrodynamic, hydrologic, and remote sensing data collection activities to verify that sample collection, handling, observations, and measurement procedures comply with established protocols. These audits should be coordinated with the appropriate RECOVER PIs, contract managers, data management stewards, and CERP project managers.

5. Improve monitoring plan review process

The QAOT is responsible to review monitoring plans to ensure that the documents are detailed and contain QA/QC requirements. Review of representative documents for on-going monitoring activities should continue and the review process should be better defined.

6. Management of QASR Revisions

The last posted version of the QASR is June 2006. The revisions made by SFWMD contractors in 2006 were recently posted for public comment. The QASR should be revised and published in 2008.

7. Review of alternative procedures

The QASR specifies that the QAOT is responsible to review alternative procedures. No alternative procedures were submitted for review during the report period and it is likely that this requirement is largely unknown to CERP technical personnel. The definition of an alternative method and the need for submitting these methods for review and approval should be communicated to project managers and PIs.

8. Ensure that the QAOT website is current

The QAOT section of www.evergladesplan.org lists several documents in preparation. These should be reviewed for relevance, and either assigned for completion or removed from the list.

1.0 INTRODUCTION

It is critical that the environmental/ecological monitoring and assessment data generated for the restoration of the Everglades as part of the Comprehensive Everglades Restoration Plan (CERP) be able to withstand rigorous scrutiny. This means that data must be of known and documented quality. For CERP, achieving high-quality data is particularly challenging because data used for CERP are collected by many organizations for projects and programs whose monitoring activities may have different objectives. It is the role of the CERP Quality Assurance Oversight Team (QAOT) to provide quality assurance (QA) guidance at the program level to ensure data quality so that data collected for CERP can be merged to generate an overall picture of the current state of the Everglades system, and to track the ecological and hydrologic improvements that result from CERP projects that will span the next 30 years or more. The use of data with unknown, unequal, or untraceable quality could result in decision errors or legal challenges. Programmatic data quality will be achieved by systematically incorporating quality assurance/quality control (QA/QC) into every aspect of data collection.

The Quality Assurance Systems Requirements (QASR) manual http://www.evergladesplan.org/pm/program_docs/qasr.cfm defines the system developed by CERP to assure data quality. The QASR establishes fundamental QA/QC procedures that, if implemented, will assure that the data generated for CERP are “of acceptable and verifiable quality, generated in a consistent manner to allow sharing and utilization of data” (CERP Monitoring Program QA/QC Vision, 2004). The QASR incorporates, by reference, the Florida Department of Environmental Protection (FDEP) Quality Assurance Rule Chapter F.A.C 62-160 and standard operating procedure (SOP) DEP-SOP-001/01. The QASR requirements are applicable to all data that will be used for CERP purposes. Implementation of QASR requirements for program level activities and each CERP system-wide, project, and permit monitoring activity is ultimately the responsibility of the RECOVER principal investigators (PIs) and project managers, respectively. The QAOT is responsible for assisting the project managers, PIs, and technical personnel by providing guidance, instruction and technical advice in QA/QC related issues. Furthermore, the QAOT is essentially the “QA Officer” for CERP, responsible for establishing procedures for assessing compliance with the QASR. CERP Guidance Memorandum (CGM) 41 specifies that as part of this oversight responsibility the QAOT will prepare an annual Quality Assessment Report (QAR).

The purpose of the QAR is to provide to CERP management an assessment of the state of data quality for CERP system-wide, project, and permit monitoring activities being conducted for CERP. The goals of the QAR are to identify practices that are contributing to quality data, to report on the activities of the QAOT, and to recommend improvements to the quality system. As such, when specific data quality issues are discussed in this report, a less-than-perfect assessment is meant to identify an opportunity for improvement, not failure.

This document provides an assessment of CERP data quality and QAOT activities for the period between May 1, 2006 and April 30, 2007, hereafter referred to as the *report period*. The QA/QC elements of the CERP quality system² as defined in the 2006 QASR are used as the basis of the assessment to the extent that data are available. This document contains numerous tables and figures to illustrate the results of

² **Quality System:** a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA/ QC. (ANSI/ASQC E-41994).

data quality assessments. To facilitate reading of the text, the tables and figures associated with each section are provided at the end of each section.

2.0 SCOPE AND APPLICATION

The scope of the QAR is to describe the state of data quality being generated for CERP during the time period between May 1, 2006 and April 30, 2007. This report assesses data quality both directly and indirectly. Direct assessment of data quality was accomplished only for CERP project and permit monitoring. Assessments included reviews of field and laboratory quality control (QC) data, the results of performance evaluation (PE) samples, and reviewing the findings³ of, recommendations to, and responses from field and laboratory audits. Indirect assessment of data quality was accomplished by conducting interviews with agency, CERP system-wide, project, and permit monitoring staff at the South Florida Water Management District (SFWMD), US Army Corps of Engineers (USACE), Florida Department of Environmental Protection (FDEP), US Geological Survey (USGS), and Florida Gulf Coast University (FGCU); and reviewing monitoring plans. Most biological and ecological monitoring conducted for CERP is performed for Restoration Coordination and Verification (RECOVER). The term CERP is an umbrella term for many different activities. These include RECOVER system-wide monitoring efforts (i.e., Monitoring and Assessment Plan [MAP]), project monitoring, and permit-driven regulatory monitoring. Throughout this report, the terms “system-wide monitoring” will be used to designate RECOVER activities, “project monitoring” to denote CERP and Advanced Construction Projects monitoring, and “permit monitoring” to denote permit-driven regulatory monitoring. This report focuses on CERP environmental monitoring activities. Throughout the report, the terms “system-wide monitoring,” “project monitoring,” and “permit monitoring” are used when referencing specific data quality assessments. The term **CERP** is used generically to include system-wide, permit, and project monitoring.

The QAOT employed a variety of methods to understand the QA/QC procedures being implemented for CERP that could impact data quality. Assessment of CERP data quality was accomplished by conducting interviews with agency QA staff, project managers and PIs, and reviewing monitoring plans. Assessment of CERP project and permit water quality data quality was accomplished through the review of field and laboratory QC data, the results of laboratory performance evaluation (PE) samples, and the results of field and laboratory audits. For this report, no attempt was made to assess the QC results of CERP system-wide monitoring data. For CERP project and permit water quality QC data, the QAOT found that little data were available in a consistent, comprehensive, and readily accessible data format. Overall, this report presents an opportunistic “snapshot” of CERP data quality. The results are not necessarily representative due to the small number of assessments performed in each category and cannot be extrapolated to CERP as a whole. This is a major limitation of this report, and one of the biggest challenges for the QAOT in the future.

This QAR focuses primarily on analytical chemistry data generated for CERP projects because the data were available in a consistent and readily accessible data format from the SFWMD. However, it is recognized that this focus is not representative of current CERP monitoring. Over 85% of CERP monitoring conducted during this report period supported CERP system-wide assessments (e.g., biological/ecological data) but the preponderance of data quality information presented in this report is for water quality monitoring for projects and permit compliance. With the exception of an interview with one RECOVER PI and the review of one RECOVER monitoring plan, no CERP system-wide input was used to develop this report.

³ **Finding:** an assessment conclusion, referenced to a documented Standard and supported by objective evidence that identifies a deviation from the Standard requirement (adapted from National Environmental Laboratory Accreditation Conference [NELAC] Standard, 2003).

3.0 LIST OF KEY PARTICIPANTS AND ORGANIZATIONS

The preparation of this report was supported by the major contributions of QAOT members who provided audit reports, data, contact names, plus valuable direction, oversight, and comments. In addition, interviews with FDEP, SFWMD, and USGS QA officers, CERP project managers, and RECOVER PIs provided the information used to assess the current CERP QA/QC practices at the system-wide, permit, and project monitoring level. The cooperation of environmental testing laboratories in providing PE sample reports enabled an assessment of passing and failing analytical results that might be applicable to CERP. Finally, the RECOVER Assessment Team (AT) Chairs assisted the QAOT in developing a focused QA/QC questionnaire for RECOVER PIs. Table 3-1 lists the people who contributed text to this document, including those who provided supporting documentation and review comments. However, in order to protect confidentiality of the interview and monitoring plan review process, the names of those individuals are not included. Further, due to the size of the QAOT inventory participant list, respondents to the inventory questionnaire are not listed.

Table 3-1. Contributors to the 2007 Quality Assessment Report

Name of Participant	Organization
Joanne Arsenault	Battelle (SFWMD Contractor)
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John Coates	USACE
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Orlando Ramos-Gines	USACE
Gregory Graves	SFWMD
Lisa Gued	USACE
Matthew Harwell	US Fish and Wildlife Service (USFWS)
John Hess	USACE
Jeffrey Hendel	USACE
Eliza Hines	Everglades Partnership Joint Venture (EPJV) (USACE contractor)
R Scott Huebner	SFWMD
Zdzislaw Kolasinski	SFWMD
Silky Labie	FDEP
Francine Matson	SFWMD
Lynn McLeod	Battelle (SFWMD Contractor)
John Moorman	SFWMD
Patti Sime	SFWMD
Pamela Telis	USGS
Sharon Smith-Tembe	SFWMD
David Splichal	USACE
Les Vilchek	USFWS
Michael Wright	SFWMD

4.0 QA/QC PROCESSES IN EFFECT

The quality system for CERP is defined in the QASR and, by reference, the FDEP SOPs. The QASR defines QC procedures and QA responsibilities for most monitoring activities. Based on the snapshot of agency and CERP system-wide, project, and permit monitoring practices identified in this report it appears that QC processes include:

- Preparation of some type of planning document that describes the monitoring purpose and technical procedures. The content and attention to QA/QC details varies;
- At least initial review of field and laboratory procedures by the project manager or PI to ensure that technical procedures are implemented properly;
- Defining some QC procedures in the sampling and analysis design and defining acceptance criteria for them; and,
- Data assessment procedures that assess data reasonableness and a process to ensure that questionable data are not used.

Current QA practices vary among project managers, PIs, stake-holder agencies and by the QAOT. The following QA practices are implemented for some CERP monitoring activities:

- Training programs for field and laboratory staff;
- Documented technical procedures;
- Field audits (limited);
- Laboratory audits (limited);
- Acceptance standards for laboratories (National Environmental Laboratory Accreditation Conference [NELAC]) certification); and,
- Data verification, validation, and the assignment of data qualifiers.⁴

This QAR presents several assessment activities conducted by the QAOT during this report period. Table 4-1 presents a summary of the input used to develop the QAR. Specific QAOT activities included the following:

- An aggressive inventory was conducted to determine “who is monitoring what and where is it being monitored?” (Section 5.1).
- Quality Systems interviews were conducted to assess the type and rigor of quality systems being implemented by representative organizations responsible for funding CERP monitoring activities (Section 5.2).
- Two monitoring plans were reviewed to determine if elements impacting data quality were adequately addressed (Section 5.3).
- A questionnaire was developed with the AT Co-chairs and distributed to RECOVER PIs to identify current QA/QC practices for biological/ecological monitoring (Section 5.5) and identify topics for a potential future biological workshop.
- QAOT field audits were conducted to identify practices and trends that could impact data quality (Section 6.1).

⁴ Data qualifiers or “flags” are assigned to data to indicate that the data may be compromised. Data may be compromised if quality control data are unacceptable, instrument calibration failed, holding times were exceeded, sample preservation was unacceptable, etc.

- QAOT laboratory audits were conducted to identify practices that could impact data quality (Section 7.1).
- A small subset of relevant CERP-related water quality data was extracted from DBHYDRO. An assessment of field and laboratory data quality was performed (Sections 6.1 and 7.3, respectively).
- Results of PE samples and round robin studies were analyzed to assess the performance of laboratories generating water quality data that will be used for CERP (Section 7.2).

Table 4-1. Summary of Data Input Used to Develop the 2007 Quality Assessment Report

Quality Systems Assessment	Organization	Application to CERP ⁵
Quality System Interview	SFWMD	Agency quality system for water quality monitoring
	USGS	Agency quality system for chemistry (water, soil, tissue) and biology
	SFWMD	Agency quality system for hydrology and hydrodynamics
	USACE (CESAJ-ENGE)	Project monitoring
	USACE (CESAJ-PD-EQ)	Short-term project monitoring
	FDEP	General ⁶ water quality and biology monitoring
	FGCU	Project and permit-related monitoring of biology population and habitat
	USGS	System-wide monitoring
	USGS	Project monitoring
Monitoring Plan Reviews	USGS	System-wide monitoring
	USGS	Project monitoring
Field Audits	Golder Associates, Inc.	VOW ESP, L8RT (Project and general monitoring)
	Milian, Swain, & Associates, Inc. (MSA)	C139B (Permit monitoring)
	TetraTech EC, Inc. (TTECI)	BIRP, WQM, ACRA, RASR (Project and general monitoring)
Laboratory Audits	Advanced Environmental Laboratories, Inc. (AEL) Jacksonville	General QA/QC compliance audit
	ELAB, Inc.	BIRP (General monitoring)
	CAS Jacksonville	RFGW (Project monitoring)
	KSA Environmental Laboratory, Inc. (KSA)	General QA/QC compliance audit
	SFWMD	General QA/QC compliance audit
	US Biosystems, Inc. (USBS)	VOW ESP, L8RT (Project and general monitoring)

⁵ SFWMD acronyms are given for some monitoring activities. A complete list of definitions is provided as Attachment A.

⁶ General application indicates that monitoring or analytical activities may not support a specific CERP activity but will generate data that may be used to support CERP.

**Table 4–1. Summary of Data Input Used to Develop the 2007 Quality Assessment Report
(continued)**

Quality Systems Assessment	Organization	Application to CERP
Performance Evaluation Sample Results	AEL Gainesville	C-43 West Reservoir (Project Monitoring)
	AEL Jacksonville	Ten Mile Creek (Project monitoring)
	CAS Jacksonville	ASR Kissimmee Cycle Testing (Project monitoring)
	Collier County	Picayune Strand Restoration (Project monitoring)
	DB Environmental Laboratory	Transect & WQ Biological Sampling (General monitoring)
	ELAB, Inc	General QA/QC compliance audit
	FDEP	Transect & WQ Biological Sampling IRL South- Allapattah Wetlands Restoration (Permit and general monitoring)
	Florida International University (FIU)	Monitoring Tree Islands in Everglades National Park (ENP)-Big Cypress Periphyton Mat Cover, Structure & Composition (System-wide monitoring)
	KSA Environmental	General QA/QC compliance audit
	USGS National Water Quality Laboratory	RECOVER MAP Activity 3.1.3.3 (System-wide monitoring)
	SFWMD	C-51 & L-8 Reservoir, Phase 1 Acme Basin B IRL South- Allapattah Wetlands Restoration (Project and permit monitoring)
	Test America Denver	CERP Lake Okeechobee Watershed Project (Project monitoring)
	Test America Savannah	Aquifer Storage and Recovery (ASR) Kissimmee Cycle Testing (Project monitoring)
	Test America Tallahassee	L-31N/L-30 Seepage Management Pilot Project (Project monitoring)
	Results of Field Quality Control Samples	UFL-IFAS-WBL
US Biosystems		VOW ESP, L8RT Project and general monitoring)
Xenco		ASR Kissimmee Cycle Testing (Project monitoring)
FDEP	RASR (Project monitoring)	
Foster Wheeler Energy Corp. (FWEC)	RASR RFGW (Project monitoring)	

**Table 4–1. Summary of Data Input Used to Develop the 2007 Quality Assessment Report
(continued)**

Quality Systems Assessment	Organization	Application to CERP	
	Golder Associates, Inc.	L8RT (Project monitoring)	
	SFWMD	ACRA C111D L8RT (Project and permit monitoring)	RASR TCSTA (Project and permit monitoring)
Results of Laboratory Quality Control Samples	CAS Jacksonville	RASR RFGW (Project monitoring)	
	DB Environmental Laboratory	ACRA (Project monitoring)	
	Everglades Laboratory	L8RT (Project monitoring)	
	FDEP	ACRA C111D C111F (Project and permit monitoring)	L8RT RASR TCSTA (Project and permit monitoring)
	US Biosystems	L8RT (Project monitoring)	
	SFWMD	ACRA C111D C111F (Project and permit monitoring)	L8RT TCSTA (Project and permit monitoring)

5.0 OVERALL ASSESSMENT OF THE QUALITY OF DATA AND PROCESSES

The QAOT conducted several activities to assess the overall status of CERP data quality and implementation of the QASR. An inventory of current CERP monitoring activities was conducted. Quality system interviews were conducted to determine the QA/QC policies for CERP sponsor agencies and the implementation of those policies for specific monitoring. A checklist was developed to assess the completeness of monitoring plans versus the QASR requirements. The checklist was used to assess two monitoring plans. Ten of eleven chapters of the QASR manual were reviewed and updated as needed to reflect current practice. A questionnaire was developed with the AT Co-chairs to identify current QA/QC practices for CERP system-wide activities. These six activities were intended to provide an overall assessment of the quality of data and QA/QC processes implemented for CERP. A detailed discussion of each is presented below.

5.1 Inventory of Monitoring Activities

A major task for the QAOT was the need to identify the CERP system-wide, project, and permit activities that involved the collection of environmental data; the types of data being collected; and the organizations collecting the data (QAOT, 2006). An inventory of active monitoring was conducted in March 2007 by the QAOT.

The QAOT started with a list of CERP system-wide, project, and permit activities, the funding agency, status, the contract award, the contract manager, and the project manager or PI affiliation (Attachment B). An Inventory Form (Attachment C) was developed and distributed to each CERP project manager or RECOVER PI in order to determine what data were being collected, the organizations performing field activities, and the laboratories generating either chemical or biological data. The QAOT inventory results were entered into an Access database, standardized, and used for the analysis of current monitoring activities.

Essentially 100% response was received from CERP project managers and RECOVER PIs, meaning that the QAOT inventory accurately represented the current and proposed environmental monitoring activities. Responses were received for 7 CERP project or permit and 48 system-wide activities. The inventory provided:

- A list of CERP activities that are or will be collecting environmental data.
- A list of laboratories performing analysis for CERP and the specific analyses being performed by each laboratory. This information could be used to prioritize laboratory audits and to schedule PE samples.
- A list of field teams and monitoring procedures being performed by each field team. This information could be used to identify field teams that should receive audits.
- A list of sponsoring agencies. This information could be used to identify organizations that fund data collection and many of these were interviewed during 2007 about their quality systems.
- A list of project managers and PIs. This information could be used to identify project managers or PIs for quality system interviews.
- A list of parameters being monitored. This information could be used to identify the parameters to include in future PE samples.

The complete project inventory contains 571 rows and 14 columns of data. It is posted in the CERPZone within the QAOT Project Team cabinet in a folder entitled QAOT Documents.

5.2 Quality System Interviews

NELAC (2003) defines Quality System as: “a structured and documented management system describing the policies, objectives, principles, organization authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC” (NELAC, 2003). As such, the quality system of an organization guides and directs the activities of the organization. If a quality system is sufficiently detailed to define procedures adequate to promote quality work, and if it is successfully implemented, then the result should be quality data that are accurate, complete, traceable, and defensible.

During the report period, nine interviews were conducted to determine if the quality systems being implemented for CERP were compliant with the 2006 QASR. Interviews were conducted with five different organizations (FDEP, USACE, FGCU, SFWMD, and USGS) that are conducting or sponsoring the majority of the current CERP monitoring. Overall, these five organizations represent one third of the organizations currently conducting monitoring for CERP. (A full list of organizations conducting CERP monitoring is provided in the Attachment B QAOT Inventory). The quality system interviews successfully achieved two primary objectives:

1. Interviews with agency representatives assessed organizational policies and procedures versus the QASR. Three agency interviews were conducted.
2. Interviews with selected CERP project managers and CERP system-wide PIs to assess implementation of QASR requirements for specific monitoring efforts. Six project, permit, or system-wide specific interviews were conducted.

Interviews were conducted either by telephone or as part of presentations to the QAOT. Detailed questions were answered by each interviewee about the application of quality system elements to field and/or laboratory activities sponsored or conducted by their organization. The quality system elements were assessed within 11 categories:

- Field Monitoring Methods
- Qualifications of Field Staff
- Quality Control for Monitoring Activities
- Field Data Verification and Validation
- Quality Assurance for Field Monitoring Activities
- Data Assessment
- Laboratory Analytical Methods
- Qualifications of Laboratory Staff
- Quality Control for Laboratory Activities
- Laboratory Data Verification and Validation
- Quality Assurance for Laboratory Activities

Table 5-1 presents the outline of the questionnaire with references to the applicable QASR requirements. An example interview form is provided in Attachment D. The results of the interviews were compiled in a matrix of quality system elements for each of the 11 categories above for each interview. To simplify the analysis, responses were coded to indicate whether the QASR requirement was fully met (**Excellent**); partially met (**Adequate**); or not met (**Limited**). The results of the interviews are summarized in Table 5-2 and illustrated as percent compliance with the QASR requirements in Figure 5-1. To calculate percent compliance, the response to each interview question (Table 5-1) was converted to a numerical score between 0 and 3 for each element where 0 = not implemented at all and 3 = fully implemented. Each interview was assessed separately because some quality system elements were not applicable to some monitoring activities. The results within each question category were summed and the percent

compliance calculated based on the total applicable elements. The overall QASR compliance for each interview was calculated as the average and standard deviation of all categories.

Based on the three agency-level interviews, compliance with QASR requirements was rated “excellent.” Of the six monitoring activity-specific interviews, four of the six received an overall rating of “excellent” And the two biologically-focused activities received overall ratings of “adequate.” The “adequate” rating was related to responses to questions in the Field QA and Laboratory QA categories. While it is recognized that the monitoring activity-specific interviews represent the practices of individuals and cannot be extrapolated to represent QA/QC activities overall, the results imply that, overall, project managers and PIs are implementing the quality systems of their organizations.

Across all interviews, average compliance for each quality system category was excellent for all except two categories (lack of a QA Officer or program in the field and laboratory). QASR Section 2.2 states that an audit program for field and laboratory activities and data QA and data quality investigations are requirements for CERP. The need for QA involvement with monitoring activities is recognized by the QAOT and the assignment of USACE and SFWMD staff to act as QA officers for CERP is being implemented. For the nine interviews presented in this report, other positive trends of note include:

- The QASR requirements for analytical chemistry field and laboratory activities are understood and implemented at both the agency, permit, and project levels.
- QC activities are generally implemented and include both frequency and acceptance criteria.
- Data review is generally implemented for both field and laboratory activities.
- Rigorous data quality assessment tools that include statistical analysis of the data are used systematically by most interviewees.
- For two monitoring activities, the contractor was responsible for field audits; this was considered acceptable because the need for audits was recognized and specifically delegated in the contractor statement of work.
- QA practices in both the field and laboratory received low ratings for several reasons including: lack of a QA officer, reports to management, or a corrective action process.
- Currently, there is no direct analog for field hydrometeorological audits equivalent to those done for water quality sampling nor are there QA procedures equivalent to those conducted for analytical chemical laboratories. However, internal technical reviews are performed by a Supervisor and/or Crew Chief and the results are sent to the Supervisor. From this perspective, the scoring is not representative of the quality systems currently in place for hydrology and hydrodynamics data at the SFWMD. Nevertheless, SOPs for field procedures do exist and there are staff devoted to processing data from remote sensors prior to upload to the corporate database.

In general, it appears that the QASR requirements are codified at the agency level and implemented for individual monitoring activities. The technical review and assessment of the data indicate that data can be used with confidence.

The six interviews for individual monitoring activities represent approximately 10% of the environmental monitoring currently being conducted for CERP. However, the preponderance of current monitoring is occurring for system-wide activities; the two biologically-focused interviews conducted represent less than 1% of those activities. Thus, the QAOT interviews do not provide an adequate assessment of biological/ecological monitoring compliance with the QASR. Based on this small sample size, the following general concerns are noted:

- More field and laboratory audits or assessments should be implemented wherever possible.
- Experimental or biological field studies may not be supported by documented procedures that will enable consistent practices and comparable data.
- If field work is subcontracted, resources and procedures should be implemented to ensure that the field teams are adequately trained in the technical and QA/QC procedures.

The interviews also identified gaps in the QASR that should be addressed (Section 5.4).

5.3 Review of Monitoring Plans and the Monitoring Plan Checklist

According to CGM 40, a monitoring plan ensures that the hydrometeorological and water quality issues identified in the Project Management Plan (PMP) and the Project Implementation Report (PIR), if any, are addressed. CGM 40 also defines the content and format of the monitoring plan and provides a checklist to assess monitoring plan completeness.⁷ QASR Section 2.2.3 identifies the review of monitoring plans for implementation of and adherence to the QASR as a responsibility of the USACE and SFWMD.

The QAOT reviewed two monitoring plans during the report period. The purposes of the reviews were to assess the usability of the Monitoring Plan Checklist outlined in CGM 40.01 as well as to assess the completeness of the monitoring plans versus the content requirements defined in CGM 40. The checklist is provided in Attachment E. One monitoring plan (prepared in 2004) described a biological system-wide monitoring activity involving the assessment of fish populations in a wetland area; the second monitoring plan (prepared in 2007) described the collection of water samples for an aquifer storage and recovery area pilot project. The monitoring plans were selected to test the checklist on a “chemical” and “biological” monitoring plan. The two monitoring plans were distributed prior to the July 13, 2007 QAOT meeting.⁸ During the meeting, the QAOT members used the checklist to assess each element of the monitoring plans. The adequacy of each element of each monitoring plan was determined by consensus and assessed as Acceptable (A), Unacceptable (U), Insufficient (NI), or Not Applicable (NA).

The monitoring plan reviews represent an extremely limited snapshot of the adequacy of monitoring plan contents. However, in general it was noted that:

- Both monitoring plans fully or partially addressed over 75% of the monitoring plan elements.
- Technical elements of the monitoring plans were adequately or partially addressed.
- For the chemical monitoring plan, the field procedures and documentation requirements were not addressed in adequate detail.
- The discussion of QA/QC requirements did not include requirements for QC sample types, frequency, and acceptance criteria; audits; data verification and validation; and data and records management procedures.

The QAOT has committed to reviewing all monitoring plans unless the volume of documents becomes too large. Seven CERP project, permit, or Advanced Construction Projects are currently conducting monitoring activities and all have a monitoring plan in place or in process (Scott Huebner, personal communication). The SFWMD has an internal review process for these documents, but none were

⁷ Monitoring may also occur prior to development of the PIR; the CGM 40 requirements do not apply to this monitoring.

⁸ Although the actual reviews of the monitoring plans were conducted by the QAOT in July 2007, the results are presented in this QAR because the monitoring plans were in place and implemented during the report period.

submitted to the QAOT for review. In addition, based on a review of www.evergladesplan.org it appears that monitoring plans exist for other CERP system-wide, project, and permit monitoring activities, which were not submitted to the QAOT for review. This may be, in part, because there has been no step-by-step process detailing when the monitoring plan must go to the QAOT for review and to whom the plan is to be submitted (i.e., the point of contact). Draft CGM 40.01 now clarifies the 3-4 week monitoring plan review process for CERP (CMG 40.01 Figures 1 and 2). Overall, the adequacy of monitoring plans being prepared for CERP could not be fully evaluated based on the two reviews conducted and summarized in this report because the small number reviewed is not adequate for generalizations. The adequacy of monitoring plans is critical to data quality and is a critical aspect of QAOT responsibilities. Therefore, improvements in communication, process, and procedures are needed.

The monitoring plan review checklist provided in CGM 40.01 is designed to assess each element of the monitoring plan template. As such, it is long (eight pages) and, at times, redundant. Based on the results of the “test” of the monitoring plan checklist the QAOT formed a subcommittee to streamline the checklist. The following observations summarize the current checklist:

- The current checklist is too specific to apply to all monitoring.
- The checklist should be generalized so that it can be applied to biological/ecological, hydrology and hydrodynamics, and remote sensing monitoring.
- The checklist should focus on the QA/QC elements of the monitoring plan rather than the design and technical approach.
- Some elements, such as an approval page, are not included in monitoring plans because the approval is managed for the statement of work or contract.
- Some information required in the current monitoring plan templates are “nice,” but should not be required. These include a table of contents and acronyms list.

5.4 Review and Revision of the Quality Assurance Systems Requirements Manual

The CERP QASR manual defines the quality system for CERP. It defines the protocols and procedures that must be implemented for CERP data collection activities to ensure that data are accurate, defensible, and comparable. As stated in the QASR:

“A defined system of QC practices and SOPs is critical for ensuring the environmental data collected and analyzed is scientifically sound and defensible. This manual is the foundation of the CERP QA program” (QASR, 2006).

To the extent that the QASR is implemented, it should result in quality data that are accurate, complete, traceable, defensible, and comparable.

During 2006-2007, the June 2006 QASR posted on www.everglades.org was reviewed and revised to identify errors, inconsistencies, and technical updates. The purpose of the revision was to improve the accuracy and usability of the document. In all, ten chapters of the QASR were reviewed for technical adequacy, professional format, grammar, and spelling correctness. A unified outline for the procedural chapters was developed so that similar information in each chapter was located in the same sections. An editorial review of each chapter was also performed to correct format, grammatical, and spelling errors. Technical changes and suggestions for further improvement were summarized in a separate document. A summary of the changes to each QASR chapter as of the end of this report period is provided in Attachment F. In October 2007, QASR chapters were assigned to technical experts to assess the technical

content for accuracy and applicability to CERP. It is anticipated that revised chapters will be posted on the QAOT webpage during 2008.

As noted earlier, the preponderance of data currently being collected for CERP are biological data. Review of Chapter 8 *Biological Monitoring and Assessment Procedures* and the six related appendices indicated that some procedures lacked discussion of QA/QC procedures and that the monitoring procedures needed to be reviewed for comparability and consistency. In lieu of a biological workshop (Section 5.5), Chapter 8 was distributed to the RECOVER AT Co-chairs in October 2007. During the next (2008) QAR report period, the chapter will be distributed to PIs for review to ensure that the technical procedures are accurate and current and to ensure that QA/QC procedures applicable to ecological and biological monitoring are incorporated.

The QASR is a “living document” and it will continue to be revised as technical procedures are developed and refined. The current version is easier to use, addresses errors, and provides useful links within the document and to external resources. However, additional work is needed. The current QASR chapters contain redundancies and discrepancies that will be addressed by the QAOT in future updates, e.g.,

- Text for the data quality objective process is repeated in several chapters. Because the document is meant to be an electronic resource, the data quality objective (DQO) process should be defined in Chapter 2.0 and linked to the QAOT standard operating procedure elsewhere in the document.
- Discussion of QA requirements, including the responsibilities of QA personnel and the conduct of field and laboratory audits should be moved to a new chapter that contains all QA related requirements.
- Discussion of Data Management procedures is outdated and not aligned to the current Information and Data Management/Program Management Plan. The current procedural chapters contain data management text, as does Chapter 10 *Information and Data Management*. Particularly to ensure that data are submitted in appropriate formats, all text related to electronic data submission and code lists should be reviewed, standardized, and linked to governing documents as appropriate.
- The QASR does not provide adequate guidance for when work plans, monitoring plans, or QA project plans should be prepared.
- Minimum standards for data verification and validation are not defined in the QASR for each technical discipline.⁹ In reality, verification and validation procedures are applicable for all technical data and data qualifiers. Data quality flags should be applied to any questionable CERP data unless suspect data are eliminated from the data set.
- The QASR does not define quality system requirements consistently between the technical sections and it does not include an overall QA section. Thus, few quality system elements are defined for hydrology and hydrodynamics and remote sensing (Table 5-1).

5.5 QAOT Outreach for CERP Systems Activities

Of the 55 CERP system-wide, project, and permit monitoring activities currently involved in the active collection or generation of environmental data, over 85% are collecting biological and ecological data. One of the 2006 QAR¹⁰ action items was to initiate outreach to PIs conducting biological monitoring.

⁹ Currently QASR Chapter 5 is titled *Verification and Validation of Water Quality Data* although it contains verification checklist elements for biological data. It is referenced in Chapter 7 for the verification and validation of soil and sediment data, but not Chapter 8 *Biological Monitoring and Assessment Requirements and Guidance*.

¹⁰ The 2006 QAOT QAR covered the period from May 2005 through April 2006.

The QAOT initiated planning for a biological workshop in June 2006 to address these concerns. The initial purpose of the biological workshop was to:

1. Get PI feedback and input on biological/ecological methods (including relevant QA/QC information) in QASR Chapter 8;
2. Educate PIs about QA/QC for biological/ecological monitoring; and
3. Allow the PIs time to work together to complete a QA/QC template as it relates to their MAP monitoring component.

In order to assess the QA/QC procedures currently implemented for biological and ecological monitoring, a questionnaire “CERP QA Questionnaire: QA/QC Practices for CERP Monitoring” focused on CERP system-wide monitoring was developed by the QAOT and the AT Co-chairs. The stated objective of the questionnaire was to “help identify areas where assistance in developing or improving processes can be focused... and to develop focused sessions at upcoming biological workshops. The stated goal was to identify and resolve real problems while continuing to assure high data quality.” The questionnaire is provided as Attachment G. The questionnaire asked focused questions related to CERP system-wide field and laboratory practices. Major areas of interest for field activities included the existence of a monitoring plan and technical standard operating procedures; staff qualifications; and QC, data management, and data verification and validation procedures. The major areas of interest for laboratory analyses included the existence of documented procedures, laboratory certification, compliance with QASR requirements; staff qualifications; QA/QC procedures; data management; and the application of data qualifiers.

Separate, tailored questionnaires were prepared for each MAP PI. The Project Name, Monitoring Area, Organization, Project Contact, and Matrix were filled in by Ms. Eliza Hines (USACE Contractor EPJV) and emailed to each PI. By the end of June 2007, all questionnaires had been distributed with a one-month due date. At the time of this report, most questionnaires had been returned and the data were being compiled. The results will be summarized as part of the 2008 QAR. The results of the AT questionnaires will be used to by the QAOT and AT Co-chairs to identify the QA/QC procedures currently being implemented for CERP system-wide monitoring and to determine compliance with the QASR. Gaps and substantive issues will be categorized. The QAOT is in the process of working with the AT Co-chairs to develop effective outreach mechanisms, including teleconferences or focused workshops, to address substantive issues and QA/QC gaps. These activities will be summarized as part of the 2008 QAR.

Table 5-1. Content of Quality Systems Questionnaire and QASR References

Quality System Questionnaire	QASR Chapters or Section References				
	Water	Hydrology and Hydrodynamics	Sediment	Biological	Remote Sensing
Applicable QASR Chapters ¹¹	1, 2, 3, 4, 5, 10, 11	1, 2, 6, 10, 11	1, 2, 3, 4, 5, 7, 10, 11	1, 2, 5, 8, 10, 11	1, 2, 9, 10, 11
Field Monitoring Methods					
Are field methods documented?	2.6 ¹²	2.6	2.6	2.6	2.6; 9.16
Are procedures for field instrument operation, maintenance, and calibration documented?	2.6	2.6	2.6	NRS ¹³	2.6; 9.17
Are field observations assessed to confirm that they are implemented correctly?	3.41		3.41	8.4	9.16
Qualifications of Field Staff					
Is field team training completed prior to independent sample collection?	3.4	NRS	7.17	8.9.1; Table 8.2	9.16
Is field team training documented?	3.4	NRS	7.17	Table 8.6	NRS
Quality Control for Monitoring Activities					
Are field QC procedures defined?	2.6	2.6; 6.0	2.6	2.6; 8.6	2.6; 9.15
Do field QC requirements define frequency and acceptance criteria?	2.6	2.6; 6.0	2.6	2.6	2.6; 9.15
Are corrective action procedures for failed field QC defined?	2.6	2.6	2.6	2.6	2.6; 9.16
Are field records (e.g., logbooks) verified for completeness and accuracy?	Table 3.1	NRS	Table 3.1; 7.17	8.36	NRS
Field Data Verification and Validation					
Are field QC results reviewed versus the frequency and acceptance criteria?	Table 3.1 3.39	NRS	Table 3.1; 7.17	8.12.3	9.18
Are field data verification procedures defined?	2.6	2.6	2.6	2.6; 8.12.3	2.6; 9.18
Are field data independently validated?	3.39	6.25	7.17	NRS	9.18
Are field data qualifiers applied or data not used if QC criteria are not met?	3.40	NRS	7.17	8.36	NRS

¹¹ Bolded numbers indicate technical chapters.

¹² EPA QA/R-5 *EPA Requirements for Quality Assurance Project Plans* is referenced in the QASR and specifies that this requirement be addressed in a QAPP; QASR Chapter 2.6 specifies that *Projects that do not have QAPPs are required to have the necessary QA elements in their project plan.*

¹³ NRS: No Requirement Stated in the QASR for this technical area.

Table 5-1. Content of Quality Systems Questionnaire and QASR Reference (continued)

Quality System Questionnaire	Technical Area				
	Water	Hydrology and Hydrodynamics	Sediment	Biological	Remote Sensing
Quality Assurance for Field Monitoring Activities					
Is a QA Officer or specialist involved with field aspects of your project?	Table 3.1	2.2.3	Table 3.1; 7.3	8.5	9.19
Are QA audits or assessments performed for field activities?	Table 3.1; 3.7; 3.41;	2.2.3	Table 3.1; 7.17	8.12.3	9.19
Are QA findings documented in reports to management?	2.6; 3.41	2.6	2.6; 3.41	2.6; 8.40	2.6
Does a corrective action process exist?	2.6; 3.40	2.6	2.6; 7.17	2.6	2.6
Laboratory Analytical Methods					
Are laboratory methods documented in an SOP or manual?	2.6; 3.2	NA ¹⁴	2.6; 7.17	2.6	NA
Are laboratory instrument operation, maintenance, and calibration procedures documented in an SOP or manual?	2.6; 4.3; 4.4	NA	2.6; 4.3; 4.4	2.6; 4.3; 4.4	NA
Is NELAC accreditation required for laboratories?	1.3	NA	1.3	1.3 (Selected parameters)	NA
Qualifications of Laboratory Staff					
Is a formal training process required for laboratory analysts?	4.10	NA	4.10	4.10 (Selected parameters)	NA
Quality Control for Laboratory Activities					
Are QC procedures required for laboratory activities defined?	2.6	NA	2.6	2.6	NA
Do laboratory QC requirements define frequency and acceptance criteria?	2.6	NA	2.6	2.6	NA
Are corrective action procedures for failed laboratory QC defined?	2.6	NA	2.6	2.6	NA

¹⁴ Not applicable to this technical area.

Table 5-1. Content of Quality Systems Questionnaire and QASR Reference (continued)

Quality System Questionnaire	Technical Area				
	Water	Hydrology and Hydrodynamics	Sediment	Biological	Remote Sensing
Laboratory Data Verification and Validation¹⁵					
Are laboratory QC results reviewed versus frequency and acceptance criteria?	4.6.2; 5.2	NA	4.6.2; 5.2; 7.22	5.2; 8.39	NA
Are laboratory data verification procedures defined?	2.6	NA	2.6	2.6; 8.39	NA
Are laboratory data independently validated?	5.3	NA	5.3; 7.22	8.39	NA
Are validation qualifiers applied to failed data?	5.3	NA	5.3; 7.22	8.39	NA
Quality Assurance for Laboratory Activities					
Is a QA Officer or specialist involved with laboratory aspects of your project?	4.2.2	2.2.3	4.2.2	8.5	NA
Are QA audits or assessments performed for laboratory activities?	4.8	2.2.3	4.8	8.40	NA
Are QA findings documented in reports to management?	2.6	NA	2.6	2.6; 8.40	NA
Does a corrective action process exist?	2.6; 4.6.3	NA	2.6; 4.6.3	2.6	NA
Data Assessment					
Is a formal process implemented to assess data usability? Are the assessment procedures and criteria documented?	11.0	11.0	11.0	11.0	11.0
Does the data usability assessment include statistical analysis?	11.0	11.0	11.0	11.0	11.0

¹⁵ Note that the QASR Chapter 5 title indicates that only water is addressed; in fact, biological validation is also included)

Table 5-2. Summary of Compliance with QASR Requirements Based on Quality Systems Interviews

QASR Quality System Category	Quality System Interview Type, Organization, and Monitoring Focus										Average for Category	
	Agency (SFWMD) Water Quality	Agency (USGS) Chemistry & Biology	Agency (SFWMD) Hydrology and Hydrodynamics	Project (USACE) Water Quality	Project (USACE) Water Quality	Project (USACE) Water Quality	General (FDEP) Water quality & biology	Project & Permit (FGCU) Biology population & habitat	System-wide (USGS) Biology & water quality	Project (USGS) Watershed monitoring		
Field Monitoring Methods	E	E	E	E	E	E	E	A	A	E	E	E
Qualifications of Field Staff	E	E	E	E	E	E	E	A	A	E	E	E
Quality Control for Monitoring Activities	E	E	E	E	E	E	E	A	A	E	E	E
Field Data Verification and Validation	E	E	E	E	E	A	E	E	E	E	E	E
Quality Assurance for Monitoring Activities	E	E	A	E	E	E	E	L	L	E	E	A
Laboratory Analytical Methods	E	E	E	E	E	E	E	A	A	E	E	E
Qualifications of Laboratory Staff	E	E	E	E	E	E	E	E	E	E	E	E
Quality Control for Laboratory Activities	E	E	A	E	E	E	E	E	E	E	E	E
Laboratory Data Verification and Validation	E	A	E	E	E	E	E	E	E	A	E	E
Quality Assurance for Laboratory Activities	E	E	L	E	E	E	E	L	L	L	L	A
Data Assessment	E	E	E	E	E	A	E	E	E	E	E	E
Overall Average per Interview	E	E	E	E	E	E	E	A	A	E	E	E

E = Excellent, A = Adequate, L = Limited.

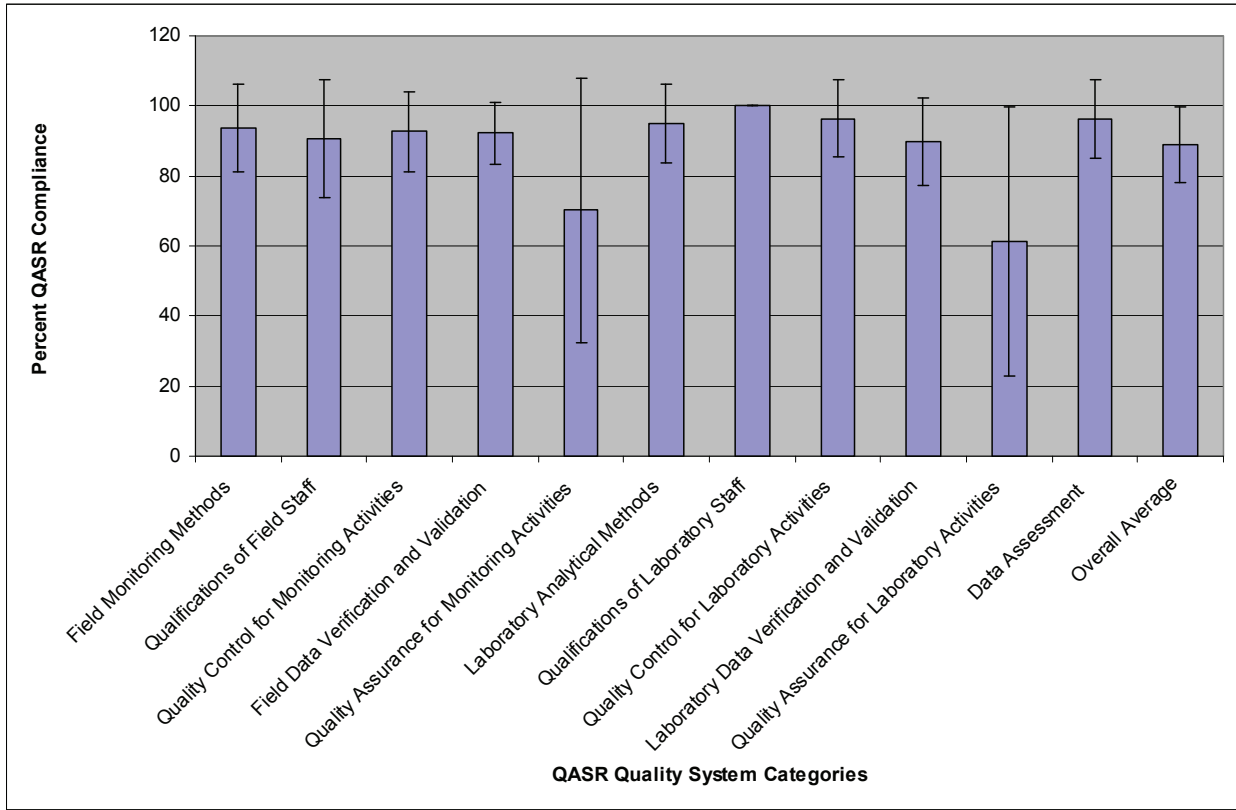


Figure 5-1. Percent QASR Compliance for Selected Quality System Elements Based on Interviews

6.0 GENERAL EVALUATION OF THE QUALITY OF FIELD DATA

Field assessments are critical to the generation of quality data because the sample collection and handling procedures will profoundly impact sample integrity and thus, data quality (Claycomb, 2000). Further, the integration of field QC samples into a field program will not reveal fatal flaws in sample collection procedures. The technical robustness of field sampling techniques can only be verified by direct observation. Thus, field assessments involve accompanying a field sampling team during the collection of field samples or data.¹⁶

Sample collection and handling procedures profoundly impact sample integrity and, thus, data quality. In fact, data quality can never overcome compromises related to poor field techniques. Four types of field data are important to the CERP objectives:

1. Field sample collection activities where collection techniques can impact the final analytical results;
2. Field measurements (e.g., temperature, conductivity) where instrument maintenance, calibration, and operation will directly impact the quality of the resultant data;
3. Field measurements that are “unmanned” collections (remote sensing, flow rate, gage height) where the operation of the equipment must be consistent and correct without direct intervention; and,
4. Direct biological observations that rely on the consistent application of a defined procedure for data quality and comparability.

Sections 6.1 and 6.2 present the results of QA assessments of CERP project and permit field sample collection and field measurement activities. Section 6.3 presents information related to CERP biological and ecological monitoring based on two quality system interviews.

Field sample collection activities and measurements can be assessed through field audits which observe the field team procedures, equipment operation, sample handling, and decontamination techniques. The analytical results of field-collected QC samples (field blanks, and to a lesser degree, field duplicates) can be used to quantitatively assess field techniques. Field blanks assess decontamination procedures and cross-contamination; field duplicates assess sampling reproducibility.

Based on the QAOT inventory and interviews with SFWMD staff, 28 organizations are currently collecting field samples or data for CERP system-wide, permit, and project monitoring. During the report period, field audits were conducted for three of the organizations performing field work for CERP project and permit monitoring (TTECI, MSA, and Golder Associates) and field QC data are available for four field teams performing field work for CERP project and permit monitoring (Golder Associates, SFWMD, FDEP, and FWEC). Thus, some measure of field data quality can be assessed for approximately 20% of the field teams collecting data for CERP. The field audit results and field QC data presented in this section are “opportunistic” and represent information that was available from the SFWMD during 2007. The QAOT continues to develop a systematic approach to target field audits towards critical activities, but this was not fully implemented in 2007. A complete list of field organizations and the types of monitoring currently being performed is provided in Attachment H.

¹⁶ Field samples and data may include (a) discrete samples such as a bottle of stream water or a fish specimen; (b) direct observations of qualitative environmental conditions such as weather; (c) *in situ* data that are recorded directly from field instruments such as temperature, pH, conductivity; (d) taxonomic identifications; (e) environmental assessments and habitat state.

6.1 Assessment of Field Data Quality through Field Audits

Four audits of three contractor field teams that covered five CERP projects or permits were conducted during the report period (Table 6-1). The reference list of audit reports from which these data are derived is provided in Attachment I.

The results of the audits are summarized in Tables 6-2 and 6-3 and Figures 6-1 and 6-2. The 19 field related findings fell into two categories: documentation (32%) and analytical issues (68%). Documentation issues included incomplete header sheets and inconsistencies between the field notes and the custody forms. Analytical issues included improper rinsing procedures (38%) and sampling method procedures (54%) (Table 6-2). TTECI findings identified during two separate audits represented 42% of the total findings with Golder and MSA findings representing 32% and 26%, respectively (Table 6-3 and Figure 6-1). These results demonstrate the importance of field audits; approximately two-thirds of the field audit findings could result in inaccurate or incomparable analytical data that would not be possible to identify by reviewing the analytical results.

6.2 Assessment of Field Monitoring Quality Control Data

The results of field QC samples are an important indicator of data quality. Field measurement data in DBHYDRO for six project monitoring locations that may contribute data to CERP were used to assess the quality of a snap shot of field measurement data:

- ACRA - Allapattah Complex Restoration Area (a component of the IRL-South CERP project)
- C111D– C-111 project sampling locations (C-111 Spreader Canal project – CERP and Advanced Construction Projects; DEP emergency order permit monitoring)
- L8RT – L8 Reservoir (a component of the North Palm Beach County - Part 1 CERP project)
- RASR – Regional ASR Baseline Water Quality Monitoring (ASR Regional Study)
- RFGW – Regional Floridan Groundwater Monitoring (also associated with the ASR Regional Study)
- TCSTA – Taylor Creek STA (a Critical Project authorized by WRDA 1996; permit monitoring). Although not a CERP project the QAOT determined that it should be included in the QAR analysis.

The combined data sets contained 3530 data points and included eight field parameters (total depth, dissolved oxygen (DO), oxidation reduction potential (ORP), field pH, salinity, Secchi disk depth, specific conductivity, and temperature). It is acknowledged that this data set is a miniscule relative to the amount of field-measured water quality data currently collected for CERP; it is opportunistic rather than representative because it reflects data collected for one organization (i.e., SFWMD) operating under a field program with a highly developed quality system.

Given that the “snapshot” is small, the results are excellent. Ninety-seven percent (97%) of the 3530 field measurements in the snapshot were not qualified in any way, indicating that instrument calibration, sample handling, and associated QC samples were acceptable. Only 3% of the data were qualified (Figures 6-3 and 6-4; Table 6-4). The most prevalent data qualifiers were applied to ORP (100% of the ORP data; 48% contribution) and dissolved oxygen (4% of the DO data were qualified; 37% contribution).

Of the 3% of the field data with qualifiers, J5 (improper laboratory or field protocol) was responsible for 66% and J3 (precision or accuracy criteria not met) was responsible for the remaining 34%. J3 qualifiers

accounted for most DO failures and J5 accounted for all ORP failures. The source of all field data with J3 or J5 qualifiers was the SFWMD.

Some data qualifiers applied in the laboratory identify data quality problems that originate in the field (Table 6-5). Approximately 1% of the data were qualified due to field-related QC failures. These data can be analyzed based on parameter class or qualifier abundance. Nutrient data represent the largest parameter class in the data set reviewed. Less than two percent (1.5%) of the nutrient data were qualified with J5 (improper laboratory or field protocol), W1 (field blank), or W2 (equipment blank). An even smaller percent (0.1%) of the data for the second largest parameter class, major ions, had field-related data qualifiers. Of the three strictly field-related qualifiers (P, W1, and W2) plus the ambiguous J5, more data were qualified with W2 qualifiers than any other was, but these qualifiers still represented less than 1% of the data set. In summary, based on the data set reviewed, field QC results appear to be in control, accounting for approximately 1% of the qualified data.

6.3 Assessment of Quality Systems Applied to Biological Monitoring Activities

No quantitative QC data or field audit results were available to the QAOT to assess the quality of biological data being generated for CERP. As discussed in Section 5.2, two of the quality systems interviews conducted involved a RECOVER PI and a CERP project manager involved in biological and ecological monitoring. These interviews provided the following snapshot of the QA/QC procedures being implemented:

- QC samples or procedures include a method to measure data accuracy or precision. Both the project manager and PI incorporate replicates into their sampling design.
- Taxonomy voucher specimens are the “reference samples” of taxonomy. Both the project manager and PI included the collection of voucher specimens for all new or uncommon species and consulted with other taxonomists as needed to verify identifications.
- The accuracy of field documentation is critical for biological monitoring. Both the project manager and PI use standardized field sheets that prompt for critical information and review the field records for accuracy and completeness.
- Data assessment is used to “ground truth” the data to historical values, and identify trends or suspect values. Both the project manager and PI used statistical data assessment tools to analyze the biological data. Suspect data are not used, rather than assigned qualifiers.
- Independent data verification procedures assure that data entry, calculation, or assessment errors are identified and corrected. The PI implemented a peer review process for all data; the project manager conducted only self-checks.
- Field team training and experience is critical to quality biological data. Training includes demonstration of activities and oversight of field team techniques. The experiences of the two interviewees differed in this area: the PI had oversight responsibility and was directly involved in every aspect of field sampling and analysis. The project manager was involved only in the analysis aspects of the project and did not have responsibility or authority over the field team subcontractor.
- Written protocols ensure that technical procedures are performed consistently over time and across sampling teams. Initially neither the PI or project manager had written procedures for the experimental work they were performing. Later, the PI was funded to prepare written protocols. However, the project manager has not received permission or funding to document the field procedures used for the project.

- QA audits of field procedures verify compliance with project and QASR requirements, and the traceability of data. No QA officer or specialist was involved in the two biological monitoring activities represented by the interviews.

Table 6-1. Field Team Audits and Related CERP Water Quality Monitoring Activities

SFWMD Monitoring Code	Title	Field Team Contractor
WQM	SFWMD water quality monitoring	TTECI
ACRA	Allapattah Complex Restoration Area (a component of the IRL-South CERP project)	
RASR	Regional ASR Baseline Water Quality Monitoring (ASR Regional Study)	
C139B	Contract sampling at the farm level in the C139 basin	MSA
L8RT	L8 Reservoir (a component of the North Palm Beach County - Part 1 CERP project)	Golder & Associates, Inc.
RASR	Regional ASR Baseline Water Quality Monitoring (ASR Regional Study)	TTECI

Table 6-2. Detailed Deficiencies Identified During Water Quality Field Team Audits

Category Details	Classification	Golder Associates, Inc.	MSA	TTECI	Total
Improper/Incomplete documentation	Documentation		3		3
Incorrect data	Documentation			1	1
Method	Analytical Issues	3	1	3	7
Preservation	Analytical Issues			1	1
Rinsing	Analytical Issues	3		2	5
Standard/Reagent tracking	Documentation		1	1	2
Total		6	5	8	19

Table 6-3. Summary of Deficiencies Identified During Water Quality Field Team Audit

Category	Golder Associates, Inc.	MSA	TTECI	Grand Total	Percent of Findings by Category
Analytical Issues	6	1	6	13	68%
Documentation		4	2	6	32%
Grand Total	6	5	8	19	
Percent Findings per Field Organization	32%	26%	42%		

Table 6-4. Data Qualifiers Assigned to Field-Collected Water Quality Data

TEST NAME	Count of Data Points	Records Qualified	J3	J5	Contribution of Parameter to Qualified Records
Depth, Total	97	0	0	0	0%
Dissolved Oxygen	810	34	26	8	37%
ORP	44	44		44	48%
pH, Field	807	2		2	2%
Salinity	123	0	0	0	0%
Secchi Disk Depth	29	0	0	0	0%
Sp Conductivity, Field	810	11	5	6	12%
Temp	810	0	0	0	0%
Total	3530	91	31	60	100%
Percent		3%	34%	66%	

Table 6-5. Field-Related Data Qualifiers Assigned to Analytical Data

Parameter Class	J5 ¹	P	W1	W2	Total Field Qualified Data	Number of Records	Percent Field-Qualified Records
Biology		1			1	325	0.3%
Isotope		6		1	7	411	1.7%
Major ions		2			2	2192	0.1%
Metals			5	15	20	1722	1.2%
Nutrient	16		6	29	51	3331	1.5%
Polychlorinated biphenyls (PCB)					0	70	0.0%
Pesticide					0	830	0.0%
Wet Chemistry		1	5	1	7	1257	0.6%
Total Qualifiers	16	10	16	46	88	10138	0.9%
Percent Records Qualified	0.16%	0.10%	0.16%	0.45%	0.87%		

¹ J5 may be applied to either field or laboratory data. It has been applied to both field and laboratory data in this analysis.

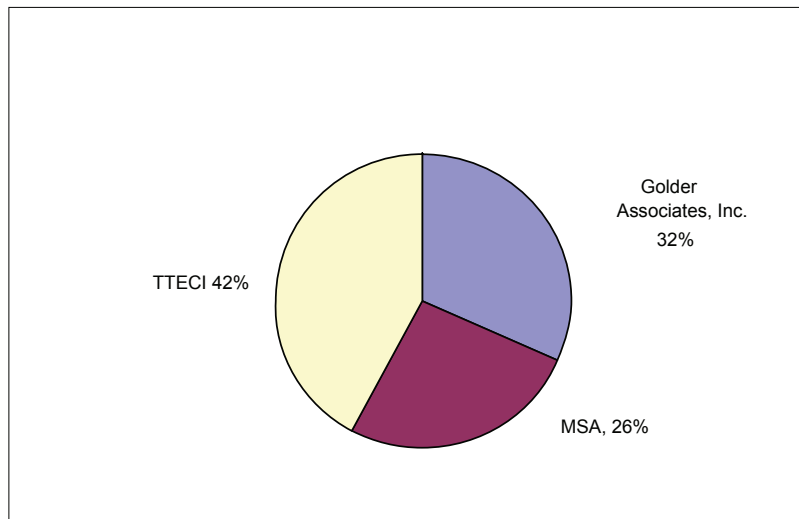


Figure 6-1. Percent Field Audit Findings by Water Quality Field Team

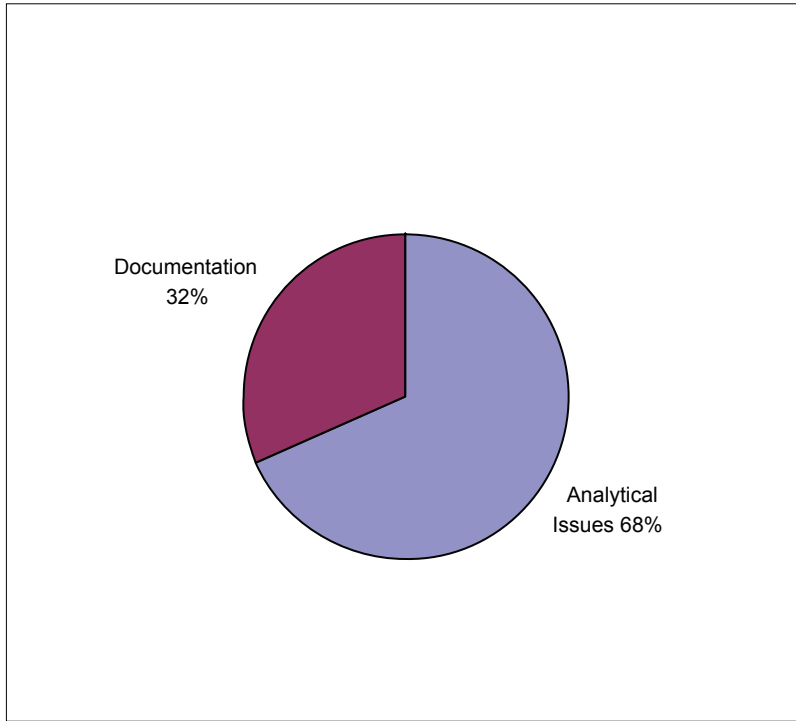


Figure 6-2. Percent Water Quality Field Audit Findings by Category

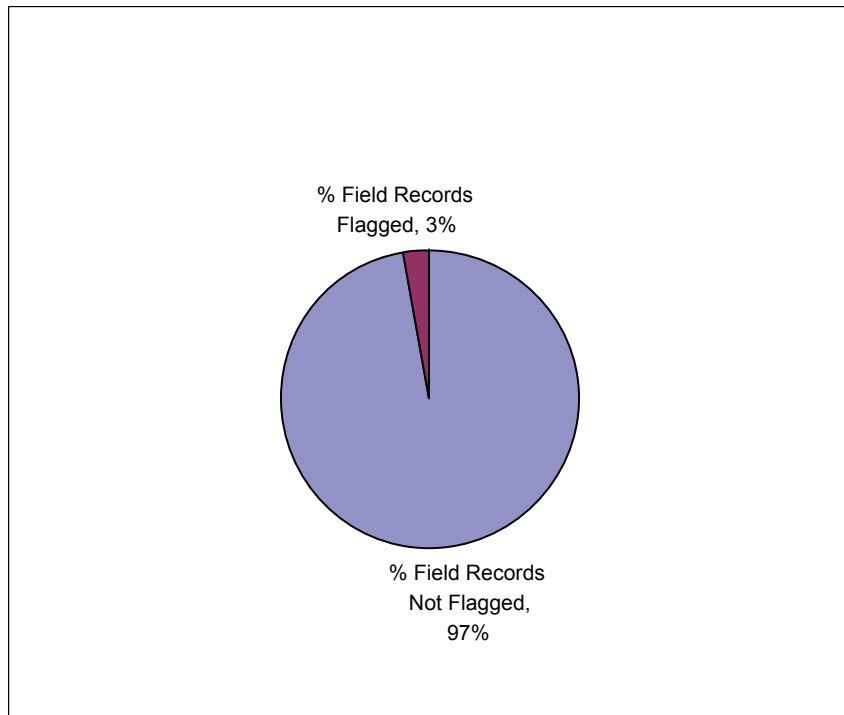


Figure 6-3. Percent CERP Field-Collected Water Quality Data in DBHYDRO with Data Qualifiers

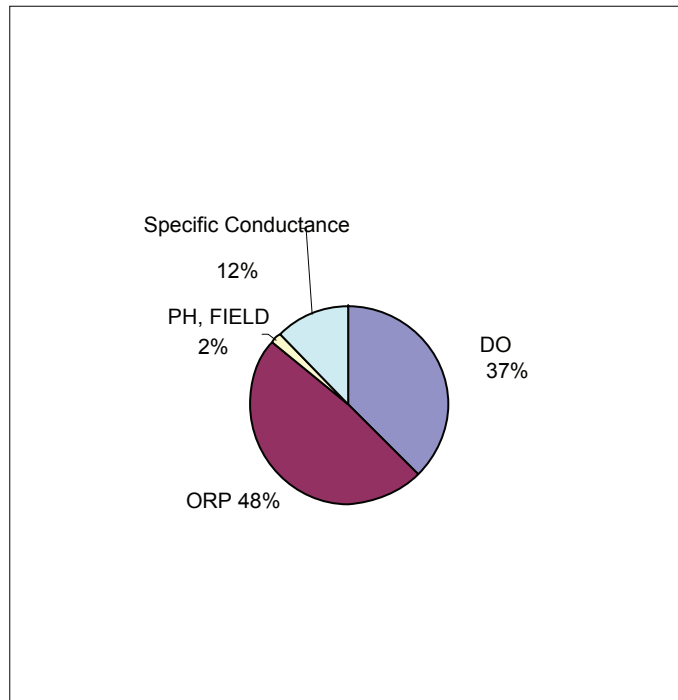


Figure 6-4. Contribution of Each Field-Collected Water Quality Parameter Qualified in DBHYDRO

7.0 GENERAL EVALUATION OF THE QUALITY OF LABORATORY DATA

The purpose of this section is to evaluate the quality of data being generated by laboratories currently performing analysis for CERP project and permit monitoring activities; it is not intended to be a comparison of laboratories. Thirty-two (32) chemistry and biology laboratories were identified in the QAOT inventory as currently analyzing data for CERP system-wide, project, and permit monitoring. During the report period, the QAOT assessed data quality for laboratories performing chemical analyses for CERP project and permit monitoring in several ways: laboratory audits were conducted for six organizations, limited laboratory QC data available from the SFWMD were assessed for six laboratories, and the results of PE samples were requested and obtained for 17 laboratories. A complete list of laboratories and the types of analyses currently being performed is provided in Attachment J. Biological data quality is not discussed in this report.

All 17 laboratory organizations discussed in this section are NELAC certified¹⁷. The QAOT analysis did not compare NELAC certified fields of testing versus the analyses currently performed by these laboratories for CERP. CERP project managers and PIs are responsible to verify that laboratories selected to perform chemical analysis for CERP are certified for the parameters of interest. As noted in Section 6.0 for field data quality, laboratory audit results and laboratory QC data presented in this section are “opportunistic” and represent information that was available during 2007. The QAOT continues to develop a systematic approach to target laboratory audits towards critical activities, but this was not fully implemented in 2007.

7.1 Assessment of Laboratory Data Quality through Laboratory Audits

Six laboratory audits for CERP-related project and permit monitoring activities were conducted by the QAOT during the report period (Table 7-1). All six audits were on-site assessments. One audit included an extensive desk audit of the laboratory’s quality manual and SOPs and is analyzed as two separate audits. The results of the audits are summarized in Tables 7-2 and 7-3; Figures 7-1 and 7-2. A reference list of audit reports from which these data are derived is provided in Attachment K.

The 69 laboratory related audit findings were spread evenly among four categories: analytical issues (30%), documentation (26%), instrument and equipment (16%), and quality systems (28%). Analytical issues included use of standards past the expiration date and inappropriate digestion methods; Documentation issues included lack of electronic file back-up procedures and errors in hand-written records; Instrument and Equipment issues included temperature monitoring problems and use of non-calibrated instruments; and Quality Systems issues included not meeting contract Scope of Work (SOW) and SOPs with insufficient detail. Overall, SOP-related issues represented the single largest category (16%), followed by labeling and temperature monitoring issues (12% each) and method deviations (9%). Of the 69 findings identified in the seven laboratory audits, the most findings were identified during the more detailed audits conducted at the SFWMD (28%), and the AEL desk and on-site audits (26%). The fewest findings were identified at ELAB (7%).

¹⁷In some cases, a laboratory organization has several locations. The information available for this report did not always identify the laboratory city. In these cases it is possible that a specific location is not accredited.

These results demonstrate the importance of laboratory audits; approximately half of the laboratory audit findings could result in inaccurate or incomparable analytical data that would not be possible to identify by reviewing the analytical results.

7.2 Assessment of Laboratory Data Quality through Performance Evaluation Data

QAOT members identified 17 laboratories that are currently or potentially contracted to analyze chemistry samples for CERP project or permit monitoring activities. These laboratories were contacted to request the results of PE samples analyzed during the report period. In all, the results of 32 different PE studies were reported by the laboratories, ranging from one PE study reported by Collier County to six reported by Xenco Laboratory. Two of the PE studies were sponsored by the QAOT in 2006: one water PE study for pesticide compounds and one water PE study for inorganic compounds. Table 7-4 lists the CERP laboratories, the PE studies that they participated in, and the overall results of the studies. PE samples are an unbiased measure of a laboratory's ability to obtain accurate data for a laboratory-prepared sample whose concentration is known by the PE provider, but is unknown to the laboratory. The same PE sample is provided to multiple laboratories and passing and failing results are identified statistically.

The QAOT inventory was used to identify chemical parameters of interest for CERP projects and permits. The results for these parameters in the PE studies were assessed to identify trends. Of the 108 failures reported for the 32 PE studies, most were single failures associated with volatile or semivolatile compounds. Few parameter-related trends were identified: only four parameters failed three or more times by more than two laboratories (Table 7-5).

- Alkalinity failed three times by three laboratories. Failing data were reported for two different methods. This represents 11% of the alkalinity tested in 26 PE samples; 89% of the results were acceptable.
- Ammonia as N failed four times by three laboratories. Failures were reported for two different methods. This represents 23% of the ammonia tested in 23 PE samples; 77% of the results were acceptable.
- TKN failed seven times by four laboratories. Failures were reported for two different methods. This represents 29% of the TKN tested in 20 PE samples; 71% of the results were acceptable.
- Total hardness failed three times by three laboratories. Failures were reported for two different methods. This represents 17% of the total hardness tested in 24 PE samples; 83% of the results were acceptable.

One laboratory participated in the CERP QAOT- pesticide study conducted in FY06. Of the six parameters included in the water sample, four of six results were acceptable. Three laboratories participated in the CERP QAOT inorganic PE study; five parameters were included in the water sample. Values for three parameters were acceptable for all participating laboratories. Results for two parameters (TKN for one laboratory; ammonia as N for two laboratories) were unacceptable. A full discussion of the results of PE samples analyzed by each of the 17 laboratories is provided in Attachment L.

7.3 Laboratory Quality Control

To present a snapshot of data quality for CERP, chemistry data in DBHYDRO identified as CERP-related were downloaded for analysis. These data are all associated with SFWMD projects or permits; data from other agencies were not available in a consistent, comprehensive, and readily accessible format usable for analysis. The laboratory QC data presented in this report are “opportunistic” and represent information that was available for the period covered by this report. The QAOT continues to develop a systematic approach to obtain laboratory QC data, but this was not fully implemented in 2007.

Data for seven SFWMD project and permit-related monitoring activities in DBHYDRO were identified as CERP-related:

- ACRA - Allapattah Complex Restoration Area (a component of the IRL-South CERP project)
- C111D & C111F – C-111 project sampling locations (C-111 Spreader Canal project – CERP and Advanced Construction Projects; DEP emergency order permit monitoring)
- L8RT – L8 Reservoir (a component of the North Palm Beach County - Part 1 CERP project)
- RASR – Regional ASR Baseline Water Quality Monitoring (ASR Regional Study)
- RFGW – Regional Floridan Groundwater Monitoring (also associated with the ASR Regional Study)
- TCSTA – Taylor Creek STA (a Critical Project authorized by WRDA 1996; permit monitoring). Although not a CERP project the QAOT determined that it should be included in the QAR analysis.

These were identified as CERP-related based on the descriptions in DBHYDRO (Section 6.2). The data set contained 10,138 values for 171 laboratory parameters representing eight parameter classes: biology, isotope, major ions, metals, nutrients, polychlorinated biphenyls (PCBs), pesticides, and wet chemistry. DBHYDRO contains three types of data qualifiers: flags, reason codes, and comments, that are assigned to data that do not meet QC criteria. The most specific of these codes were used to assess the quality of each value. Table 7-6 defines the data qualifiers and reason codes identified in DBHYDRO. Based on data qualifiers assigned to authentic samples (not to QC samples), 97% of the data were of high quality, requiring no data qualifiers. A total of 293 sample values (~3%) were qualified with laboratory data quality flags; no data were rejected (Table 7-7; Figures 7-3, 7-4, and 7-5). The most prevalent qualifiers were “UJ” (indicates the compound or analyte was analyzed for but not detected; the sample detection limit is an estimated value), most of which were applied to pesticide data and “V” (analyte detected in both the sample and the associated method blank), most of which were applied to nutrient data. The most heavily qualified parameter classes were PCBs (14%), pesticides (13%), and isotopes (9%). Although a higher percentage of PCB and pesticide data were qualified, these two parameter classes represent a relatively small percentage of the overall data set (9%).

An analysis of the analytical parameters included in each parameter class enables identification of the most troublesome parameters. Table 7-8 presents the ten parameters with the highest counts of qualified data. Based on the laboratory data qualifiers in the data set analyzed, the nutrient nitrate+nitrite-N received the most data qualifiers (45); this accounted for 7% of the data for this parameter. The isotope gross alpha ranked second with 39 (10%) values qualified. Table 7-9 presents the ten parameters with the highest percent qualified data. Based on the laboratory data qualifiers in the data set analyzed, the data for pesticides dichlorodiphenyltrichloroethane (DDT),-p,p' and methamidophos ranked highest with 100% of the data being qualified. With the exception of total chromium, all parameters with 50% or more data qualified were all pesticides.

The analytical data analyzed for this report was generated by six laboratories: Columbia Analytical Services (CAS) Jacksonville, FL, DB Environmental Labs, Inc. (DBLB), Everglades Laboratory (EVER), FDEP, US Biosystems (USBS), and the SFWMD. Figure 7-6 presents the percent contribution of each laboratory to data qualifiers assigned in DBHYDRO for the report period. The following text summarizes the data qualifiers applied to data generated by each laboratory.

DB Environmental Laboratory (DBLB). There were 12 data points representing four samples in the CERP DBHYDRO download for DBLB. Three parameters, Sulfur, Iron and total organic carbon (TOC) in solids were analyzed in each sample. No data were qualified.

Everglades Laboratory (EVER). There were 62 data points representing 32 samples in the CERP DBHYDRO download for EVER. Two parameters, Fecal and Total Coliform were analyzed in the samples. No data were qualified.

US Biosystems (USBS). There were 387 Gross Alpha data points in the CERP DBHYDRO download for USBS. Of these, 33 (9%) of the data were qualified. The most prevalent qualifiers were J (6%) and UJ (2%). It is noted that this analysis is subcontracted by USBS to another laboratory.

Columbia Analytical Laboratory, Jacksonville (CAS). There were 2521 data points in the CERP DBHYDRO download for CAS. Of these, 67(3%) of the data were qualified (Figure 7-4). The most prevalent qualifiers were V (1%) and J (0.8%) (Figure 7-6). Total Chromium (38%) biochemical oxygen demand (BOD) (38%), and Nitrate-N (25%) had the highest percentage of qualified data (Figure 7-7).

Florida Department of Environmental Protection (FDEP). There were 1308 data points in the CERP DBHYDRO download for FDEP. Of these, 130 (10%) of the data were qualified (Figure 7-4). The most prevalent qualifiers were UJ (8%) and S (0.9%) (Figure 7-6). Methamidophos and DDT-p,p' had the highest percentage of qualified data (100% each)¹⁸, followed by Acifluorfen (75%) and Diuron (70%) (Figure 7-8).

South Florida Water Management District (SFWMD). There were 5848 data points in the CERP DBHYDRO download for SFWMD. Of these, 54 (0.9%) of the data were qualified (Figure 7-4). The most prevalent qualifier was V (0.5%). Four other qualifiers (J4, J5, PMR, and Q) represented 0.1% each of the total number of values qualified (Figure 7-6). Color and Nitrate+Nitrite-N had the highest percentage of qualified data (6.2% and 3%, respectively) (Figure 7-9).

Based on data qualifiers in DBHYDRO, the most problematic parameter classes were pesticides and nutrients, with 42% and 15% of the data being qualified, respectively. An analysis of individual parameters indicated that Methamidophos (100%), DDT-p,p' (100%), Acifluorfen (75%), and Diuron (70%) had the highest percentage of qualifiers. For an additional 12 pesticide/herbicides, the percent data qualified was $\geq 40\%$. The next highest parameters were PCB-1260 (40% qualified) and Total Chromium (8%). The most prevalent qualifiers were UJ (107 qualifiers; 1%) and V (57 qualifiers; 0.5%). The SFWMD was responsible for generating over 50% of the individual parameter data; of these, 0.9% were qualified.

¹⁸ In both cases, the number of values represented is small (two and six, respectively). It should be noted that DBHYDRO also contains 23 values for DDT-p,p analyzed by FDEP which are not qualified.

Table 7-1. Laboratory Audits for CERP-Related Monitoring Activities

SFWMD Monitoring Code	Title	Laboratories
BIRP	Optimization of BMPS for Beef Cattle Ranching, L.O. Basin	ELAB, Inc.
No specific project	NA	KSA Environmental Laboratory, Inc.
VOW	Village of Wellington Water Quality Monitoring	USBS
ESP	Everglades Stormwater Program Upstream Monitoring	
RFGW	Regional Floridan Groundwater Monitoring	CAS, Jacksonville
No specific project	NA	AEL Environmental Laboratory Jacksonville (Desk audit and on-site audit)
No specific project	NA	SFWMD

Table 7-2. Detailed Deficiencies Identified During Laboratory Audits

Category Details	AEL-Desk	AEL-On-Site	CAS	ELAB	KSA	SFWMD	USBS	Grand Total	Percent
Calibration	1		1			2		4	6%
Co-elution with contaminant peak		1						1	1%
Contract			1					1	1%
Corrective Action			1					1	1%
Data errors					1		1	2	3%
Data management					1			1	1%
Documentation issues					1		2	3	4%
Experience/ Training				1	1			2	3%
Imprecise measurements		1						1	1%
Incorrect Station ID						1		1	1%
Inspections	1							1	1%
Labeling				1		7		8	12%
Log book						2		2	3%
Management Reviews							1	1	1%
Method Detection Limits (MDLs)			2		1		1	4	6%
Method	1	3			2			6	9%
Potential carry-over		1						1	1%
QA					1			1	1%
QA Manual	2							2	3%
QC Procedures/ Failures					2		1	3	4%
SOP-related issues	7		1	2		1		11	16%
Standards and Reagents			4					4	6%
Temperature Monitoring				1	1	6		8	12%
Grand Total	12	6	10	5	11	19	6	69	
Percentage	17%	9%	14%	7%	16%	28%	9%		

Table 7-3. Summary of Deficiencies Identified During Laboratory Audits

Category	AEL-Desk	AEL-On-Site	CAS	ELAB	KSA	SFWMD	USBS	Grand Total	Percent
Analytical Issues	1	6	6	1	5		2	21	30%
Documentation	1			2	2	11	2	18	26%
Instrument/Equipment	2		1		1	7		11	16%
Quality Systems	8		3	2	3	1	2	19	28%
Grand Total	12	6	10	5	11	19	6	69	100%
Percent Findings per Laboratory	17%	9%	14%	7%	16%	28%	9%		

Table 7-4. Summary of Laboratory Performance Evaluation Sample Results

Laboratory	PE Sample Provider	Results
AEL Gainesville	Wibby WP0706	All Pass
	Wibby WP1206	Pass/fail. See Table 7-5 for failures
	Wibby WP0407	All Pass
AEL Jacksonville	ERA WP-142	Pass/fail. See Table 7-5 for failures
	ERA WP-143	Pass/fail. See Table 7-5 for failures
	CERP PES1 FY06¹⁹	Pass/fail. See Table 7-5 for failures
CAS	Wibby WS0706	Pass/fail. See Table 7-5 for failures
	Wibby WS0107	Pass/fail. See Table 7-5 for failures
	FDEP TP Round Robin	See Appendix K; Table 4
Collier County	CERP ERA FY06	Pass/fail. See Table 7-5 for failures
DB Environmental	ERA WP-135	All Pass
	ERA WP-141	All Pass
	CERP ERA FY06	All Pass
	FDEP TP Round Robin	See Appendix K; Table 4
ELAB, Inc	NSI WP-124	All Pass
	NSI DMRQA-26	Pass/fail. See Table 7-5 for failures
	NSI WP-118	All Pass
	FDEP TP Round Robin	See Appendix K; Table 4
FDEP	ERA WP-134	All Pass
	ERA WP-146	All Pass
	FDEP Hg Round Robin	See Appendix K; Tables 2 and 3
	SFWMD Sediment Hg PE	All Pass
FIU	CERP ERA FY06	Pass/fail. See Table 7-5 for failures
	FDEP Hg Round Robin	See Appendix K; Table 4
	FDEP TP Round Robin	See Appendix K; Table 4
KSA Environmental	RTC WP06-3B	Pass/fail. See Table 7-5 for failures
	Wibby WP0207	Pass/fail. See Table 7-5 for failures
	FDEP TP Round Robin	See Appendix K; Table 4
SFWMD	ERA WP-147	All Pass
	ERA WP-135	All Pass
	FDEP TP Round Robin	See Appendix K; Table 4

¹⁹ PE studies sponsored by the QAOT are bolded.

Table 7–4. Summary of Laboratory Performance Evaluation Sample Results (continued)

Laboratory	PE Sample Provider	Results
Test America Denver	USGS Spring 2006 SRS	Pass/fail. See Table 7-5 for failures
	USGS Fall 2006 SRS	Pass/fail. See Table 7-5 for failures
	FDEP TP Round Robin	See Appendix K; Table 4
Test America Savannah	ERA WS-120	Pass/fail. See Table 7-5 for failures
	Wibby WS0107	Pass/fail. See Table 7-5 for failures
	FDEP TP Round Robin	See Appendix K; Table 4
Test America Tallahassee	ERA WP-144	Pass/fail. See Table 7-5 for failures
	ERA WP-138	Pass/fail. See Table 7-5 for failures
	FDEP TP Round Robin	See Appendix K; Table 4
US Biosystems	ERA WS-117	Pass/fail. See Table 7-5 for failures
	ERA 080406	Pass/fail. See Table 7-5 for failures
	ERA WP-135	Pass/fail. See Table 7-5 for failures
	FDEP TP Round Robin	See Appendix K; Table 4
UFL-IFAS-WBL	CERP ERA FY06	All Pass
	FDEP TP Round Robin	See Appendix K; Table 4
USGS National Water Quality Laboratory	NYDoH ELAB Shipment 295	All Pass
	NYDoH ELAB Shipment 300	All Pass
Xenco	Wibby WS0706	Pass/fail. See Table 7-5 for failures
	Wibby WP0706	Pass/fail. See Table 7-5 for failures
	Wibby RR-03190	Pass/fail. See Table 7-5 for failures
	Wibby RR-03191	Pass/fail. See Table 7-5 for failures
	APG January 2007 WP	Pass/fail. See Table 7-5 for failures
	APG January 2007 WS	Pass/fail. See Table 7-5 for failures

Table 7-5. Laboratory Performance Evaluation Water Sample Failures

Laboratory	Parameter	Method	PE Study
AEL Gainesville	Total Hardness as CaCO ₃	SM2340B	Wibby (Jan 2007) ¹
AEL Jacksonville	Indeno(1,2,3-cd)pyrene	EPA 625, EPA 8270C	WP-142
	Benzyl alcohol	EPA 8270C	WP-142
	Beryllium	EPA 200.8, EPA 6020	WP-143 ²
	Iron	EPA 200.8, EPA 6020	WP-143 ²
	Alkalinity as CaCO ₃	EPA 310.1	WP-143
	Alachlor²⁰	EPA 508	CERP PES1 FY06
	Hexachlorocyclopentadiene	EPA 508	CERP PES1 FY06
CAS	Alkalinity as CaCO ₃	SM 18/19 th 2320B	Wibby WS0706 ¹
	Chromium	EPA 200.7 Rev 5	Wibby WS0107 ²
	Silver	EPA 200.7 Rev 5	Wibby WS0107 ²
	Total Filterable Residue	EPA 160.1	Wibby WS0107
Collier County	Ammonia as N		CERP ERA FY06
	TKN		CERP ERA FY06
ELAB, Inc	Silver	EPA 200.7	DMRQA-26 ²
	Specific Conductance	EPA 120.1	DMRQA-26 ²
	Total Solids	EPA 160.3	DMRQA-26 ²
FIU	Ammonia as N		CERP ERA FY06
KSA Environmental	TKN	EPA 351.2	RTC WP06-3B ¹
	Nitrite as N	EPA 300	Wibby WP0207
Test America Denver	Ammonia + Organic Nitrogen as N (22 Colorimetric)		USGS 2007a USGS 2007b
Test America Savannah	1,2-Dichlorobenzene	EPA 524.2	ERA WS-120 ¹
	Styrene	EPA 524.2	ERA WS-120 ¹
	Total Xylene	EPA 524.2	ERA WS-120 ¹
	Fluoride	EPA 340.2, SM4500 F-C	ERA WS-120 ²
	Total Hardness as CaCO ₃	SM 2340 C, EPA 130.2	ERA WS-120 ²
	Metribuzin,	EPA 525.2	ERA WS-120 ¹
	Simazine	EPA 525.2	ERA WS-120 ¹
	Copper	EPA 200.8	Wibby WS0107 ²
	Aldrin	EPA 508	Wibby WS0107 ²
Test America Tallahassee	4,4-DDE	EPA 8081A, EPA 608	WP-144 ¹
	2,4-Dinitrotoluene	EPA 8270C, EPA 625	WP-144 ¹
	Ortho-phosphate as phosphorous (P)	EPA 365.2	WP-138
	Methoxychlor	EPA 8081A, EPA 608	WP-138

²⁰ QAOT-sponsored PE studies are bolded.

Table 7–5. Laboratory Performance Evaluation Water Sample Failures (continued)

Laboratory	Parameter	Method	PE Study
US Biosystems	Sulfate	EPA 300	ERA WS-117
	Selenium	EPA 200.8	ERA WS-117 ²
	Vanadium	EPA 200.8	ERA WS-117 ²
	Thallium	EPA 200.9	ERA WS-117 ²
	pH	EPA 150.1, EPA 9040	ERA WP-135
	TKN	EPA 351.2	ERA WP-135
	Total Solids	EPA 160.3, EPA SM540G	ERA WP-135
Xenco	Antimony	EPA 200.8	Wibby WS0706; APG January 2007 WS
	Beryllium	EPA 200.8	Wibby WS0706
	Arsenic	EPA 200.8, SW 6020	Wibby WP0706 ¹
	Cobalt	EPA 200.8, SW 6020	Wibby WP0706 ¹
	Copper	EPA 200.8, SW 6020	Wibby WP0706 ¹
	Manganese	EPA 200.8, SW 6020	Wibby WS0706; Wibby WP0706 ¹
	Molybdenum	EPA 200.8, SW 6020	Wibby WS0706 Wibby WP0706 ¹
	Nickel	EPA 200.8, SW 6020	Wibby WP0706 ¹
	Vanadium	EPA 200.8, SW 6020	Wibby WS0706 Wibby WP0706 ¹
	Calcium	EPA 200.8, SW 6020	Wibby WP0706 ¹
	Total Filterable Residue	EPA 160.1	Wibby WS0706
	Chloride	EPA 300	Wibby WS0706 ¹
	Sulfate	EPA 300	Wibby WS0706 ¹
	Calcium Hardness as CaCO ₃	SM 3240B	Wibby WP0706 ¹
	Total Hardness as CaCO ₃	SM2340B	Wibby WP0706 ¹
	Ammonia as N	EPA 350.1, EPA 350.3	Wibby WP0706 APG January 2007 WP
	Orthophosphate as P	EPA 300, SW 9056, EPA 365.1	Wibby WS0706 Wibby WP0706 Wibby RR-03191 ² APG January 2007 WS ²
	TKN	EPA 351.2, EPA 351.4	Wibby WP0706; APG January 2007 WP
	Total Phosphorous	EPA 356.3	Wibby WP0706; APG January 2007 WP
	3,3'-Dichlorobenzidine	SW 8270C, EPA 625	Wibby WP0706 ¹

Table 7–5. Laboratory Performance Evaluation Water Sample Failures (continued)

Laboratory	Parameter	Method	PE Study
Xenco (continued)	N-Nitrosodiphenylamine	SW8270C, EPA 625	Wibby WP0706 ¹
	4-Nitroaniline	SW 8270C, EPA 625	Wibby WP0706 ¹
	2-Nitrophenol	SW 8270C, EPA 625	Wibby WP0706 ¹
	Nitrate as N	EPA 353.2	Wibby RR-03190 APG January 2007 WP ²
	Nitrate and Nitrite as N	EPA 353.2	Wibby RR-03191 ¹
	Nitrite as N	EPA 354.1, EPA 353.2	Wibby RR-03191 APG January 2007 WP ²
	Benzo(g,h,i)perylene	EPA 610, EPA 8310	APG January 2007 WP ²
	Chrysene	EPA 610, EPA 8310	APG January 2007 WP ²
	Aroclor 1232	EPA 608, EPA 8082	APG January 2007 WP
	Aroclor 1242	EPA 608, EPA 8082	APG January 2007 WP
	Toxaphene	EPA 608	APG January 2007 WP ²
	Titanium	EPA 6020, EPA 200.8	APG January 2007 WP
	Styrene	EPA 624, EPA 8260	APG January 2007 WP
	Dieldrin	EPA 525.2	APG January 2007 WS ²
	Endrin	EPA 525.2, EPA 508	Wibby WS0706; APG January 2007 WS ²
	Potassium	EPA 200.8	APG January 2007 WS
	Sodium	EPA 200.8	APG January 2007 WS
	Benzo(k)fluoranthene	EPA 610	APG January 2007 WS ²
	Dibenz(a,h)anthracene	EPA 610	APG January 2007 WS ²
	Indeno(1,2,3-cd)pyrene	EPA 610	APG January 2007 WS
	1,2-Dichloroethane	EPA 524.2	APG January 2007 WS
	Styrene	EPA 524.2	APG January 2007 WS
	Dibromomethane	EPA 524.2	Wibby WS0706 ¹
	1,1,2,2,-Tetrachlorethane	EPA 524.2	Wibby WS0706 ¹
	1,2,3-Trichlorobenzene	EPA 524.2	APG January 2007 WS
	1,2,3-Trichloropropane	EPA 524.2	Wibby WS0706 APG January 2007 WS
	1,2,4-Trichlorobenzene	EPA 524.2	Wibby WS0706 ¹
	Butachlor	EPA 525.2	Wibby WS0706 ¹
	Hexachlorobenzene	EPA 525.2	Wibby WS0706 ¹
	Lindane	EPA 525.2	Wibby WS0706 ¹
	Trifluralin	EPA 525.2	Wibby WS0706
	Alkalinity as CaCO ₃	EPA 310.1	APG January 2007 WP
	Total Dissolved Solids	EPA 160.1	APG January 2007 WS

¹Results acceptable in subsequent PEs.

²Parameter reported for more than one method; passed in the other method.

Table 7-6. Summary of Qualifiers Used to Qualify Data in DBHYDRO

Qualifier ²¹	Qualifier Description ²²	Assigned by
J	Estimate due to QC failure	Laboratories
J3	Precision or accuracy criteria not met	SFWMD
J4	Matrix interference	SFWMD
J5	Improper laboratory or field protocol	SFWMD
PMR	Project manager remarks	SFWMD
Q	Out of holding time	SFWMD
U	Indicates that the compound was analyzed for but not detected	SFWMD
S	Surrogate internal standard	FDEP
Q1	Holding time: Sampling to Analysis	FDEP
Q2	Holding time: Sampling to Extraction	FDEP
Q3	Holding time: Extraction to Analysis	FDEP
M1	Matrix Spike (MS)/MS Duplicate (MSD) Recovery	FDEP
L1	Laboratory Control Sample (LCS) Recovery	FDEP
L2	LCS Relative Percent Difference (RPD)	FDEP
G	Detection Limit	FDEP
W1	Field Blank	FDEP
W2	Equipment Blank	FDEP
P	Field Duplicate	FDEP

²¹ Codes PMR (Project Manager Remark) and NOB (No bottle) were not used in the analysis because these did not represent QC failures.

²² These QC flags represent failures (e.g., the “P” qualifier signifies that the field duplicate precision requirement was not achieved).

Table 7-7. Laboratory Qualifiers Assigned to CERP Project and Permit-Related Data in DBHYDRO

Parameter Class	Biology	Isotope	Major ions	Metals	Nutrient	PCB	Pesticide	Wet Chemistry	Total Qualified Data	Percent Records Qualified
G		2							2	0.02%
J		22	19	1				1	43	0.42%
J3								1	1	0.01%
J4				8					8	0.08%
J5 ¹					16				16	0.16%
L1							3		3	0.03%
L2							2		2	0.02%
M1		1	8	1			13		23	0.23%
M1,L1							1		1	0.01%
PMR			1		3			1	5	0.05%
Q								4	4	0.04%
Q1								3	3	0.03%
Q2								3	3	0.03%
Q2,Q3								3	3	0.03%
S							12		12	0.12%
UJ		9		8		10	80		107	1.06%
V		1	1	19	34			2	57	0.56%
Total Lab-Qualified Data	0	35	29	37	53	10	111	18	293	2.89%
Number of Records	325	411	2192	1722	3331	70	830	1257	10138	100.00%
Percent Lab-Qualified Records	0.0%	8.5%	1.3%	2.1%	1.6%	14.3%	13.4%	1.4%	2.9%	2.9%

¹J5 may be applied to either field or laboratory data. It has been applied to both field and laboratory data in this analysis

Table 7-8. Ten CERP Project and Permit--Related Parameters Most Commonly Qualified in DBHYDRO

TEST_NAME	PCT Qualified	Count	Records Qualified	PARAM_CLASS
NITRATE+NITRITE-N	7%	613	45	Nutrient
GROSS ALPHA	10%	387	39	Isotope
CHROMIUM, TOTAL	67%	24	16	Metals
NITRATE-N	5%	303	14	Nutrient
COPPER, TOTAL	3%	363	12	Metals
DDT,O,P	43%	23	10	Pesticide
PHOSPHATE, ORTHO AS P	2%	411	10	Nutrient
POTASSIUM	5%	217	10	Major ions
ALKALINITY, BICARB, CACO3	3%	206	7	Major ions
ALKALINITY, TOT, CACO3	2%	315	7	Major ions

Table 7-9. Ten CERP Project and Permit-Related Parameters with the Highest Percentage of Qualified Values in DBHYDRO

TEST_NAME	PCT Qualified	Count	Records Qualified	PARAM_CLASS
DDT-P,P'	100%	6	6	Pesticide
METHAMIDOPHOS	100%	2	2	Pesticide
ACIFLUORFEN	75%	8	6	Pesticide
DIURON	70%	10	7	Pesticide
CHROMIUM, TOTAL	67%	24	16	Metals
2,4-D	63%	8	5	Pesticide
IMIDACLOPRID	63%	8	5	Pesticide
2,4,5-TP	56%	9	5	Pesticide
2,4,5-T	50%	8	4	Pesticide
CYPERMETHRIN	50%	10	5	Pesticide
METHOXYCHLOR	50%	12	6	Pesticide
NALED	50%	10	5	Pesticide

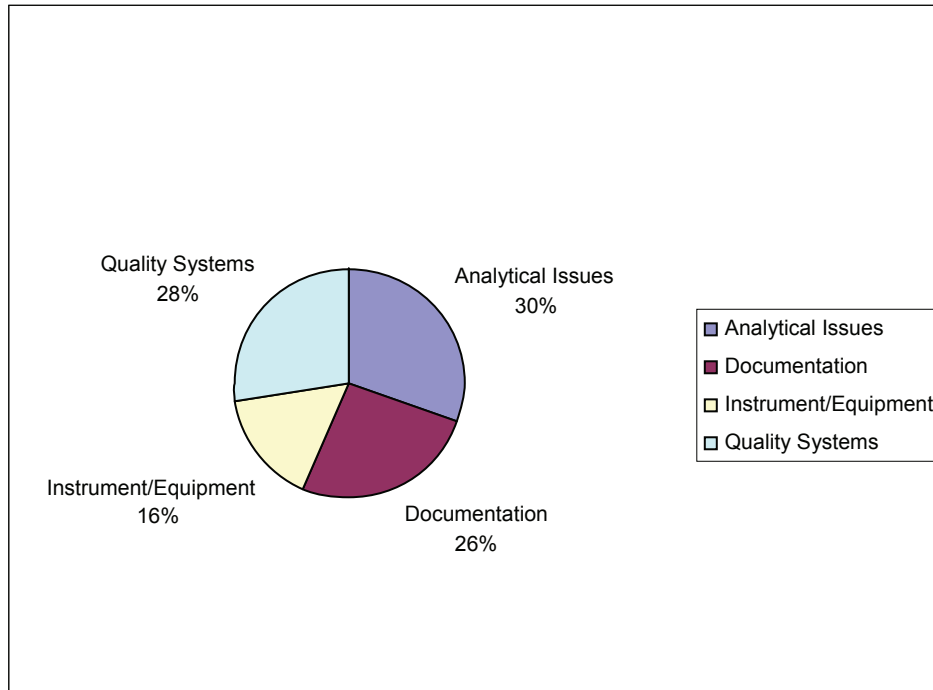


Figure 7-1. Percent Finding Categories for Laboratory Audits

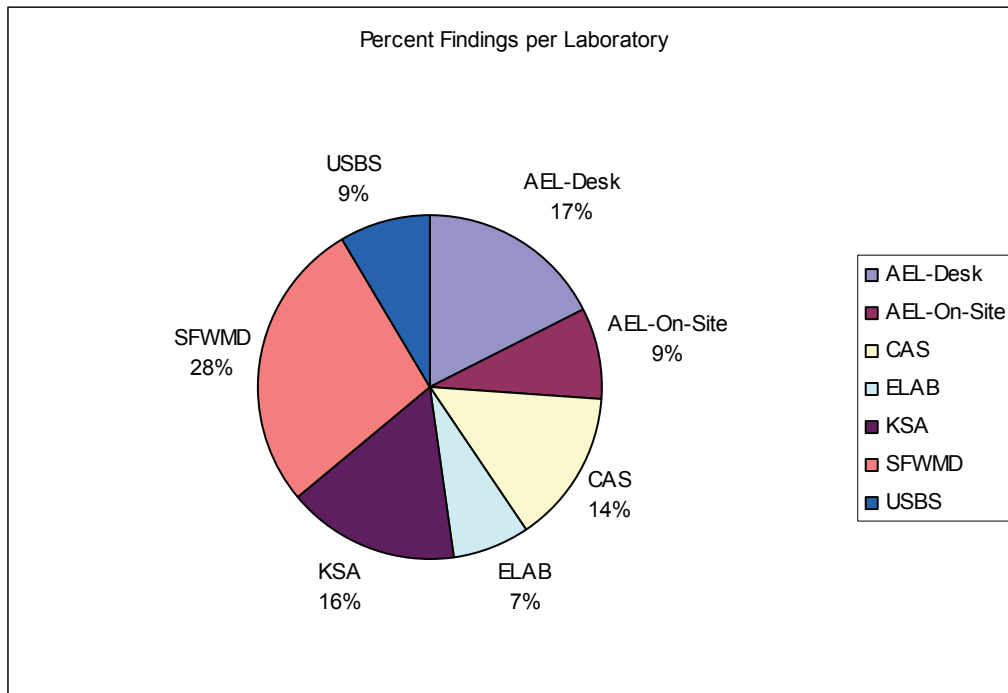


Figure 7-2. Percent Audit Findings per Laboratory

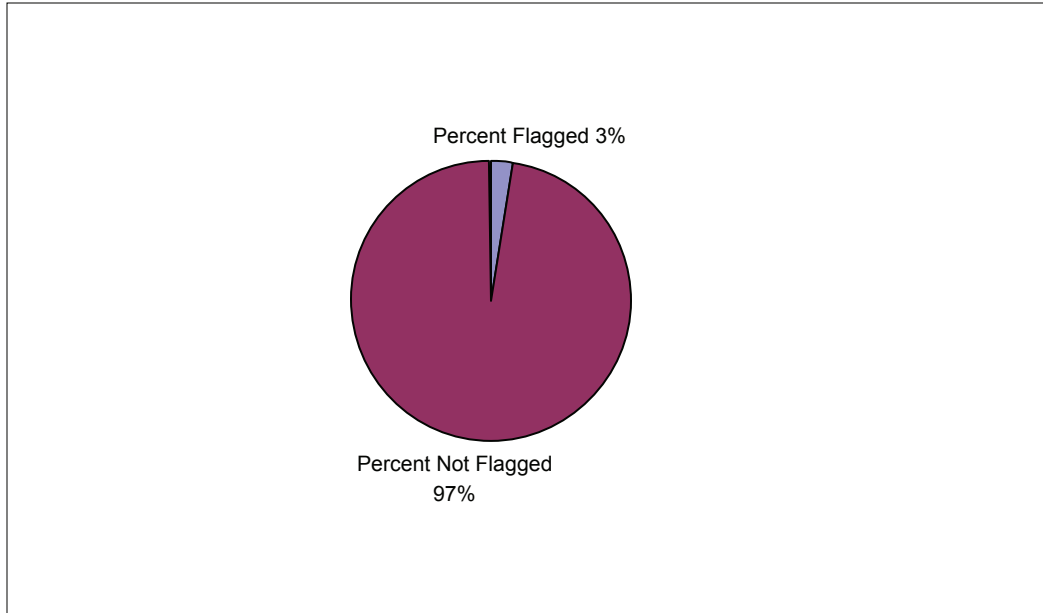


Figure 7-3. Percent Laboratory Data with Qualifiers

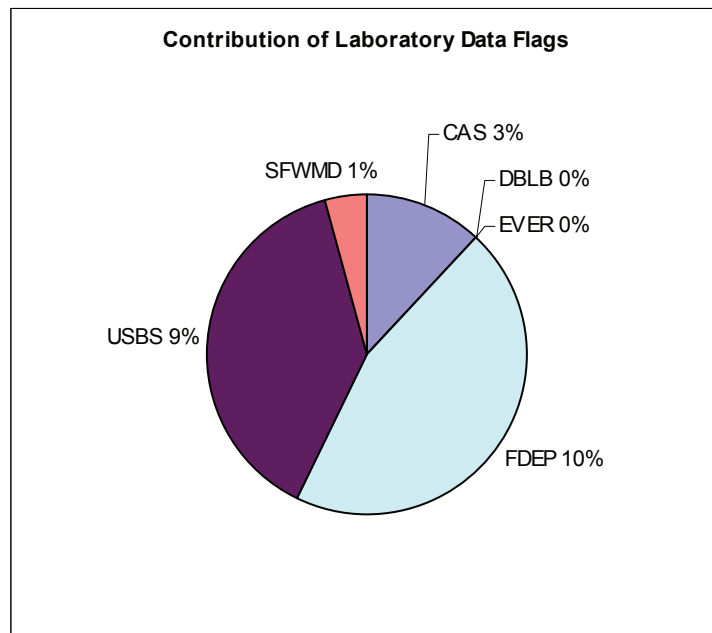


Figure 7-4. Contribution of Laboratory Data Qualifiers

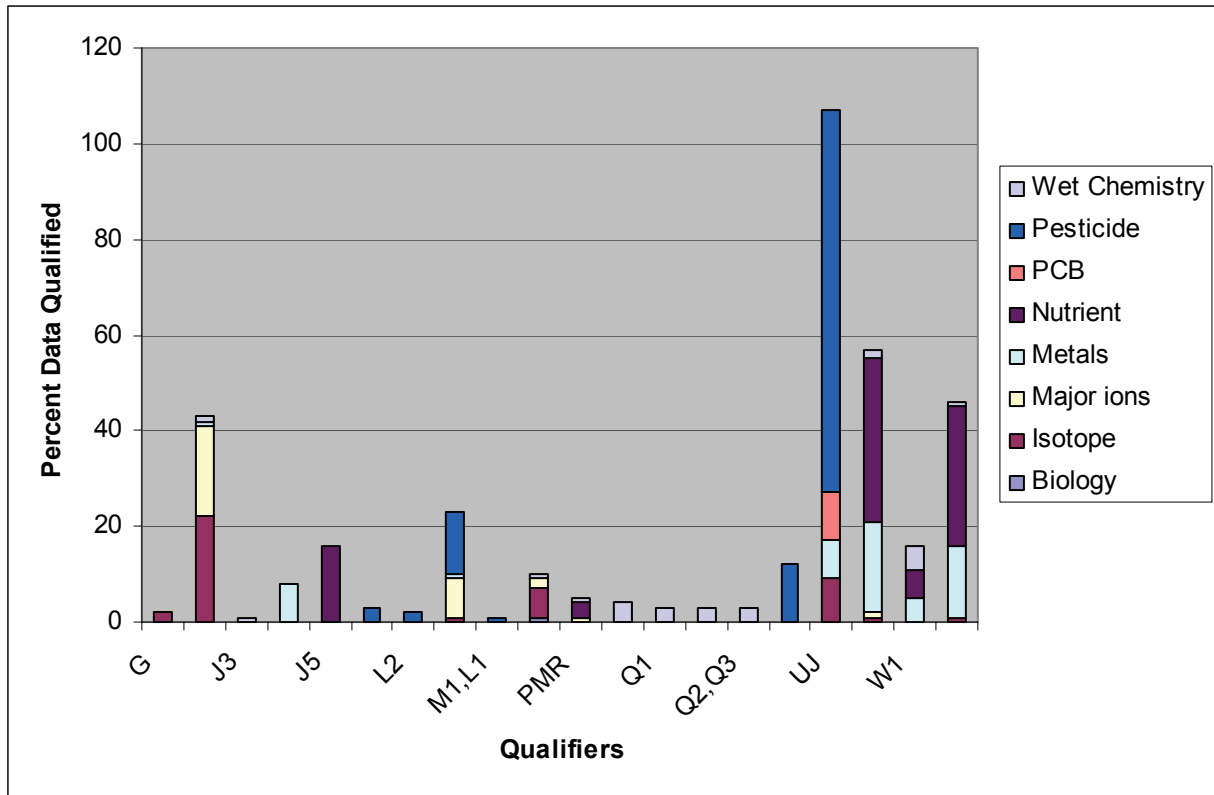


Figure 7-5. Percent CERP-Related Data in DBHYDRO with Laboratory Qualifiers

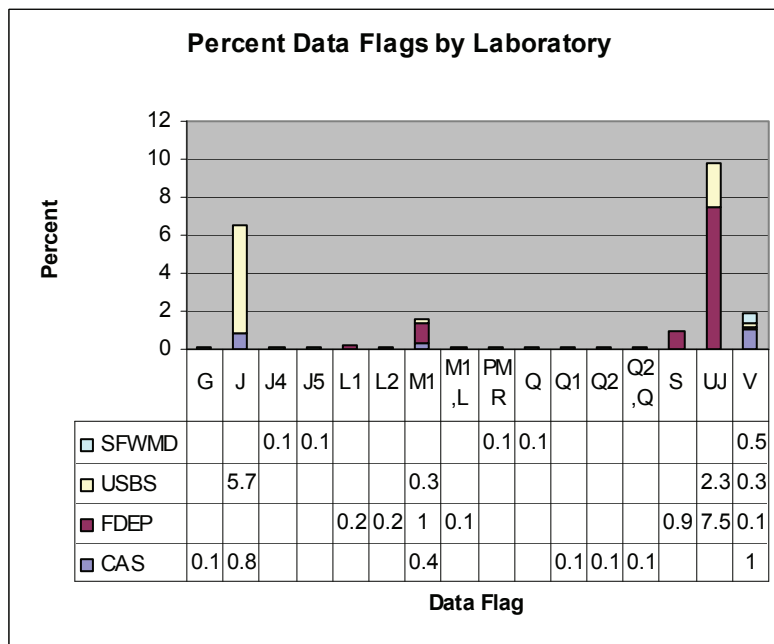


Figure 7-6. Percent CERP-Related Data Qualifiers by Laboratory

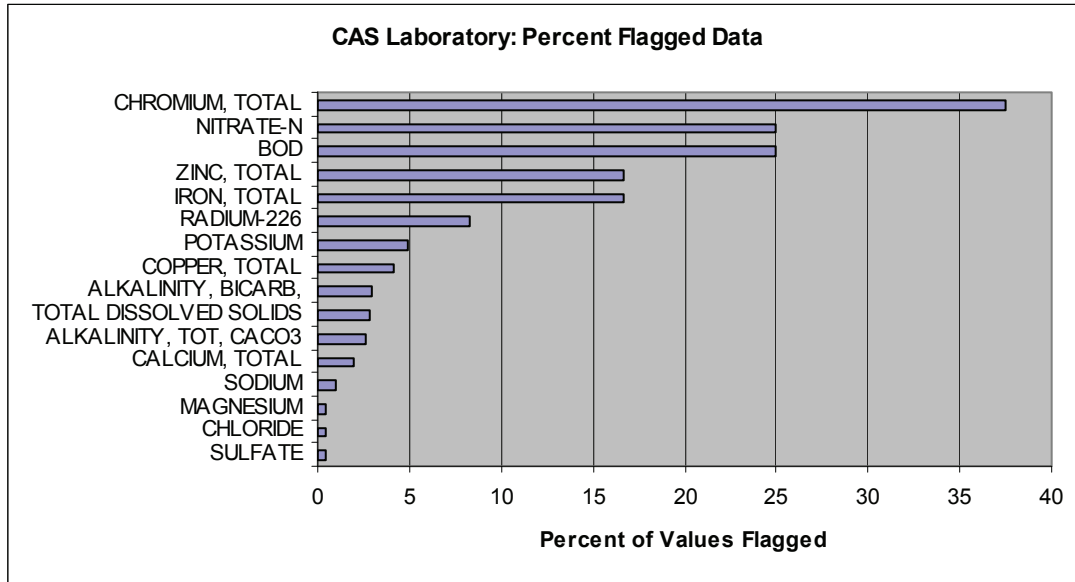


Figure 7-7. CAS Laboratory: Percent Qualified Data

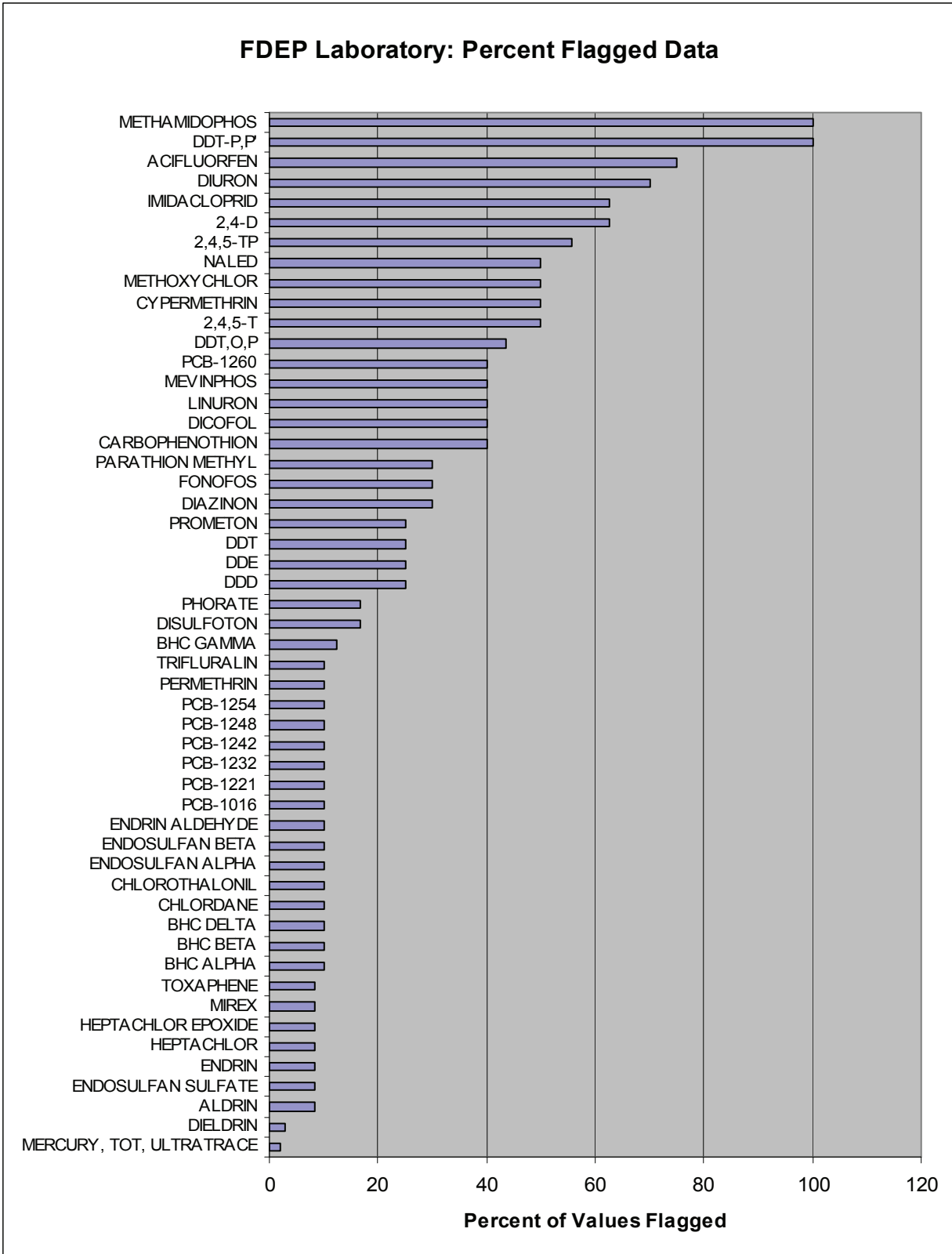


Figure 7-8. FDEP Laboratory: Percent Qualified Data

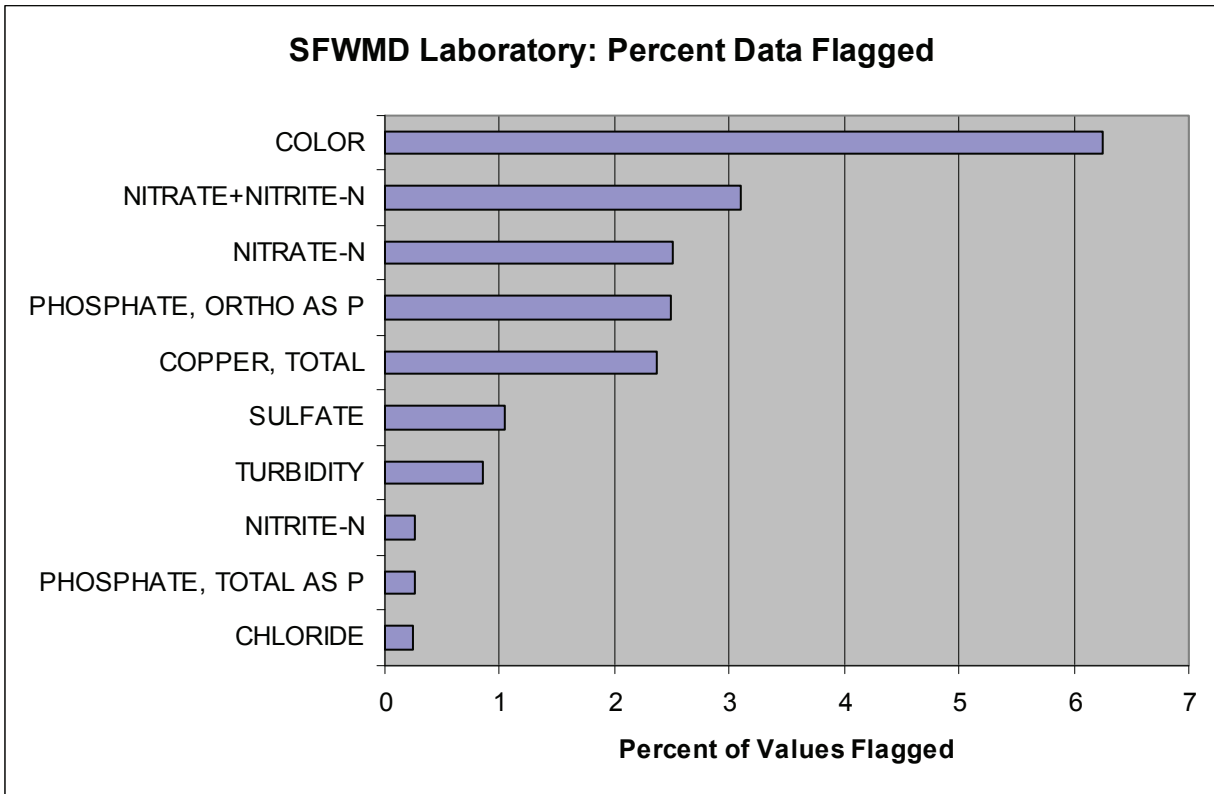


Figure 7-9. SFWMD Laboratory: Percent Data Qualified

8.0 ALTERNATIVE PROCEDURES APPROVED

According to CGM 41, the QAOT is responsible, with the CERP Water Quality Team or Project Delivery Team (PDT), for the review and approval of QASR variances (alternative procedures)²³. A variance is any change from the requirements of the QASR and may include the use of an alternative laboratory procedure, field procedure, QA/QC requirement, data validation procedure, or data management procedure. Between May 2006 and April 2007, no applications for approval of alternatives procedures were submitted to the QAOT. However, it is likely that most CERP project managers and RECOVER PIs are not familiar with this QASR requirement.

²³ The QASR defines an alternative procedure as a variance from the established method or procedure. These variances may be driven by project limitations, areas of enhancements or improvements such as better technology, or for experimental or research purposes. The ultimate goal of the alternative procedure review process is to ensure that the proposed alternative produces the same or better quality results and will maintain consistency within the program or within CERP. The variances may involve the use of alternate laboratory or field procedures, QA/QC elements, data validation, or data management procedures. (2006 QASR Section 2.3)

9.0 DEVIATIONS FROM CERP QASR AND CORRECTIVE ACTIONS

No known deviations from the CERP QASR or specific monitoring plan requirements were identified by the QAOT or key organizations, other than those discussed in Sections 6.0 and 7.0. The 2006 QAR identified four QAOT activities that could result in improved data quality. These areas, the corrective action initiated for each, and the status of the corrective action are summarized in Table 9.1.

Table 9-1. Status of Corrective Actions for 2006 QAR Recommendations²⁴

Improvement Area	Status of Corrective Action
<p>The QASR requirements should be communicated to the biological monitoring community to ensure that managers who are responsible for QASR implementation understand the requirements. (2006 QAR)</p>	<p>The need to comply with QASR requirements was communicated to RECOVER PIs during AT meetings. A secondary result of the AT questionnaire (Section 5.5) provided to RECOVER PIs was to identify QASR requirements and expectations for monitoring level QA/QC.</p> <p>The biological chapter of the QASR (Chapter 8) will be distributed to RECOVER PIs for review during 2008. This will serve to both communicate the current requirements and ground-truth the methods referenced in the chapter. As needed, dedicated workshops of teleconferences will be conducted to communicate QA/QC requirements to RECOVER PIs.</p>
<p>CERP project managers and PIs need greater understanding of the CERP QA/QC and Quality System, and their responsibilities for implementing it. (2006 QAR)</p>	<p>The QAOT members continue to communicate QASR requirements during routine interaction with CERP project managers and PIs within their organizations. This is an on-going activity. Specific outreach activities have not been identified.</p> <p>The review of monitoring plans provides an opportunity to ensure and communicate the inclusion of QASR requirements.</p>
<p>Designating personnel to perform QA functions (e.g., QA Officers) and training those personnel in quality oversight activities and field and laboratory auditing procedures is needed. (2006 QAR)</p>	<p>Personnel have been identified within the SFWMD and the USACE to perform QA Officer functions for:</p> <ul style="list-style-type: none"> ○ Water quality monitoring ○ Biological/ecological monitoring ○ Hydrology and hydrodynamics monitoring ○ Organic and inorganic laboratory analysis <p>A QAOT subteam has been identified to define the responsibilities of the QA Officers. These responsibilities will be finalized in 2008 and training will be conducted.</p>
<p>Appropriate, quantifiable QC procedures for biological parameters are needed. This will be addressed during 2007 through a series of biological workshops. (2006 QAR)</p>	<p>Biological workshops were not held. Current QA/QC procedures for biological monitoring will be determined through the questionnaire developed with the AT Co-chairs and used to identify the need for additional QC procedures. As needed, dedicated workshops of teleconferences will be conducted to communicate QA/QC requirements to PIs.</p>

²⁴ The 2006 QAR covered the period from May 2005 through April 2006.

10.0 RECOMMENDATIONS FOR QA/QC PROGRAM IMPROVEMENTS

As discussed throughout this report, success in implementing the CERP QA/QC program is essential to ensure that CERP data are of consistent high quality, accurate, traceable, and comparable. Eight specific recommendations for improvement are defined below.

1. Establish a systematic water quality data review process

The QAOT should assess the quality of all water quality data being generated for CERP. A process to receive, review, and assess water quality QA/QC results is needed.

2. Consistent, comprehensive, and readily accessible water quality data formats.

The formats of water quality data and meta data are not consistent between organizations and laboratories. This needs to be addressed. The QASR requirement for the use of ADaPT was intended to address this issue, however ADaPT is not used by many organizations generated chemistry data for CERP. The QAOT recognizes that the use of ADaPT is an ongoing issue and is working on additional training of CERP staff in each agency.

3. Outreach/training and workshops.

The need for outreach to project managers and PIs is a continued need to ensure that the requirements of the QASR are understood and implemented. The QAOT is in the process of working with the AT Co-chairs to develop effective outreach mechanisms, including teleconferences or focused workshops, to address QA/QC gaps.

- Outreach to CERP project managers and PIs is needed to ensure that they understand the QASR data collection and QA/QC requirements (Section 9.0).
- Outreach to system-wide monitoring PIs should be based on the results of the AT questionnaire and geared to address undocumented or inconsistent technical procedures to ensure data comparability and to facilitate implementation of QA/QC procedures to ensure data robustness and defensibility.
- Outreach to hydrodynamic, hydrologic, and remote sensing project managers to facilitate implementation of QA audits of field and post-processing procedures.
- Outreach to CERP project managers to improve understanding of the CERP QA/QC and Quality System, and their responsibilities for implementing it.

4. Focused laboratory and field audits

Establish an integrated audit program to ensure that organizations generating monitoring data for CERP are being audited at defined frequencies.

- Expand the audit program to include water quality, biological, ecological, hydrodynamic, hydrologic, and remote sensing data collection activities to verify that sample collection, handling, observations, and measurement procedures comply with established protocols. These audits should be coordinated with the appropriate RECOVER PIs, contract managers, data management stewards, and CERP project managers.
- Designate personnel to perform QA functions for all field data collection activities and train those personnel in QA procedures.

5. Improve monitoring plan review process

Review of monitoring plans is a defined QAOT responsibility. The purpose is to make sure that the documents are detailed and contain detailed QA/QC requirements. The review process is defined in draft CGM 40.01 and should be communicated to project managers and PIs. Existing monitoring plans are posted on the CERP website. Review of representative documents for on-going CERP monitoring activities should continue. The preparation of monitoring plans should be clarified in the QASR and the review process better defined.

6. Management of QASR Revisions

The last posted version of the QASR is June 2006. The revisions made by SFWMD contractors in 2006 were recently posted for public comment. The QASR should be revised and published in 2008.

7. Review of alternative procedures

The QASR specifies that the QAOT is responsible to review alternative procedures. No alternative procedures were submitted for review during the report period and it is likely that this requirement is largely unknown to CERP technical personnel. The definition of an alternative method and the need for submitting these methods for review and approval should be communicated to project managers and PIs.

8. Ensure that the QAOT website is current

The QAOT section of www.evergladesplan.org lists several documents in preparation. These should be reviewed for relevance, and either assigned for completion or removed from the list.

11.0 SUMMARY OF QAOT ACTIVITIES FOR THE YEAR

QAOT activities for the report period are detailed throughout this report. These included:

- Survey of CERP project managers and RECOVER PIs that resulted in an inventory of projects including field monitoring and laboratory analysis during the 2007 QAR period
- Quality System interviews
- Review of monitoring plans and development of a monitoring plan checklist
- Revision of the QASR
- Development of a QA/QC questionnaire for RECOVER PIs
- Field and laboratory audits
- Data validation
- Administration and analysis of PE samples

In addition, the QAOT accomplished the following:

- Finalized the QAOT PMP, which was approved by the QAOT co-chairs, Design Coordination Team (DCT), SFWMD, and the Project Review Board on May 15, 2007.
- Developed a project inventory database.
- Revised CGM 40.
- Prepared the 2007 Annual QAR.
- Presented *QAOT 2007 Annual QA Report Status Update* to the DCT. The presentation is now posted on the QAOT website at www.everglades.org.
- Presented *CERP QA Program: Overseeing its implementation* at the National Conference on Ecosystem Restoration (NCER) Conference in Kansas City, MO.
- Presented periodic status reports to the DCT and AT.

12.0 RESOURCE NEEDS

To implement CGM 41.01, QA Officers have been identified to perform field and laboratory assessments (Section 10.0). Funding to train and support the positions is needed.

The QAOT Support contract ends in FY09 (December). Renewal of this contract is needed to ensure that the QAOT has the resources needed to achieve their responsibilities for ensuring that the quality of data generated for CERP is rigorous and defensible.

13.0 REFERENCES

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