Memorandum

17 October 2005

To: TOC members

From: Matt Harwell, A.R.M. Loxahatchee National Wildlife Refuge

Subject: Refuge response to State's reports on May and June 2005 EVPA sampling events

This memo is a response to the 8 September (SFWMD) and 12 August (FDEP) 2005 reports on the May and June 2005 EVPA sampling events. In summary, I am disappointed that these reports were issued without prior discussion with us, and I disagree with many of the technical findings. More significantly, I am concerned about inaccurate and/or incomplete portrayals of Refuge sampling staff statements made during the SFWMD audit. These inaccuracies could have been resolved if the SFWMD interviewers had checked back with Refuge staff to confirm their understanding of Refuge staff statements before report publication. Attached to this memo is a compilation of detailed comments on the reports that could be used as a basis for further discussions.

I do appreciate the time spent by SFWMD and DEP technical staff meeting with DOI staff on 10 August 2005 in an attempt to resolve some of these disagreements. Some progress was made, although a substantial level of technical disagreement remains.

The TOC-appointed working group to focus on better communication among agency sampling teams is a positive approach to improving sampling. Specifically, a series of workshops were identified to address sample collection, sample processing, and SOP revisions. The first such workshop (held on 26 September 2005) focused solely on sample collection. At this first workshop, SFWMD, FDEP, ENP, and Refuge staff discussed sample collection training, as well as initiated discussion on needed improvements to the SOP (monitoring plan) for the EVPA project. I look forward to this and other activities in the future to continue collaborative efforts to improving our understanding of water quality in the Refuge.

Technical Review Summary

"Assessment of the Quality of May-June 2005 TP Data and the Monitoring Process for EVPA (LOX) Project"
prepared by D. Ivanoff; draft 8 Sept. 2005

AND

"Technical Support Document in Support of Data Quality Screening of Water Quality Data Collected During the May and June 2005 Monitoring Events for the EVPA (LOX) Project"
prepared by FDEP; draft 12 Aug. 2005

Refuge Technical Comments
17 October 2005

This is a technical review of the 17-page SFWMD document and the 3-page FDEP document posted on the TOC web site. Below is a summary of overall findings/conclusions. Appendix A provides a list of specific comments; Appendix B is a report prepared by D. Surratt in June 2005 describing the transfer of project responsibilities for the EVPA and LOXA projects in spring 2005.

General Comments

- Despite some concerns noted below, the July audit by the SFWMD and resulting discussions within the TOC-appointed sampling working group have lead to a number of good suggestions on improvements to the sampling protocols and methods. These good suggestions may lead to improvements to the Refuge sampling SOP (monitoring plan), and have led to the agreement to staff future EVPA sampling events with one Refuge person and one SFWMD person.

- There was some confusion generated by changing descriptions of the interview process by the state. Several terms were used by SFWMD staff to describe the July 2005 interviews, including "observation", "training", and "unofficial audit". On several occasions when the Deputy Refuge Manager was contacted about having discussions between SFWMD and Refuge sampling staff, it was explicitly stated by SFWMD staff that it wasn't an audit. It wasn't until after-the-fact, on August 10^{th,} that Refuge received clarification that the interviews already completed were an official audit.
    - The SFWMD interviews of the 11 July 2005 sample processing component of the EVPA sampling was characterized by Refuge staff as being disorganized and stressful with staff being asked the same questions by multiple SFWMD staff.

- Refuge staff perceived that while some SFWMD staff viewed the interaction as a positive effort to improve sampling (similar to previous audits), other SFWMD staff viewed the interaction as an investigation.
- The early miscommunication and the different approaches by SFWMD staff created an unnecessarily negative environment for all involved and may have led to an incorrect perception that Refuge technical staff do not interact positively with the SFWMD.

- The DEP report is based on the draft report of the SFWMD, on which we had no opportunity to comment, and other limited information. Therefore, the DEP report suffers from the same technical problems as its underlying SFWMD report.

- We agree with the DEP recommendations to focus on further refinement of the sampling protocols as appropriate. The Marsh Sampling Workshop, held on 26 September 2005, highlighted multiple areas of the sampling protocols that will require additional discussion for sampling protocol refinement.

- Refuge staff disagreed with SFWMD staff about several sampling issues, or observed disagreement among SFWMD staff. Most importantly are differences in opinion (e.g., among SFWMD staff; between SFWMD staff and FDEP staff) on what constitutes sampling of a representative area.

- The reports could have been more objective if SFWMD interviewers had confirmed understanding of interview results with Refuge staff that were interviewed prior to publishing the report.
  - SFWMD's reporting of conversations with Refuge staff was not always accurate, and included some misinterpretations with respect to May and June 2005 sampling. The third draft of the SFWMD report reflected changes to correct the majority of these instances, pointing out the value of prior discussions.
  - Suggestions for future audits include minimizing confusion up front, providing written questions and answers, and taking effort to ensure that all parties agree to what was said in an interview.

- The report reached too far by implying that observations made in July were applicable uniformly to sampling in May and June. In addition, it was implied that concerns regarding the May 2005 sampling event equally applied to the June 2005 sampling event.

- In these contentious times, it is helpful to avoid inflammatory language and statements to the greatest degree possible. Focus on strictly technical information and less reliance on circumstantial information will yield great benefits.

Appendix A: Specific Comments on:

"Assessment of the Quality of May-June 2005 TP Data and the Monitoring Process for EVPA (LOX) Project"
prepared by D. Ivanoff; draft 8 Sept. 2005

AND

"Technical Support Document in Support of Data Quality Screening of Water Quality Data Collected During the May and June 2005 Monitoring Events for the EVPA (LOX) Project"
prepared by FDEP; draft 12 Aug. 2005

SFWMD Report

Section 3.0 (Overview of Field Collection Procedure):

1) The first sentence, containing the phrase "representative samples" is a key point for the EVPA program. The marsh sampling protocol authored by Nearhoof (1995) stresses the need to collect a sample representative of all of the marsh in the vicinity of the sampling point. During the July 2005 EVPA sampling effort, R. Smith (Refuge) observed that when N. Ralph (SFWMD) was collecting samples, he sought an open and clear water area, which did not necessarily represent the marsh around the collection site. Seeking open and clear water areas could have resulted in lower-than-expected July values, especially given the amount of bypass and loading to the Refuge in the recent past.

Section 6.1 (Contract Compliance):

1) Sample Procedure (General): There appeared to be differences in opinion among SFMWD staff on sample collection. While there were minor differences on some issues (e.g., when and how much you rinse as part of water processing), there were several potentially significant differences. These differences highlight shortcomings of word-of-mouth communications and reinforce the importance on clarification of written sampling protocol language. For example: (1) R. Smith noted that there was a discrepancy between K. Larson and N. Ralph over what is a representative sample area (K. Larson's view is correct in that the idea is to identify a representative area, but N. Ralph was the SFWMD staff person conducting the first field audit day). (2) R. Smith noted that SFWMD lab staff would decide whether or not a sample collected with a lot of floc/suspended solids or from the helicopter float would be processed further. However, he also noted that, "there was some indecision as to the protocol among the SFWMD staff as to when to throw out the sample once collected (based on its appearance)." These issues warrant further discussion in the TOC-appointed working group and written clarification in revisions to SOPs.

2) Sample Procedure and QA/QC, Findings #1: "*There was no indication that Refuge personnel deliberately failed to follow any of the FSQM provisions.*" This statement is inflammatory. Refuge staff are professionals, and there should be no implication that a deliberate failure is even a possibility. Refuge staff has followed the FSQM from the inception of sampling, and on 1 April 2005, formally adopted the SFWMD's FSQM for both water quality monitoring programs as well as provided information on additional training requirements for field staff, including a 4-page training checklist for all aspects of both water quality monitoring programs. It wasn't until 2 days after D. Ivanoff's 13 July 2005 draft report was generated (although we didn't receive it that day), that D. Ivanoff informed us of SFWMD's final determination that the Refuge needed its own Quality Manual.

3) Sample Procedure and QA/QC, Findings #3: "*No documentation to indicate that this is being done.*" This statement is inflammatory, as it suggests that Refuge field staff have not read the FSQM. In fact, they specifically responded to interview questions that they had read the FSQM. In addition, this statement raises the question as to whether or not documentation is required to indicate that field staff is reading the FSQM.

4) Sample Procedure and QA/QC, Findings #4, 1st para: "*Field notes only indicated the use of 2L containers.*" This sentence needs to be clarified as applicable only for LOX7, as the rest of the text discusses other stations.

   More importantly, what is missing from this text is that the sampling protocols in existence at the time of the May 2005 EVPA sampling state that the initial determination of depth occurs from the helicopter and that the final depth for sample collection is determined after samples are collected. The tone of this portion of the QA report suggests that problems existed with sampling personnel; however, D. Surratt followed his training and the sampling protocols at LOX7. This fact is absent and detracts from the report's objectivity.

5) Sample Procedure and QA/QC, Findings #4, 1st para: "*Using such large containers in shallow causes disturbance of the floc layer.*" While this is a true statement in general, it did not capture D. Surratt's discussion with D. Ivanoff. From his recollection, "Further, it should be noted that I told D. Ivanoff that the site was filled with floc everywhere I could see and the sampling container size had nothing to do with the presence of floc during the sampling."

6) Sample Procedure and QA/QC, Findings #4, 2nd para: "*Both these scenarios could have occurred during the May or June sampling events.*" This is a speculative statement, and there is no information either way on this subject for the May and June 2005 EVPA sampling events.

7) Sample Procedure and QA/QC, Findings #4, 2nd para: "*Mr. Smith indicated that he didn't know or realize the impact of … the use of big containers in shallow*

depths, until this 7/11 trip." This statement implies that R. Smith didn't know the procedure determining bottle choices, while R. Smith's comments were about understanding the implications of bottle selection. These are two different things. There is no indication in this report that R. Smith did anything wrong regarding sampling containers for May or June 2005.

8) Sample Procedure and QA/QC, Findings #4, 3rd para: *"On more than one occasion, she experienced difficulty in wading that required the pilot to ease up the helicopter to get to her."* S. Rinker isn't the only person to encounter challenges in working in Everglades marshes. In July, Refuge staff noted that N. Ralph (SFWMD) stretched forward to retrieve samples. The type of language in the SFWMD report seems pointed at discrediting S. Rinker and is not conducive to working through the issues in a collaborative manner.

9) Sample Procedure and QA/QC, Findings #4, 4th para: "*SFWMD clarified that sampling depth must be entered immediately after collection and before leaving each site.*" Refuge staff followed their training. The December 2004 EVPA sample collection followed the same procedure of dividing the total depth by 2 and entering that on the header sheet. The December 2004 EVPA sample collection was audited by SFWMD staff, and this procedure was not identified at that time to be of concern.

10) Sample Procedure and QA/QC, Findings #5, 3rd para: "*There were preservation errors observed during the 7/11 sampling. This could have been caused by distractions, since training, interviews, and processing were occurring at the same time.*" The notes in this section are incomplete, and highlight a potentially significant problem created by SFWMD staff during this audit. The stressful atmosphere created by this audit was such that sample preservation errors were made by SFMWD staff involved in training sampling crews. It was fortunate that the errors were not made on TP samples.

11) Sample Procedure and QA/QC, Findings #5, 3rd para: S. Rinker and R. Smith also made similar comments about the "disorganized and mildly stressful" environment created by the number of people in the lab and the myriad of questions that were asked during this audit. It is our understanding that previous lab audits by SFWMD were conducted in a way that did not create a chaotic environment caused by the involvement of a large number of SFWMD staff, a myriad of questions all at once, with the significant potential for concentration to be diminished.

12) Sample Procedure and QA/QC, Findings #5: See comment below on Section 6.1 Skills and Training, Findings #2.

13) Skills and Training, Findings #1: "*There was no available documentation to indicate that there was adequate training provided*." indicates that the SFMWD treated this as an audit, although Refuge staff was informed that it was it was not

an audit. Appendix B, prepared by D. Surratt in June 2005 documents the training and transfer of responsibilities for the EVPA and LOXA water quality programs.

14) Skills and Training, Findings #2: "*K. Larson indicated that SFWMD field staff were instructed that they are no longer to train contractors*." In the absence of SFWMD training, Refuge staff took the initiative and has provided extensive training to new members of the sampling crew (see Appendix B).

Section 6.2 (Compliance to Chapter 62-160, F.A.C. and DEP SOP FA3300 (DEP 01/001, 2004):

1) "*Although there is no direct connection between the lack of* [a FSQM] *and the quality of the sampling process and data collected…*" This is another inflammatory comment. Is the implication that there was an indirect connection? If so, supporting information should have been provided.

Section 6.3 (Adherence to SFWMD Field Sampling Quality Manual and EVPA SOP):

1) "*There was no indication that any of the sampling personnel were deliberately not following any of the SOP or FSQM provisions.*" Again, Refuge staff are professionals, and there should be no implication that a deliberate failure is even a possibility. Refuge staff has followed the FSQM since the beginning, and on 1 April 2005, formally adopted the SFWMD's FSQM for both water quality monitoring programs as well as provided information on additional training requirements for field staff, including a 4-page training checklist for all aspects of both water quality monitoring programs. It wasn't until 2 days after D. Ivanoff's 13 July 2005 draft report was generated (although we didn't receive it that day), that D. Ivanoff informed us of SFWMD's final determination that the Refuge needed its own Quality Manual.

Section 6.4 (General Quality Practices):

1) First paragraph: "*Some of these conditions were observed by N. Ralph (SFWMD) when he joined the 7/11/05 sampling trip.*" This statement is nebulous. What were "some of these"? Where observed? It would be helpful to have any specific details that were used to support this statement. More importantly, there is no indication of any connection, one way or the other, between observations made by N. Ralph in July 2005 and the May and June 2005 EVPA sample collections.

2) Second paragraph: A very important point missing from this discussion is that Refuge staff employed good judgment, and followed approved protocols, when determining whether remaining on the helicopter float would create less sediment disturbance than wading to obtain a sample. The staff noted a very clear water column from the helicopter float, showing that no disturbance was present. Field notes from sites sampled from helicopter floats support this decision in that they indicated low suspended solids.

Section 6.5 (Data Verification, Validation and Assessment):

1) Increasing the number of people involved in receiving OLECAS reports is a good suggestion.

   It is our understanding that for the LOXA sampling program, Refuge staff are sent the data from the current month's sample collection to examine whether there are any potential issues with the data that need to be re-examined before the 28-day sample holding time expires. This process has occurred successfully in the past, although it is unclear whether this procedure is automated enough to ensure that this timely distribution of data occurs monthly. Perhaps Refuge staff can be in the distribution of the OLECAS reports to help aid in the effort to understand if there are future samples that may be of concern.

2) First paragraph, last sentence: "*In the case of May and June 2005 EVPA data, no one took any action to further investigate or communicate the anomalous results.*" We assume that this occurred because of the last sentence of Section 5.3 (Data Validation), "*In the case of EVPA May and June sampling, data met the routine criteria.*"

Section 6.6 (Quality of May and June 2005 Data):

1) First paragraph: "*The objective of water sampling for this project is to obtain representative samples. The facts indicate that the samples collected were not representative.*" The first statement is true, but there is no factual basis for the second statement and other explanations are possible. As mentioned previously, it is possible that high TSS water was representative of all or portions of the Refuge during May and June 2005. The Refuge sampling crew reported high suspended sediment levels based on visual observation at some stations in May and June. In addition, we are concerned that during the July 2005 sampling, SFWMD staff may have biased the sampling process by searching for clear water when water with suspended sediments was more representative of specific sites.

2) First paragraph: "*Whether the high level of TSS was due to sampler error, helicopter impact, or other factors is not certain at this time. The samplers assigned on these two events were inexperienced….*" The first version of this sentence read, "*… or wind event or other factors is not known*". The changed language suggests a shift toward blaming high TP values on the sampling crew – a shift that is not supported by facts. "*… is not known*" correctly reflects the fact that we do not have the ability to *a posteriori* recreate knowledge of specific conditions.

   The second statement is prejudicial and incorrect. The Refuge sampling staff received extensive training, as outlined in Appendix B. In this appendix, D. Surratt documents the transfer of responsibilities for the EVPA and LOXA water quality programs between successive sampling personnel. See also comment #3 in the section on Interviews with Refuge Sampling Personnel below illustrating

the number of new Refuge staff collecting samples from January to July 2005 for which there were no exceedances from January to April.

3) Section 6.6 a. General: This section is an exercise to look backwards to flag historical data, and is well beyond the scope of these reports.

   It is our conclusion that unusually high values should only be rejected from consent decree data sets when there is clear and specific evidence of error. There should be no "upper control limit" for data used in the consent decree calculations. Because the compliance levels in the consent decree are based on occurrence of events that are expected to be rare under the assumption of no degradation, no automatic rejection of high values should be applied. The consent decree did provide that a geometric mean be used. The geometric mean is relatively insensitive to higher values and very sensitive to lower values in the set of observations. Thus, there is already a mechanism within the consent decree to reduce sensitivity to abnormally high observations.

   If an upper control limit approach were applied, D. Ivanoff's calculations are incorrect. The designation of an upper control limit 3 standard deviations (SDs) above the mean is based on an assumption of normality, that is, that the data are symmetrically distributed in a "bell-shaped" curve. This is seldom true for environmental data and is not the case here. Under the assumption of normality, an upper control limit 3 SDs above the mean is exceeded only 0.135% of the time. This is a rejection rate of 1 sample out of 741. As indicated by D. Ivanoff, 18 of 279 samples would exceed her proposed limit of 15.5 mg/L TSS; this rejects 6.5% of all observations. Thus, D. Ivanoff proposes a rejection rate of over 1 out of each 16 samples. At the 0.135% upper control level it would be likely that no observations were rejected from a set of 279 (expected value = 0.4 samples rejected). The error in D. Ivanoff's approach was discussed at our meeting on August 10, 2005. At that meeting it was suggested that the error could be corrected by either finding a transform that changes the data to exhibit an approximately normal distribution. A log transformation is often successful with environmental data. Alternatively, a non-parametric approach could be applied.

4) Section 6.6 a. Second paragraph: The month-to-month consistency in TSS values for 3 stations discussed in this paragraph is evidence against random sampler-introduced error.

5) Section 6.6 a. Last paragraph: "*Based on observed sampling problems, the potential mixing of porewater with surface water and its influence on the level of analytes cannot be ruled out as well.*" This is a speculative statement that has no factual basis. There is no indication of any connection, one way or the other, between the "observed sampling problems" of some unknown origin and the May and June 2005 sampling events.

6) Section 6.6 b.: The status of the May 16 LOXA value for the FCEB remains unclear. D. Struve hypothesized that this sample may have been a replicate sample, as parameter values were very close to those observed in the previous sample (pers. comm. after the August 2005 TOC meeting).

Section 7.0 (Corrective Actions and Rationale):

1) Part b: "*DOC* (Demonstration of Capability) *will be certified by SFWMD upon evaluation of the field documentation and sample results from these two trips.*" Is the implication of this sentence that the July 2005 EVPA sample results have to be low in order for certification to occur? This section highlights the need to focus attention on clarifying protocols, including a discussion on representative samples. For example: (1) in July 2005. N. Ralph (SFWMD) intentionally searched for a clear water column to collect a sample when that wasn't representative of the area; (2) discussions with B. Arrington (former Refuge staff) indicate that he might not have taken that sample; (3) at the 10 August 2005 meeting on the draft SFWMD report, R. Frydenborg (FDEP) indicated that he would have taken a sample representative of the area even if the area as a whole was characterized by notable TSS levels; and (4) current Refuge sampling crew did take representative samples.

2) Part b, second paragraph: "*This* (sampling methodology) *workshop will address recent findings*." This focus is not part of the scope of the TOC-appointed workgroup. The workgroup will address sampling in general, not May and June 2005. The first workshop will address field sampling; the second is envisioned to address lab processing.

3) Part c: "*… TSS values can be a useful screening indicator of the quality of the water sample collected.*" Is the implication that all high TSS data will be flagged and discarded? What is the scientific justification for this statement?

4) Part d: As commented above, keeping Refuge staff in the loop on information distribution would add to the benefits of this recommendation. Also, as part of the SOP, it would be good to lay out the data dissemination mechanisms such that data are being looked at in real-time, rather than up to 7-8 weeks later as indicated by the last sentence in Section 6.5.

Table 1: Why are some items in bold text in this table? It appears as if there is an attempt to make specific emphases using bold text, without any corresponding discussion in the body of the report.

Interviews with Refuge Sampling Personnel (page 16 of 17):

1) General: One clear conclusion from this exercise is that there is a strong potential for incorrectly capturing comments made by those being audited. Future audits of this nature should consider a question-and-answer exchange in writing. This approach would have eliminated a notable portion of the stressful environment created by SFWMD during the July 2005 EVPA sample processing. This

approach also would provide a mechanism to ensure that responses to questions are correctly captured, which did not happen always during the preparation of these reports.

2) The table below indicates the number of EVPA and LOXA sample collections that each Refuge crew member participated in from January through July 2005. The numbers illustrate that the field crew is not always consistently the same two individuals, and that changing crew members does not always result in exceedances.

EVPA Jan-July 2005	LOXA Jan-July 2005
B. Arrington - 4	R. Smith - 4
R. Smith - 3	S. Rinker - 3
D. Surratt - 2	B. Arrington - 3
S. Rinker - 2	G. Martin - 3
A. Darby - 2	S. Teel - 2
SFWMD staff - 2	A. Darby - 2
	D. Surratt - 1
	SFWMD staff - 1

3) Donatto Surratt, 12 July 2005, "Did you observe resuspension of sediment during sample retrieval, and if you did, what did you do: *Field notes did not indicate the use of smaller bottles.*" The field data sheet blank forms were revised after the July 2005 EVPA collection to capture the bottle size information. Therefore, it is not appropriate to question the lack of specific field note information from a point in time where that information was not required to be recorded.

4) R. Smith, 11 July 2005, "Did you observe resuspension of sediment during sample retrieval, and if you did, what did you do: *Discard if not acceptable, and re-sample.*" The response R. Smith actually provided at that time was more detailed, "I noted to D. Ivanoff that I remember heavy suspended solids in some of the May samples, but I noted it in the notes." This comment gets at a critical aspect of representative sample collection – if the water contains suspended solids not introduced by the sampling process, then the sample should contain suspended solids.

Helicopter Pilot Interview (page 17 of 17): The post-report interview of a helicopter pilot who is not trained in water quality sampling does not seem appropriate for a field audit. The questions asked of the pilot also could be characterized as leading.

FDEP Report

Recommendations:

1) Many of the statements in the DEP report mirror those made in the SFWMD report, and are discussed above.

2) There is no technical information supporting the statement, "*Due to the strong probability that the invalid data resulted from improper sampling techniques utilized by inexperienced personnel concerning the validity of all the data collected in this matter.*" beyond that presented in the SFWMD report. As detailed above, the SFWMD report provides no conclusive information that sampling error is responsible for the values seen in May and June 2005.

3) DEP incorrectly identifies water levels as being low in May and June 2005, and uses this as part of their argument for sample collection error. Water levels in the Refuge in May and June 2005 were not low. Figure 2 of the SFMWD Settlement Agreement Report for April-June 2005 clearly shows this: (http://www.sfwmd.gov/org/ema/reports/settlement/sa_apr_jun2005.pdf).

4) An additional limitation of the DEP report is the presentation and interpretation of data in Figure 1, specifically as it encompasses data for only a short period of time (2003-2005). A similar curvilinear relationship exists for data over a longer period of record, with other data points at the end of the distribution. Therefore, DEP's presentation of a shorter period of record inappropriately attempts to highlight the May and June 2005 data.

   We conjecture that the reduced sediment-related P concentration at the May and June 2005 high TSS sites (TP/TSS) is indicative of older detrital material that has undergone significant remineralization. This conjecture is consistent with the hypothesis that high TSS was related to detrital floc rather than suspended living periphyton or plankton.

Appendix B:

EVPA AND LOXA
TRANSFER OF PROJECT RESPONSIBILITIES

Prepared by:
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A.R.M. Loxahatchee National Wildlife Refuge
June 2005

Purpose
This document highlights the procedures used for transferring sample collection and processing responsibilities resulting from recent (February 2005 – Present) personnel changes. C. Darby and B. Arrington were directly responsible for the sample collection/processing and conductivity sonde maintenance (calibration and data collection) for sites designated under the Consent Decree (EVPA) and the Refuge's Enhanced Water Quality Monitoring Project (LOXA). Beginning in February 2005, a systematic effort was initiated to train technical staff in EVPA and LOXA procedures. This document identifies the training the replacement team received during the period of February to May 2005.

EVPA and LOXA Training
B. Arrington was the primary person responsible for field sample collection for both the EVPA and LOXA projects until April 2005. During March and April 2005 B. Arrington trained the replacement team (Table 1) in multiple aspects of grab sample collection. As described below, training was separated into: (1) pre-field operations, (2) field operations, and (3) post-field operations.

Conductivity sonde maintenance training is described at the end of this report.

Table 1. Key Personnel and Responsibilities with respect to EVPA and LOXA Sample Collection and Conductivity Sonde Maintenance (as of June 2005).

Personal	**Responsibilities**
Donatto Surratt (Ecologist)	LOXA Project Manager – Ensure completion of (1) flight scheduling for both EVPA and LOXA, (2) site maintenance, inventory control, (3) conductivity sonde collection and maintenance, and (4) field sample collection and laboratory sample filtration and preservation (processing) for both EVPA and LOXA
Robert Smith (Biology Science Tech)	Perform: (1) Schedule flights for both EVPA and LOXA, (2) field sample collection and laboratory processing for both EVPA and LOXA, (3) conductivity sonde collection and maintenance for the LOXA project, and (4) site maintenance
Serena Rinker (Park Ranger)	Perform: field sample collection and laboratory processing for both EVPA and LOXA
Kevin Maier (Forest Tech/Firefighter)	Perform: (1) helicopter-based conductivity sonde collection for the LOXA project, (2) support EVPA and LOXA field sample collection and laboratory processing
Gayle Martin (Wildlife Biologist)	Trained by B. Arrington and District staff prior to the transfer of responsibilities. Duties include: supporting the EVPA and LOXA field sample collection and laboratory processing
Susan Teel (Biologist)	Trained by B. Arrington prior to the transfer of responsibilities. Duties include: supporting the EVPA and LOXA field sample collection and laboratory processing

Pre-field operations

Each individual on the replacement team was trained in each of the pre-field operations for 2-3 days.

Pre-field operations for grab sample collection consists of pre-field preparation of sampling equipment and sample bottle labeling, sample collection, and sample storage. Required sampling equipment is identified in Table 2.

Table 2. Check list for EVPA and LOXA grab sample projects.

CHECK LIST ITEMS	CHECK
Wading Boots	
Flight Suit	
Helmet	
Ear Plugs	
EVPA field notebook	
Sharpies (ultra fine tip)	
Example of past header sheets	
Project head sheets	
Pilot flight book	
Multi-probe Minisonde	
Minisonde cable	
Surveyor	
2 liter bottles	
250 mL and 0.5 L bottles	
EVPA SOP	
Meter stick	
Labels	
SFWMD Manual	
GPS Coordinates	
Access Badge	
Rubber Gloves	
Dive bag (net type)	
Map of sites	
Radio Channel for flight following	
Helicopter flight plan document	
Cell phone	
Radio (LOXA only)	
2 coolers	
Mini-Sonde guard	
Bottle with moist napkin	
Paper towels	
Swing blade	

Pre-field activities related to data sondes consist of Hydrolab Mini-Sonde calibrations for temperature, conductance, dissolved oxygen (DO), and pH as well as the preparation of the Calibration Summary Report (CSR). B. Arrington first explained the purpose of and mandates governing the pre-field operations. Each person from the replacement team was instructed to read and understand the SFWMD 'Field Sampling Quality Manual'. Following the explanation of the purpose of pre-field activities, B. Arrington defined the structure of the CSR and highlighted the mandatory fields. The CSR consists of both qualifiers and quantifiers. The list of qualifiers includes the Instrument ID (which is

located on the Hydrolab Mini-Sonde); prelogin codes (identified by SFWMD as a part of the labeling protocol and found on the labels of each sample to be analyzed by the District laboratory); date and time of pre-field mini-sonde calibration; location where the pre-field calibration was performed; standard set ID (the label applied to the standards used for the calibration of the mini-sonde); technician responsible for the calibration of the mini-sonde. These qualifiers are applied to pre-calibrations values, calibration values, initial calibration verification (pre-field performance check of the mini-sonde calibration), and continuing calibration verification (post-field performance check of the mini-sonde calibration). The list of quantifiers includes pre-calibration values, calibration values, initial calibration verification values (ICV - pre-field mini-sonde performance test), and continuing calibration verification values (CCV - post-field mini-sonde performance test – discussed in the post-field operations section). Each of these quantifiers is applied to the calibration parameters (specific conductance, pH, temperature, and DO) in the appropriate fields on the CSR. Each of these quantifiers has a qualifier of pass or fail. The quantifier receives a pass code if the measured calibration value is with in 5% of the expected values and receives a fail code if it is >5% away from the expected value. Specific conductance has a two point calibration at 0 and 720 $\mu S\ cm^{-1}$. The District reduced the upper limit on the specific conductance in May from 2000 to 720 $\mu S\ cm^{-1}$, which no longer covers the specific conductance range for canal samples that often reach values >1000 $\mu S\ cm^{-1}$. The ICV applied is generally 100 or 200 $\mu S\ cm^{-1}$. Temperature is calibrated against the NIST standard thermometer maintained by the District. The pH is calibrated at 7 and 10 prior to going to the field. DO is temperature-dependent and calibrated based on the DO chart provided by the District. Each member of the replacement team was trained extensively on the procedures to ensure the CSR is completely filled out and that all parameters are calibrated and fully functional prior to field operations. If the mini-sonde receives a failure status for any of the parameters, the mini-sonde is returned to the District (if it is a District mini-sonde) and another mini-sonde is taken through the same procedures until all the fields are passed.

Field operations

B. Arrington spent several weeks ensuring everyone on the replacement team was able to perform sample collection properly.

There were several offsite classes dedicated to training and testing everyone, which were held on the Refuge in an impoundment. Each replacement team member was also trained and tested for their ability to properly perform actual field sample procedures. Several key components were necessary for each member to pass the sample collection test. The replacement team members had to demonstrate a clear understanding of depth to the consolidated substrate, total water column depth, and components that could potentially foul the samples (e.g., suspended particulates, vegetation, and insect or other living creatures). Each member had to further demonstrate the proper collection procedure for each type of sample (2 L bottles or 250 mL bottles). The sample bottle selection is dependent on water column depth such that when the water column is greater than 20 cm, the 2 L bottle is used for sample collection, and when the water column is between 10 and 20 cm, the smaller bottles are used to reduce possible resuspension of sediments into

the water column. Prior to completely filling the bottle, each sampling bottle had to be rinsed three times with field water from the respective site.

One important component of sampling collection that B. Arrington consistently demonstrated was the wading technique. B. Arrington explained the necessity of being able to wade while disturbing the water column as little as possible and collecting the sample in the area upstream of the wader to reduce the amount of resuspended sediments collected during sample collection. B. Arrington also demonstrated the correct immersion technique for collecting the samples. This technique consisted of immersing the bottle neck first with the lid on the bottle, completely submersing the sampling container and with gloves donned, removing the lid of the bottle and allowing the bottle to fill to capacity while submerged, and finally returning the lid to the closed position on the sample bottle while immersed in the water column. Finally, B. Arrington demonstrated the storage procedure for the samples by placing all the samples in a cooler submerged in ice. All members of the replacement team successfully fulfilled all of these tasks.

Post-field operations

Post-field operations consist of sample processing and mini-sonde performance verification. Sample processing received the most attention during all of the training activities. Each member of the replacement team received at least 3 to 4 days of practice before B. Arrington released them to perform independent sampling.

B. Arrington trained everyone in setting up the work station first and foremost. The work station consisted of a District-cleaned bucket and lid, syringes (60 mL), filters (0.45 µm), labeled sample bottles for each parameter, HNO_3 and H_2SO_4 acids, gloves, and solutions (conductance, pH, temperature, and DO). Following the preparation of the work station, each sample is split into the appropriate sample container and processed through a combination of filtering and acidifying (for preservation of the samples until analysis). A small portion of each 2 L sample from each site is poured into the bucket and used to rinse the bucket with sample water and this procedure is performed three times for each sample site. Unfiltered sub-sample bottles are rinsed twice with a small portion of the sample in the bucket and the sub-sample bottles are then filled, closed, and set aside for acidification if necessary. During the transfer from bucket to sub-sample bottles, the bucket is kept agitated by light shaking to ensure the homogeneity of the sub-samples. Filtered samples are prepared next. Sub-samples are extracted from the bucket with a 60 mL syringe. Prior to sub-sample collection each syringe is rinsed three times with bucket sample water and 30 mL of sub-sample are ran through the 0.45 µm filters to remove any loose silicates. The rinse is discarded. Following the rinse, several mL of filtered sample are injected into the sub-sample vials to rinse the bottles with filtered sample water. After this rinse, 60 mL of sub-sample are injected into the respective bottles for total dissolved nutrients, dissolved nutrients, anions, dissolved metals, etc. Once all sub-sample bottles have been filled, the operator acidifies the samples according to District protocols. Samples acidified with H_2SO_4 include TKN, TPO4, TOC, NOX, NH4, TDPO4, TDTKN, and DOC. Samples acidified with HNO_3 include TOTFE, Ca, Mg, Na, and K. For the larger bottles (250 and 125 mL) of acidified samples, 12 to 15 drops of

acid are added to reduce the pH of the samples below 2, and for the smaller bottles (60 mL), 6 to 8 drops are applied to reduce the pH below 2. Following filtration and acidification, the bottle caps are secured to the bottles and the samples are placed on the analytical desk in numerical order unless the analytical attendant is not there or directs us otherwise.

On the CSR, there are sections to check each calibrated parameter (CCV) upon the return of the mini-sonde to the laboratory. Similar to pre-field operations, the CCV for specific conductance must be with 5% of the expected value to receive a passing status and is generally performed at 100 or 200 $\mu S\ cm^{-1}$. Dependent on values observed in the field, the CCV for pH is either 4 or 10. Te DO is temperature dependent and to receive a pass code the DO value must fall in the range established in the District guidelines. Temperature is also checked against the NIST.

Conductivity Mini-Sonde Maintenance

Staff trained initially in Hydrolab mini-sonde maintenance were S. Rinker and D. Surratt. D. Surratt in turn trained R. Smith on mini-sonde maintenance. On 22 March 2005, D. Setaram, a technical representative of Hydrolab, provided a one-day training session on the Hydrolab mini-sonde. D. Surratt and R. Smith were trained on YSI conductivity mini-sonde maintenance in the field by P. McCormick (USGS), and they received further training from the YSI representative in a one-day training session. Maintenance consists of mini-sonde collection, data download, mini-sonde cleaning, mini-sonde calibration, file creation for the next data collection period, and mini-sonde redeployment. Mini-sondes can be collected by helicopter or airboat; each method requires slightly different approaches.

Mini-sonde maintenance from airboats generally occurs at the site or at the far end of the conductivity transect, dependent upon the operator. Regardless of the approach, the operator first acquires the depth to consolidated substrate (DCS), the total water column depth (tdepth), and the sonde to water surface depth (SWS). C. Darby ensured that these terms were clearly understood. DCS is the depth between the water column surface and the more solid material on the marsh floor (consolidated substrate). The tdepth is the depth between the water column surface and the detrital layer, and the SWS is the depth between the water column surface and the top of the mini-sonde. If the mini-sonde maintenance is performed on site, then the outside of the mini-sonde casing is cleaned and the probe guard is removed and replaced with the calibration and storage cup. The mini-sonde is then connected to either the surveyor (Surveyor4a) or the laptop (hyperterminal software) for data download. Following the data download, the data are observed for the specific conductance values collected over the mini-sonde deployment period and the highest values are used to assess the desired conductivity solution to use for the CCV. After this determination is made, the calibration cup is filled with the appropriate conductivity solution and the value is checked to determine if the mini-sonde is still operating properly by checking that the registered values are within 5% of the expected value. If the mini-sonde passes, then the mini-sonde is cleaned. In the case of

the Hydrolab mini-sondes, the DI water is used to rinse the probes (temperature and conductivity), and a set of soft bristle brushes are used to clear all fouling material from the probes. Next a thin film of non-abrasive cleaning agent (i.e., toothpaste) is applied to the probes and then rinsed. This procedure is not recommended for the YSI mini-sondes. Following the cleaning, the mini-sondes (both Hydrolab and YSI) are calibrated. The Hydrolab has a two-point calibration (0 and 2000 $\mu S\ cm^{-1}$) and the YSI has a one-point calibration (2000 $\mu S\ cm^{-1}$). Prior to entering each calibration, the pre-calibration value is recorded for each calibration solution (2000 $\mu S\ cm^{-1}$) and then the system is calibrated with the appropriate calibration solution. A qualifier of pass and fail is assigned to the calibrated parameters and the temperature is checked against a field NIST thermometer and this value is qualified as pass or fail. The calibration cup is removed and the probe guard is returned to the mini-sonde. A new file is created on the mini-sonde, the sonde is redeployed, and the DCS, tdepth, and SWS are recorded.

If the operator simply collects the mini-sondes (as well as DCS, tdepth, and SWS) and performs the maintenance at the far end of the conductivity transects, then all the maintenance is done at that final site according to the procedures outlined above. Then the sondes are redeployed at the respective sites and the DCS, tdepth, and SWS are recorded.

Mini-sonde maintenance from the helicopter requires the collection of each mini-sonde, DCS, tdepth, and SWS for each site and then returning all the collected mini-sondes to the on-site laboratory for data download, cleansing, and calibration according to the procedures outlined in the Airboat mini-sonde maintenance section above. The next day, the mini-sondes are redeployed and the new DCS, tdepth, and SWS are recorded.