

Comprehensive Everglades Restoration Plan

2008 Annual Quality Assessment Report

for

May 2007 – April 2008

Quality Assurance Oversight Team

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ACRONYMS AND ABBREVIATIONS¹

ADaPT	Automated Data Processing Tool
AEL	Advanced Environmental Laboratories, Inc.
AOML	Atlantic Oceanographic and Meteorological Laboratory
AT	Assessment Team
BOD	Biochemical Oxygen Demand
CAS	Columbia Analytical Services
CCPC	Collier County Pollution Control
CCV	Continuing Calibration Verification
CERP	Comprehensive Everglades Restoration Plan
CGM	CERP Guidance Memorandum
COC	Chain of Custody
COD	Chemical Oxygen Demand
CompQAP	Comprehensive Quality Assurance Plan
DBE	DB Environmental Laboratory
DBHYDRO	The South Florida Water Management District hydrometeorologic, water quality, and hydrogeologic data retrieval system.
DCB	Decachlorobiphenyl
DCT	Design Coordination Team
DO	Dissolved Oxygen
DoD QSM	Department of Defense Quality Systems Manual
EDD	Electronic Data Deliverable
EDMS	Environmental Database Management System
EMCT	Environmental Monitoring Coordination Team
EMCX	Environmental and Munitions Center of Expertise
EPA	U.S. Environmental Protection Agency
EPJV	Everglades Partners Joint Venture
ERDP	Everglades Research Database Production
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FIU	Florida International University
FRS	Frontier Services
FWEC	Foster Wheeler Energy Corporation
FY	Fiscal Year
GAI	Golder Associates, Inc.
GC/ECD	Gas Chromatography/Electron Capture Detector
GC/MS	Gas Chromatography/Mass Spectrometry
GPS	Global Positioning Service
IAG	International Analytical Group, Inc.

¹ Attachment A contains the complete list of all project code acronyms received from the South Florida Water Management District (SFWMD).

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ICP	Inductively Coupled Plasma
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
IDC/ODC	Initial Demonstration of Capability/On-Going Demonstration of Capability
IRL	Indian River Lagoon
LCS	Laboratory Control Sample
LFB	Laboratory Fortified Blank
LFM	Laboratory Fortified Matrix
LIMS	Laboratory Information Management System
LPC	Laboratory Performance Check
LRD	Loxahatchee River District
MAP	Monitoring and Assessment Plan
MDL	Method Detection Limit
MRL	Method Reporting Limit
MPV	Most Probable Value
NA	Not Applicable
NELAC	National Environmental Laboratory Accreditation Conference
ORP	Oxidation Reduction Potential
OCP	Organochlorine Pesticide
OPP	Organophosphorus Pesticide
PADI	Professional Association of Diving Instructors
PAR	Photosynthetically Active Radiation
PCBs	Polychlorinated Biphenyls
PDT	Project Delivery Team
PE	Performance Evaluation
PI	Principal Investigator
PMP	Project Management Plan
PMR	Project Manager Remark
PQL	Practical Quantitation Limit
PT	Performance Test
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAMP	Quality Assurance Management Plan
QAOT	Quality Assurance Oversight Team
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QAR	Quality Assessment Report
QASR	Quality Assurance Systems Requirements
QATS	Quality Assurance Technical Support
QC	Quality Control
QM	Quality Manual
RECOVER	Restoration Coordination and Verification
SAV	Submerged Aquatic Vegetation
SERC	Southeast Environmental Research Center

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SFWMD	South Florida Water Management District
SJRWMD	St. Johns River Water Management District
SOP	Standard Operating Procedure
SOW	Scope of Work
SRP	Soluble Reactive Phosphate
SRS	Standard Reference Sample
STA	Storm Treatment Area
TBD	To Be Determined
TC	Total Carbon
TCMX	2,3,4,6-Tetrachloro-m-xylene
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TOC	Total Organic Carbon
TP	Total Phosphorus
TSS	Total Suspended Solids
USACE	U.S. Army Corps of Engineers
USBS	U.S. Biosystems, Inc.
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VSS	Volatile Suspended Solids
WP	Work Plan

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EXECUTIVE SUMMARY

Since passage of the Water Resource Development Act 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) 41.00 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 41.00 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, 2007 and April 30, 2008. The term CERP is an umbrella term for many different activities. These include 1) Restoration Coordination and Verification (RECOVER) system-wide monitoring efforts (i.e., Monitoring and Assessment Plan [MAP]), 2) project monitoring, and 3) permit-driven regulatory monitoring. It was necessary to assess activities independently as each has specific requirements, restrictions, and monitoring objectives that affect design and implementation. Therefore, the term “RECOVER” will be used to designate RECOVER monitoring activities, “CERP project” to denote CERP and Advanced Construction Projects monitoring, and “CERP permit monitoring” to denote permit-driven regulatory monitoring.

RECOVER MAP was designed to be the primary tool to assess and guide restoration. The overarching goal to accomplish this objective was for the MAP to represent a single, integrated, system-wide monitoring and assessment plan that will be used and supported by all participating agencies and tribal governments. This required that the MAP build upon and complement monitoring that was being performed by several agencies across the ecosystem as possible and prudent to do so. The data from several sources that may potentially be used by RECOVER are examined in this report to assess the compatibility and quality of these data from a QA/QC perspective. However, it must be recognized that most of these data collection activities were not funded by RECOVER and therefore as a secondary user RECOVER has no direct control over the quality of the data. One goal of this report is to provide insight and direction to RECOVER regarding the overall quality and compatibility of the data.

The applicability of specific water quality monitoring activities to RECOVER, CERP Projects, and CERP Permits was reviewed by RECOVER, the QAOT, and cognizant SFWMD staff. In addition, the SFWMD assignment of “P” budget designations was used as a tool to identify potential CERP-related monitoring activities. The identification of potential RECOVER data from outside agencies was communicated by the QAOT RECOVER Liaison based on the *Identification of RECOVER Water Quality Monitoring Stations*. In some cases identifying monitoring activities as CERP or RECOVER-related was difficult because while not directly funded by CERP or RECOVER, it is possible that the data may be used for RECOVER or CERP system-wide assessments in the future. For this report, if it was reasonably possible that the monitoring data would be used by RECOVER or CERP then the data were included for analysis. If a monitoring activity was determined to be potentially or definitely CERP or RECOVER-related the data for the entire SFWMD project code were down-loaded from DBHYDRO, the South Florida Water Management District hydrometeorologic, water quality, and hydrogeologic data retrieval system, without consideration of specific station locations.

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The QAOT employed a variety of methods to evaluate the QA/QC procedures being implemented for CERP that could impact data quality. Among them, QA/QC questionnaires focused on specific RECOVER monitoring activities, reviews of a CERP Project statement of work (SOW) and CERP Permit monitoring plan, biological/ecological field visits to observe RECOVER and Permit-related monitoring, on-site field and laboratory audits, assessment of field and laboratory water quality data that may potentially be used for RECOVER or CERP, and administration of organic and inorganic laboratory performance evaluation (PE) samples. Overall, this report presents a snapshot of data potentially useful for RECOVER and CERP project and CERP permit data quality and is not necessarily representative of the entire CERP data spectrum because of the relatively small number of assessments performed compared to the volume of monitoring being conducted.

ASSESSMENT of RECOVER MONITORING ACTIVITIES

The MAP (RECOVER, 2004) was conceived as the primary tool by which the RECOVER program will assess the performance of the south Florida ecosystem as it responds to restoration initiatives. The overarching goal for implementation of the MAP is to have a single, integrated, system-wide monitoring and assessment plan that could be used and supported by all participating agencies and tribal governments as the means of holistically tracking and measuring the status of the Everglades ecosystem. However, due to many factors, the implementation of MAP is not uniform across the system, which compounds the complexities associated with providing holistic guidance regarding monitoring procedures. Therefore, several distinct activities were necessary to adequately assess the quality of data being generated for the RECOVER program. These included:

1. Development and review of a QA/QC questionnaire targeting biological/ecological related activities.
2. Development and review of a QA/QC questionnaire targeting remote sensing related activities.
3. Observations of three separate RECOVER-related biological/ecological monitoring activities.
4. Assessment of water quality measurements generated by field teams and support laboratories.

In addition, field audits, laboratory audits, and the PE sample program assessed organizations that may provide data for CERP system assessment activities. The results are discussed later in this summary.

QA/QC Biological/Ecological Questionnaires

During the report period, a QA/QC Biological/Ecological Questionnaire was used to determine the strength and weakness of QA/QC practices being applied to the RECOVER MAP. The questionnaire was developed by the QA/QC Questionnaire Sub-team (Sub-team) in coordination with the RECOVER Assessment Team (AT) Chairs. The questionnaire covered QA/QC practices for both field and laboratory monitoring activities. A total of forty eight (48) questionnaires were distributed to MAP Principle Investigators (PIs) in late summer 2007. MAP PIs completed one questionnaire for each monitoring component of the MAP. Of the 48 questionnaires that were distributed to the MAP PIs, 36 of these questionnaires were ultimately deemed appropriate for review. For the purpose of analysis, responses were grouped into three categories:

- Most PIs: question received a positive response 75-100% of the time
- Some PIs: question received a positive response 50-74% of the time
- Few PIs: question received a positive response less than 50% of the time

Based on these three categories, all PIs (100%) reported provisions for long-term data storage and were able to identify at least two locations for data backup. Most PI responses indicated that quality systems

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and procedures were in place for field standard operating procedures (SOPs) (79%), staff training (92%) and verification of field staff procedures (87%), integration of QA/QC into their monitoring (84%) with corrective action if QA/QC checks do not yield acceptable results (87%), and methods for dealing with questionable data (84%). Most PIs reported that they perform their own laboratory analysis (86%), quality systems and procedures were in place for laboratory SOPs (95%), integration of QA/QC into their biological/chemical analyses in the laboratory (77%), methods for dealing with questionable data (86%), provisions for long-term data storage backup (95%), and data verification (77%). Some PIs (68%) reported they knew whether their laboratory was National Environmental Laboratory Accreditation Conference (NELAC) certified however, many biological/ecological parameters are not standard certified parameters for NELAC and the questionnaire did not delineate between certified and non-certified parameters. Some PIs (59%) reported they implement laboratory training of some type and described it and some PIs (73%) reported they check their staff on a regular basis to ensure they are following laboratory procedures properly and have laboratory procedures documented in a notebook that is readily accessible to staff. Few PIs (36%) reported they were aware that their laboratory methods complied with the Quality Assurance System Requirements (QASR).

Recommendations resulting from the questionnaire included (1) development of a comprehensive MAP QA/QC plan template, and changes in SOW to require development of a QA/QC plan, references and links to the QASR, and inclusion of the MAP QA/QC plan template as an attachment, and (2) the development of short, topic-specific QA/QC training modules and workshops focused on the MAP PIs to facilitate dialogue between the QAOT, MAP Module Leads, and the MAP PIs about important QA/QC topics.

QA/QC Remote Sensing Questionnaires

During the report period, QA/QC Remote Sensing Questionnaires were also completed for two different MAP activities (IRL Seagrass Mapping and CERP Vegetation Mapping). The questionnaires, consisting of 64 questions, were based on QASR Chapter 9 QA/QC requirements and technical guidance. The purpose of the questionnaires was to assess the compliance of remote sensing activities with the QASR and was not an assessment of the entire project. The questionnaires were sent to the PIs via email. The PIs entered answers to each of the 64 questions and returned the questionnaires for evaluation by the QAOT. Follow-up conversations and correspondence clarified responses so that the results could be accurately evaluated.

The questionnaire for Indian River Lagoon (IRL) Seagrass Mapping: Section 3.3.3.3 of RECOVER MAP activity was provided to the South Florida Water Management District (SFWMD) Project Manager, who completed the questionnaire and provided additional information during a follow-up interview. This mapping project is a cooperative effort between SFWMD and St. Johns River Water Management District (SJRWMD) and has a long history going back to the pre-CERP days. Because of the maturity of the project, the project team has established procedures that are fully compliant with QASR guidance. Many of the project manager responses offered greater detail than just a "Yes" or "No" which was helpful in the evaluation.

The questionnaire for CERP Vegetation Mapping activity was provided to an active participant in the project at the SFWMD who completed the questionnaire. Additional information was provided during a follow-up interview and by the module lead. Many of the responses to questions referenced the SOW; however, the SOW did not provide details because development of a QA/QC plan and SOP (with pertinent details) was defined in the SOW as one of the first deliverables. The following observations were made based on the assessment of the questionnaire and follow-up interview (given the caveats that the first SOW for this project was initiated prior to the charter for the QAOT sub-team, and that the project has an otherwise active and extensive QA initiative): No data management plan is specifically

defined, but the SOW requirement states that the plan must satisfy CERP data management standards. The SOW does not define the contents of a QA/QC Plan, although reference is made to "standardized quality control and assurance procedures" and the need to provide documentation of the rigorousness of the method if standardized QA/QC methods do not exist (SOP). The SOW was not reviewed by the QAOT/designee/Remote Sensing sub-team and does not provide details on the content of a SOP to be developed as the first deliverable.

Based on the results of the remote sensing QA/QC Questionnaire responses and assessments, the recommendations were developed to improve the questionnaire, the QASR, and QAOT involvement in remote sensing activities.

RECOVER Monitoring Field Observations

Three separate on-site field visits were conducted by the QAOT during the report period: (1) American Alligator Distribution, Size, and Hole Occupancy (MAP 3.1.3.15) and American Crocodile Juvenile Growth and Survival (MAP 3.1.3.16); (2) St. Lucie Estuary, Seagrass Monitoring and Observations; and (3) Loxahatchee River Project, Seagrass Monitoring and Observations. These on-site visits were not audits but rather represented the first effort by the QAOT to observe biological/ecological field monitoring activities from a QA/QC perspective. It is anticipated that these visits will enable the QAOT to develop procedures for field audits of RECOVER monitoring in the future.

During the field observation for the MAP 3.1.3.15 and MAP 3.1.3.16, the SOW SOP, QASR Chapter 8, and field procedures excerpted from undetermined larger documents were used to provide guidance on the essential evaluation criteria for the on-site field study review. The objectives of the field visits were to review required project documents, field team qualifications, and field procedures/methodologies, and internal QA/QC and data management procedures. The crocodylian monitoring for these MAP elements was observed for compliance with the SOW, SOPs, and QASR. The results of the review indicated that project documents and data recording procedures, field team experience, field procedures and methods, and QA/QC procedures were appropriate and acceptable. A few items identified in the QASR as essential elements of project documentation or data management were not performed because the PI determined that these procedures were not applicable. The SOPs used for this study are excerpted from larger, unidentified documents and it was unclear which SOP was the official version. One recommendation of the field visit was that one SOP be prepared that combines the appropriate elements of the variously referenced documents.

St. Lucie Estuary, Seagrass Monitoring and Observations study involves the non-destructive monitoring of submerged aquatic vegetation (SAV). The data will be used by RECOVER for restoration assessment, but the study is not funded by, and thus not directly under the control, of RECOVER. During the field visit the monitoring was assessed for compliance with the SOW, field team qualifications were reviewed, and specific collection elements were observed. Based on a comparison of field procedures and methods with the SOW, the observer concluded that samples are collected and instruments calibrated appropriately for the project objectives. The techniques observed were performed appropriately for the required data collection. The study methods are adequately described in the written protocols. The field methods used for monitoring conform to the written protocols. All observed procedures followed the SOW. The results of the review indicated that project documents and data recording procedures, field team experience, field procedures and methods, and QA/QC procedures were appropriate and acceptable.

The field visit to Loxahatchee River Project, Seagrass Monitoring and Observations was conducted one day after the St. Lucie Estuary, Seagrass Monitoring observation visit. The sampling procedures and design are identical for the two projects. Non-destructive monitoring of SAV was observed to assess compliance with the SOW. Field team qualifications were reviewed. Based on a comparison of field

procedures and methods with the SOW, the observer concluded that samples are collected and instruments calibrated appropriately for the project objectives. The techniques observed were performed appropriately for the required data collection. The study methods are adequately described in the written protocols. The field methods used for monitoring conform to the written protocols. All observed procedures were in accordance with those detailed in the SOW. The results of the review indicated that project documents and data recording procedures, field team experience, field procedures and methods, and QA/QC procedures were appropriate and acceptable.

Quality of Field-Collected Water Quality Data

RECOVER MAP was designed to build upon and complement the existing suite of monitoring that was being performed in South Florida by various entities. Therefore, wherever possible and prudent, RECOVER utilizes non-MAP-funded data collected by several agencies, given the caveat that monitoring objectives may differ to varying degrees with the objectives of the MAP. While it is important to assess this data from a QA/QC perspective, it must also be recognized that RECOVER has no direct control over these various databases, but can only act in cooperation with the QAOT in an advisory role. Therefore, this assessment is intended to provide insight and direction to RECOVER regarding the overall quality and compatibility of this data.

Field water quality data collected from monitoring stations potentially useful for RECOVER was assessed for quality control (QC)-related data qualifiers. Data from Caloosahatchee Estuary, IRL, Loxahatchee Estuary, Southern Estuary, plus nine SFWMD projects that may potentially provide data useful for RECOVER were included in the assessment. Data quality was assessed based on the assignment of data quality control (QC) qualifiers applied to indicate that instrument calibration, replicate analysis, equipment blank, or field procedures were unacceptable. Overall, less than 1% of field-collected water quality measurements were qualified although in some cases QC-related qualifiers were assigned to more than 25% of the data from a specific field team.

Laboratory Data Quality Control

The quality of laboratory water quality data from stations that may potentially provide data useful for RECOVER was assessed. In all, eight laboratories (Florida International University [FIU], Lee County, Loxahatchee River District [LRD], SJRWMD, plus four laboratories with data housed in DBHYDRO) generated these data. Data quality was assessed using data qualifiers assigned to reported values by the laboratory or independent data reviewers (i.e., validators). Data qualifiers are codes that provide information to a data user about the data. Not all data qualifiers indicate data quality problems (e.g., a qualifier is used to indicate that a method detection limit (MDL) has been inserted into the result field because the result is less than the laboratory MDL). However, other qualifiers indicate that the data did not achieve the measurement quality objectives for accuracy and precision, holding times, instrument calibration requirements, etc. Qualifiers that identified problems that could impact data quality were quantified as “QC qualifiers.” It is up to the discretion of the data user to determine if data are useable for a specific intended purpose. Key Findings of the data review included:

- The FIU data set contained 19,248 data results. QC related qualifiers were assigned to 80% of the FIU data including 100% of the Ammonia (NH₃), Total Organic Carbon (TOC), Nitrite+Nitrate, Nitrite, and Total Phosphorus (TP).
- The Lee County data set contained 3,010 data results. Most (95%) of the Lee County data had no QC-related qualifiers. QC qualifiers were assigned to 5% of the data. Qualifiers assigned to Biological Oxygen Demand (BOD) data accounted for 63% of the qualified data.
- The LRD data set contained 1,333 data results. Most (80%) of the LRD data had no QC-related qualifiers. QC qualifiers were assigned to 20% of the data. The top four parameters with

qualified data were chlorophyll a (100%), TP (52%), NH₃ (48%), total Kjeldahl nitrogen (TKN) (44%).

- The SJRWMD data set contained 1278 data results. Most (98%) of the SJRWMD data had no QC-related qualifiers. QC qualifiers were assigned to 2% of the data.

The DBHYDRO database is the data storage vehicle for data collected by or funded by the SFWMD. Data for nine SFWMD project were identified as potentially providing data useful for RECOVER (CAMB, CESWQ, CR, IRL, SE, SGGE, TCSTA, TMC, and X). The combined data set was comprised of 20,850 data results. Overall, 97% of the data had no QC qualifiers and QC related qualifiers were assigned to 3% of the data, including: 70 – 100% of the polychlorinated biphenyls (PCBs), and 35% of the pesticide data.

CERP PROJECT MONITORING

Three separate activities were performed during the report period to assess the quality of data being generated for CERP project monitoring (SOW review, assessment of field data quality and assessment of laboratory data quality). In addition, field audits, laboratory audits, and the PE sample program, which are discussed later in this summary, supported CERP system, project, and permit-related monitoring activities.

SOW Review

One draft SOW for CERP project C-11 was evaluated by the QAOT during the report period. The QAOT monitoring plan review checklist was used as the basis of the review. Of the eight major QA/QC elements assessed, five (63%) were acceptable. The three unacceptable elements were related to project and data assessment organizations and responsibilities and report documentation requirements. All technical elements of the SOW were acceptable with two exceptions: (1) The SOW did not define an acceptable method for methyl mercury (MeHg). (2) The SOW did not require the use of the Automated Data Processing Tool (ADaPT) as the data reporting format.

Field Quality Control Data

Based on a query of DBHYDRO, field data for two CERP Projects (Regional Floridan Groundwater Monitoring [RFGW] and Regional Aquifer Storage and Recovery Biological Monitoring [RASR]) were analyzed during the report period. The data set contains 466 field measurements. Based on an analysis of QC qualifiers, 89% of the field measurements did not have and 11% did have QC qualifiers assigned. The only parameter, oxidation reduction potential (ORP) for which more than 25% of the data were qualified included only three measurements.

Laboratory Quality Control Data

Data for RFGW and RASR water quality stations were analyzed by the SFWMD and its contractor, Columbia Analytical Services (CAS) during the report period. The data set was comprised of 1320 data results. Overall, 98% of the data did not have QC qualifiers and 2% did have QC qualifiers, including 100% of the total chromium and methyl mercury data.

CERP PERMIT MONITORING

Four separate activities were performed during the report period to assess the quality of data being generated for CERP permit monitoring (monitoring plan review, biological/ecological field observations, assessment of field data quality and assessment of laboratory data quality). In addition, field audits, laboratory audits, and the PE sample program, which are discussed later in this summary, supported CERP system, project, and permit-related monitoring activities.

Monitoring Plan Review

One monitoring plan for CERP Permit monitoring for Biscayne Bay Coastal Wetlands was evaluated by the QAOT during the report period. The QAOT monitoring plan review checklist was used as the basis of the review. Of the eight major QA/QC elements assessed, five were applicable to the project. All five elements were acceptable, including all technical elements. It was noted that the monitoring plan did not provide detection limits or the calculations for bias and precision, but the reviewer noted that an attachment appeared to be missing from the review version.

Field Observations

During the field visit to the 10 Mile Creek Stormwater Treatment Area (STA), Observation of Fish Tissue Sampling, the collection of *Gambusia affinis* (Mosquito fish) for analysis of Hg in fish tissue was observed for compliance with CGM 42.00 Appendix A: *District Guidance in the Design of a Project-level Monitoring and Assessment Plan for Mercury and Other Toxicants* and the SOP SFWMD-Hg-04 Rev 1.2 *Mercury in Fish*. Observations included fish collection, preservation, labeling, field documentation and custody, equipment cleaning, and sampling pre-processing. In two instances double-bagging of material was not performed as required by the SOP. The requirements of CGM 42.00 Appendix A: *District Guidance in the Design of a Project-level Monitoring and Assessment Plan for Mercury and Other Toxicants* and the SOP SFWMD-Hg-04 Rev 1.2 *Mercury in Fish* should be compared to ensure that sampling procedures are consistent. The results of the review indicated that project documents and data recording procedures, field team experience, field procedures and methods, and QA/QC procedures were appropriate and acceptable.

Field Quality Control Data

Field data for six CERP Permit monitoring activities were collected during the report period. The data set contains 754 field measurements. Based on an analysis of QC qualifiers, 97% of the field measurements did not have QC qualifiers and only 3% had QC qualifiers; no trends were noted.

Laboratory Quality Control Data

Water quality data in DBHYDRO for seven CERP permit monitoring activities were analyzed by the SFWMD and its contractors during the report period. The entire data set was comprised of 3435 data results. Overall, 90% of the data did not have QC qualifiers and 10% did have QC qualifiers, 80 – 100% of the PCB data, and 25% of the Gross Alpha and pesticide data.

FIELD TEAM AUDITS

As part of its routine audit schedule, the SFWMD audited five water quality monitoring field teams that collected samples during the report period that may be used in support of RECOVER, CERP projects, and CERP permit monitoring: Collier County Pollution Control (CCPC), TetraTech ECI Foster Wheeler Environmental Corporation (FWEC), Golder Associates, Inc., SFWMD-STA and SFWMD Lake Okeechobee teams. In all, these teams collect samples and perform field water quality measurements that may be used for least five CERP permits, two CERP projects, and nine RECOVER monitoring activities. These audits included observing sample collection procedures, equipment calibration and use, field measurements, and data recording procedures. Each audit assessed compliance with the SFWMD Field Sampling Quality Manual, applicable SOPs, and the Florida Department of Environmental Protection (FDEP) field SOPs. Audit results were summarized in a field audit report that classified each issue as either a Finding or Observation. A corrective action was required for each Finding and a recommendation was made for each Observation.

The 44 field-related Findings fell into two broad categories: documentation (61%) and technical (39%). The types of documentation issues identified during field audits included improper documentation of sample preservation on the chain of custody forms and lack of documentation for the slope associated

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with pH electrode response. The types of technical issues identified during field audits included failure to measure depth to water level during monitoring well purging to monitor recharge rate and using special treatment in the collection of equipment blanks. Almost one third (30%) of the Findings were related to equipment documentation or use, followed by sample custody and handling (23%) and method-related errors that could impact data (20%).

LABORATORY AUDITS

The US Army Corps of Engineers (USACE) and SFWMD audited nine water quality monitoring laboratories that performed analyses during the report period that may be used in support of RECOVER, CERP projects, and CERP permit monitoring because the selected laboratories have current SOWs with either the SFWMD or the USACE, Jacksonville District.

USACE completed assessments for four laboratories for organics during the May 2007 through April 2008 reporting period: CompuChem, Cary, NC, TestAmerica Savannah, Savannah, GA, SunLabs, Inc. Tampa, FL and CAS, Kelso, WA. The Environmental and Munitions Center of Expertise (EMCX), Omaha, NE performed the assessments in conjunction with representatives from the QAOT-USACE. The assessment process consisted of three components used to evaluate laboratory performance: a remote desk assessment, an on-site assessment, and PE samples.

- The methods assessed for CompuChem were U.S. Environmental Protection Agency (EPA) methods 608 and 625. The laboratory's responses to the Observations, Recommendations and Deficiencies were adequately addressed. The PE sample results showed that the laboratory can qualitatively and quantitatively identify pesticides analyzed by method 608. There were no Findings that would indicate potential problems with data generated, in terms of data quality/usability or defensibility, by this laboratory for CERP projects.
- The methods assessed at TestAmerica Savannah were EPA methods 515.1, 508, and 525.2. The laboratory addressed Observations, Recommendations and Deficiencies, especially where their policies were in direct conflict with the method requirements. The PE sample results also showed that the laboratory can qualitatively and quantitatively identify pesticides analyzed by method 508. With the accepted change to policy for surrogates, laboratory fortified matrix (LFM) and laboratory performance check (LPC), there were no other Findings that would indicate potential problems with data generated, in terms of data quality/usability or defensibility, by this laboratory for CERP projects.
- The method assessed at CAS Kelso, WA was EPA method 508.1. No on-site assessment was conducted for CAS due to contract expiration. The laboratory was dropped from the contractor's base contract, thus some Recommendations and Deficiencies were not totally addressed. The PE sample results indicated that the laboratory can qualitatively and quantitatively identify organochlorine pesticides analyzed by method 508.1.
- The methods assessed at SunLabs were EPA methods 8318, 8081A, and modified 8270C. SunLabs addressed Observations, Recommendations and Deficiencies, including providing additional information to USACE concerning the sample preparation deviation for method 8318. The PE sample results also showed that the laboratory can qualitatively and quantitatively identify target parameters for the three methods assessed. There were no other Findings that would indicate potential problems with data generated, in terms of data quality/usability or defensibility, by this laboratory for CERP projects.

As part of its routine audit schedule, the SFWMD completed assessments for five laboratories that performed inorganic analyses for RECOVER, CERP projects, and/or CERP permit monitoring during the

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report period: Advanced Environmental Laboratories, Inc. (AEL) Gainesville, CCPC, DB Environmental (DBE), FDEP and FIU. Each assessment consisted of a desk audit review of laboratory documents and an on-site assessment. The audits were conducted by HSW Engineering, Inc on behalf of the SFWMD

- The focus of the AEL Gainesville, audit was on the ability of the laboratory to analyze aqueous samples for nutrients, water quality parameters, chlorophyll a, color, and metals by specific EPA methods. Nine Findings and one Observation were identified during the audit. The 10 issues were categorized as Documentation (7) and Quality System (3) issues. Among the ten audit Findings or Observations, of particular concern are those related to a delay in accessing records stored with the laboratory's former owner, improper labeling of working standards and reagents, and not tracking preservative or container lots used in container shipping.
- The focus of the CCPC audit was on the ability of the laboratory to analyze aqueous samples collected by the CCPC for nutrients, and other general chemistry parameters, various metals, plant pigments, and microbiological analyses. Four Findings and seven Observations were identified during the audit. The 11 issues were categorized as Documentation (3), Analytical (3), and Quality System (5) issues. The more important of the Observations and Findings are related to MDLs: the likely increase of the MDL for TKN above the contract specifications, the need to repeat the NO₃-NO₂ MDL that is currently calculated as zero, and the need to investigate whether other MDL studies need to be repeated. In addition, CCPC needs to expedite reporting to the SFWMD, including laboratory receipt deliverables and quarterly reports.
- The focus of the DBE audit was on the ability of the laboratory to analyze SFWMD samples – primarily sediment and plant tissue – for nutrients, metals, and volatile solids. Two Findings and four Observations were identified during the audit. The six issues were categorized as Documentation (3), Instruments/maintenance (1), and Quality System (2) issues. One important recommendation resulting from this audit related to the various manual processes that are key components of DBE's data reduction and reporting process. Also, per the NELAC standards, the laboratory's CompQAP should be revised such that the Quality Manager is clearly identified as such.
- The focus of the FDEP Central Laboratory and Innovation Park Laboratory audit was on the ability of the laboratory to analyze environmental samples for low-level nutrients, metals, low-level mercury (Hg), MeHg, herbicides, organochlorine pesticides, organophosphorus pesticides, and PCBs. One Finding and three Observations were identified during the audit. The four issues were categorized as Documentation (3) and Quality System (1) issues. The four audit Findings or Observations resulting from this audit include the lack of a preparation date on standards and reagent containers, and the laboratory's uncertainty of what comprises the QC check sample listed in the Quality Manual.
- Emphasis during the on-site audit of FIU Southeast Environmental Research Center (SERC) was placed on analyses for nutrients, TOC and plant pigments. Fourteen Findings and four Observations were identified during the audit. The eighteen issues were categorized as Documentation (9), Analytical (4), and Quality System (5) issues. Some of the more important Observations and Findings included holding time exceedances for parameters with 48-hour holding time limits, absence of qualifiers for analyses performed in excess of allowable holding times, absence of FDEP or SFWMD approval for freezing samples to extend 48-hour holding times, absence of alternate method approval for analysis of NH₃, the need to establish the low calibration standard at the Practical Quantitation Limit (PQL) for all methods, the need to complete the Quality Assurance Plan (QAP) with all NELAC required elements, and the need to be in full compliance with reporting requirements in the SFWMD contract (in particular, providing ADaPT deliverables).

PERFORMANCE EVALUATION SAMPLES

During the report period, organic and inorganic PE samples were analyzed by water quality monitoring laboratories that performed analyses during the report period that may be used in support of RECOVER, CERP projects, and CERP permit monitoring because the selected laboratories have current SOWs with either the SFWMD or the USACE. The purpose of the PE samples was to assess laboratory performance on single blind samples. The laboratories participating in the PE studies may generate data for any CERP monitoring activities. The results of three organic PE samples for CERP are described as part of the USACE laboratory audit process above.

Two inorganic PE studies were conducted during the report period. The QAOT PE program focused on PE samples for Major Ion, Trace Element, and Nutrient at low concentrations. Eighteen laboratories participated in the July 2007 inorganic PE study. Overall, 665 results were reported for 44 parameters. Of these, 83% of the Z-scores (indicating accuracy) were passing. Based on the percent difference between the reported results and the Most Probable Value (MPV), 74% were passing. Sixteen laboratories participated in the January 2008 inorganic PE study. Overall, 657 results were reported for 70 parameters. Of these, 89% of the Z-scores were passing. Based on the percent difference between the reported results and the MPV, 82% were passing. Both accuracy and precision results showed improvement in 2008 compared with the 2007 results.

RECOMMENDATIONS

As a result of QAOT activities over the report period, 14 recommendations for improvement were identified: five from QAOT observations, two from the Chapter 9 remote sensing QA/QC questionnaire results, five from the RECOVER QA/QC Questionnaire results; and two from the biological/ecological field visits. The QAOT will prioritize these recommendations during the coming year to identify the activities that will result in the greatest overall improvement in the quality of data generated for CERP.

The QAOT has targeted several specific activities to assess and improve data quality. These include completing audits for several laboratories generating data for CERP which have not previously been audited by the QAOT, improving the quality of field and laboratory audits by focusing on issues that directly impact data quality and defensibility, revising QASR Chapter 6 (Hydraulics and Hydrology) and developing metrics that demonstrate that the QAOT has been effective in improving the data generated for CERP. The remote sensing QA/QC questionnaire identified the questionnaire, itself, as an important tool that should be incorporated into QASR Chapter 9. However, the questionnaire will be shorted and some questions clarified. In addition, as a result of the questionnaire results the QAOT will request and review a sampling of current SOWs. The RECOVER QA/QC questionnaire identified the need for a comprehensive MAP QA/QC plan template, QA/QC training to the MAP PIs, a glossary of QA/QC terms, better communication of the location and applicability of the QASR to MAP PIs, and further review of the questionnaire results to assess training procedures, methods for dealing with questionable data, and SOPs/methods provided with questionnaires. The QAOT will address this issue with the AT Co-chairs. The biological/ecological field visits indicated that the essential elements of project documentation defined in the QASR and its applicability to MAP projects should be assessed and clarified and that the review and standardization of protocols for similar monitoring procedures should be encouraged, where appropriate to promote consistency.

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. 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. Restoration Coordination and Verification (RECOVER) will define the appropriate subset of data necessary to generate an accurate, holistic understanding of the current state of the Everglades system, and will use subsequent similarly appropriate data streams to track water quality and the ecological and hydrologic improvements that result as restoration proceeds. 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 roles, responsibilities, and accountability of the QAOT are defined in CERP Guidance Memorandum (CGM) 41.00 (November 19, 2003). This document defines the QAOT purpose as (1) being responsible to provide guidance on monitoring procedures, QA/QC, and data validation for CERP Projects and (2) providing a forum to develop consistency among entities involved with environmental monitoring, data quality and QA/QC processes.

The CERP program document Quality Assurance Systems Requirements (QASR) manual http://www.evergladesplan.org/pm/program_docs/qasr.cfm lays out the protocols and procedures for environmental data gathering activities for the implementation of CERP and defines the quality 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) QA Rule Chapter [Florida Administrative Code](#) (F.A.C.) 62-160 and SOP DEP-SOP-001/01. The QASR requirements are applicable to all data that will be used for CERP purposes. Implementation of the QASR for program level activities and each CERP system monitoring activity is ultimately the responsibility of the RECOVER principal investigators (PIs) and CERP 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. CGM 41.00 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 CERP management an assessment of the state of data quality for RECOVER, CERP project, and CERP permit monitoring activities. The goals of the QAR are to identify practices that are contributing to quality data, to identify data quality problems and best practices, 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. The QAR is identified as an annual report in the QAOT Management Plan for CERP Monitoring Programs QA/QC Fiscal Year 2007-2011 (PMP; January 17, 2007). As described in the PMP, the QAR integrates into one document the results of CERP quality assessment and QAOT activities performed during each report year.

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This document provides an assessment of CERP data quality and QAOT activities for the period between May 1, 2007 and April 30, 2008, hereafter referred to as the *report period*. This document contains numerous tables and figures to illustrate the results of 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.

This is the third QAR developed by the QAOT. It describes several QAOT cooperative initiatives with RECOVER designed to reach out to CERP project managers and PIs and to assess the quality of monitoring activities and data. A full summary of QAOT activities is provided in Section 9.0. Some of the QAOT initiatives for the report period include:

- RECOVER has provided a liaison to participate in and contribute a CERP system perspective to QAOT meetings and documents.
- Outreach to RECOVER PIs via distribution and analysis of a QA/QC questionnaire (developed during the 2007 report year) to collect information on current QA/QC practices for RECOVER.
- Distribution and assessment of a QA/QC questionnaire focused on remote sensing and compliance with QASR Chapter 9.
- Review and analysis of QASR Chapter 8 by the Monitoring and Assessment Plan (MAP) module leads and PIs as part of a major revision of this chapter.
- Retrieval and assessment of water quality data collected for RECOVER.

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, 2007 and April 30, 2008. The report focuses on CERP environmental monitoring activities. The QAOT employed a variety of methods to evaluate the QA/QC procedures being implemented for CERP that could impact data quality.

This report assesses CERP data quality both directly and indirectly. Direct assessments included reviews of field and laboratory QC data, the results of performance evaluation (PE) samples, and reviewing the Findings² of, recommendations to, and responses from field and laboratory audits. Indirect assessments of data quality were accomplished using QA/QC questionnaires and by reviewing a monitoring plan and a scope of work (SOW).

The term CERP is an umbrella term for many different activities. These include RECOVER system-wide monitoring efforts (i.e., MAP), CERP project monitoring, and CERP permit-driven regulatory monitoring. Throughout this report, the term “RECOVER” will be used to designate either RECOVER-specific monitoring activities or data that may be used by RECOVER, “CERP project” to denote CERP and Advanced Construction Projects monitoring, and “CERP permit monitoring” to denote permit-driven regulatory monitoring.

RECOVER MAP was designed to be the primary tool to assess and guide restoration. The overarching goal to accomplish this objective was for the MAP to represent a single, integrated, system-wide monitoring and assessment plan that will be used and supported by all participating agencies and tribal governments. This required that the MAP build upon and complement monitoring that was being performed by several agencies across the ecosystem as possible and prudent to do so. The data from several sources that may potentially be used by RECOVER are examined in this report to assess the compatibility and quality of these data from a QA/QC perspective. However, it must be recognized that most of these data collection activities were not funded by RECOVER and therefore as a secondary user RECOVER has no direct control over the quality of the data. One goal of this report is to provide insight and direction to RECOVER regarding the overall quality and compatibility of this data.

The applicability of specific water quality monitoring activities to RECOVER, CERP Projects, and CERP Permits was reviewed by RECOVER, the QAOT, and cognizant SFWMD staff. In addition, the SFWMD assignment of “P” budget designations was used as a tool to identify potential CERP-related monitoring activities. The identification of potential RECOVER data from outside agencies was communicated by the QAOT RECOVER Liaison based on the *Identification of RECOVER Water Quality Monitoring Stations*. In some cases identifying monitoring activities as CERP or RECOVER-related was difficult because while not directly funded by CERP or RECOVER, it is possible that the data may be used for RECOVER or CERP system-wide assessments in the future. For this report, if it was reasonably possible that the monitoring data would be used by RECOVER or CERP then the data were included for analysis. If a monitoring activity was determined to be potentially or definitely CERP or RECOVER-related the data for the entire SFWMD project code were down-loaded from DBHYDRO without consideration of specific station locations.

² **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] Standards, 2003).

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During the report period the QAOT drafted a SOP for preparation and review of the QAR. The SOP established a review process that included the QAOT and RECOVER liaison and a CERP-wide review. The final QAR represents the combined contributions and suggestions of all reviewers.

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, questionnaires completed by RECOVER PIs provided the information used to assess the current CERP QA/QC practices at the CERP system level. Table 3-1 lists the people who contributed text to this document, including those who provided supporting documentation and review comments.

In addition to these contributors, the QAOT acknowledges the participation of the many MAP PIs who completed the QA/QC Biological/Ecological Questionnaire and the field and laboratory personnel who participated in the site-wide monitoring field visits and the field and laboratory audits conducted for the QAOT.

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Table 3-1. Contributors to the 2008 Quality Assessment Report

Name of Participant	Organization
Joanne Arsenault	Battelle (SFWMD Contractor)
Sarah Brennan	
Rosanna Buhl	
Heather Thurston	
Richard Uhler	
Eliza Hines	Everglades Partners Joint Venture (EPJV) (USACE contractor)
Deborah Scerno	
Silky Labie	Florida Department of Environmental Protection (FDEP)
Cindy Lee Westergard	HSW Engineering, Inc (SFWMD Contractor)
Betheny Loewer	Lee County Environmental Laboratory
Wendy Tweedale	St. Johns River Water Management District (SJRWMD)
Kenneth Chen	South Florida Water Management District (SFWMD)
Ming Chen	
Linda Crean	
Gregory Graves	
Tom Dreschel	
Chris King	
Zdzislaw Kolasinski	
Darlene Marley	
Francine Matson	
John Moorman	
Jana Newman	
Taiye Sangoyomi	
Bruce Sharfstein	
Brian Turcotte	
Michael Wright	
Andrew Casper	US Army Corps of Engineers (USACE)
Dena Dickerson	
Lisa Gued	
Jeffrey Hendel	
John Hess	
Tim Lewis	
Chetta Owens	
Sal Resurreccion	
David Splichal	
Rebecca Terry	
Les Vilchek	US Fish and Wildlife Service (USFWS)
Pamela Telis	US Geological Survey (USGS)

4.0 CURRENT QA/QC PROCESSES

This section summarizes QAOT activities conducted to assess current QA/QC processes implemented at the program level. The quality system³ 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, QA/QC questionnaires were distributed and evaluated for RECOVER and remote sensing, and reviews of a monitoring plan and a SOW were performed to assess QA/QC processes being implemented for CERP.

4.1 RECOVER Monitoring

4.1.1 QA/QC Biological/Ecological Questionnaires

4.1.1.1 Methods and Materials

During the report period, a QA/QC Biological/Ecological Questionnaire was used to determine the strengths and weakness of QA/QC practices being applied to the RECOVER Monitoring and Assessment Plan (MAP). The questionnaire (Attachment B) was developed by the QA/QC Questionnaire Sub-team (Sub-team) in coordination with the RECOVER Assessment Team (AT) Chairs. The questionnaire covered QA/QC practices for both field and laboratory monitoring activities. For field data collection the questionnaire covered the following activities:

- Documentation of methods: the existence of a work plan or monitoring plan and the methods/protocols implemented for monitoring and analytical procedures.
- Qualifications of staff: requirements for staff qualifications, training procedures, and methods to check proper implementation of the field data collection methods.
- Quality control: QC requirements, procedures, acceptance criteria, and on-site checks.
- Data management: field documentation, data storage and backup.
- Data verification and validation: procedures to verify that data are complete, correct, and compliant with field collection methods and identification and handling of questionable data.

Results of the field questions are summarized in Table 4-1.

The laboratory analysis portion of the questionnaire was sub-divided to assess QA/QC procedures for analyses performed by the PIs own laboratory vs. those that were subcontracted to other laboratories. The laboratory questions covered the following activities:

- Analytical methods used for each parameter.
- Laboratory certification by National Environmental Laboratory Accreditation Conference (NELAC) for those parameters where certification is relevant and appropriate.
- Conformance to the QASR.

³ Quality System: 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).

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- Staff qualifications and training requirements.
- Methods to check proper implementation of the laboratory analytical methods.
- QC samples integrated into routine analytical procedures.
- Laboratory documentation procedures.
- Data management: data storage and backup.
- Procedures to verify that data are complete, correct, and compliant with laboratory data collection methods and identification and handling of questionable data.

Results of the laboratory questions are summarized in Table 4-2.

A total of 48 questionnaires were distributed to MAP PIs in late summer 2007. MAP PIs completed one questionnaire for each monitoring component of the MAP. The MAP PIs were also asked to attach any SOPs and methods, as well as any other documents that might include relevant QA/QC information (*i.e.*, work plans, monitoring plans, QA project plans [QAPPs], QA/QC plans etc.) as part of their response. Questionnaires were accepted until April 1, 2008.

4.1.1.2 Results

The results of the questionnaire responses were summarized in a report and presented to the QAOT at the April 2008 meeting. The results are summarized in Tables 4-1 and 4-2. The full report is provided in Attachment C.

Response Rate.

Of the 48 questionnaires that were distributed to the MAP PIs, nine (9) questionnaires were eliminated from potential analysis because these MAP monitoring components were closed out, delayed for funding in the next fiscal year (FY), or cancelled. Thirty-nine (39) questionnaires were left for analysis.

All 39 questionnaires included a field component; 36⁴ of these questionnaires were returned (92 percent return rate) and deemed adequate for review. Twenty-four (24) of the 39 questionnaires included a laboratory component. Of those, 21⁴ PIs submitted questionnaires (88 percent return rate) that were deemed adequate for review.

Analysis Procedures

The questionnaire responses were reviewed, compiled, and analyzed by the Sub-team for each questionnaire. It was not possible to strictly quantify PI implementation of specific QA/QC components because the responses required subjective assessment. The Sub-team used best professional judgment in their interpretation of responses. PIs were provided “benefit of the doubt” if the Sub-team disagreed about how well a question was answered or if the question was poorly worded. In addition to yes/no answers, the Sub-team used the designation “partial” (P) if the PI answered some portion of a question. To some degree the results reflex artifacts of the questionnaire itself as well as the QA/QC practices of the MAP PIs. For the purpose of analysis, responses were grouped into three categories:

1. Most PIs: question received a positive response⁵ 75-100% of the time

⁴ There are three (3) outstanding questionnaires for the field component; the AT Chairs/MAP Module Leads are addressing this on a per module/PI basis.

⁵ A positive response to a question could either mean a yes/no question was answered affirmatively or the PIs provided the information that the question asked for (in the case that the question was not strictly worded in the yes/no format).

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2. Some PIs: question received a positive response 50-74% of the time
3. Few PIs: question received a positive response less than 50% of the time

The analysis of questionnaire responses did not include an assessment of adequacy because this was not part of the Sub-team task, e.g., SOPs/methods, training procedures, and procedures for treatment of questionable data were not reviewed by the Sub-team for adequacy, comprehensiveness, or completeness.

Field Component Results

SOPs – Most PIs (79%) reported they have a SOP/method for each parameter being measured in the field.

Training – Most PIs (92%) reported they implement some type of training and described it. In addition, most PIs (87%) reported they check their staff on a regular basis to ensure they are following field procedures properly and have field procedures documented in a notebook that is readily accessible to staff.

Integration of QA/QC – Most PIs (84%) reported they integrate QA/QC into their monitoring (*i.e.*, defined frequency, acceptance criteria, skill verification, ground truthing, accuracy of taxonomy etc.) though very few PIs articulated the specific details of how this was accomplished. This lack of articulation was probably due to the confusing nature of the question as well as lack of a “common” QA/QC vocabulary understood by the QAOT and the AT, PIs etc. Most PIs (87%) reported they take corrective actions if QA/QC checks do not yield acceptable results.

Data Storage and Data Backup – All PIs (100%) reported they have provisions for long-term data storage and were able to identify at least two locations for data backup.

Data Verification – Few PIs (47%) reported they “verified” their data, but this Finding was subsequently attributed by the Sub-team to lack of clarity in the questionnaire as to what constituted verification. One of the QAOT goals for 2009 is to develop a glossary of QA/QC terms that will address this confusion.

Dealing with Questionable Data – Most PIs (84%) reported they dealt with questionable data in a reasonable manner and most described their process.

Laboratory Component Results

The questionnaire defined a “laboratory” activity as any activity not conducted in the field (e.g., counting feathers, taxonomic classification, shoot counts, species identification etc.) and encompassed a wide range of biological and ecological analyses. Most PIs (86%) reported that they perform their own laboratory analysis.

SOPs – Most PIs (95%) reported they have a SOP/method for each parameter being measured in the field.

NELAC Certification – Some PIs (68%) reported they knew whether their laboratory was NELAC certified however, many biological/ecological parameters are not standard certified parameters for NELAC and the questionnaire did not delineate between certified and non-certified parameters. The PIs doing laboratory analyses at universities or large federal/state agencies (*e.g.*, University of Florida, National Oceanic and Atmospheric Administration, USGS, FDEP) were most likely to know the details of NELAC certification requirements because their laboratories had undergone that process. The QAOT will provide guidance for determining when NELAC certification is a necessary element of an approvable QA system to resolve current uncertainty on the part of the PIs as to when formal certification may or may not be appropriate.

QASR Compliance – Few PIs (36%) reported they were aware that their laboratory methods complied with the QASR. There was much confusion about where the document was located, which chapters applied to the MAP PIs, and whether “alternative” methods still had to be approved by the AT and

QAOT. Most PIs reported only knowing about Chapter 8 (Biological and Ecological Monitoring and Assessment) and that the chapter was being revised.

Training – Some PIs (59%) reported they implement laboratory training of some type and described it. Some PIs (73%) reported they check their staff on a regular basis to ensure they are following laboratory procedures properly and have laboratory procedures documented in a notebook that is readily accessible to staff.

Integration of QA/QC – Most PIs (77%) reported they integrate QA/QC into their biological/chemical analyses in the laboratory though very few PIs articulated the specific details of how this was accomplished. This lack of articulation was probably due to the confusing nature of the question as well as lack of a “common” QA/QC vocabulary. Most PIs (86%) reported they deal with questionable data in a reasonable manner.

Data Storage and Data Backup – Most PIs (95%) reported they have provisions for long-term data storage and were able to identify at least two locations for data backup.

Data Verification – Most PIs (77%) reported they verified their data though the Sub-team observed significant discrepancy in expected answers and the answers provided by the PIs. Sub-team determined this percentage was not accurate because the question was confusing and the term “verification” was misinterpreted by the PIs.

Recommendations

The Questionnaire Analysis made two specific recommendations (below).

1. The QAOT and AT module leads should develop a comprehensive MAP QA/QC plan template. The SOW should require development of a QA/QC plan, include references and links to the QASR, and include the MAP QA/QC plan template as an attachment.
2. Topic specific QA/QC training modules and workshops should be developed for the MAP PIs to facilitate dialogue between the QAOT, MAP Module Leads, and the MAP PIs about important QA/QC topics. It should be noted that PIs are often scientific experts in emerging fields of investigation, and that two-way communication and understanding is paramount to achieving and maintaining quality objectives. Training modules/workshops of 30-45 minutes in length targeting one specific QA/QC “problem” area for the MAP PIs could occur in conjunction with MAP module meetings over the course of several months. Topics might include application of the QASR to MAP PIs, the status, scope, and application of Chapter 8, the MAP QA/QC plan template, effective training programs and checks for consistent implementation of SOPs, integration of QA/QC into monitoring procedures, data verification and validation, and the need for NELAC certification where appropriate and necessary.

4.1.2 Remote Sensing QA/QC Questionnaires

Two quality systems questionnaires provided an assessment of remote sensing being conducted for two different RECOVER MAP activities. The questionnaire was developed based on QASR Chapter 9 QA/QC requirements and technical guidance. Sixty-four (64) questions were developed under seven categories:

- Project planning and QA/QC strategy.
- Data acquisition and assessment.
- Data calibrations (or pre-processing).

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- Data analysis, including ground truthing, qualifications of field staff, QC for monitoring activities, field data verification and validation, and QA for field monitoring activities.
- Accuracy assessment, including spatial accuracy and thematic accuracy.
- Reporting, including maps and metadata.
- Specific remote sensing applications (water quality remote sensing).

The purpose of the questionnaire was to assess the compliance of remote sensing activities with the 2006 QASR and was not an assessment of the entire project, i.e., the questionnaire assessments do not represent an overall project assessment but only an assessment vs. the current version of the QASR. In addition to assessing compliance, the results of the questionnaire will aid in the revision of QASR Chapter 9. The questionnaires were sent to the PIs via email. The PIs entered answers to each of the 64 questions and returned the questionnaires for evaluation by the QAOT. Follow-up conversations and correspondence clarified responses so that the results could be accurately evaluated. The completed questionnaires are provided in Attachment D. The results are summarized below; references to row numbers indicate the questionnaire row number.

Indian River Lagoon (IRL) Seagrass Mapping: Section 3.3.3.3 of RECOVER MAP

The questionnaire for this activity was provided to Becky Robbins (Project Manager, SFWMD), who completed the questionnaire and provided additional information during a follow-up interview. This mapping project is a cooperative effort between SFWMD RECOVER and St. Johns River Water Management District (SJRWMD) and has a long history going back to the pre-CERP days. Because of the maturity of the project, the project team has established procedures that are fully compliant with QASR guidance. Many of the project manager responses offered greater detail than just a "Yes" or "No" which was helpful in the evaluation. One technical observation was noted:

- SOW Review: It is not clear whether QAOT or the Remote Sensing Sub-Team reviewed the SOW, however, the QAOT and Sub-Team may not have existed at the time that the SOW was developed. The document was reviewed by SJRWMD, although this may not be considered an outside peer reviewer because they are part of the multiagency effort (Row 52).

RECOVER Vegetation Mapping

The questionnaire for this activity was provided to Ken Rutchey (SFWMD) and completed by Tom Dreschel (SFWMD); additional information was provided during a follow-up interview and later input from the module lead, Jana Newman. The interaction between the QAOT and the MAP PIs did not occur through the RECOVER AT module leads; therefore Ms. Jana Newman (SFWMD Module Lead) reviewed the completed questionnaire and clarified responses where it was possible to do so in time for this report, however, it is recognized that some items required more investigation time than available for this report. In general, this assessment was difficult due to several confounding factors. First, because the raw data (aerials) were collected under a separate contract there will be two sets of deliverables (the aerials and then the photo interpretation results). Secondly, the SOW was not detailed because all the details, especially regarding a QA/QC plan, are to be developed in an SOP as one of the first deliverables.

Because much of the work is yet to be done many of the questionnaire responses are "to be determined" (TBD). Lastly, many of the questionnaire responses pointed to the SOW (i.e., responded "See SOW") rather than answer the question directly. This resulted in the need to search the SOW to determine QASR compliance. The interviewer provided additional clarification on the questionnaires when possible. These additions are in red on the questionnaire; additional comments provided by Ms. Newman are in blue (Attachment D). The following observations were made based on the assessment of the questionnaire and follow-up interview:

- Data Management Plan: The contents of the data management plan are specifically defined, but the SOW requirement states that the plan must satisfy CERP data management standards (Row 15).
- QA/QC Plan: The SOW does not define a QA/QC Plan, although reference is made to "standardized quality control and assurance procedures" and the need to provide documentation of the rigorosity of the method if standardized QA/QC methods do not exist (SOP) (Row 16).
- SOW review: the SOW was not reviewed by the QAOT/designee/Remote Sensing sub-team and also one outside peer reviewer (Row 52) because it was prepared before these organizations and the review process were established.
- QA/QC Strategy: The project is relatively unique in that much of the details on methods and QA/QC will be detailed in a SOP to be developed as the first deliverable. The SOW does not define the contents that should be included in the SOP (Row 55).
- The use of the term "ground truthing" should be reviewed and clarified in the QASR.

This is the first time that the QAOT has generated and conducted a questionnaire that directly reflects the QASR requirements for remote sensing activities. Based on the results of these questionnaires the following recommendations are noted:

1. The questionnaire needs to be shortened and some of the questions reworded for clarity, perhaps with examples.
2. The QAOT may review the remote sensing SOWs to provide a QA perspective.
3. The final questionnaire should be incorporated into the QASR as a checklist for project planning and SOW development.
4. References in Chapter 9 to CGM 36 should specify section numbers.

4.2 QAOT Review of a CERP Project Monitoring Scope of Work

One CERP project Scope of Work (SOW) was evaluated by the QAOT during the report period: a draft SOW (undated) for C-11 was reviewed on December 7, 2007. The results are summarized in Table 4-3. The QAOT monitoring plan review checklist was used as the basis of the review. Of the eight major QA/QC elements assessed, five (63%) were acceptable. The three unacceptable elements were related to project and data assessment organizations and responsibilities and report documentation requirements. The Title Page was determined to be acceptable although some information was missing. All technical elements of the SOW were acceptable with two exceptions:

1. The SOW does not define an acceptable method for methyl mercury (MeHg). The SOW requires the use of EPA SW846 methods for all target chemical parameters. However, SW846 does not include a method for the analysis of MeHg.
2. The SOW does not require the use of the Automated Data Processing Tool (ADaPT)⁶ and the related Environmental Database Management System (EDMS) as the data reporting format; all other technical details were presented in adequate detail.

⁶ The ADaPT and EDMS software programs were developed on a Microsoft ACCESS 2000/2002 platform as tools to support technical staff in the evaluation of analytical chemistry data using an expedited and cost effective automated process. The electronic data deliverables (EDD) provides a standardized format, allowing laboratories to streamline the data deliverable process. The ADaPT and EDMS processing allows the data end user to efficiently evaluate large data sets for key indicators and ultimately determine the usability of the data.

4.3 QAOT Review of a CERP Permit Monitoring Plan

One CERP Permit monitoring plan was evaluated by the QAOT during the report period: the Biscayne Bay Coastal Wetlands monitoring plan (November 3, 2006) was reviewed on September 28, 2007. The results are summarized in Table 4-3. The QAOT monitoring plan review checklist was used as the basis of the review. Of the eight major QA/QC elements assessed, five were applicable to the project. All five elements were acceptable, including all technical elements. It was noted that the monitoring plan did not provide detection limits or the calculations for bias and precision. The reviewer noted that a QASR attachment that would have provided this information appeared to be missing.

4.4 Summary of Current QA/QC Processes

Responses to the QA/QC biological/ecological questionnaires indicated that most PIs have QA/QC procedures in place and are implementing them for most of the elements investigated. Due to confusion over the interpretation of terms such as “verification” the questionnaire did not provide accurate information regarding when, how, or to what degree data verification is currently being implemented by PIs. Few PIs were aware of whether or not their laboratory methods complied with the QASR. Based on the results of the QAOT assessments it appears that remote sensing being performed for CERP system monitoring is technically compliant with the QASR, although documentation of QA/QC and data management procedures are not detailed for one project. Reviews of a CERP Project SOW and a CERP Permit Monitoring Plan indicated that the plans were largely complete and acceptable with few technical issues identified. Specific recommendations to address the issues raised during these QAOT activities are included in Section 10.0.

Respondents to the questionnaires completed by RECOVER PIs have noted that the respondents were not fully aware of how the questionnaire data would be used or that their responses would be included in this report. In the future the QAOT will ensure that the intent and outcome of these types of activities will be sufficiently explained to respondents at the time that the questionnaires are distributed.

The application is designed to perform compliance screening of the EDD and routine data quality accuracy and precision checks traditionally performed through a manual data review. The EDD is checked for standard value errors, incorrect formatting, and missing information from required fields through the Contract Compliance Screening module (CCS). The CCS software verifies the EDD immediately for completeness and compliance against project specific criteria. The Automated Data Review module (ADR) performs an automated data review equivalent to an EPA Level 3 evaluation and provides the user with discrete data qualification. Data qualifiers are appended to each result in the EDD. The qualified data are then exported into the EDMS software program for further assessment such as comparison against Maximum Contamination Levels (MCLs), historical data trending, and generation of Quality Control Summary Reports. (From FDEP Website <http://www.dep.state.fl.us/labs/dqa/adaptedms.htm> [9-04-08]).

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Table 4-1. Summary of RECOVER QA/QC Questionnaires: Procedures for Field Monitoring

Question	Percent	Meaning	Implications
Is there a SOP for each parameter?	79%	79% of MAP PIs have an SOP	Although most PIs have SOPs, very few (less than 30%) actually attached the SOPs to the questionnaire. Others referenced work plans and QA/QC plans that were not attached either.
Was the SOP(s) attached?	24%	Only 24% attached the SOP	
Does the PI implement some type of training and was it described?	92%	92% have some type of training; in most cases, more detail was needed about this training.	Although most PIs implement training, it might be useful to elaborate on what constitutes adequate training. Might need additional info from PIs about their training in order for workshop topic to be couched correctly.
Are staff periodically checked to ensure they are following proper field procedures?	87%	87% of PIs periodically check staff to ensure they are properly following field procedures.	Although most PIs check staff periodically, it would never hurt to review the importance of checking staff to ensure they are following proper field procedures.
Is QC integrated into the monitoring (i.e., defined frequency, acceptance criteria, skill verification, ground truthing, accuracy of taxonomy etc.)	84%	84% have integrated QC into monitoring.	15% of the PIs did not understand what it meant to integrate QC into their monitoring. Integrating QC into field monitoring procedures should be addressed to reinforce what it is and its importance.
Are corrective actions taken if QC checks are not acceptable?	87%	87% of PIs take acceptable actions if QA checks are not acceptable	Most PIs take acceptable actions if QA checks are not acceptable; there is need to review the types of corrective actions that are acceptable.
Are field procedures documented somewhere (i.e., a notebook)?	84%	84% of PIs have field procedures documented	There are no issues with field procedure documentation (there is confusion with documenting field procedures and providing SOPs)
Is data housed in a backed-up location?	100%	100% have data housed in back-up location	There are no issues with backing data up.
Where is data stored?	100%	100% house their data on an acceptable server	There are no issues with housing data on an acceptable server.
Are data verified?	47%	Only 47% verified their data	There is a need to review data verification and validation. Most PIs did not understand this concept and only partially answered the question. Most PIs confused data verification with verification of data as it is translated from field to computer.
Are questionable data dealt with in a reasonable manner?	84%	84% dealt with questionable data in a reasonable manner	There is a need to review how questionable data is dealt with; most PIs did not understand this or only partially answered the question (i.e., data is eliminated from dataset - is data really eliminated?)

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Table 4-2. Summary of RECOVER QA/QC Questionnaires: Procedures for Laboratory Analyses

Question	%	Meaning	Implications
Is there a SOP for each parameter?	95%	95% have an SOP	Although most PIs have SOPs, very few (less than 60%) actually attached the SOPs to the questionnaire. Others referenced work plans and QA/QC plans that were not attached either.
Was the SOP(s) attached?	55%	55% attached the SOP	
Did the laboratory perform its own analysis or was it subcontracted out?	14%	Only 14% (3 PIs) subcontract their laboratory work	There are no implications to either subcontracting laboratory analysis or the PIs doing it themselves; since so many do laboratory work in their own labs, perhaps less focus should be put on subcontracting out analysis.
Was the laboratory NELAC certified?	32%	32% did not know whether their laboratory was NELAC certified	There is a need to review when NELAC certification is required and when it is not. There was quite a bit of confusion about whether it was required for all types of analyses or just some types.
Did the PI confirm their laboratory methods with those outlined in the QASR?	64%	64% do not know if their methods comply with the QASR (or what they think is the QASR)	64% of MAP PIs did not know if their methods complied with the QASR; there was also much confusion about the QASR, especially what version to use, where it was located, how updated it was etc.
Is training required for staff (if so, how) and what are the minimum qualifications?	59%	59% implemented some type of training.	59% implemented some type of training.
Are staff periodically checked to ensure they are implementing laboratory methods appropriately?	73%	73% periodically check their staff to ensure compliance with laboratory procedures	73% periodically check their staff to ensure compliance with laboratory procedures
Chemical/Biological Are Quality Control Procedures implemented during analyses?	77%	77% integrate QA/QC into their biological/chemical analyses	77% integrate QA/QC into their biological/chemical analyses.
Are laboratory procedures documented?	73%	73% have laboratory procedures documented in laboratory notebook.	There was confusion between documentation of laboratory procedures in a field notebook and attaching methods/SOPs; this could have been an artifact of the question.

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Table 4–2. Summary of RECOVER QA/QC Questionnaires: Procedures for Laboratory Analyses, continued

Question	%	Meaning	Implications
Where is data stored? Is data backed up? Is there a long term storage mechanism?	95%	95% house their data on an acceptable server	There are no issues with data backup and storage.
Are data verified to ensure they are complete, correct and compliant with data collection methods?	77%	77% verify their data	77% verify their data but there was not complete understanding of data verification.
Are questionable data dealt with in a reasonable manner?	86%	86% dealt with questionable data in a reasonable manner	There is a need to review how questionable data is dealt with; most PIs did not understand this or only partially answered the question (i.e., data is eliminated from dataset - is data really eliminated?)

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Table 4-3. Results of QAOT Reviews of a CERP Project-Level Monitoring Plan and a SOW.

Monitoring Plan/SOW Element	C-11 ^a	Biscayne Bay Coastal Wetlands
1. Title Page	A	A
○ Contains project title, revision and date	U	U
2. Project Organization and Responsibilities	U	NA
3. Data Assessment Organizations and Responsibilities	U	A
4. Data Quality Objectives	A	A
• Data use background: defines project specific data needs; describes media and analyses required to meet the data needs	A	A
• Measurements of quality objectives: required reporting limits, precision, accuracy, comparability and acceptance criteria	A	A
5. Sample Receipt, Custody and Holding Time Requirements	A	NA
6. Analytical Procedures	A ^b	NA
• Preventative maintenance	A	NA
• Calibration procedures and frequency	A	NA
• Laboratory QC procedures: type and frequency of internal QC measures	A	A
• Performance and system audits	A	A
• Nonconformance / corrective actions for field and laboratory	A	A
• Data reduction / calculation of data quality indicators: describes bias, accuracy, limits of detection, and precision calculations	A	A/U ^c
7. Report Documentation: Defines Report format and Data Archival Requirements	U ^d	A
8. Data Assessment Procedures	A	A
• Data verification	A	A
• Data validation	A	A

^a Review Codes: A (Acceptable), U (Unacceptable), NA (Not applicable *at this level of plan*).

^b Requires EPA SW-846 Test Method. There is no SW846 EPA Test Method for Methyl Mercury.

^c There is a detection limits section but detection limits are not listed. Completeness targets are listed; bias or precision calculations are not defined. It appeared that a QASR attachment is missing.

^d Does not require ADaPT format; other requirements acceptable.

5.0 EVALUATION OF FIELD DATA POTENTIALLY USED BY CERP

This section summarizes QAOT activities to assess the quality of CERP field monitoring. Assessment input for field data quality consists of RECOVER field observations, CERP project and CERP permit monitoring field audits, and the quality of field-collected water quality parameters.

5.1 Field Observations of RECOVER Monitoring Activities

Three separate on-site field observation visits were conducted by the QAOT during the report period. These on-site visits were not audits but rather represented the first effort by the QAOT to observe field monitoring activities from a QA/QC perspective. The full observation reports are provided in Attachment E and discussed below. A similar format was used for each visit; a summary of observations is tabulated in Table 5.1.

5.1.1 American Alligator Distribution, Size, and Hole Occupancy (MAP 3.1.3.15) and American Crocodile Juvenile Growth and Survival (MAP 3.1.3.16) (Key Largo, Florida Everglades National Park)

On February 20-21, 2008 an on-site visit was conducted to observe crocodile and alligator monitoring. Due to inclement weather, observation of alligator procedures on the second field day was cancelled. Extensive discussions about the overall project protocols and documentation were conducted on the 21st, instead. The crocodilian monitoring was led by project PI Michael Cherkiss and staff from the University of Florida. The field activities were assessed for compliance with the SOW, SOPs, and QASR. The objectives of the review were to (1) review required project documents maintained; (2) review field procedures/methodologies; and (3) review internal QA/QC and data management procedures. The SOP (from the Methods section of the SOW) and the following documents were used to provide guidance on the essential evaluation criteria for the on-site field study review:

- CERP Monitoring and Assessment Plan Component FY07 SOW for MAP Activity: *American Alligator Distribution, Size, and Hole Occupancy and American Crocodile Juvenile Growth and Survival*, MAP Activity Numbers 3.1.3.15 ad 3.1.3.16.
- *Alligator Capture Procedure* (Version 1), Eliza Gilbert 12 September 2005, 11 pages (excerpt from undetermined larger document).
- *Alligator Spotlight Survey Protocol B*: B. Jeffery, Updated 6 November 2006, 15 pages (excerpt from undetermined larger document).
- CERP QASR Chapter 8 *Biological Monitoring and Assessment Procedures* and Appendix N *Reptile and Amphibian Methods Summary*.

The results of the on-site field review are summarized below. The full report is provided in Attachment E.

Review of Required Project Documents

The QASR Table 8.3 defines document types and elements applicable to biological/ecological monitoring. The field review confirmed that the documents appropriate for field activities were in place. These included

- **State and Federal (USFWS) permits** for collecting and handling threatened and endangered species as required by the Endangered Species Act.
- **Contract SOW** includes specific contract requirements and deliverables with effective dates for each version.

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- **Work Plan (WP)** details the project objectives, design, organization, and QA/QC protocols with effective dates for each version.
- **SOP** outlines the methods used in the project and is provided in the form of the “Methods” section in the SOW.
- **Quality Manual (QM)** stipulates the policies/procedures for data quality.
- **Training and Safety documentation** verifies the qualifications of the participants in the project.
- **Field Notes/Logbook** archives the field measurements/observation data. The data elements defined in the QASR Table 8.4 that are applicable to these field studies are being recorded into the field notes/logbook as appropriate.

Review of Field Procedures/Methodologies

Field procedures and methodologies performed during the site visit on February 20, 2008 were compared with the methods outlined in the study SOWs. For every crocodylian captured, morphometric measurements were taken (snout/vent length, total length, head measurements, sex, and width), identification tags/scute clippings were done, and anomalies recorded. In addition, environmental data were collected for each sighting location (Global Positioning System [GPS], time, air/water temperature, salinity, marsh depth, bedrock depth, etc). Specific collection elements observed during the field visit included field survey equipment and methods, sampling location documentation, the collection and recording of field data, and chain of custody procedures.

Review of Internal QA/QC and Data Management

The assessment of QA/QC and data management procedures was based on extensive discussions with Mr. Cherkiss rather than actual observations of these procedures during the on-site field visit because this would have required an additional trip to the main offices in Fort Lauderdale, FL. Based on the procedures described by Mr. Cherkiss, it was determined that

- Methods are implemented in the study design for internal QC checks (e.g. skill verification, replicates, ground truthing, identification consistency).
- Documentation is maintained for verification, validation, assessment, reporting, and archiving of all data.
- Procedures are in place for ongoing oversight and review of data collected.
- A unique numbering system is being used for each sample/field observation.
- Data elements defined in the QASR Table 8.4 are being recorded, as applicable to the studies.
- Data verification and validation procedures described in the QASR sections 8.9.3.1 and 8.9.3.2 are applied to project data, as applicable.
- Data archiving procedures for records custody, security and access meet the QASR section 8.11 specifications.

Summary

Based on a comparison of field procedures and methods with the SOW, the study design and objectives appear to address the overall needs and questions of CERP and the proposed field study. Data are being collected appropriately for the project objectives. Field techniques are appropriate for the required data collection. The study design adheres to standard scientific protocols for data quality and sampling methods adhere to appropriate protocols for the study design. The study methods are adequately

described in the written protocols (crocodile and alligator study references listed above). The field methods used for monitoring conform to the written protocols. The results of the review indicated that

- All documents required by QASR Table 8.3 are maintained and provide the appropriate level of detail.
- The field team is experienced and qualified for the work being performed.
- All documentation appropriate to the field work is maintained in field notes and a logbook.
- Field procedures and methods are appropriate for the study design. The methods and design address the project and overall CERP questions and objectives.
- The study design adheres to standard scientific protocols for data quality; sampling methods adhere to appropriate protocols for the study design.

Recommendations

A few procedures identified as essential elements of project documentation or data management by the QASR are not performed because the PI determined that these procedures were not applicable to the project at this time. The reviewer recommended that the rationale should be further clarified and/or approved since these are identified as essential data management components by the CERP QASR. The two missing elements were:

1. **Required Project Documentation:** Equipment logs and chain of custody forms are not currently maintained.
2. **Internal QA/QC Procedures:** The data verification process does not include identification of the equipment/instruments used in the procedure, documentation of equipment/instrument maintenance, documentation of information that could affect data quality, and verification that data entries on chain-of-custody form and field notes agree. The data validation process does not include determination that sample identifications match on all chain-of-custody forms.

The SOPs used for this study are excerpted from larger, unidentified documents. During the site visit it was unclear which SOP was the official version. A SOP that combines the appropriate elements of the current documents could be prepared to avoid confusion.

5.1.2 St. Lucie Estuary, Seagrass Monitoring and Observations

On April 1, 2008 an on-site field visit was conducted to observe submerged aquatic vegetation (SAV) monitoring at field sites within the Southern IRL, St. Lucie Estuary and Lake Worth Lagoon. During the one-day visit, two sites were assessed to determine CERP/RECOVER methodologies on seagrasses within this South Florida ecosystem. Bimonthly SAV monitoring of 1m x 1m plots including percent cover of species, seagrass canopy height and water quality sampling was observed. The data will be used by RECOVER for restoration assessment, but the study is not funded by, and thus not directly under the control, of RECOVER. Personnel from the SFWMD led by Senior Environmental Scientist Rebecca Robbins conducted the SAV monitoring. A representative from the Loxahatchee River District (LRD) participated in the sampling because both LRD and SFWMD use the same CERP/RECOVER methods and the site visit exchange ensures that all projects are being similarly conducted. The field activities were assessed for compliance with the SOW. The results of the on-site field review are summarized below. The full report is provided in Attachment E.

- **Crew Composition and Qualifications:** The six-person field team, led by Rebecca Robbins consisted of five long-term employees of the SFWMD and one representative from the LRD. The team members are highly qualified to perform the SAV project monitoring. Training and

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experience includes diving (**Professional Association of Diving Instructors - PADI** certification) and seagrass monitoring, GPS usage, and seagrass and marine algae identification. The team participated in the training conducted by Diane and Mark Littler (Smithsonian Station, Fort Pierce, Florida) prior to study initiation. (Since both the LRD and the SFWMD are using the same CERP/RECOVER methods, a site visit exchange between groups ensures all projects are being similarly conducted).

- **Monitoring Equipment:** Waterproof clipboard, pencil, and several blank datasheets were used for recording SAV sampling location. A Trimble GPS with sub-meter accuracy was used to determine sampling location coordinates. This unit auto-calibrates for compass and altimeter; software was current and the batteries maintained. Water quality data (pH, temperature, specific conductance, dissolved oxygen (DO), and salinity) were collected using a calibrated Yellow Springs Instruments 650 MDS unit and sonde. The unit was pre-calibrated in the laboratory on the day of sampling according to standard manufacturing methods for accuracy and verified for accuracy post sampling. Water samples collected for laboratory analysis of chlorophyll and turbidity were placed in bottles that were rinsed three times with site water before collecting the samples. A Secchi depth reading was taken according to standard methods for this procedure. All observed procedures were followed according to SOW.
- **Field Monitoring:** Thirty points each were sampled at Boy Scout Island and St. Lucia estuary. One (1) m² quadrats of twenty-five 20-cm x 20-cm cells were deployed at 30 randomly placed buoys. SAV (total seagrass and total macroalgae), bare sediment, and maximum seagrass canopy height at the buoy were recorded. The GPS reading at the buoy was directly associated with the hand-entered field data. Water quality readings were conducted from the boat at the depths specified in the SOW; depths were recorded. No photosynthetically active radiation (PAR) readings were observed. All observed procedures followed those specified in the SOW.
- **Field Preservation Techniques:** No destructive sampling was conducted on plants. Water samples for chlorophyll and turbidity were stored in appropriate containers for transportation to SFWMD laboratory for analysis. Field datasheets (SAV and water chemistry) were collected and placed into appropriate containers for transport to SFWMD headquarters. All observed procedures were in accordance with those specified in the SOW.
- **Sample labeling:** Each blank datasheet was completed with site name, GPS File#, depth (cm), diver (Staff name), date, scored 0 to 25 for seagrass presence/absence and algae. All datasheets were printed on Xerox NeverTear paper and filled out with pencil.
- **Monitoring location documentation:** Monitoring sites (10) were chosen by Rebecca Robbins at the beginning of the project. These sites are monitored bimonthly; points within the chosen sites are random. Sites were chosen based on the following criteria: 1) persistent beds of sea grasses and macroalgae, 2) not on urban shoreline, and 3) five miles or more from mouth of St. Lucia River. All observed procedures followed those outlined in the SOW.
- **Field sheets/chain of custody:** All required information was collected including name, station, diver, weather conditions, time and tidal stage. All hard copies of field datasheets were attached at the appropriate buoy and were collected after the information was entered into the handheld GPS unit. Rebecca Robbins retained custody of the water samples and completed datasheets transported to the SFWMD Laboratory. She indicated that data sheet records were compared to Excel files downloaded from the GPS unit. All hard copies were maintained in an appropriate file in her office. Each diver initialed their completed datasheet. All observed procedures adhered to the SOW.

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- **Field sheets:** All field monitoring sheets were pre-printed on water proof Never-tear paper. The same blank datasheet was used bimonthly, thus ensuring diver familiarity with the study parameters.

Summary

Based on a comparison of field procedures and methods with the SOW, it appears that samples are collected and instruments calibrated appropriately for the project objectives. The techniques observed were performed appropriately for the required data collection. The study methods are adequately described in the written protocols. The field methods used for monitoring conform to the written protocols. All observed procedures were followed according to SOW. The results of the review indicated that

- The field team is experienced and qualified for the work being performed
- Monitoring equipment is appropriate for the work and calibrated prior to use with verified post sampling. All observed procedures followed the SOW
- Field monitoring was performed and documented according to the procedures documented in the SOW. No PAR readings were observed
- Field preservation techniques for water quality samples were collected and stored according to the procedures specified in the SOW
- Sample labeling was completed on data sheets completed for each sampling location
- Monitoring locations were chosen and monitored following the procedures outlined in the SOW
- Field sheets/chain of custody were completed and entered into the GPS unit. Data were verified when downloaded and hard copies maintained. All observed procedures adhered to the SOW
- Standard preprinted field sheets on Never-tear paper are used for bimonthly sampling.

Recommendations

No recommendations were noted by the observer.

5.1.3 Loxahatchee River Project, Seagrass Monitoring and Observations

On April 2, 2008 an on-site field study review was conducted to observe SAV monitoring at one field site within the LRD to assess seagrasses within this South Florida ecosystem. The SFWMD contracted this project to the LRD. Bimonthly SAV monitoring of 1m x 1m plots including percent cover of species, seagrass canopy height and water quality sampling were observed. Personnel from the LRD led by Laboratory Director Lorene Bachman conducted the SAV monitoring. The field activities were assessed for compliance with the SOW. The results of the on-site field review are summarized below. The full report is provided in Attachment E.

- **Crew Composition and Qualifications:** The three-person field team, all long-term employees of LRD, was led by Lorene Bachman. The team members are highly qualified to perform the SAV project monitoring. Training and experience includes diving (PADI certification) and seagrass monitoring. The team was cross-trained by Rebecca Robbins (SFWMD) and participated in the training conducted by Diane and Mark Littler (Smithsonian Station, Fort Pierce, FL) prior to study initiation. Voucher specimens are maintained at the LRD, though none were collected on the sampling trip being observed.
- **Monitoring Equipment:** Waterproof clipboard, pencil, and several blank datasheets were used for recording SAV sampling locations and data. A Trimble GPS with sub-meter accuracy and TerraSync2 was used to determine sampling location coordinates. This unit auto calibrates for

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compass and altimeter; software was current and the batteries maintained. Water quality data (pH, temperature, specific conductance, DO, and salinity) were collected using a calibrated HydroLab Surveyor unit. The unit was pre-calibrated in the laboratory on the day of sampling according to standard manufacturing methods for accuracy and verified for accuracy post sampling. Water samples collected for laboratory analysis of chlorophyll and turbidity were placed in bottles that were rinsed three times with site water before collecting the samples. A Secchi depth reading was taken according to standard methods for this procedure. PAR readings were taken using a Licor Li1400. Not all readings were collected due to a faulty connector, which has since been replaced. All observed procedures were followed according to SOW.

- **Field Monitoring:** Thirty-two points were monitored at the chosen site. Although the SOW specified monitoring of at least 30 points, the LRD chose two additional sites. One (1) m² quadrat of twenty-five 20-cm x 20-cm cells was deployed at 32 randomly placed buoys and SAV, bare sediment, and maximum seagrass canopy height at the buoy were recorded. The GPS reading at the buoy was directly associated with the hand-entered field data. Water quality readings were conducted from the boat at the depths specified in the SOW; depths were recorded. All observed procedures followed those specified in the SOW.
- **Field Preservation Techniques:** No destructive sampling was conducted on plants. Field datasheets (SAV and water chemistry) were collected and placed into appropriate containers for transport to the LRD laboratory. All observed procedures adhered to those outlined in the SOW.
- **Sample labeling:** Each blank datasheet was completed with site name, GPS File#, depth (cm), diver (Staff name), date, scored 0 to 25 for seagrass presence/absence and algae. All datasheets were printed on Xerox NeverTear paper and filled out with pencil.
- **Monitoring location documentation:** Five monitoring sites were chosen for bimonthly monitoring, one control and four river sites; points within the chosen sites were random. Sites were chosen based on the following criteria: 1) persistent beds of sea grasses and macroalgae and 2) not on urban shoreline. All observed procedures followed those outlined in the SOW.
- **Field sheets/chain of custody:** All hard copies of field datasheets were attached at the appropriate buoy and were entered into the GPS unit. Lorene Bachman retained custody of the samples and the completed hardcopy field datasheets for transportation to the Wildpine Ecological Laboratory. All incoming samples are recorded into laboratory logbook. All hard copies of the original field data sheets are compared to Excel files downloaded from the GPS unit. All hard copies are maintained in an appropriate file in Ms. Bachman's office. Each diver initialed their completed datasheet. All observed procedures were in accordance with those documented in the SOW. The field data sheets do not include a place to identify the person collecting and recording the raw data.
- **Field sheets:** All field monitoring sheets were pre-printed on water proof Never-tear paper. The same blank datasheet was used bimonthly, thus ensuring diver familiarity with the study parameters.

Summary

Based on a comparison of field procedures and methods with the SOW, it appears that samples are collected and instruments calibrated appropriately for the project objectives. The techniques observed were performed appropriately for the required data collection. The study methods are adequately described in the written protocols. The field methods used for monitoring conform to the written protocols. All observed procedures were in accordance with those detailed in the SOW. The results of the review indicated that

- The field team is experienced and qualified for the work being performed.

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- Monitoring equipment is appropriate for the work and calibrated prior to use with verified post sampling. All observed procedures followed the SOW.
- Field monitoring was performed and documented according to the procedures documented in the SOW.
- Field preservation techniques for water quality samples were collected and stored according to the procedures specified in the SOW.
- Sample labeling was completed on data sheets completed for each sampling location.
- Monitoring locations were chosen and monitored following the procedures outlines in the SOW.
- Field sheets/chain of custody were completed and entered into the GPS unit. Data were verified when downloaded and hard copies maintained. All observed procedures adhered to the SOW.
- Standard preprinted field sheets on Never-tear paper are used for bimonthly sampling.

Recommendations

No recommendations were noted by the observer.

5.2 Field Observations of a CERP Permit Monitoring Activity

On January 22, 2008 an on-site field study review was conducted to observe the collection of *Gambusia affinis* (Mosquito fish) for analysis of Hg in fish tissue at the Ten Mile Creek Stormwater Treatment Area (STA). Personnel from the SFWMD (Pat Davis and Mark Roberson) conducted the fish tissue sampling. The field activities were assessed for compliance with CGM 42.00 Appendix A: *District Guidance in the Design of a Project-level Monitoring and Assessment Plan for Mercury and Other Toxicants* and the SOP SFWMD-Hg-04 Rev 1.2 *Mercury in Fish*. The results of the on-site field review are summarized below. The full report is provided in Attachment E.

Review of Sampling Procedures for Fish Tissue collected for Hg Analysis

The field visit was made at the Ten Mile Creek (TMC) STA and SFWMD Okeechobee field station. Eight elements of *Gambusia* collection were observed during the field visit.

- **Crew composition and qualifications:** Based on discussion with the crew it was determined that they were experienced with both STA-specific protocols and with general SFWMD water quality and organism sampling protocols. Conversation indicated that training documentation is maintained in the Okeechobee field office and audited according to SFWMD schedules and protocols.
- **Collection Equipment:** Dip nets used for fish collection were $\leq 3/16$ inch mesh size, as specified in the SFWMD SOP. It was noted that the specific net and mesh size is not defined in the protocols and that this is being refined due to seasonal fish size demographics that influence catch rate. It was also noted that there is overlap between the SFWMD SOP and the CGM 42.00 and a lack of clarity on exact methods to be used. Calibration of water quality instruments was not observed.
- **Field Collection:** Field collection was accomplished by wading into the sampling area from three entry points determined by the team leader based on aerial photos, sampling area, habitat, and fish abundance. Entry point coordinates were determined using a handheld GPS with sub-meter accuracy and recorded onto field sheets. *Gambusia* were collected from the nets and held live in a bucket of ambient water; non-target fish were released. No formal QA/QC procedure for field taxonomy is defined in the SOPs other than best professional judgment consensus between

the crew members; however, a second taxonomic examination occurs during laboratory pre-processing.

- **Field Preservation Technique:** The fish sampled over the 1 to 1.5 hour effort at each of the three sites were placed into a single bucket and extraneous debris and non- *Gambusia* fish removed. As specified in the SOP, surgical gloves were worn by one team member during this process. Approximately 200-300 fish were collected at each site. The live fish were transferred to double Ziploc bags and placed on ice in a cooler. It was noted that the ice in the cooler was not double bagged, as specified in the SOP, and it was not possible to determine if the ice was purchased commercially or produced with tap water or laboratory deionized water.
- **Sample labeling:** Pre-printed field sheets, field labels, and processed sample shipping labels were generated by the SFWMD laboratory information management system (LIMS). However, the field crew filled in labels on Ziploc bags by hand with a permanent marker because a pre-login code had not yet been assigned in the LIMS.
- **Sampling location documentation:** GPS coordinates were recorded on field sheets. GPS calibration procedures and schedule were not ascertained during the visit. GPS and aerial photos are used by the field crew for return visits to confirm entry points.
- **Field sheets/chain of custody:** A pre-login summary report, a field data sample sheet and a chain of custody form were used to document sample collection and shipment to the FDEP analytical laboratory. Basic information was recorded on the forms, which were signed by the field sampling personnel.
- **Field notes:** A LIMS pre-login number was pre-printed on the three types of field sheets. Hard copies of field sheets with chain of custody signatures and field notes are maintained at the Okeechobee field office; field notes are also scanned into the SFWMD LIMS. The three codes (pre-login, sample ID, combined project name/station) are entered into LIMS and link the sample with field sheet information.

Review of Laboratory processing (post-collection but prior to shipment for chemical analysis)

- **Equipment storage:** Dedicated laboratory processing equipment for TMC-STA samples was stored together in a separate cabinet in a large plastic bag. All processing equipment was washed immediately after use with Alconox™ detergent. However, there was no indication of the length of time the equipment was stored between uses and no indication as to whether it was washed immediately before use.
- **Sample processing/holding:** Fish samples arrived in the sample pre-processing facility alive and were placed in a standard (-20°C) freezer in double Ziploc bags for approximately one hour to kill the fish for ease of processing. The freezer appeared to be a general purpose freezer not exclusive to the project. Bagged fish samples were brought to room temperature, counted, taxonomy confirmed, cleaned of additional debris, and recorded on the laboratory bench sheet as per the SOP. Throughout this process one team member wore gloves, the other did not. Fish were then placed in a stainless steel grinding vessel and a wet weight determined and recorded. The scale used for wet weight determination was calibrated with a known weight immediately before fish weights were measured but any other scale maintenance and calibration procedures were not examined during the visit. The fish from each station were ground to a paste which was transferred to two 20 mL brown-glass sample bottles. Pre-printed labels were affixed to each bottle and the bottles returned to the freezer, one for analysis and one for archival. Preparation and storage of the sample bottles was not observed during the visit. It was observed that bottles were not double bagged, as required by the SOP, while stored in the freezer. The team leader indicated that composited tissue samples are held frozen for up to a year in order to have

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sufficient numbers of samples to ship to the FDEP analytical laboratory. This holding period conforms to the SOP. No procedural blank or any other QC samples were collected. The team leader indicated that a procedural blank was prepared once a year and carried through the entire tissue sample preparation process. The processing equipment was washed immediately after the sample processing/grinding was finished.

- **Data/Information Management:** SFWMD LIMS system uses the project/station name as the root code for SFWMD LIMS records. Geographic position (GPS coordinates) is documented with the project/ station name. Signed chain-of-custody forms and field sheets are filed in the field office.

Summary

Based on a comparison of field collection and laboratory pre-processing procedures with the SOP it appears that samples are collected and instruments calibrated appropriately for the project objectives. The techniques observed were performed appropriately for the required data collection. The study methods described in the written protocols are generally adequate. The field methods used for monitoring conform to the written protocols. Minor discrepancies or exceptions are noted above. The results of the review indicated that

- The field team is experienced and qualified for the work being performed.
- Sampling equipment is appropriate for the study design.
- Field collection methods are consistent with the SOP.
- Sample handling followed the SOP with one exception (ice not double-bagged).
- Sample labeling was appropriate for a project for which no pre-login code was assigned.
- Sampling locations determined by GPS were documented appropriately.
- Field sheets/chain of custody were completed and signed.
- Field notes were entered on pre-printed sheets per standard protocol.
- Dedicated laboratory processing equipment was washed immediately after use and bagged. Pre-sampling cleaning was not determined.
- Laboratory sample processing documentation procedures followed the SOP; processing procedures were appropriate for Hg analysis. Annual processing blanks are collected as specified in the SOP. Sample homogenates were not double-bagged as required by the SOP.
- Standard Data/Information Management practices using the SFWMD LIMS are followed. Sample custody is documented appropriately.

Recommendations

No specific recommendations were noted by the observer. However, in two instances double-bagging of material was not performed as required by the SOP. Personnel should be reminded of these procedures. The requirements of CGM 42.00 Appendix A: *District Guidance in the Design of a Project-level Monitoring and Assessment Plan for Mercury and Other Toxicants* and the SOP SFWMD-Hg-04 Rev 1.2 *Mercury in Fish* should be compared to ensure that sampling procedures are consistent.

5.3 Field Team Audits for Water Quality

This section describes the results of QAOT on-site field audits. These audits included observing sample collection procedures, equipment calibration and use, field measurements, and data recording procedures.

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This report section is not sub-divided into RECOVER, CERP project, and CERP permit monitoring because the field teams audited during the report period may collect samples or data which may be used by one or more of these CERP monitoring activities. Field audits for four organizations, including both the SFWMD STA and SFWMD Okeechobee water quality sampling groups were conducted during the report period by the SFWMD as part of its routine audit schedule. Table 5-2 lists the field teams audited during the report period and the RECOVER, CERP Projects, and CERP Permit monitoring that they may support. Not all of these projects were specifically audited; however, each of the field teams collected samples either specifically for CERP or that may be used for CERP purposes by a secondary user.

Each field audit assessed compliance with the SFWMD Field Sampling Quality Manual, applicable SOPs, and the FDEP field SOPs. Audit results were summarized in a field audit report that classified each issue as either a Finding or Observation. The audit reports were provided to field team management for review and response. A corrective action was required for each Finding and a recommendation was made for each Observation. Field team organization responses were documented directly in the field audit report table with the planned implementation date and returned to the auditor. The auditor assessed the response and indicated whether the response was sufficient or whether additional action was required. The results of the audits are summarized below and in Table 5.3. The completed audit report tables with responses are provided in Attachment F.

The 44 field-related Findings fell into two broad categories: documentation (61%) and technical (39%). Proper documentation of procedures and support activities is important to ensure that reported data are traceable and defensible. The types of documentation issues identified during field audits included:

- The chain of custody forms did not indicate if the samples were shipped on ice.
- The instrument maintenance records do not indicate the slope associated with pH electrode response.
- The training documentation provided was dated after the audit date.
- The location where the continuing calibration verification (CCV) was performed was not documented on the Field Test Report page.

Proper technical procedures are important to ensure that data are accurate, complete, and defensible. Technical issues have a direct impact on data quality. The types of technical issues identified during field audits included:

- Filtered samples and Gross Alpha samples were processed prior to the Total (unfiltered) samples.
- Depth to water level was not measured during purging to monitor recharge rate.
- An equipment blank was not collected prior to the collection of the first samples required on the chain of custody form.
- The intermediate sampling collection device was given an extra rinse prior to filling for the field-collected equipment blank sample collection.

Almost one third (30%) of the Findings were related to equipment documentation or use, followed by sample custody and handling (23%) and method-related errors that could impact data (20%). The results for individual field teams are summarized below.

Collier County Pollution Control (CCPC)

An audit of CCPC field procedures was conducted in August 2007 for CCWQ activities, but CCPC also supports SGGE permit monitoring, which may provide data for RECOVER and CERP. In all five

Findings and two Observations were identified. Findings included the sample preservation, collection, and documentation-related issues. Several initial responses to the audit required follow-up with the auditor.

Golder Associates, Inc. (GAI)

Two field audits were conducted of GAI. An audit in June 2007 reviewed field sampling activities for the one project that may potentially provide data for CERP (RFGW) and an audit in February 2008 reviewed field sampling activities for L8RT CERP permit-related monitoring. In all 18 Findings and two Observations were identified. Almost half of the Findings were equipment-related. Calibration procedures, standards, and equipment use were cited most frequently. Method or data-impact related issues (25%) included improper well sampling procedures. All responses received from GAI were determined to be sufficient with implementation times within two months of the audit.

South Florida Water Management District

The SFWMD supports several field teams; two were audited during the report period. In August 2007 the SFWMD Okeechobee Water Quality Sample group was audited. Two Findings and two Observations were identified. Both Findings were related to documentation: e.g., the deionized water carboys used on the trip were not documented. The responses received from the field team were determined to be sufficient with implementation times within two months of the audit. In February 2008 the SFWMD STA field team was audited. Two Findings and one Observation were identified. Both Findings were related to sample handling: e.g., the equipment blank was collected incorrectly. The responses received from the field team were determined to be sufficient with implementation times within two months of the audit.

The SFWMD field audits provide a representative sample of the quality of work and data generated by its field teams, which conduct water quality monitoring for several projects that may provide data useful for CERP or RECOVER (Table 5-2).

TetraTech ECI/ Foster Wheeler Energy Corporation (FWEC)

An audit of a FWEC field team was conducted in September 2007. The ACRA CERP project activities were observed but FWEC performs monitoring activities for other projects that may provide data for CERP or RECOVER (Table 5-2). Seven Findings and three Observations were identified. Three Findings were related to improper chain of custody procedures and three related to equipment use or maintenance.

After each audit, the audit issues were discussed with the field teams while on-site and documented in an audit report that was submitted to the field team manager. Audit reports included recommended corrective actions for each issue. The field team manager provided a proposed corrective action plan and implementation date for each item, which the auditor evaluated for adequacy. Each audit item was considered complete when the proposed corrective action plan and implementation date were accepted by the auditor. Ultimately, field audits result in continuous improvement in the field procedures and data.

5.4 Quality of Field-Collected Water Quality Data

The quality of field measurement data (e.g., DO, salinity) that is specifically collected for, or that may be used for RECOVER, CERP projects, or CERP permit monitoring is assessed in this section. Data qualifiers may be assigned to field measurement data to indicate the acceptability of the data as a result of data validation or internal review by the organization collecting the data. Determination of acceptability may be based on the results of instrument calibration, replicate analysis, and the use of proper field procedures. Most data qualifiers indicate that QC problems identified during the review may limit the use of data and that the data should be used with caution at the discretion of the user. Other qualifiers provide

added information about the data but do not indicate a quality-related problem. A full list of data qualifiers is provided in Table 5-4. For this analysis, QC-related qualifiers were quantified to assess data quality. Detailed tables that quantify the specific qualifiers assigned to each parameter are provided in Attachment G. Table 5-2 lists the field teams that collected *in situ* water quality data during the report period and the RECOVER, CERP Projects, and CERP Permit monitoring that these data may support. While these data may not have been collected specifically for CERP, they may be used for CERP purposes by a secondary user.

5.4.1 Field Data Which May be Useful for RECOVER

Representative system-wide monitoring data potentially used by RECOVER were identified using the Identification of RECOVER Water Quality Monitoring Stations (2/27/08) and input from the SFWMD Everglades Restoration Resource Area RECOVER Division Lead Scientist (Greg Graves, personal communication). Data from Florida International University (FIU), Lee County, LRD, SJRWMD, and SFWMD were prioritized for review. Data not included in the analysis included

- Northern Estuaries Fort Worth subregion from STORET/PBCERM
- Everglades WCA3 subregion from Everglades Research Database Production (ERDP), the Everglades Division database.
- Southern Estuaries Biscayne Bay and Florida Bay subregions from Alternative “O” Map (Locations Atlantic Oceanographic and Meteorological Laboratory [AOML]).

5.4.1.1 FIU Field Data Quality

FIU collected water quality samples that may provide data useful for RECOVER at Caloosahatchee Estuary ROOK Stations and Southern Estuary BISC, FLAB, TTI, and ROOK stations. Field measurements from 130 stations were collected during the report period. FIU field data collected for these stations were downloaded from the FIU website by the SFWMD into the ADaPT format; laboratory qualifiers were applied prior to submission. Data were re-validated at the SFWMD using an enhanced ADaPT process and the data QA/QC narratives. Additional flags were applied to the data as needed.

The FIU data set was comprised of 10,128 field measurements from 2,537 samples for four field parameters (DO, pH, salinity, temperature). QC qualifiers were assigned to less than 1% of the field data overall and for each parameter. Detailed qualifier tables are provided in Attachment G-1.

5.4.1.2 Lee County Field Data Quality

Lee County staff collected water quality samples that may provide data useful for RECOVER at 13 Pine Island Sound water quality stations in the Caloosahatchee Estuary. Data collected for these stations during the report period were downloaded from the Lee County website:

http://www.lee-county.com/NaturalResources/Environmental/Autopage_T33_R20.htm

Lee County field data are validated internally by the laboratory based on pre and post-sampling instrument calibration and QC samples results. A 3-tiered process is used for this validation; first the field collector performs an initial screening, next the QA Officer performs a second-level screen and assigns qualifiers, and finally the laboratory director reviews and approves the data set.

The Lee County data set was comprised of 955 field measurements from 156 samples and seven field measurements (conductance, DO, pH, salinity, Secchi depth, temperature, and turbidity). No QC qualifiers were assigned to the field data. Detailed data tables are provided in Attachment G-2.

5.4.1.3 LRD Field Data Quality

LRD staff collected water quality samples that may provide data useful for RECOVER at 12 water quality stations in the Loxahatchee Estuary (51, 60, 67, 68, 69, 72, 81, 92, 100, 104, 105 and 106). Data collected for these stations during the report period were downloaded from the Loxahatchee website:

<http://www.loxahatcheeriver.org>

The data set was comprised of 867 field measurements from 126 samples and nine field measurements (conductance, depth, DO, percent light (at 1 M and 2 M), pH, salinity, Secchi depth, and temperature). LRD does not validate the field data, thus no assessment of QC-related qualifiers could be performed (Attachment G-3).

5.4.1.4 SJRWMD Field Data Quality

The SJRWMD staff sampled four water quality stations (IRJ08, IRJ12, IRJ07, and IRJ05) that may provide data useful for RECOVER. Data collected for these stations during the report period were provided by Wendy Tweedale at wtweedale@sjrwmd.com. The SJRWMD laboratory applies comment codes and performs laboratory QA on data prior to release. Data are inspected for consistency and anything that falls 'out of bounds'. Once checks are performed and any appropriate qualifiers applied, the data are submitted for storage in the SJRWMD Environmental Database.

The data set was comprised of 768 field measurements from 64 samples and twelve (12) field parameters (air temperature, cloud cover, specific conductance, DO, pH, salinity, Secchi depth, stream depth, water temperature, weather, wind direction, and wind speed). QC qualifiers were assigned to less than 2% of the field data overall, related to one parameter: 19% of the Secchi disk values were qualified as off-scale high (L). Detailed qualifier tables are provided in Attachment G-4.

5.4.1.5 BROW, CCPC, DADE, DERM, FWEC, and SFWMD Field Data Quality from DBHYDRO

Field data for nine projects (CAMB, CESWQ, CR, IRL, SE, SGGE, TCSTA, TMC, and X) that may provided data useful for RECOVER were collected during the report period and stored in DBHYDRO, the South Florida Water Management District hydrometeorologic, water quality, and hydrogeologic data retrieval system. The data were validated by the SFWMD using an enhanced ADaPT process. The six field teams responsible for the field measurements are listed in Table 5-2. No field team was listed for a subset of 126 CESWQ and SE values but no QC qualifiers were assigned to these data.

The data set was comprised of 11,189 field measurements from 107 stations for six field measurements (dissolved oxygen, pH, salinity, Secchi disk depth, specific conductance, and temperature). QC qualifiers were assigned to less than one percent (1%) of the data. No trends ($\geq 25\%$ qualifiers) were noted for the field parameters. Detailed qualifier tables are provided in Attachment G-5. Qualifier and laboratory trends are summarized below:

- 100% of the specific conductance data (one value) collected by CCPC were qualified as estimated or inaccurate (J).
- 25% of the qualified field data were qualified as estimated or inaccurate (J).
- 35% of the qualified field data were qualified because precision or accuracy criteria were not met (J3).
- 38% of the qualified field data were qualified because an improper field protocol was used (J5)

5.4.2 CERP Project Monitoring

Field data for two projects (RASR and RFGW) that may provide data for CERP were collected during the report period and stored in DBHYDRO. The field data were validated by the SFWMD using an enhanced ADaPT process and assigned QC qualifiers that indicate the acceptability of the data. The three field teams responsible for the field measurements are listed in Table 5-2.

The data set was comprised of 466 field measurements from 77 stations for six field measurements (DO, oxidation reduction potential [ORP], pH, Secchi disk depth, specific conductance, and temperature). QC qualifiers were assigned to 11% of the field measurements; 89% of the field measurements did not have QC qualifiers. Detailed qualifier tables are provided in Attachment G-6. The following trends ($\geq 25\%$ qualifiers) were noted:

- 100% of the ORP data (three values) were qualified. These measurements were performed by the SFWMD. Less than 25% of other field data were assigned QC qualifiers.
- 39% of the qualifiers were assigned because accuracy or precision criteria were not met (J3)
- 100% of DO data (three values) measured by the SFWMD were qualified.
- 67% of specific conductance data (3 values) collected by the SFWMD were qualified.
- Overall, 53% of the SFWMD field measurements were QC qualified.

5.4.3 CERP Permit Monitoring

Field data for six permit monitoring activities (ACRA, C43RES, L8RT, SGGE, TCSTA, and TMC) that may provide data for CERP were collected during the report period and stored in DBHYDRO. The field data were validated by the SFWMD using an enhanced ADaPT process and assigned QC qualifiers that indicate the acceptability of the data. The four field teams responsible for the field measurements are listed in Table 5-2.

The data set was comprised of 754 field measurements from 25 stations for seven field measurements (DO, ORP, pH, salinity, Secchi depth, specific conductance, and temperature). QC qualifiers were assigned to approximately 3% of the field measurements; 97% of the field measurements did not have QC qualifiers. Detailed qualifier tables are provided in Attachment G-7. No trends ($\geq 25\%$ qualifiers) were noted for the field parameters or qualifiers. 100% of the specific conductance data (one value) collected by CCPC was qualify as estimated or inaccurate (J).

5.5 Summary

Based on the evidence collected during the report period, it appears that, in general, field monitoring procedures are conducted by experienced personnel, follow established methods, generate traceable documentation, and yield quality data. However, equipment and method-related field audit issues were prevalent during audits conducted by the SFWMD, indicating that emphasis on training, method compliance, and verification by project managers is needed. Additional effort is needed to determine if RECOVER SOPs are sufficiently detailed, QASR requirements are met, and data are verified prior to release. Based on the application of qualifiers, less than 1% of field measurements have QC issues. Quality issues are most often associated with DO.

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Table 5-1. Summary of QAOT Observations of RECOVER Field Activities.

Monitoring Activities	3.1.3.15 American Alligator^a 3.1.3.16, American Crocodile	St. Lucie Estuary, Seagrass Monitoring and Observations	Loxahatchee River Project, Seagrass Monitoring and Observations
Field activities			
• Crew composition and qualifications	✓	✓	✓
• Monitoring/Collection Equipment	✓	✓	✓
• Field Collection/ monitoring	✓	✓	✓
• Field Preservation Techniques	NA	∅	∅
• Sample Labeling	NA	✓	✓
• Monitoring location documentation	✓	✓	✓
• Field sheet/chain of custody	Field sheet ✓ Chain of custody NA	✓	✓
• Field sheets/Notes	✓	✓	✓
• Data management	✓	✓	✓
Laboratory processing			
• Equipment storage	NA	NA	NA
• Sampling processing/holding	NA	NA	NA
• Data/Information Management	✓	✓	✓

^a ✓(Observed or confirmed through discussion), NA (not applicable), ∅ (not addressed in observation report)

Table 5-2. Summary of Field and Laboratory Assessments with Potential RECOVER and CERP Projects

Project Code	Description	Field Team Audit ^a	Field Data Measurements ^b	Laboratory Audit ^a	Laboratory Data ^c	RECOVER	CERP Permit	CERP Project
ACRA	Allpatah Complex Restoration Area	FWEC	FWEC	DBE FDEP	FDEP SFWMD		X	
BISC FLAB ROOK TTI	Southern Estuary ^d		FIU	FIU	FIU	(X)		
C2324STA	C2324 Fish Sampling			FDEP	FDEP		X	
C43RES	C43 Basin Storage Reservoir		WSI	AEL Gainesville	AEL-G		X	
CAMB	Conservation Area Mass Balance (WCAs Inflows and Flows)	SFWMD	BROW DADE DERM SFWMD		SFWMD	(X)		
CESWQ	Caloosahatchee Water Quality Parameters	FWEC SFWMD	FWEC SFWMD		SFWMD	(X)		
CR	Caloosahatchee River Study	SFWMD	SFWMD		SFWMD	(X)		
Inflows and Estuary Stations	Loxahatchee Estuary ^d		LRD		LRD	(X)		
IRL	Indian River Lagoon Water Quality Monitoring	FWEC	FWEC	AEL Gainesville	SFWMD	(X)		

^a The field teams and laboratories indicated are involved in data collection for the associated project code. The audit may not have reviewed procedures for each project that the field team or laboratory supports.

^b Field data for this project code are analyzed in this report. The field teams responsible for performing the field measurements are indicated in the table.

^c Laboratory data for this project code are analyzed in this report. The laboratories responsible for performing the analyses are indicated in the table.

^d From: Identification of RECOVER Water Quality Monitoring Stations v.04 (July 9, 2008. Greg Graves email attachment).

Table 5-2. Summary of Field and Laboratory Assessments with Potential RECOVER and CERP Projects, continued.

Project Code	Description	Field Team Audit	Field Data	Laboratory Audit	Laboratory Data	RECOVER	CERP Permit	CERP Project
IRL North	Indian River Lagoon ^d		SJRWMD		AEL-G	(X)		
L8RT	L8 Water Quality Monitoring (Palm Beach Aggregates)	GAI SFWMD	GAI SFWMD	FDEP	FDEP FRS SFWMD USBS		X	
Pine Island Sound	Caloosahatchee Estuary Stations ^d		Lee County		Lee County	(X)		
RASR	Regional Aquifer Storage and Recovery Biological Monitoring	FWEC	FWEC	FDEP	CAS FDEP USBS			X
RFGW	Regional Floridan Groundwater Monitoring	GAI SFWMD	GAI SFWMD		CAS SFWMD			(X)
ROOK	Caloosahatchee Estuary Stations ^d		FIU	FIU	FIU	(X)		
SE	St. Lucie Estuary	FWEC	FWEC	AEL Gainesville	SFWMD	(X)		
SGGE	Southern Golden Glades Estates	CCPC	CCPC	CCPC	CCPC USBS	(X)	X	
TCSTA	Taylor Creek Stormwater Treatment Area	SFWMD	SFWMD	FDEP	FDEP SFWMD	(X)	X	
TMC	TEN MILE CREEK	SFWMD	SFWMD	FDEP	FDEP SFWMD	(X)	X	
X	Lake Okeechobee Monitoring	SFWMD	SFWMD		LRD SFWMD	(X)		

^d From: Identification of RECOVER Water Quality Monitoring Stations v.04 (July 9, 2008. Greg Graves email attachment).

X – Data associated with CERP activity.

(X) – Data may be used for CERP activity.

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Table 5-3. Summary of Deficiencies Identified During Water Quality Field Team Audits.

Collection Agency	Custody/Handling	Documentation	Equipment	Improper QC sample Collection	Method/Data Impact	QC Sample Collection Error	Training	Grand Total	Percent of Findings
SFWMD - STA	2					1		3	7%
SFWMD - OKEEWQ	2	1			1			4	9%
Collier County	2	1	1		3			7	16%
FWEC	3	1	3	1	1		1	10	23%
Golder Associates (2 audits)	1	3	9		4	3		20	45%
Count of Findings	10	6	13	1	9	4	1	44	100%
Percent of Findings	23%	14%	30%	2%	20%	9%	2%	100%	

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Table 5-4. Data Qualifiers, Definition, and Designation of QC Qualifiers.

Flag	Flag Definition	Source	QC Qualifier (Yes/No)^a
PMF	Project Manager Flag	SFWMD	Yes
?	Data is rejected and should not be used.	FDEP	Yes
M	When reporting chemical analyses: presence of material is verified but not quantified: the actual value is less than the value given.	FDEP	No
N	Presumptive evidence of presence of material.	FDEP	Yes
NVZ	NOT A VALID ZERO VALUE; REQUEST ORIGINAL VALUE FROM LAB	SFWMD	Yes
D	Measurement was made in the field (i.e. in-situ).	FDEP	No
PMR	Project Manager Remarks	SFWMD	No
NOB	NO BOTTLE SAMPLE	SFWMD	No
A	Value reported is the mean (average) of two or more determinations.	FDEP	No
B	Results based upon colony outside the acceptable range.	FDEP	No
F	When reporting species : F indicates the female sex	FDEP	Yes
J	Estimated value: value not accurate.	FDEP	Yes
K	Off-scale low. Actual value is known to be less than the value given.	FDEP	Yes
I	The reported value is between the lab method detection limit and the lab practical quantitation limit.	FDEP	No
!	Data deviates from historically established concentration ranges.	FDEP	No
L	Off-scale high. Actual value is known to be greater than value given.	FDEP	Yes
O	Sampled but analysis lost or not performed.	FDEP	Yes
T	Value reported is less than the laboratory method detection limit.	FDEP	Yes
U	Indicates that the compound was analyzed for but not detected.	FDEP	No
V	Indicates that the analyte was detected in both the sample and the associated method blank.	FDEP	Yes
Y	The laboratory analysis was from an unpreserved or improperly preserved sample. The data may not be accurate.	FDEP	Yes
Z	Too many colonies were present (TNTC) the numeric value represents the filtration volume.	FDEP	Yes
J1	Surrogate % Recovery Exceeded	SFWMD	Yes
J2	No Known QC Criteria Exists	SFWMD	Yes
J3	Precision or Accuracy Criteria Not Met	SFWMD	Yes
J4	Matrix Interference	SFWMD	Yes
J5	Improper Lab or Field Protocol	SFWMD	Yes
Q	Out of Holding Time	DEP	Yes

^a Non-QC qualifiers provide additional information about the data but do not indicate quality problems.

6.0 EVALUATION OF LABORATORY DATA POTENTIALLY USED BY CERP

This section summarizes QAOT activities to assess the quality of data generated by laboratories that may provide water quality data for RECOVER, CERP projects, and CERP permit monitoring under existing SOWs or contracts with the SFWMD or USACE. Four types of assessments were performed to assess the quality of laboratory data: desk audits, on-site laboratory audits, PE samples, and the evaluation of laboratory QC data.

6.1 Laboratory Audits

Audits of nine laboratories that may generate data CERP were conducted during the report period. The selected laboratories have current SOWs with either SFWMD or USACE. The section is not sub-divided into RECOVER, CERP project, and CERP permit monitoring because under the current SOWs these laboratories may contribute analytical support to one or more of these CERP monitoring activities, in addition to non-CERP activities. Eight of the nine laboratory audits conducted during the report period were on-site assessments. No on-site audit was conducted for Columbia Analytical Services (CAS). The audits of four laboratories performing organics analyses for CERP monitoring activities were conducted by the USACE (section 6.1.1) at the request of the QAOT. The audits of five laboratories performing inorganic analyses for CERP monitoring activities were conducted by the SFWMD (section 6.1.2) as part of their overall quality system requirement to conduct on-site audits of contract laboratories. The complete audit reports are provided in Attachment H.

6.1.1 QAOT-USACE Laboratory Audits: Organics

USACE completed assessments for four NELAC-certified organic chemistry laboratories (CompuChem, TestAmerica Savannah, Columbia Analytical Services (CAS), and SunLabs, Inc.) during the May 2007 through April 2008 reporting period according to the USACE laboratory audit SOP for organics analysis. TheEMCX, Omaha, NE performed the assessments in conjunction with representatives from the QAOT-USACE. The assessment process consisted of three components used to evaluate laboratory performance:

- Remote Desk Assessment - (Phase I).
- On-Site Assessment - (Phase II).
- Performance Evaluation Samples (PEs) – (Phase III).

The purpose of a laboratory assessment is to evaluate, at the bench-level, the proficiency that the laboratory has to perform chemical analysis. The assessment is to ensure that the analytical chemistry laboratories meet the QA/QC requirements defined in the EPA methods that are specified in the project documents and the QASR. The primary focus of the USACE assessment program is to provide a mechanism to verify, document and improve, (whenever possible), the analytical procedures used by the laboratory to generate chemical measurement data.

For the Remote Desk Assessment (Phase I), documentation supplied by the laboratory is thoroughly reviewed by the assessor. The latest Laboratory Quality Management Manual or Quality Assurance Manual, current SOPs, current proficiency testing (PT) results for NELAC, Method Detection Limit (MDL) studies, method performance control charts from laboratory control samples (LCS) and data deliverable packages are reviewed and compared to method and NELAC requirements, CERP guidelines and where applicable, the Department of Defense Quality Systems Manual for Environmental Laboratories (DoD QSM). These reviews are extremely detailed and Findings are discussed with the

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laboratory until corrective actions are agreed to. The laboratory proposes corrective actions and implementation dates for each item, which the auditor evaluates for adequacy. Once the corrective action plan is approved, the assessor proceeds with the On-Site Assessment.

The On-Site Assessment (Phase II) focuses primarily on the actual implementation of the various methods used (or expected to be used) by the laboratory for the CERP projects. A QAOT representative accompanies the EMCX assessor during the on-site assessment phase. The On-Site Phase effort is to complement the NELAC Accrediting Authority audit. The laboratory's implementation of each analysis is presented at the laboratory bench by the individuals responsible for its actual performance within the laboratory. The procedures used within the laboratory are checked by the assessor for consistency with the laboratory's published SOPs, printed reference methods and best scientific practices. The On-Site Assessment includes an on-instrument review of calibration data, method detection limits and analysis sequences for the primary analytical methods. The on-instrument review is extremely detailed and also allows for the evaluation of the analyst's ability to fully use their instrument and any of its controlling and analytical software. The Findings are discussed with the laboratory until corrective actions are agreed upon. The laboratory proposes corrective actions and implementation dates for each item, which the assessor evaluates for adequacy. Once the corrective action plan is approved, the On-Site Report is compiled.

For both the Remote and On-Site Assessments, the Findings are characterized as Observations, Recommendations or Deficiencies. These terms are defined as:

Observations (O): These Observations either provide context to the inspection report or they represent variances/deviations from typically observed method implementation but do not necessarily impact data quality.

Recommendations (R): These Findings represent deviations, which if corrected, may effect an improvement in data quality or compliance with a cited requirement. These are changes to the laboratory's implemented method that should be incorporated barring a conflicting reason.

Deficiencies (D): These Findings represent deviations that should be corrected to effect an improvement in data quality or compliance with a cited requirement. These are either deviations from the accepted method or method implementation that has a significant probability of adversely impacting data quality and usability. It is strongly recommended that these Findings be addressed by the laboratory by incorporating a change to the affected procedure.

The PE samples analysis and review (Phase III) of the laboratory assessment process is an integral part of evaluation of the laboratory. Phase III can be initiated anytime after the initial request for assessment is received by the EMCX. The EPA's Contract Laboratory Program Quality Assurance Technical Support (QATS) PE sample program, is utilized for issuance of PE samples. Instructions accompany the PEs to the laboratory to insure proper preparation and analysis are completed. Laboratory results are sent to the EMCX where they are compared to acceptance limits provided by QATS based on the Superfund PEs Scoring-Web application. Warning limits are calculated at the 95% confidence level, and action limits are calculated at the 99% confidence level. In rare cases, PE samples may be ordered from a commercial NELAC accredited provider. The results are discussed with the laboratory. The laboratory responds accordingly, and proposes corrective actions (reanalysis, review of chromatograms, review of calibrations, etc) for each item, which the auditor evaluates for adequacy. Once all issues are addressed, the PE Sample Summary Report is compiled.

6.1.1.1 COMPUCHEM

CompuChem, a Division of Liberty Analytical Corporation, Cary, NC was the first of four laboratories to be assessed during the reporting cycle. The methods assessed were EPA methods 608 (Organochlorine Pesticides and polychlorinated biphenyls [PCBs]) and 625 (Base/Neutrals and Acids). The Desk Assessment was performed beginning April 19, 2007 with the On-Site Assessment conducted June 6, 2007. David Splichal (EMCX) and Lisa Gued (USACE) performed the On-Site Assessment. A PE sample for the determination of pesticides by EPA method 608 was sent to the laboratory for extraction and analysis.

CompuChem is well-equipped and well-staffed with more than adequate space to house their operations. Individuals were quite helpful during the inspection process, and they provided all of the information requested. The individuals had an obvious dedication to their work, and were well prepared for their role in the laboratory and for the assessment. The individuals generally had extensive experience with the preparatory methods, analytical methods, review functions and quality assurance oversight.

6.1.1.1.1 Desk Assessment (Phase I)

From the desk assessment, there were 12 Observations, 25 Recommendations, and 19 Deficiencies. Examples of representative deficiencies, along with resolution to the Findings, are presented below:

Method: In the SOP for the analysis of aqueous acid and base-neutral extractables by method 625, the Standards and Reagents Section, a deficiency was noted: "A table showing how each individual standard is prepared needs to be included in this SOP or referenced to another SOP if appropriate". The laboratory responded "Standard preparation information will be added to this SOP". The USACE review of the revised SOP showed sufficient preparation procedures were added to the SOP to adequately address this deficiency.

Quality Systems - Deficiencies for MDLs: Six Deficiencies dealt with MDLs for the two organic methods reviewed. For the deficiencies identified, the laboratory was not properly comparing the mean recovered concentration of the parameter to the calculated MDL. A specific deficiency was noted for Aroclor 1221 where the MDL of 1.61 µg/L was determined to be higher than the laboratory reporting limit of 1.25 µg/L. New MDL studies were performed; results were reviewed by USACE and determined to meet method requirements.

6.1.1.1.2 On-Site Assessment (Phase II)

From the on-site assessment, there were 9 Observations, one Recommendation, and one Deficiency noted in the final report. The deficiency, along with resolution to the Finding, is presented below:

Quality Systems: The laboratory could not provide USACE with documentation (verification) of method detection limits as described in the DoD QSM. The laboratory responded stating "On a monthly basis for CERP projects, a batch containing one or more MDL verification samples will be extracted for 608 (8081/8082) and 625 (8270C). Due to the number of compounds to be verified, it is likely that more than one sample with compounds spiked at various concentrations will be needed for MDL verification. These samples will be analyzed on a quarterly basis and as needed due to the performance of major instrument maintenance to confirm that the established MDLs remain valid."

6.1.1.1.3 Performance Evaluation Samples (Phase III)

A PE sample was not provided for method 625. From the PE sample results for method 608, the laboratory reported a result for every compound spiked into the sample. They reported no false positives

or false negatives. Results for two compounds were reported “warning high” meaning they were between the 95th and 99th confidence intervals. It was recommended that the laboratory review chromatograms, calibration curves and other QC samples to determine the potential cause for the slightly high bias for these two parameters. The laboratory reported that the LCS analyzed was within MDL, and that the compounds were calculated without error. Because the results were within the upper confidence interval, the laboratory was not required to perform further investigation.

6.1.1.1.4 Conclusions

The laboratory’s responses to the Observations, Recommendations and Deficiencies were adequately addressed. The PE sample results also showed that the laboratory can qualitatively and quantitatively identify pesticides analyzed by method 608. There were no Findings for this laboratory for CERP projects that would indicate potential problems with data generated, in terms of data quality/usability or defensibility.

6.1.1.2 *TESTAMERICA SAVANNAH*

TestAmerica Savannah, Savannah, GA was the second of four laboratories to be assessed during the reporting cycle. The methods assessed were EPA methods 515.1 (Determination of Chlorinated Acids in Water by Gas Chromatography with an Electron Capture Detector [GC/ECD]), 508 (Determination of Chlorinated Pesticides in Water by Gas Chromatography with an ECD), and 525.2 (Determination of Organic Compounds in Drinking Water by Liquid-Solid Extraction and Capillary Column Gas Chromatography/Mass Spectrometry [GC/MS]). The Desk Assessment was performed beginning August 17, 2006 with the On-Site Assessment conducted September 25 - 26, 2006. Douglas Taggart of the USACE EMCX performed the On-Site Assessment. A PE sample for the determination of chlorinated pesticides by EPA method 508 was received by the laboratory for extraction and analysis on September 28, 2006.

TestAmerica Savannah was formerly known as Severn-Trent Laboratory Savannah until June 18, 2007. The laboratory has adequate instrumentation, personnel and facilities to complete required analyses for CERP projects. The individuals have the required education, training, and experience, to properly extract, analyze, interpret and report results for CERP samples. The laboratory provided requested documentation and showed a willingness to work with the assessor to resolve deficiencies.

6.1.1.2.1 Desk Assessment (Phase I)

From the desk assessment, 10 Observations, 21 Recommendations, and 2 Deficiencies were identified. An example of a deficiency, along with resolution to the Finding, is presented below.

Method: For method 508, chlorinated pesticides by GC/ECD, section 11.1.1 of the SOP stated that “two surrogates are spiked into each sample and QC item prior to preparation. Decachlorobiphenyl (DCB) and 2,3,4,6-tetrachloro-m-xylene (TCMX) are the recommended surrogates. DCB should be evaluated as the primary surrogate; TCMX is evaluated if there is matrix interference with DCB.” USACE Finding to this policy was that it violated the requirements of the method that explicitly states that multiple surrogates can be used; however, all surrogates must pass with acceptable recoveries. The laboratory agreed with the USACE Finding in their response “The requirement that both surrogate compounds (TCMX and DCB) must pass acceptance criteria will be addressed on a project-specific basis. For upcoming work performed for compliance to the CERP QA plan, the laboratory will adhere to this requirement.”

6.1.1.2.2 On-Site Assessment (Phase II)

From the on-site assessment, 5 Observations, 4 Recommendations, and 3 Deficiencies noted in the final report were identified. The deficiencies, along with resolution to the Findings, are presented below:

Quality Systems: The laboratory could not provide examples of when Laboratory Fortified Matrix (LFM) samples were extracted or analyzed during the on-site assessment. It appeared to the assessor that the laboratory was not routinely preparing LFM samples because, in many cases, there was lack of sufficient volume received for these added QC samples; however, this was not documented in the extraction area. This documentation was not provided during the on-site assessment. The laboratory's response to this Finding was that they are performing LFM extractions/analyses within the requirements of the method, but that "when investigating this response, the QA Manager determined that, although a Non-conformance Memo was consistently being written, the bench sheets were not consistently annotated when this situation arose. As such, a specific Data Type has been created to capture this information on the bench sheet. This Data Type will ensure better documentation of this issue." An example of the revised bench sheet was provided to USACE for review and found to be acceptable.

Methods: For the drinking water methods assessed, there was considerable discussion between the EMCX and the laboratory regarding the proper generation of control charts for compounds detected by the appropriate method. The three methods contain subtle, yet significant, differences in how acceptance limits for control charting are derived (refer to Attachment H for the Final Report and detailed discussion). The laboratory policy of "70%-130%" recovery for all compounds for every method was in direct conflict with two of the three methods assessed. Due to the subtlety of these differences, the EMCX contacted the EPA for clarification. The EPA responses validated the USACE Findings and consequently, the laboratory agreed to implement the correct generation of control chart limits based on individual method requirements.

The same deficiency for the two GC/ECD methods (515.1 and 508) was observed during the on-site assessment. The laboratory was either not analyzing the Laboratory Performance Check (LPC) sample or only evaluating it only for compounds requested in the appropriate method. The purpose of the LPC sample is to monitor instrument characteristics (sensitivity, column performance, chromatographic performance) through injection of compounds designated to indicate potential problems. These LPC compounds are method specific and analysis of this sample is required in both methods. The laboratory responded "The laboratory is evaluating vendors for the purchase of a LPC standard. The requirement to analyze this standard will be incorporated into the next revision of the SOP." USACE accepted the laboratory's response as adequately addressing this issue.

6.1.1.2.3 Performance Evaluation Samples (Phase III)

A PE sample was not provided for methods 515.1 or 525.2. From the PE sample results for method 508, acceptable results were reported for every compound spiked into the sample. The laboratory reported one false-positive (endrin aldehyde at an estimated value of 0.032 µg/L). It was recommended that the laboratory review chromatograms, calibration curves and other QC samples to determine the potential cause for the reporting of the low level detection for this compound. The laboratory reported that the second column confirmation result for this compound was also 0.032 µg/L, and since the values are less than the laboratory's reporting limit, the result is most likely due to endrin breakdown in the sample. Because all the nine compounds were reported within acceptance limits, and since the result for endrin aldehyde was estimated, the laboratory was not required to perform further investigation.

6.1.1.2.4 Conclusions

The laboratory addressed Observations, Recommendations and Deficiencies, especially where their policies were in direct conflict with the method requirements. The PE sample results also showed that the laboratory can qualitatively and quantitatively identify pesticides analyzed by method 508. With the accepted change to policy for surrogates, LFM, and LPC, as noted above, there were no other Findings for this laboratory for CERP projects that would indicate potential problems with the organics data generated, in terms of data quality/usability or defensibility.

6.1.1.3 COLUMBIA ANALYTICAL SERVICES(CAS)

CAS of Kelso, WA was the third of four laboratories to be assessed during the reporting cycle. The method assessed was EPA method 508.1 (Determination of Chlorinated Pesticides, Herbicides, and Organohalides by Liquid-Solid Extraction and GC/ECD). The Desk Assessment Report was sent to CAS on August 14, 2007. The On-Site Assessment was not conducted for CAS because on September 6, 2007, MACTEC Engineering and Consulting, Inc. removed CAS from their base contract. A PE sample for the determination of chlorinated pesticides by EPA method 508.1 was sent to the laboratory for extraction and analysis on July 17, 2007.

6.1.1.3.1 Desk Assessment (Phase I)

From the desk assessment, there were 14 Observations, 22 Recommendations, and 19 Deficiencies. Examples of representative deficiencies, along with resolution to the Findings, are presented below. The laboratory response indicated the correctives actions would be complete by October 1, 2007; however, correspondence and future investigation with the laboratory ceased since the laboratory was dropped from the contractor's base contract.

Quality Systems: The laboratory QA Manual stated "As required by NELAC and DoD protocols, the validity of derived MDLs is verified using MDL verification samples." The MDL verification results for method 508.1 were not supplied to USACE for review even though the initial letter sent from the EMCX to CAS requested them to be sent. It appeared that the laboratory did not have MDL verification results available for the desk assessment.

There were also discrepancies in the results for the data packet reviewed for many of the pesticide Method Reporting Limits (MRLs) compared to the MRLs listed in the SOP. For example, the reported MRL for lindane was 0.010 µg/L, whereas the MDL from the SOP was 0.006 µg/L. The laboratory responded "Some MRLs have been recently adjusted. The SOP will be revised to update the MRL table".

Documentation: Review of the Data Packet received showed a discrepancy between actual laboratory practices versus what is written in the SOP for method 508.1. The data sheet (Quantitation Report) showed that Aroclor 1260 was used for the Laboratory Fortified Blank (LFB) whereas the SOP states that Aroclor 1248 is used for the LFB. The laboratory responded "The laboratory rotates the spiking solution. The SOP will be revised to reflect this".

6.1.1.3.2 Performance Evaluation Samples (Phase III)

From the PE sample results for method 508.1, the laboratory reported acceptable results for each of the nine compounds spiked into the sample. They reported two false-positives (4,4'-DDE at an estimated value of 0.0010 µg/L, and 4,4'-DDD at an estimated value of 0.0022 µg/L). No further investigation was performed into the potential reasons for the false positives reported.

6.1.1.3.3 Conclusions

Since the laboratory was dropped from the contractor's base contract, no on-site assessment of the laboratory was conducted. In addition, there were some Recommendations and Deficiencies not totally addressed because additional information from the laboratory could not be requested. The PE sample results indicated that the laboratory can quantitatively identify organochlorine pesticides analyzed by method 508.1, with some false-positives that need additional follow-ups.

6.1.1.4 *SUNLABS*

SunLabs, Incorporated of Tampa, FL was the last of four laboratories to be assessed during the reporting cycle. The methods assessed were EPA methods 8318 (n-Methylcarbamates by High Performance Liquid Chromatography), 8081A (Organochlorine Pesticides by Gas Chromatography), and modified 8270C (Semivolatile Organic Compounds by GC/MS). The Desk Assessment Report was sent to the laboratory on September 28, 2007 with the On-Site Assessment conducted October 22 – 23, 2007. David Splichal (EMCX) and Lisa Gued (USACE) performed the On-Site Assessment. PE samples, for all three methods, were received by the laboratory for extraction and analysis on September 28, 2007.

SunLabs, Inc. is a well equipped laboratory with adequate space to house their operations. SunLabs is a relatively small laboratory (13 total employees, of these, 11 are technical), but has sufficient experience with the preparatory methods, analytical methods, review functions and quality assurance oversight. The individuals were helpful during the assessment process and provided the government assessors with all of the information requested. The employees interviewed have an obvious dedication to their work. The laboratory is neatly kept, with two major areas: sample log-in/analysis and sample preparation (organic and inorganic).

6.1.1.4.1 Desk Assessment (Phase I)

From the desk assessment, there were 14 Observations, 17 Recommendations, and 6 Deficiencies. An example of a deficiency, along with resolution to the Finding, is presented below.

Method: For modified method 8270C, Semivolatile Organic Compounds by GC/MS, the acceptable recovery range calculated for an organophosphate pesticide Azinphos, methyl was questioned. The laboratory reported a lower control limit of 0% and an upper control limit of 144%. The USACE Finding stated "Recovery of 0% is questionable and the reason for low recoveries should be investigated". The laboratory responded "Recovery was obtained for all LCS samples (26-127%). There is a wide variability in the recovery of pesticides from soil. The control limits reflect the variability and the accompanying high standard deviation". The USACE review of SunLabs response further pointed out that EPA method 8000C states "In-house QC limits must be examined for reasonableness. It is not EPA's intent to legitimize poor recoveries that are due to the incorrect choice of methods or spiking levels". During the on-site assessment, this deficiency was discussed with the laboratory. The laboratory agreed to use the "lower warning limit" of 13% recovery to determine when re-extraction would occur (i.e. if recovery is <13% in the LCS, then the batch would be re-extracted).

Observation: SunLabs informed USACE that the actual field samples received for CERP were from another laboratory and that SunLabs never received a copy of the Quality Assurance Project Plan or other project documentation. The other laboratory went so far as to remove labels from the sample jars and replace CERP identifiers with their own specific identification codes. This placed SunLabs in the difficult position of not knowing the Data Quality Objectives for CERP, including detection limits required. This Observation is presented as information only.

6.1.1.4.2 On-Site Assessment (Phase II)

From the on-site assessment, there were 9 Observations, 5 Recommendations, and 2 Deficiencies noted in the final report. An example of a deficiency, along with resolution to the Finding, is presented below:

Method: There was one major deviation from the recommended extraction procedure observed for method 8318. The laboratory is only using 2 grams of sample extracted with 5 milliliters (mL) of acetonitrile. The method recommends 20 grams of sample with 50 mL of acetonitrile. USACE questioned the use of this procedure because although the solvent to weight ratio is the same (5:2) using either procedure, since homogeneity of soils is an issue, use of a larger amount of sample may enhance reproducibility of results and provide better representation of the true concentration of parameter(s) in field samples. The USACE asked for comparison results from each procedure, which could not be provided. The laboratory performed a side-by-side study in February 2008. The results showed no apparent differences in results for either procedure for a well characterized and homogeneous soil (study was performed on a PE sample since the laboratory claimed to have never received a real world sample that contained detectable results for carbamates). In this case, the laboratory has demonstrated that acceptable results can be achieved for clean matrices; however, it is not clear whether the smaller sample size will introduce larger error into field sample results. Although USACE still has reservations concerning the use of smaller sample size and extraction volume for field sample preparation, the laboratory has shown adequate documentation and the laboratory can use the modified procedure for CERP projects.

6.1.1.4.3 Performance Evaluation Samples (Phase III)

Soil PE samples were provided for all three methods. For modified method 8270C, atrazine was correctly identified and reported by the laboratory. Two compounds were reported high in the PE sample analyzed by method 8081A. It was recommended that the laboratory review chromatograms, calibration curves and other QC samples to determine the potential cause for the high values reported. There were no obvious anomalies observed for this analytical batch. The results for parameters reported from method 8318 were within acceptable limits. There were no major problems associated with the PE samples analyzed by the laboratory.

6.1.1.4.4 Conclusions

SunLabs addressed Observations, Recommendations and Deficiencies, including providing additional information to USACE concerning the sample preparation deviation for method 8318. The PE sample results also showed that the laboratory can qualitatively and quantitatively identify target parameters for the three methods assessed. There were no other Findings for this laboratory for CERP projects that would indicate potential problems with data generated, in terms of data quality/usability or defensibility.

6.1.2 QAOT-SFWMD Laboratory Audits: Inorganics

SFWMD completed assessments for five laboratories for inorganics during the 2008 reporting period as part of their routine audit schedule. HSW Engineering, Inc., a SFWMD contractor, performed the assessments. Table 5-2 lists the laboratories audited during the report period and the RECOVER, CERP Projects, and CERP Permit monitoring that they may support. Not all of these projects were specifically audited, however, each of the laboratories generated data either specifically for CERP or that may be used for CERP purposes by a secondary user.

The assessment process consisted of a review of laboratory documents, raw data, implementation of the laboratory quality system, and the performance of analytical methods at the bench. The purpose of a laboratory assessment is to evaluate the laboratory's capabilities to support SFWMD, USACE, and/or

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CERP projects and to assess laboratory compliance with SFWMD contract requirements, NELAC standards, and the laboratory's Quality Manual or Quality Assurance Management Plan (QAMP) and SOPs. Audits were conducted according to the SFWMD SOP QA-008 *Conducting Laboratory Audits*. Prior to each laboratory audit the following documents were reviewed in preparation for the on-site visit:

- SFWMD contracts or SOWs.
- Laboratory Quality Manual.
- SOPs for audited parameters and methods.
- EPA methods corresponding to the audited SOPs.
- Most recent external audit report with corrective actions.
- Most recent NELAC audit report with corrective actions.

For some laboratories, a list of major analytical instrumentation or equipment associated with the audited methods and parameters or the latest internal audit or QA assessment were also requested and reviewed. The document reviews enabled the auditor to become familiar with the laboratory's quality system and analytical requirements. Errors or questionable practices were discussed during the on-site visit.

The on-site visit was conducted to confirm, through independent observation, that the procedures defined in the laboratory quality documents were being implemented effectively. An opening meeting was conducted to discuss the audit logistics, schedule, and scope. The on-site audit consisted of staff interviews, demonstrations, and a review of pertinent records and raw data. The following aspects of analytical laboratory operation were reviewed at each laboratory:

- Adequacy of the laboratory facility, records management, and personnel qualifications.
- Sample handling, shipping, receiving, and custody procedures.
- Analytical laboratory equipment, reagents and standards, bench-level documentation, and analytical procedures vs. the SOP and method requirements.
- Report preparation, data verification, and data validation.
- MDL determination and currency.
- Initial demonstrations of capability and ongoing demonstrations of capability (IDC/ODC).
- Previous audit Findings and implementation of corrective actions.
- Results of recent PE samples and corrective actions.

A closing meeting was conducted at the end of each audit to discuss preliminary Findings and corrective actions. The meetings also allowed the laboratory an opportunity to provide records or documentation to resolve auditor questions. Issues identified during the audits were categorized as Observations or Findings with the following definitions:

Finding (F): Pertinent statement of fact based on a comparison of actual laboratory practice to the minimum requirements of the method, standard, system, or contract.

Observation (O): A comment based on actual laboratory practice in which the auditor believes a modification may improve operations. Not considered a Finding.

An audit report was prepared within 30 days of each audit. The audit reports detail positive practices, Findings, and Observations. Findings and Observations were also tabulated and categorized as

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- D - Documentation
- I - Instrument or Equipment Maintenance
- A - Analytical
- Q - Quality System

The audit summary table also included recommendations for each Observation and the required corrective action for each Finding, with the reference that defines the requirements. Additional tables summarize issues identified during the most recent NELAC audit, the most recent external audit, and the previous SFWMD audit with an assessment of the adequacy of the corrective actions implemented by the laboratory and verified by the auditor during the on-site visit. Laboratories are given 30 days to respond with a corrective action plan and implementation date. The auditor assesses each response for adequacy and documents when each item is addressed satisfactorily. No item is “closed” until the auditor accepts the laboratories corrective action plan. The following sections summarize the results of each laboratory audit.

6.1.2.1 Advanced Environmental Laboratories, Inc. (AEL) Gainesville

An audit of Advanced Environmental Laboratories, Inc. (AEL) Gainesville, FL was conducted on August 23-24, 2007. In June 2006, AEL purchased PPB Environmental Laboratories in Gainesville, Florida. Since this purchase, AEL has combined its two Gainesville operations into one laboratory. AEL Gainesville generated water quality data for several projects that may provided data for CERP or RECOVER (Table 5-2). The focus of this audit was on the ability of the laboratory to analyze aqueous samples for nutrients (total phosphorus [TP], orthophosphate, and nitrogen-containing compounds), water quality parameters (alkalinity, total suspended solids [TSS], volatile suspended solids [VSS], turbidity, chloride), chlorophyll a, color, and Inductively Coupled Plasma (ICP) metals by specific EPA methods:

EPA 365.1 TP	EPA 160.4 VSS
EPA 200.7/6010 ICP Metals	EPA 110.2 Color
EPA 325.2 Chloride	EPA 353.2 NO ₂ -NO ₃
EPA 365.2 Orthophosphate	EPA 375.4 Sulfate
EPA 160.2 TSS	SM 10200H Chlorophyll a
EPA 180.1 Turbidity	EPA 351.2 TKN
EPA 350.1 Ammonia	EPA 310.1 Alkalinity

AEL facilities, personnel, sample handling, IDC/ODCs, and MDLs are compliant with the laboratory’s quality system and NELAC requirements. The laboratory is sufficiently prepared to perform the analyses defined in their SOW except as specified in the audit and summarized below.

6.1.2.1.1 Assessment

Nine Findings and one Observation were identified during the audit. The 10 issues were categorized as Documentation (7) and Quality System (3) issues. Example Findings and the required corrective actions are presented below:

Documentation: Standards and reagents for TKN and orthophosphate are made fresh daily and often are made up in unlabeled or improperly labeled containers. The corrective action required is based on NELAC 5.5.6.4.(f): Properly label all standard and reagent containers, including those made fresh daily.

Quality System: Hardcopy laboratory records, generated prior to the transition from PPB to AEL in July 2006, are stored in boxes in the garage of the laboratory's former owner. Therefore, these records may not

be readily retrievable and the environment may not be suitable to preclude deterioration. The corrective action required is based on NELAC 5.4. 12.1.2: The laboratory should implement a system to ensure that records are stored and retained in such a way that they are readily retrievable.

6.1.2.1.2 Performance Evaluation Samples

AEL participated in two inorganic PE samples during the report period. For the July 2007 PE sample, 78% of the results had passing accuracy and 67% had passing percent differences. For the January 2008 PE samples, 86% of the results had passing accuracy and 80% had passing percent differences. These data represent improvements in both assessments.

6.1.2.1.3 Previous Audits and Corrective Actions

The laboratory's last NELAC audit was in November 2006, and the SFWMD last audited AEL (as PPB) in February 2005. Corrective actions for each of the Observations or Findings applicable to the audited methods were confirmed as having been implemented during the August 23 - 24, 2007 audit.

6.1.2.1.4 Conclusions

AEL Gainesville has implemented good quality systems as demonstrated by standards tracking and review of data and documentation of these reviews. Among the ten audit Findings or Observations, of particular concern are those related to a delay in accessing records stored with the laboratory's former owner, improper labeling of working standards and reagents, and not tracking preservative or container lots used in container shipping.

6.1.2.2 *Collier County Pollution Control (CCPC) Laboratory*

An audit of CCPC, Naples, Florida was conducted on November 15, 2007. CCPC is a small laboratory that specializes in testing of aqueous environmental samples for nutrients, metals, and other inorganic parameters, as well as microbiological parameters (enterococci and coliforms) and plant pigments (chlorophyll *a* and pheophytin *a*). Organics analyses are subcontracted to Elab, Inc., in Ormond Beach or Genapure (formerly U.S. Biosystems) in Boca Raton. CCPC generated water quality data for one project (SGGE) that may provide data useful for RECOVER or CERP. Emphasis during the on-site audit was placed on analyses for nutrients (specifically, nitrate [NO₃], nitrite [NO₂], TKN, ammonia [NH₃], TP, dissolved orthophosphate), and other general chemistry parameters (total dissolved solids, TSS, chloride, sulfate [SO₄], and dissolved silica [SiO₂]), various metals (by both inductively-coupled plasma /mass spectrometry [ICP/MS] and flame atomic absorption spectrophotometry, and microbiological analyses (plant pigments such as chlorophyll *a* and pheophytin *a*, and fecal and total coliforms).

CCPC facilities, personnel, sample handling, data reporting/verification, and IDC/ODCs are compliant with the laboratory's quality system and NELAC requirements. The laboratory is sufficiently prepared to perform the analyses defined in their SOW except as specified in the audit and summarized below.

6.1.2.2.1 Assessment

Four Findings and seven Observations were identified during the audit. The 11 issues were categorized as Documentation (3), Analytical (3), and Quality System (5) issues. All Documentation issues were categorized as Observations. Example Findings and the required corrective actions are presented below:

Quality System: Bottles of working solutions of pH buffers are labeled with lot numbers of stock standards but are not labeled with expiration dates. The corrective action required is based on NELAC 5.5.6.4 (d): Label all bottles containing pH buffer solutions with dates of expiration.

Analytical: Several of the laboratory's most recent MDL studies do not meet the requirement of 40 CFR 136 Part B that the spike concentration be greater than the calculated MDL but less than ten times the calculated MDL. The corrective action requires the laboratory to investigate the issue and repeat the MDL studies or otherwise document why the requirement defined in the QAMP Appendix G and as the referenced document (40 CFR Part 136 Appendix B) cannot be met.

6.1.2.2.2 Performance Evaluation Samples

CCPC laboratory participated in two inorganic PE samples during the report period. For the July 2007 PE sample, 100% of the results had passing accuracy and 84% had passing percent differences. For the January 2008 PE samples, 96% of the results had passing accuracy and 79% had passing percent differences. These data represent a slight decrease in both assessments.

6.1.2.2.3 Previous Audits and Corrective Actions

The laboratory's last NELAC audit was conducted January 31 – February 2, 2006, and the SFWMD last audited the CCPC laboratory on February 12, 2004. Corrective actions for each of the Observations or Findings applicable to the audited methods were either confirmed as having been implemented during the November 15, 2007 audit or were verbally attested to by the laboratory supervisor as having been corrected.

6.1.2.2.4 Conclusions

The laboratory has a capable staff and has made many improvements to its quality systems, including better tracking and more timely updates of SOPs and the QAMP. The more important of the Observations and Findings are related to MDLs: the likely increase of the MDL for TKN above the contract specifications, the need to repeat the NO₃-NO₂ MDL that is currently calculated as zero, and the need to investigate whether other MDL studies need to be repeated. In addition, CCPC needs to expedite reporting to the SFWMD, including laboratory receipt deliverables and quarterly reports.

6.1.2.3 *DB Environmental Laboratories, Inc.*

An audit of DB Environmental Laboratories, Inc., Rockledge, FL (DBE) was conducted on October 11, 2007. DBE is a relatively small commercial laboratory that specializes in testing of environmental samples (aqueous, soil, sediment, and plant and other biological material) for a limited number of parameters, primarily nutrients, metals, and other inorganic parameters. The only biological testing performed is for chlorophyll. Analyses for some parameters such as TKN are subcontracted to other laboratories, typically Elab, Inc., in Ormond Beach, Florida. DBE generated water quality data for one CERP permit (ACRA). The focus of this audit was on the ability of the laboratory to analyze SFWMD samples – primarily sediment and plant tissue – for total nitrogen (TN), total carbon (TC), total organic carbon (TOC), total inorganic carbon, TP, orthophosphate, sulfate (SO₄), volatile solids, and select metals (primarily calcium [Ca], aluminum [Al], iron [Fe], potassium [K], and magnesium [Mg]).

DBE facilities, personnel, sample handling, analytical procedures, IDC/ODCs, and MDLs are compliant with the laboratory's quality system and NELAC requirements. The laboratory is sufficiently prepared to perform the analyses defined in their SOW except as specified in the audit and summarized below.

6.1.2.3.1 Assessment

Two Findings and four Observations were identified during the audit. The six issues were categorized as Documentation (3), Instruments/maintenance (1), and Quality System (2) issues. Example Findings and the required corrective actions are presented below:

Documentation: Some obliterations or improper corrections were noted in the review of handwritten logbooks located in the main laboratory. The corrective action required is based on NELAC 5.4.12.1.5.f: Re-train staff in the proper procedure for error correction (i.e., one line through the error and correct entry written to the side, with the correction initialed and dated).

Quality System: The laboratory's Quality Manager is not clearly identified in the laboratory's Comprehensive Quality Assurance Plan (CompQAP) (multiple individuals are indicated as "QA Officer"). The corrective action required is based on NELAC 5.4.1.5.i: Update the CompQAP to clearly identify the laboratory Quality Manager, who shall ensure that the quality system is implemented and followed at all times.

6.1.2.3.2 Performance Evaluation Samples

DBE participated in FDEP's most recent TP Round Robin (TPRR XVII) inter-laboratory comparison study of the analysis of TP in water and was one of only two laboratories out of 22 participating laboratories to have earned an overall score of 5.0 (highest possible).

6.1.2.3.3 Previous Audits and Corrective Actions

The laboratory's last NELAC audit was in August 2006, and the SFWMD last audited DBE on the day immediately following the 2006 NELAC audit. Corrective actions for each of the Observations or Findings applicable to the audited methods were confirmed as having been implemented during the October 11, 2007 audit.

6.1.2.3.4 Conclusions

DBE has a capable staff and focuses on performing a limited number of analyses well. One important recommendation resulting from this audit concerns some aspects of the various manual processes that are key components of DBE's data reduction and reporting. Also, per the NELAC standards, the laboratory's CompQAP should be revised such that the Quality Manager is clearly identified as such.

6.1.2.4 *Florida Department of Environmental Protection Central Laboratory and Innovation Park Laboratory*

An audit FDEP Central Laboratory and Innovation Park Laboratory, Tallahassee, FL was conducted on July 19-20, 2007. The Central Laboratory is the main facility located at 2600 Blair Stone Road, and the volatile organics department, in which MeHg is analyzed, is located at the Innovation Park Laboratory located at 2051 E. Paul Dirac Drive. FDEP generated water quality data for several projects that may generate data useful for CERP and RECOVER (Table 5-2). The focus of this audit was on the ability of the laboratory to analyze environmental samples for low-level TP, metals, low-level total mercury (Hg), and MeHg. In addition to these inorganics, the following organics analyses were audited as part of the SFWMD's routine audit schedule: acid herbicides, urea herbicides, organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs), and PCBs by specific FDEP SOPs and EPA methods:

EPA 365.1 Low-level TP
EPA 200.8/6020 ICP/MS Metals
EPA 245.1 Low-level Total Hg
EPA 200.7/6010 ICP Metals
EPA 1630 (draft) MeHg
EPA 8082 PCBs
EPA 8151 Acid Herbicides
EPA 8081 OCPs
EPA 8321 Urea Herbicides
EPA 8141 OPPs

FDEP facilities, personnel, sample handling, data reporting and verification, IDC/ODCs, and MDLs are compliant with the laboratory's quality system and NELAC requirements. The laboratory is sufficiently prepared to perform the analyses defined in their SOW except as specified in the audit and summarized below.

6.1.2.4.1 Assessment

One Finding and three Observations were identified during the audit. The four issues were categorized as Documentation (3) and Quality System (1) issues. The Finding and the required corrective action is presented below:

Documentation: Containers of prepared reagents for MeHg do not bear a preparation date. The corrective action required is based on NELAC 5.5.6.4.f: All containers of prepared reagents must bear a preparation date. An expiration date shall be defined on the container or documented elsewhere as indicated in the laboratory's quality manual or SOP.

6.1.2.4.2 Performance Evaluation Samples

The FDEP laboratory participated in two inorganic PE samples during the report period. For the July 2007 PE sample, 95% of the results had passing accuracy and 91% had passing percent differences. For the January 2008 PE samples, 97% of the results had passing accuracy and 97% had passing percent differences. These data represent a slight improvement in both assessments.

6.1.2.4.3 Previous Audits and Corrective Actions

The laboratory's latest NELAC audit was in October 2005, and the SFWMD's latest audit of FDEP was in March 2004. Corrective actions for each of the Observations or Findings applicable to the audited methods were confirmed as having been implemented during the July 19-20, 2007 audit with two exceptions.

6.1.2.4.4 Conclusions

FDEP laboratory has implemented good quality systems as demonstrated by complete and up-to-date documentation, including reagent, instrument, equipment, and run logs. The four audit Findings or Observations resulting from this audit include the lack of a preparation date on standards and reagent containers, and the laboratory's uncertainty of what comprises the QC check sample listed in the QM.

6.1.2.5 *Florida International University*

An audit of FIU Southeast Environmental Research Center (SERC), Miami, FL was conducted on January 25, 2008. The SERC laboratory specializes in testing surface water samples collected from Florida Bay, Biscayne Bay, the Everglades, and from other areas in South Florida in association with

university research projects, for nutrients (nitrogen and phosphorus) and other water quality and physiochemical parameters such as salinity, temperature, turbidity, and chlorophylls. FIU generated water quality data for several projects that may potentially be useful for CERP and RECOVER (Table 5-2).

The audit focused on the ability of the laboratory to analyze aqueous samples for the South Florida Coastal Water Quality Monitoring Network in which SERC collects samples for the SFWMD from Rookery Bay (ROOK), as well at three other SFWMD projects (Ten Thousand Islands [TTI], Florida Bay and Whitewater Bay [FLAB], and Biscayne Bay [BISC]). Emphasis during the on-site audit was placed on analyses for nutrients; specifically, TP, soluble reactive phosphate (SRP), NO₃, NO₂, total NO_x, NH₃, and TN. Analyses for TOC and plant pigments (chlorophyll *a*) also were reviewed.

The FIU facilities, personnel, IDC/ODCs, and MDLs are compliant with the laboratory's quality system and NELAC requirements. The laboratory has several good quality practices but the audit revealed problems with the quality system and violations of some NELAC standards and contract requirements.

6.1.2.5.1 Assessment

Fourteen Findings and four Observations were identified during the audit. The eighteen issues were categorized as Documentation (9), Analytical (4), and Quality System (5). Example Findings and the required corrective actions are presented below:

Documentation: For analyses that have a 48-hour holding time limit (SRP and NO₂), the laboratory does not qualify sample results unless the sample is analyzed in excess of 48 hours of receipt at the laboratory or, if frozen upon receipt at the lab, in excess of 48 hours of removal from the freezer for thawing. The corrective action required is based on the SFWMD contract with FIU: Add qualifiers as specified in FDEP QA Rule 62-160 to any results that are generated in excess of published or agency-approved holding time limits.

Analytical: The laboratory marks the beginning of holding times as the date and time of sample receipt at the laboratory, rather than the date and time of sample collection. The corrective action required is based on 40 CFR Part 136.3 Table II and FWMD 2004 audit Finding #2: Measure holding times from the date and time of sample collection and qualify any data generated in excess of allowable holding times in accordance with FDEP QA Rule 62-160.

Quality System: Laboratory analysts do not report matrix spike/matrix spike duplicate results when the results do not meet laboratory acceptance criteria and instrument failure is not indicated. The corrective action required is based on the SFWMD contract with FIU: Report all QC data associated with results reported to the SFWMD, regardless of whether the QC data meet laboratory acceptance criteria or not (except when attributable to instrument failure and noted as such). Qualify sample data in accordance with FDEP QA Rule 62-160.

6.1.2.5.2 Performance Evaluation Samples

FIU laboratory participated in two inorganic PE samples during the report period. For the July 2007 PE sample, 100% of the results had passing accuracy and 100% had passing percent differences. For the January 2008 PE samples, 100% of the results had passing accuracy and 80% had passing percent differences. These data represent perfect scores with the exception of a 20% drop in precision in 2008 compared to the most probable value.

6.1.2.5.3 Previous Audits and Corrective Actions

The laboratory's last NELAC audit was conducted January 16-17, 2007, and the SFWMD last audited SERC on January 29, 2004. Corrective actions for most Observations or Findings applicable to the audited methods were either confirmed during the January 25, 2008 audit as having been implemented or were verbally attested to by the laboratory supervisor as having been corrected. However, several significant Findings remain uncorrected or unresolved, including the issue of holding times and details concerning analyses for NH₃ (i.e., whether approval of an alternate method is needed or whether the SOP should be changed to make it consistent with EPA 350.1).

6.1.2.5.4 Conclusions

FIU laboratory has a capable staff and several good quality practices, including routine analysis of more QC samples than is required and use of standardized QC pages that accompany each run log. However, the audit revealed some problems in the laboratory's quality system and in data reporting, as well as violations of some NELAC standards (including repeat Findings) and SFWMD contract requirements. Validation of the results for two samples revealed several reporting errors that had not been detected by the laboratory in its review and reporting of this data to the SFWMD. As these two samples were selected at random, the Findings suggest that reporting errors may be more prevalent than assumed. Some of the more important Observations and Findings include holding time exceedances for parameters with 48-hour holding time limits, absence of qualifiers for analyses performed in excess of allowable holding times, absence of FDEP or SFWMD approval for freezing samples to extend 48-hour holding times, absence of alternate method approval for analysis of NH₃, the need to establish the low calibration standard at the Practical Quantitation Limit (PQL) for all methods, the need to complete the QAP with all NELAC required elements, and the need to be in full compliance with reporting requirements in the SFWMD contract (in particular, providing ADaPT deliverables).

6.1.3 **Recommendations for Future QAOT Laboratory Audits**

The QAOT PMP establishes that laboratory audits for organic and inorganic parameters will be conducted by the USACE and SFWMD, respectively. Currently, the procedures for these audits are defined in separate SOPs, which use different approaches and criteria for assessing audit issues. The QAOT has identified the need to develop a standard checklist and SOP to ensure that audits are conducted, and results evaluated, consistently among all auditors. A QAOT sub-team has been established to address this issue.

6.2 **Performance Evaluation Samples**

During the report period, organic and inorganic PE samples were administered to laboratories performing chemistry analysis for CERP. The purpose of the PE samples was to assess laboratory performance on single blind samples. The organic PE samples were provided to laboratories as part of the USACE laboratory audit. The inorganic PE samples were provided to laboratories that had SOWs with the SFWMD or the USACE and that may perform inorganic analyses for CERP-related water quality monitoring. This section is not sub-divided into RECOVER, CERP project, and CERP permit monitoring because under the current SOWs these laboratories may contribute data to one or more of these CERP monitoring activities.

6.2.1 Organic Performance Evaluation Samples

The results of four organic PE samples (CompuChem, Inc., TestAmerica Savannah, Columbia Analytical Services Kelso, and SunLabs, Inc.) for CERP are described as part of the USACE laboratory audit process in section 6.1.1.

6.2.2 Inorganic Performance Evaluation Samples

Two inorganic PE studies were conducted during the report period. The U.S. Geological Survey (USGS) Standard Reference sample (SRS) program provided PE samples for both studies. More than 200 laboratories participate in the SRS studies, making them statistically robust. Six SRS types are available through the USGS program (Major Ion, Trace Element, Nutrients at low concentration, Nutrients at high concentration, Precipitant, and Hg SRS). All SRS were prepared using natural water except the low concentration nutrient sample. The full sample preparation process is described at the USGS website: <http://bqs.usgs.gov/srs/>.

The USGS data evaluation uses non-parametric statistics described by Haoglin et al. (1983). These statistics are based on the results from all laboratories participating in the USGS study. Statistics calculated include a most probable value (MPV) as the “true” value, number of reported analyses (n; excluding less than [$<$] values), F-pseudosigma, upper and lower hinges, Z-score (a measure of accuracy), and percent difference (a measure of precision) between participating laboratories. USGS does not identify laboratory results as passing or failing; these designations are left to the data user. For the QAOT studies, values identified as “outliers” were considered failures. A Z-score < 6 and a percent difference < 20 were considered acceptable. Values reported as less than the laboratory detection limit were further assessed using the QUASIMEME analysis described by Wells and Scurfield (2004). SRS sample results are considered proprietary; in the following discussion and tables the results are coded. Attachment I presents a side by side comparison of Z-score (accuracy) and percent difference (precision) results on a parameter-specific basis for the two studies.

The QAOT selected 18 laboratories to participate in the July 2007 inorganic PE study. The selection of laboratories was based on current SFWMD and the USACE laboratory support contracts as well as laboratories identified during the 2007 QAOT project inventory. Overall, 665 results were reported for 44 parameters. Of these, 83% of the Z-scores were passing, 10% failed, 4% of the reported values were consistent with the MPV (based on the QUASIMEME analysis), and 3% were inconsistent with the MPV. Based on the percent difference between the reported results and the MPV, 74% were passing, 18% failed, and 8% could not be assessed because the reported value was less than the MPV.

- For Major Ions, 87% of the Z-Scores and 84% of the percent differences were passing. The most problematic parameters (vanadium and boron) are not parameters considered critical for CERP. Of the Major Ions considered critical to CERP, only one (Silica) had a failing statistic (73% percent difference).
- For Nutrients (low), 81% of the Z-Scores and 65% of the percent differences were passing. All of the most problematic parameters (those with $< 80\%$ passing Z-Scores or percent differences) were identified as critical CERP parameters: NO_3 , $\text{NO}_2 + \text{NO}_3$, TN, $\text{NH}_3 + \text{Organic Nitrogen as N}$, and Ammonia as N. There were no outliers associated with the Nutrient High sample.
- For Trace Elements, 79% of the Z-Scores and 69% of the percent differences were passing. Many of the parameters identified as critical to CERP were problematic ($< 80\%$ passing Z-Score or percent difference): Al, Arsenic (As), Beryllium (Be), Cadmium (Cd), Cobalt (Co), Copper (Cu), Fe, Lead (Pb), Nichol (Ni), Selenium (Se), Silica (Si), and Silver (Ag).

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- Standard methods were used for the analysis of all SRS parameters with the exception of TN. For this parameter, six laboratories selected the “Other Method” category. Examination of the TN data revealed that the Z-Scores were passing for five of the six laboratories. However, the percent difference was passing for only one of the six laboratories. Thus, alternative methods may yield less comparable data than standard methods.

The QAOT selected 16 laboratories to participate in the January 2008 inorganic PE study. Overall, 657 results were reported for 70 parameters. Of these, 89% of the Z-scores were passing, 7% failed, 2% of the reported values were consistent with the MPV (based on the QUASIMEME analysis), and 2% were inconsistent with the MPV. Based on the percent difference between the reported results and the MPV, 82% were passing, 12% failed, and 5% could not be assessed because the reported value was less than the MPV.

- For Major Ions, 94% of the Z-scores and 91% of the percent differences were passing. The most problematic parameters (Boron, Bromide, and Strontium) are not parameters considered critical for CERP. Of the Major Ions considered critical to CERP, all had a passing Z-score and percent differences.
- For Hg, 100% of the Z-scores and 67% of the percent differences were passing.
- For Nutrients (low), 83% of the Z-scores and 67% of the percent differences were passing. All of the most problematic parameters (those with < 80% passing Z-scores or percent differences) were identified as critical CERP parameters: NH₃ + Organic Nitrogen as N, NH₃, NO₃, NO₂+ NO₃, Orthophosphate as P, TN, and TP. One critical CERP parameter was problematic in the Nutrient High sample: NH₃ + Organic Nitrogen as N.
- For Precipitant all Z-scores and 95% of the percent differences were passing. The most problematic parameter was pH which had a passing percent difference 50%.
- For Trace Elements, 86% of the Z-scores and 80% of the percent differences were passing. Many of the parameters identified as critical to CERP were problematic (< 80% passing Z-score or percent difference): Al, As, Cu, Fe, Hg, Pb, Mo, and Se.
- Standard methods were used for the analysis of all SRS parameters with the exception of TN and Nitrate as N. For this parameter, three laboratories selected the “Other Method” category. Percent differences and z-scores were passing for nitrrrrrate as N and two of the three TN SRS.

Fifteen laboratories participated in both the September 2007 and January 2008 PE. Overall, the percent passing results improved for both Z-score and percent difference between 2007 and 2008 for essentially the same number of analytical results (Attachment I). Of the 15 laboratories participating in both PE Studies, seven labs showed improvement in their Z-scores, four laboratories exhibited no change in excellent performance between the two studies, and four laboratories showed notable to slight declines in performance. Based on percent difference, ten laboratories showed improvement and five laboratories showed notable to slight declines. Both Z-scores and percent difference improved for six laboratories and both declined for three laboratories. Detailed results are provided in Attachment I and are discussed in the two final reports (Battelle, 2007; Battelle, 2008).

6.3 Quality of Laboratory Water Quality Data

The quality of laboratory data that is specifically collected for, or that may be used for RECOVER, CERP project, and CERP permit monitoring is assessed in this section. As described for field data, data qualifiers may be assigned to laboratory data to indicate the acceptability of the data as a result of data validation or internal review by the organization generating the data. Determination of acceptability is

based on the results of instrument calibration, QC samples, and the use of proper analytical procedures. Most data qualifiers indicate that QC problems identified during the review may limit the use of data and that the data should be used with caution at the discretion of the user. Other qualifiers provided added information about the data but do not indicate a quality-related problem. A full list of data qualifiers is provided in Table 5-4. For this analysis, QC-related qualifiers were quantified to assess data quality. Detailed tables that quantify the specific qualifiers assigned to each parameter are provided in Attachment J. Table 5-2 lists the laboratories that generated water quality data during the report period and the RECOVER, CERP Projects, and CERP Permit monitoring that these data may support. While these data may not have been collected specifically for CERP, they may be used for CERP purposes by a secondary user. A summary of laboratory parameters for which over 25% of the data were QC qualified is presented in Table 6-1. Individual data users must assess data QC qualifiers to determine if the data are fit for use as secondary data.

6.3.1 RECOVER Monitoring

Representative monitoring data potentially used by RECOVER were identified using the Identification of RECOVER Water Quality Monitoring Stations (2/27/708) and input from the SFWMD Everglades Restoration Resource Area RECOVER Division Lead Scientist (Greg Graves, personal communication). Data from FIU, Lee County, LRD, and SJRWMD were prioritized for review. Data not included in the analysis included:

- Northern Estuaries Lake Worth subregion from STORET/PBCERM
- Everglades WCA3 data subregion from ERDP
- Southern Estuaries Biscayne Bay and Florida Bay from Alternative “O” Map (AOML).

Although not all CERP system data collected during the report period are included in this assessment, this analysis provides a representative sampling of the organizations currently generating data that may potentially be used by RECOVER.

6.3.1.1 FIU Laboratory Data Quality

FIU generated water quality data from Caloosahatchee Estuary ROOK Stations, and Southern Estuary BISC, FLAB, TTI, and ROOK stations that may be potentially useful for RECOVER. Sample data from 130 stations were analyzed during the report period. FIU laboratory data were downloaded from the FIU website by the SFWMD into the ADaPT format; laboratory qualifiers were applied prior to submission. Data were re-validated at the SFWMD using an enhanced ADaPT process and the data QA/QC narratives. Additional flags were applied to the data as needed.

The FIU data set was comprised of 19,248 laboratory measurements from 5116 samples for 10 parameters. QC-related qualifiers were assigned to 80% of the data (all 10 analytical parameters). The remaining 20% of the data were either not qualified or qualified with non-QC related qualifiers (i.e., U). The data were examined for parameter and qualifier trends (i.e., $\geq 25\%$ of the data qualified). Table 6-1 summarizes parameters for which more than 25% of the data were assigned QC qualifiers. Detailed qualifier tables are provided in Attachment J-1. The following trends were noted:

- 50% - 100% of each reported parameter were assigned QC qualifiers with the exception of turbidity. Multiple QC qualifiers were assigned to most of the data.

- 72% of data including all (100%) of the ammonia, TOC, Nitrite+Nitrate, Nitrite, and TP data were qualified due to improper or unpreserved sample (Y): these samples were frozen rather than preserved.
- Of the qualified data:
 - 89% of Nitrite data were qualified as estimated or inaccurate values (J).
 - 58% of Orthophosphate data were qualified due to holding time exceedances (Q).
 - 56% of silica data were qualified as estimated or inaccurate values (J).
 - 33% of the data were qualified as estimated or inaccurate (J)
 - 40% of the data were qualified because an improper protocol was used for analysis (J5), including 64% of chlorophyll-a data.

6.3.1.2 Lee County Laboratory Data Quality

Lee County generated water quality data from 13 Pine Island Sound stations in the Caloosahatchee Estuary (PI-01 through PI-14, sans PI6) that may be potentially useful for RECOVER. Data generated for these stations during the report period were downloaded from the Lee County website:

http://www.lee-county.com/NaturalResources/Environmental/Autopage_T33_R20.htm

Lee County data are validated internally by the laboratory using a 3-tiered process: the analyst screens data using validation software, the QA Officer next performs a second-level screen and assigns qualifiers, and finally the laboratory director reviews and approves the data set.

The Lee County data set was comprised of 3,010 laboratory measurements from 156 samples and 20 laboratory parameters (Attachment J-2). QC-related qualifiers were assigned to 5% of the data (13 analytical parameters). The remaining 95% of the data were either not qualified or qualified with non-QC related qualifiers (e.g., I and U). The data were examined for parameter and qualifier trends (i.e., $\geq 25\%$ of the data qualified). Table 6-1 summarizes parameters for which more than 25% of the data were assigned QC qualifiers. Detailed qualifier tables are provided in Attachment J-2. The following trends were noted:

- 63% of biological oxygen demand (BOD) data were qualified:
 - 80% of these qualifiers were assigned due to accuracy or precision failure (qualifier J3).
 - 20% were qualified due to failure of the seeded BOD sample to exhibit a DO drop of at least 2 mg/L (J99).

No other parameter or QC qualifier trends were noted.

6.3.1.3 Loxahatchee River District Laboratory Data Quality

LRD generated water quality data from 12 stations in the Loxahatchee Estuary (51, 60, 67, 68, 69, 72, 81, 92, 100, 104, 105, and 106) that may be potentially useful for RECOVER. Data collected for these stations during the report period were downloaded from the Loxahatchee website:

<http://www.loxahatcheeriver.org>

Loxahatchee Estuary data were validated by the SFWMD using an enhanced ADaPT process.

The data set was comprised of 1,333 laboratory measurements from 126 samples and 15 laboratory parameters (Attachment J-3). QC-related qualifiers were assigned to 20% of the data (8 analytical parameters). The remaining 80% of the data were not qualified. The data were examined for parameter and qualifier trends (i.e., $\geq 25\%$ of the data qualified). Table 6-1 summarizes parameters for which more

than 25% of the data were assigned QC qualifiers. Detailed qualifier tables are provided in Attachment J-3. The following trends were noted:

- 100% of the Chlorophyll a data were qualified because no known QC criteria exist (J2).
- 52% of TP data were qualified; 55% of these qualifiers were assigned due to a standard being outside the acceptable QC limits (J.1).
- 48% of NH₃ data were qualified; 56% of these qualifiers were due to spike recovery results outside acceptable QC limits (J.3A).
- 44% of TKN data were qualified; 68% of these qualifiers were due to spike recovery results outside acceptable QC limits (J.3A).
- 31% of NO₂+NO₃ data were qualified; 83% of these qualifiers were due to spike recovery results outside acceptable QC limits (J.3A).

6.3.1.4 St. Johns River Water Management District Laboratory Data Quality

AEL, Gainesville generated water quality data for the SJRWMD from four water quality stations in Indian River Lagoon (IRJ08, IRJ12, IRJ07, IRJ05) that may be useful for RECOVER. Data collected for these stations during the report period were provided by Wendy Tweedale at wtweedale@sjrwmd.com.

Both the SJRWMD laboratory and AEL, Gainesville apply comment codes and perform laboratory QA on data prior to release. Once data are approved by the SJRWMD laboratory, the SJRWMD IRL manager runs the data through an automated Statistical Analysis Software process that looks for anomalies (e.g., Blanks < 2 times the MDL, DUP ranges, physical relationships like T>-D₂, PO₄/TP, Pheophytin ratio < 1.9, etc.) and historical relationships: mean ± 1 STD. Data are then inspected for consistency and anything that falls 'out of bounds' during the automated processes together with the context provided by comments at the parameter and sample levels. Once these checks are performed and any appropriate qualifiers applied, the data are submitted for storage in the SJRWMD Environmental Database.

The data set was comprised of 1278 data points from four stations representing 20 parameters (Attachment J-4). QC-related qualifiers were assigned to 2% of the data (13 parameters). The remaining 98% of the data were either not qualified or qualified with non-QC related qualifiers (e.g., I or T). The data were examined for parameter and qualifier trends (i.e., ≥ 25% of the data qualified). Table 6-1 summarizes parameters for which more than 25% of the data were assigned QC qualifiers. Detailed qualifier tables are provided in Attachment J-4. Less than 4% of the data were qualified for individual parameters and of the qualified data, no one qualifier was assigned to more than 2% of the data. No QC qualifier-related trends were noted except for the following:

- Of the few qualifiers assigned, Q (sample analyzed out of holding time) was applied most frequently (75% of the qualifiers).

6.3.1.5 CCPC, FDEP, LRD, SFWMD, and USBS Laboratory Data Quality from DBHYDRO

Data for nine projects that may provided data for CERP (CAMB, CESWQ, CR, IRL, SE, SGGE, TCSTA, TMC, and X) were collected during the report period and stored in DBHYDRO. The data were validated by the SFWMD using an enhanced ADaPT process. The five laboratories responsible for the analyses are listed in Table 5-2. The laboratories responsible for analysis are listed in Table 5-2.

The data set was comprised of 20,850 data points from 112 stations representing seven parameter classes (biology, major ions, metals, nutrients, PCBs, pesticides, and wet chemistry). Ninety-seven percent (97%) of the data had no QC qualifiers; 3% of the data had QC qualifiers. The data were examined for parameter and qualifier trends (i.e., $\geq 25\%$ of the data qualified). Table 6-1 summarizes parameters for which more than 25% of the data were assigned QC qualifiers. Detailed qualifier tables are provided in Attachment J-5. The following QC qualifier-related trends were noted:

- Twenty-five percent (25%) or more of the data for 57 parameters were qualified. While the percentage of qualified data is high, the actual number of values may be small. In many cases less than 10 values were reported altogether. These details are provided in Attachment J-5.
- 36% of the alkaline phosphatase data were qualified because they were analyzed beyond the holding time (Q).
- 43% of the total mercury in tissue data were qualified because the reported value was estimated, not accurate (J) due to poor field duplicate precision (P).
- 50% of methyl mercury data (2 values) were qualified because the reported value was estimated, not accurate (J) due to equipment blank contamination (W2).
- 75% – 100% of the PCB aroclor data were qualified because the reported value was estimated, not accurate (J) due to poor surrogate recovery (S) or CCV failures.
- 35 pesticide parameters (Table 6-1) were qualified because the reported value was estimated, not accurate (J) due to CCV failures.

Five laboratories contributed to the data set (CCPC, FDEP, LRD, SFWMD, and USBS). No specific QC qualifier or laboratory trends ($\geq 25\%$) were noted with the following exception:

- Most qualified data were in the PCB and pesticide parameter classes analyzed by FDEP. Overall approximately 34% of the FDEP data were qualified.
- FDEP was also responsible for the mercury (43%) and methyl mercury (50%) QC qualified data.
- SFWMD was responsible for the analysis of alkaline phosphatase (36%) QC qualified data.

6.3.2 CERP Project Monitoring

Data for two projects that may have provided data for CERP (RASR and RFGW) were analyzed by the SFWMD and its contractors during the report period. Laboratory data for these stations were downloaded from DBHYDRO. The data were validated by the SFWMD using an enhanced ADaPT process. The four laboratories responsible for analysis are listed in Table 5-2.

The data set was comprised of 1,320 data points from 80 stations representing six parameter classes (biology, isotope, major ions, metals, nutrients, and wet chemistry). Ninety-eight percent (98%) of the data had no QC qualifiers; 2% of the data had QC qualifiers. The data were examined for parameter and qualifier trends (i.e., $\geq 25\%$ of the data qualified). Table 6-1 summarizes parameters for which more than 25% of the data were assigned QC qualifiers. Detailed qualifier tables are provided in Attachment J-6. The following QC qualifier-related trends were noted:

- 100% of total chromium data were qualified because the analyte was detected in both the sample and the associated method blank (V).

- 100% of methyl mercury data were qualified because the reported values were estimated, not accurate (J). The reason for the J qualifier is not identified because no comment was provided with the data.
- 25% of chemical oxygen demand (COD) data were qualified (two values). One value was V-qualified and the other J-qualified.

Four laboratories contributed data to the data set (CAS, FDEP, USBS, and SFWMD). No specific QC qualifier or laboratory trends ($\geq 25\%$) were noted with the following exceptions:

- CAS analyzed all the chromium (100% qualified) and COD (25% qualified) data
- FDEP analyzed all the methyl mercury (100% qualified) data.

6.3.3 CERP Permit Monitoring

6.3.3.1 CERP Permit-Related Water Quality Data in DBHYDRO

Data for seven permits that may provide data for CERP (ACRA, C2324STA, C43RES, L8RT, SGGE, TCSTA, and TMC) were analyzed by the SFWMD and its contractors during the report period. Laboratory data for these stations were downloaded from DBHYDRO. The data were validated by the SFWMD. Qualifiers assigned to the data were used to assess data quality. The five laboratories responsible for analysis are listed in Table 5-2.

The data set was comprised of 3,435 data points from 47 stations representing 8 parameter classes (biology, isotope, major ion, metals, nutrients, PCBs, pesticides, and wet chemistry). Ninety percent (90%) of the data had no QC qualifiers; 10% of the data had QC qualifiers. The data were examined for parameter and qualifier trends (i.e., $\geq 25\%$ of the data qualified). Table 6-1 summarizes parameters for which more than 25% of the data were assigned QC qualifiers. Detailed qualifier tables are provided in Attachment J-7. The following QC qualifier-related trends were noted:

- For 50 parameters, more than 25% of the data qualified. While the percent qualified data are high, the actual number of values may be small. In many cases less than 10 values were reported altogether
- 25% of the Gross Alpha data were qualified as estimated or inaccurate values (J).
- 25% of the pesticide data were qualified as estimated or inaccurate values (J).
- 80 – 100% of the PCB aroclor data were qualified as estimated or inaccurate values (J).
- 99% of the qualifiers assigned were Js (estimated or inaccurate values):
 - J qualifiers were assigned to nutrient data due to field blank contamination.
 - J qualifiers were assigned to metals data due to field duplicate precision and equipment blank contamination.
 - J qualifiers were assigned to PCB data due to surrogate recovery failures and CCV exceedances.
 - J qualifiers were assigned to pesticide data for a wide variety of reasons, including due to surrogate recovery failures, CCV exceedances, control limit failures, and lack of a matrix spike sample.

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Six laboratories contributed data to the data set (CCPC, FDEP, Frontier Services (FRS), AEL Gainesville, SFWMD, and USBS). No specific QC qualifier or laboratory trends ($\geq 25\%$) were noted with the following exceptions:

- FDEP was responsible for the high number of qualifiers assigned to PCB and pesticide data. Overall approximately 22% of the FDEP data were qualified.
- USBS was responsible for the gross alpha data (36% QC-qualified)

6.3.3.2 Case Narrative for Site 1 Impoundment

Field sampling and laboratory analysis in support of CERP was performed for the proposed impoundment site (Site 1) located south and east of the L-40 Canal and north of the Hillsboro Canal in Palm Beach County, FL during the report period. Sampling and laboratory coordination was performed by International Analytical Group, Inc. (IAG), who prepared field and laboratory narratives to summarize the results of the monitoring. The following parameters and responsible analytical laboratories generated data for this CERP permit monitoring activity:

Parameter	Analytical Laboratory
Fecal coliform Organophosphorus pesticides Chlorinated herbicides Total Organic Carbon	KSA Environmental Laboratory, Inc. (contracted by AEL Jacksonville)
Radioisotopes: Gross Alpha, Radium 226, and Radium 228	Florida Radiochemistry Services, Inc.
Methyl mercury	Brooksrand Trace Metals Analysis & Products
Chlorothalonil Trifluralin	Environmental Testing & Consulting, Inc.
Herbicides Organochlorine pesticides Organophosphorus pesticides Triazine pesticides	SunLabs, Inc.
Total Sulfur	SVL Analytical

The following quality-related issues were identified in the narratives:

- In an oversight, the sample time and date of the collection of the fecal coliform samples from the Canal were not noted in the Chain-of-Custody (COC) form, although the time of relinquishment to the courier by sampling personnel is recorded, as well as the time the courier relinquished the samples and the laboratory received them. In addition, the COC for the groundwater fecal coliform samples list samples CP07-WHWPA-MW-0012 and “DUP”, instead of the correct label for the duplicate sample, CP07-WHWPA-MW-0149DP.

Laboratory Analysis of Groundwater samples:

- The results for Iron, Manganese, Radium 226 and fecal coliforms differed by more than 63%, 110%, 86% and 120%, respectively between the duplicate samples. IAG asked the laboratories to double check their results. AEL Jacksonville and Florida Radiochemistry re-analyzed the samples and confirmed their results, the fecal coliform results could not be re-analyzed.

Laboratory Analysis of Imprint Samples:

- Results for Arsenic, Copper, Iron and Lead for sample Imprint 1 are flagged with a J4 qualifier because the matrix spike recoveries were outside control criteria. The spike recovery in the LCS was acceptable, which indicated that the analytical batch was in control. The spike recoveries in the samples may have been due to matrix interference.
- Copper and Lead results for all samples were qualified with a “V” to indicate method blank contamination. The method blank had concentrations of Copper and Lead above the MDL but below the PQL so results are qualified with a V to indicate that the data may be affected by the method blank contamination. However, Copper and Lead sample results in all samples were more than 10 times higher than the PQL, so the potential impact of the method blank contamination on these results is minimal.

Laboratory Analysis of Soil Samples:

- The Lead results for all samples were qualified with a V to indicate method blank contamination. The method blank had lead concentrations above the MDL but below the PQL so results are qualified with a V to indicate that the data may be affected by the method blank contamination. However, the Lead method blank result is approximately 1000 times less than the PQL, so the potential impact of the method blank contamination on these results is minimal.

6.4 Summary

Based on the evidence collected during the report period, it appears that, in general, laboratory analyses are compliant with the analytical methods and generate data of acceptable quality. However, there are some notable issues that warrant follow-up audits and verification of corrective actions. In general, the results of PE samples are acceptable but for critical parameters the results may warrant examination of methods across laboratories (e.g., acceptable accuracy was not achieved for 22% - 25% of the TN PE results in the two inorganic PE studies). Based on the volume of data generated for CERP, it appears that the quality of the data is acceptable based on the fact that most analytical data results are not qualified.

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Table 6-1. Laboratory Data Potentially Used for CERP Project or CERP Permit Purposes for Which More Than Twenty-five Percent (25%) of the Data Collected during the Report Period Were Qualified.

Laboratory	Parameter	Number of QC Qualifiers	Total Number of Data Points	Percent Data Qualified
CAS	Chromium, Total	8	8	100%
CAS	COD	2	8	25%
FDEP	2,4,5-T	4	4	100%
FDEP	2,4,5-TP	2	4	50%
FDEP	2,4-D	2	4	50%
FDEP	Acifluorfen	4	4	100%
FDEP	Alachlor	2	5	40%
FDEP	Atrazine desisopropyl	2	7	29%
FDEP	BHC Alpha	4	5	80%
FDEP	BHC Beta	4	5	80%
FDEP	BHC Delta	4	5	80%
FDEP	BHC Gamma	4	5	80%
FDEP	Carbophenothion	4	5	80%
FDEP	Chlordane	4	5	80%
FDEP	Chlorothalonil	4	5	80%
FDEP	Cis-Nonachlor	12	21	57%
FDEP	Cypermethrin	4	5	80%
FDEP	D-BHC	3	7	43%
FDEP	DDD-P,P'	5	8	62%
FDEP	DDE-P,P'	5	8	62%
FDEP	DDT,O,P	22	53	42%
FDEP	DDT,P,P	30	53	57%
FDEP	DDT-P,P'	5	8	62%
FDEP	Diazinon	2	5	40%
FDEP	Dicofol	4	5	80%
FDEP	Disulfoton	7	12	58%
FDEP	Diuron	4	4	100%
FDEP	Endosulfan Alpha	4	5	80%
FDEP	Endosulfan Beta	4	5	80%
FDEP	Endosulfan I	4	7	57%
FDEP	Endosulfan Sulfate	7	12	58%
FDEP	Endrin	8	26	31%
FDEP	Endrin Aldehyde	4	5	80%
FDEP	Heptachlor	4	12	33%

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Table 6-1. Laboratory Data Potentially Used for CERP Project or CERP Permit Purposes for Which More Than Twenty-five Percent (25%) of the Data Collected during the Report Period Were Qualified, continued.

Laboratory	Parameter	Number of QC Qualifiers	Total Number of Data Points	Percent Data Qualified
FDEP	Heptachlor Epoxide	4	12	33%
FDEP	Imidacloprid	4	4	100%
FDEP	Linuron	4	4	100%
FDEP	Meth Mercury, Tot Ultratrace	9	9	100%
FDEP	Methoxychlor	7	12	58%
FDEP	Mirex	8	12	67%
FDEP	Naled	3	5	60%
FDEP	PCB-1016	4	5	80%
FDEP	PCB-1221	4	5	80%
FDEP	PCB-1232	4	5	80%
FDEP	PCB-1242	4	5	80%
FDEP	PCB-1248	4	5	80%
FDEP	PCB-1254	4	5	80%
FDEP	PCB-1260	5	5	100%
FDEP	Permethrin	4	5	80%
FDEP	Phorate	7	12	58%
FDEP	Simazine	9	29	31%
FDEP	Trifluralin	4	5	80%
USBS	Gross Alpha	4	10	40%

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Table 6-2. Laboratory Data from Secondary Sources That May Be of Potential Use for RECOVER for Which More Than Twenty-five Percent (25%) of the Data Collected during the Report Period Were Qualified.

Laboratory	Parameter	Number of QC Qualifiers	Total Number of Data Points	Percent Data Qualified
FIU	Ammonia-N	2140	2140	100%
FIU	Carbon, Total Organic	2121	2121	100%
FIU	Chlorophyll-A	1358	2138	64%
FIU	Nitrate+Nitrite-N	2148	2148	100%
FIU	Nitrite-N	2147	2147	100%
FIU	Phosphate, Ortho As P	2066	2148	96%
FIU	Phosphate, Total As P	2140	2140	100%
FIU	Silica	145	258	56%
FIU	TN	1093	2138	51%
Lee County	Biochemical Oxygen Demand 5 Day	99	157	63%
LRD	Chl A	86	86	100%
LRD	NH ₃	32	67	48%
LRD	NO ₂ +NO ₃	29	93	31%
LRD	TKN	44	99	44%
LRD	TP	53	102	52%
SFWMD	Alkaline Phosphatase	10	28	36%

7.0 ALTERNATIVE PROCEDURES APPROVED

This section identifies any alternative procedures approved during the previous year. According to CGM 41.00, 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).⁷ 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 1, 2007 and April 30, 2008, no applications for approval of alternative procedures were submitted to the QAOT. However, based on one of the laboratory audits and the RECOVER QA/QC questionnaire it appears that the requirement to submit an alternative procedure for PDT and QAOT review and approval has not been communicated clearly to organizations generating data for CERP. As part of on-going outreach activities the QAOT will strive to communicate the requirements to RECOVER PIs, CERP project managers, and laboratories analyzing samples for CERP-related projects.

⁷The 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)

8.0 SUMMARY OF DEVIATIONS FROM QASR AND CORRECTIVE ACTIONS

This section summarizes any deviations from the QASR or CMGs during the reporting period, and any corrective action taken to address the immediate deviation and to avoid re-occurrence of the deviation. 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 4.0, 5.0 and 6.0.

9.0 SUMMARY OF QAOT ACTIVITIES FOR REPORT YEAR 2008

9.1 On-going QAOT Activities

Routine responsibilities performed by the QAOT for the report period are detailed throughout this report. These included:

- Reviewed one monitoring plan and one SOW.
- Posted revised QASR for public comment, assigned Chapter coordinators/experts for addressing comments.
- Conducted technical reviews of all QASR chapters and posted the revised drafts with peer review comments on www.evergladesplan.org.
- Administered PE sample studies. Four laboratories participated in organic PE samples. Sixteen laboratories participated in a Summer 2007 inorganic PE study and 19 laboratories participated in a Winter 2008 PE Study.
- Conducted six field audits and nine laboratory audits.
- Completed the 2007 QAR, incorporating review comments from RECOVER AT Chairs and Information and Data Management Teams. The QAR was approved by Design Coordination Team (DCT).
- Revised and finalized CGM 40.01 *Project-level Water Quality and Hydrometeorologic Monitoring and Assessment*. The CGM was approved (June 6, 2008) and posted on www.evergladesplan.org.

9.2 QAOT Initiatives in 2008

- Developed, distributed, retrieved, and tabulated the results of ecological/biological and remote sensing QA/QC questionnaires.
- Conducted four biological/ecological field visits to observe fish tissue collection for Hg analysis, SAV monitoring, and crocodile monitoring.
- Developed a SOW for hydrological field audits.
- Initiated assessment of RECOVER data through retrieval of water quality data.
- Identified and assigned new QAOT QA Officers.
- Prepared SOPs for QAOT document preparation and control, preparation of the QAR, QA Officer responsibilities, and review of monitoring plans.

9.3 QAOT Outreach in 2008

The QAOT sponsored the 2008 *CERP Water Quality and Chemistry Monitoring Quality Assurance Workshop* on April 16-17, 2008. The workshop was held at the SFWMD facilities in West Palm Beach, FL. The purpose of the workshop was to

1. Communicate requirements, guidance, and expectations related to water quality and chemistry monitoring in support of CERP projects

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2. Provide additional tools and information on quality principles, protocols, and implementation of quality systems
3. Facilitate sharing and disseminating information, innovation, and resolutions to common procedural issues.

The workshop agenda is presented on the QAOT Website.

Over 200 people participated in the workshop sessions. The general consensus of the QAOT was that the workshop was a great success and that all three workshop objectives were achieved. The workshop provided an opportunity to reach out to PIs and project managers. Many critical QA/QC issues related to CERP and the concerns of the QAOT were communicated over the two-day event. In addition, the workshop provided a venue for cross-functional QA/QC networking and constructive feedback for future approaches for CERP water quality monitoring. The work shop presentations are provided at http://www.evergladesplan.org/pm/qaot_workshop_2008.aspx.

Additional presentations and outreach during the report period included:

- Presented the final 2007 QAR to the DCT on June 24, 2008.
- Prepared the 2008 Annual QAR (this document).
- Presented periodic status reports to the DCT and AT.
- Continuously updated the QAOT websites
- Established new communication channels between QAOT co-chairs and RECOVER directors.
- Continued communication efforts with DCT and PDTs.

10.0 RECOMMENDATIONS FOR QA/QC PROGRAM IMPROVEMENTS

This section summarizes action items needed to improve CERP QA/QC processes and procedures. 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, comparable, and legally defensible. The 2007 QAR identified eight QAOT activities that could result in improved data quality. These recommendations and the QAOT initiatives to implement improvements are summarized in Table 10.1. During the report period, 14 specific recommendations for improvement were identified: five from the QAOT, two from the Chapter 9 remote sensing QA/QC questionnaire results, five from the RECOVER QA/QC Questionnaire results; and two from the biological/ecological field visits. These recommendations are summarized in Table 10.2 with proposed QAOT improvement activities.

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Table 10-1. Status of QAOT Initiatives to Improve CERP Data Quality

Improvement Area	QAOT Initiatives
<p>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.</p>	<p>The current report includes water quality data for CERP projects and CERP permits, as well as RECOVER data from several collection organizations and DBHYDRO.</p>
<p>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 that generate chemistry data for CERP.</p>	<p>The QAOT communicated the ADaPT requirement to project managers and PIs during the report period as part of monitoring plan and SOW reviews, during the QA Workshop, and by establishing use of ADaPT in new SOWs.</p>
<p>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.</p> <ul style="list-style-type: none"> • Outreach to RECOVER monitoring PIs to address needs identified by the QA/QC questionnaire. • 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. 	<ul style="list-style-type: none"> • A RECOVER liaison has joined the QAOT to participate in and contribute a CERP system perspective to QAOT meetings and documents. • The biological/ecological QA/QC questionnaire (developed during the 2007 report year) was distributed to RECOVER PIs to collect information on current QA/QC practices for RECOVER. The results of the questionnaire were tabulated and are presented in this report. • A remote sensing QA/QC questionnaire was distributed to project managers to assess compliance with QASR Chapter 9. • A two-day workshop 2008 CERP Water Quality and Chemistry Monitoring Quality Assurance Workshop was held on April 16-17, 2008. • A questionnaire based on QASR Chapter 6 was developed to assess Hydrodynamic and Hydrologic procedures. The questionnaire and field audits will be implemented during 2009. • Field observations of three RECOVER monitoring projects were conducted to assess current QA/QC procedures for biological monitoring. • The QAOT realized the necessary to improve communication between the QAOT and PDTs and initiated efforts to improve communication.

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Table 10–1. Status of QAOT Initiatives to Improve CERP Data Quality, continued

Improvement Area	QAOT Initiatives
<p>4. Focused laboratory and field audits</p> <ul style="list-style-type: none"> • 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. • Designate personnel to perform QA functions for all field data collection activities and train those personnel in QA procedures. 	<ul style="list-style-type: none"> • Six field audits and nine laboratory audits for water and sediment collection procedures were conducted. • Four field visits to observe biological/ecological monitoring practices were conducted. • Two PIs who are conducting remote sensing projects were interviewed to assess compliance with the QASR. • Audits of hydrodynamic and hydrologic procedures are planned for 2009. • QA Officers were designated for specific monitoring disciplines. Development of a SOP that described QA Officer responsibilities continued. The following QA Officers worked on behalf of the QAOT during the report period: Biological/Ecological- Tim Lewis, Corps-ERDC Water Quality - Becky Terry, Corps Hydraulics and Hydrology - Taiye Sangoyomi, SFWMD Remote Sensing - Les Vilchek, USGS Chemistry - Chris King, SFWMD
<p>5. Improve monitoring plan review process</p> <p>Review of monitoring plans is a defined QAOT responsibility. The review process is defined in draft CGM 40.01 and should be communicated to project managers and PIs. The preparation of monitoring plans should be clarified in the QASR and the review process better defined.</p>	<p>A SOP describing monitoring plan reviews by the QAOT was initiated during the report period. The process for receiving monitoring plans for review is described in CGM 40.01 and the SOP but is not fully implemented by those who develop the documents.</p>
<p>6. Management of QASR Revisions</p> <p>The last posted version of the QASR is June 2006. The QASR should be revised and published in 2008.</p>	<p>The revised QASR was posted on the QAOT web page on October 12, 2007. A preliminary version of Chapter 8 was posted but is undergoing extensive review by RECOVER. Chapters 6 and 9 are scheduled for revision in 2009.</p>
<p>7. Review of alternative procedures</p> <p>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.</p>	<p>The need to submit alternative procedures to the QAOT for review was communicated during the April 2008 workshop. The QA/QC questionnaire distributed to RECOVER PIs communicated the requirement and generated discussion about what constitutes an alternative procedure and whether all alternative procedures must comply with the requirement. The QAOT will discuss and clarify this QASR requirement in 2009.</p>

Table 10–1. Status of QAOT Initiatives to Improve CERP Data Quality, continued

Improvement Area	QAOT Initiatives
<p>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.</p>	<p>The QAOT website was reviewed and updated with current documents and helpful links.</p>

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Table 10-2. New Areas of Improvement Identified during the Report Period

Improvement Area	Proposed QAOT Activities
<p style="text-align: center;"><u>QAOT Activities</u></p> <ol style="list-style-type: none"> 1. Several laboratories performing analyses for CERP (e.g., the SFWMD laboratory), have not yet been audited by the QAOT. A review of laboratories contributing data to CERP and focused audits of these laboratories should be conducted. 2. The QAOT should develop metrics that measure whether or not the QAOT has been effective in improving the data generated for CERP. 3. Field and laboratory audits of all aspects of CERP data should be conducted by qualified QA Officers. 4. QASR Chapter 6 (Hydraulics and Hydrology) requires major revisions. During this process the use of the term “ground truthing” should be reviewed and clarified. 5. The QAOT and AT chairs should determine when NELAC certification, required by QASR, is appropriate and applicable for RECOVER laboratory analysis. 	<ol style="list-style-type: none"> 1. The QAOT will continue to identify and audit laboratories that are generating data for CERP-related projects. 2. The QAOT will develop metrics for the following areas during the next report period: <ul style="list-style-type: none"> - Monitoring plan reviews - Field audits - Laboratory audits - Data quality for key parameters (TP, TN, etc) 3. QA Officers will audit key projects and monitoring areas to identify issues that directly impact data quality and problems that impact information, defensibility, etc. 4. QASR Chapter 6 will be reviewed and revised. 5. The QASR requirement that all laboratories generating data for CERP must be NELAC certified will be reviewed and clarified, if necessary.
<p style="text-align: center;"><u>Remote Sensing Initiatives</u></p> <ol style="list-style-type: none"> 6. The Remote Sensing QA/QC questionnaire should be reviewed for clarity, condensed, and incorporated into the QASR as a checklist for project planning and SOW development. 7. The QAOT should obtain and review the remote sensing SOW to ensure that the essential QASR QA/QC elements are included. 	<ol style="list-style-type: none"> 6. The questionnaire will be reviewed, revised, and incorporated into the next version of QASR Chapter 9. 7. The QAOT will review a sampling of recent remote sensing SOWs.

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Table 10–2. New Areas of Improvement Identified during the Report Period, continued

IMPROVEMENT AREA	PROPOSED QAOT ACTIVITIES
<p><u>RECOVER-Related Initiatives</u></p> <p>8. The QAOT and AT members should develop a comprehensive MAP QA/QC plan. The SOW requires development of a QA/QC plan but inclusion of references and links to the QASR, and the MAP QA/QC plan template will assist PIs in completing the documents.</p> <p>9. Topic-specific training modules/workshops of 30-45 minutes in length targeting one specific QA/QC “problem” area for the MAP PIs could occur in conjunction with MAP module meetings.</p> <p>10. The review of the QA/QC Biological/Ecological Questionnaires did not include reviews of training procedures, methods for dealing with questionable data, or SOPs/methods. These areas should be reviewed for adequacy.</p> <p>11. The questionnaire reviewers noted confusion over QA/QC vocabulary used by the QAOT, AT, and PIs.</p> <p>12. The MAP PIs were not familiar with the location of the QASR, which chapters applied to them, whether alternative methods still had to be approved by the AT and QAOT, and exactly what that process entailed.</p>	<p>8. The QAOT and AT members will develop and distribute to PIs a comprehensive MAP QA/QC plan.</p> <p>9. The QAOT will develop a series of short, specific workshops that can be coordinated with MAP module meetings. Topics might include application of the QASR to MAP PIs, the status, scope, and application of Chapter 8, the MAP QA/QC plan template, effective training programs and checks for consistent implementation of SOPs, integration of QA/QC into monitoring procedures, data verification and validation, and the need for NELAC certification where necessary and appropriate/applicable.</p> <p>10. The QAOT Sub-team will review the results of the QA/QC Biological Ecological Questionnaires to assess the adequacy of current practices and the need for additional QA/QC activities. In some cases, the areas could be included in future field visits. In addition, discussion of what constitutes a good SOP or how to provide effective training could be the subject of a short workshop session.</p> <p>11. The QAOT will develop a glossary of common QA/QC terminology, based on the NELAC glossary, and determine whether the QASR should contain a separate glossary or whether QA/QC terminology should be incorporated into CGM 13.03 <i>Acronyms and Glossary of Terms</i>.</p> <p>12. The QAOT will continue outreach to the PIs through the RECOVER AT module leads to communicate the QASR location, requirements, and application.</p>

Table 10–2. New Areas of Improvement Identified during the Report Period, continued

Improvement Area	Proposed QAOT Activities
<p><u>Biological/ecological Field Initiatives</u></p> <p>13. Not all essential elements of project documentation or data management defined by the QASR are being performed because PIs have determined that these procedures were not applicable to the current project.</p> <p>14. Field teams or organizations performing similar monitoring procedures should compare individual SOPs, and where appropriate create one unified SOP for monitoring so that a particular monitoring technique will be applied uniformly.</p>	<p>13. The QAOT should review the documentation elements identified in the QASR as essential data management components, and review/revise the guidance, as appropriate.</p> <p>14. Resolution of this issue is primarily the responsibility of the module leads and PIs. The QAOT recognizes that geographic restraints imposed by terrain and species-specific behaviors may counterindicate standardization of procedures in many cases. The QAOT further supports the identification and utilization of the most cost-effective and scientifically-efficient procedures as conditions may demand, with the caveat that these procedures are adequately documented, formally approved, and incorporated into the QASR.</p>

11.0 RESOURCE NEEDS

11.1 Management Support from CERP and Participating Agencies

The QAOT was able to achieve several breakthrough accomplishments during the report period, in part, because of the direction and support of CERP and RECOVER management, as well as the support and cooperation of all participating agencies:

- FDEP
- SFWMD
- USACE
- US Environmental Protection Agency (USEPA)
- USFWS
- USGS

Continuous support from the CERP management and participant agencies is the key for the continued success of the QAOT. In 2009, the term of several QAOT standing members will expire and new members will be appointed. These include FDEP, USEPA, and USFWS. In addition, QA officers will be assigned, as needed.

The QAOT cannot function effectively without management support. Thus, management support for outreach of QAOT with PDTs, project managers, and module leads is needed.

11.2 Cooperation from PDT, RECOVER Leadership Group, AT, and EMCT

Under the leadership of CERP/RECOVER and the direction provided during DCT meetings, the QAOT recognizes the continued need to improve communication between QAOT and the PDTs for implementing the QASR into CERP monitoring activities. Cooperation from the PDTs, RECOVER Leadership Group, AT, and the Environmental Monitoring Coordination Team (EMCT) are essential to achieving this goal. CGM 41.00 and the QAOT PMP specify that the QAOT will review all the monitoring plans and strive to implement effective outreach mechanisms to communicate CERP QA/QC policies and procedures to the scientific community that is performing CERP activities. The QAOT needs the support and backing of the CERP leadership to improve outreach through mechanisms such as workshops.

11.3 Financial Support for QA/QC Activities

Programmatic data quality can only be achieved by systematically incorporating QA/QC into every aspect of data collection. The QAOT is committed to fulfilling its mission to ensure that the data collected for CERP are of known and documented quality and to provide QA guidance at the program level to ensure data quality. The QAOT oversees implementation of the CERP QA/QC program by providing QA/QC guidance, training, assessments, and reviews. The two primary partners in CERP (SFWMD and USACE) provide staff and budget for the minimum level of support required for these activities. However, the QAOT is also dependent upon each of the other agencies maintaining a QA/QC program of their own. These QA/QC programs should be supported by their management through the provision of adequate resources (personnel and financial) and by acting to address QA/QC issues when they are identified. This requires planning and inclusion in the contracts. It is incumbent on any monitoring activity to ensure that QA/QC is incorporated in the program design.

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Based on CGM 41.00 and the QAOT PMP, the QAOT will continue to hold monthly meetings, will start to conduct field audits for water quality, hydrology, biological and ecological activities, and will evaluate the quality of data generated for pre- and post-construction CERP and RECOVER projects.

12.0 REFERENCES

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